Report of the Comptroller and Auditor General of India

for the year ended March 2007

Union Government (Defence Services)
Air Force and Navy
No. PA 5 of 2008
(Performance Audit)

CONTENTS

Chapter	Title	Page
	Preface	iii
	Overview	v
I	Functioning of ADGES Radar in Signal Units in the Indian Air Force	1
III	Training of Pilots in the Indian Air Force	37
IIII	Operational availability and maintenance of Submarines in the Indian Navy	73

PREFACE

This Report for the year ended March 2007 has been prepared for submission to the President under Article 151 of the Constitution. The report contains results of performance audit on the following three subjects pertaining to Air Force & Navy:

Air Force

(i) The functioning of ADGES Radars in Signal Units in the Indian Air Force.
(ii) Training of pilots in the Indian Air Force.

Navy

(iii) Operational availability and maintenance of submarines in the Indian Navy.

OVERVIEW

This Audit Report includes matters arising out of performance audits of functioning of ADGES Radar/Signal Units in the Indian Air Force; training of pilots of the Indian Air Force and operational availability and maintenance of submarines of the Indian Navy.

Functioning of ADGES Radar in Signal Units in the Indian Air Force

Air Defence (AD) is critical to a nation's security both during war and peace time. The Air Defence Ground Environment System (ADGES) is an integrated network of surveillance radars, air defence control centres, air and missile bases and anti aircraft guns intended to provide an efficient and reliable defence against air attacks.

This system came into existence in 1976 and continues to be at the heart of the nation's AD system. Deployment of AD Radars at various locations in the country is aimed at providing a conducive flying environment, adequate surveillance and effective command and control of AD assets. The performance audit focused on radar availability and their performance, deployment of manpower and training infrastructure.

The important audit findings are:

- Indian Air Force (IAF) do not possess adequate number of surveillance radars needed for providing efficient and reliable detection capabilities for ensuring credible Air Defence.
- Ministry could not ensure timely acquisition of three additional high power static radars to provide effective air surveillance over certain areas that may have become vulnerable in the changed scenario.
- Shortage of medium power radars (MPRs) needed for ground control and intercept was as high as 53 *per cent* of the projected requirement. The holding of low-level transportable radars was merely 24 *per cent* of the actual requirement of the Air Force.
- Despite significant changes in security scenario, technology and growing magnitude of potential aerial threats in terms of sophistication and capabilities, Government has not approved IAF's revised plans of 1983-2000 and 1987-2007.
- Ministry failed to ensure timely upgradation, replacement and modernization of radars and associated equipment. There have been significant delay in procurement of medium power radars, as a result of which, by 2008, IAF would be compelled to operate with only 26 *per cent* of the authorized holding of these radars when large numbers of these obsolete radars become due for phase-out.

- Constant air surveillance is essential for eliminating potential enemy threats. However, actual watch hours allotted to IAF units holding radars were much lower than the watch hours prescribed by the Government. The actual surveillance levels ranged between 4 to 42 *per cent* of the approved norms.
- IAF is dependent on obsolete analog technology in its communication media due to its failure to procure new reliable digital technology even after nine years of assessment of the requirement.
- The performance of high power radars was exposed to risks due to life expired generator sets and air-conditioning systems, and medium power radars were affected by unserviceability of critical sub-systems, ageing and inadequate height accuracy.
- Signal units of Air Force, which are responsible for operation and basic maintenance of radars, have large deficiency of officers in operational and technical cadres ranging between 27 to 38 *per cent.*
- There were delays in undertaking servicing and overhaul routines of radars.
- The requirement of spares projected by repair depot was not met through centralized procurement by Headquarter Maintenance Command/Air Headquarters during 2003-07 which resulted in serious shortages and adhoc procurement of spares at local levels to meet Aircraft on Ground (AOG) demands.
- While at one training centre resources were overstretched to meet increased courses, in another centre, training facilities remained under utilised. Proposal to acquire a training radar was badly delayed even as training time was being expended on travel to other units for training in absence of a dedicated training radar.

(Chapter I)

Training of Pilots in the Indian Air Force

The Indian Air Force (IAF) requires pilots to fly its diverse range of aircrafts, from fighter planes to transport aircraft to helicopters. Thus, comprehensive professional training becomes especially crucial for providing young recruits with the expertise required for handling specialized equipment and aircrafts, and also for constantly upgrading the skills of the existing pilots. Training new pilots is a complex process involving selection of trainees, theoretical training courses, initial practical training in simulators and 'live' aircraft and operational training specific to the stream in which a pilot is commissioned. This report focuses on various stages of pilot training from the initial stages to the transfer of pilots to their operational stream.

The significant audit findings are:

- IAF has not formulated a long-term training plan for pilots of fighters and other streams in order to develop an effective training strategy consistent with the long term strategic objectives, desired force levels and technological changes.

- The number of pilots trained in various streams was much lower than planned targets indicating that either constraints are not taken into account while formulating training targets or IAF failed to ensure adequate intake of pilot trainees through an effective recruitment strategy.
- Though the IAF's requirement of trained pilots will substantially increase during 2008-2018 to meet expansion needs of IAF squadrons, and fill up back log vacancies and also the vacancies arising from high attrition rates in recent years, IAF has not implemented any effective training strategy for meeting the increased intake requirements by addressing problems related to limitations of air space/runway occupancy and other infrastructural constraints.
- The number of pilots failing to complete their training successfully was significantly higher. There was also lack of continuity in the transition of a pilot from initial training to intermediate and advanced stages of training in terms of quality, technology and avionics of the trainer aircraft used. The need for improving the quality of pilot training was highlighted by the fact that 42 *per cent* of aircraft accidents reported during 1995-2005 were attributed to human errors.
- IAF lacks adequate number of state-of-the-art aircraft for imparting pilot training. There is delay in timely completion of development and induction of jet trainers. IAF took almost 25 years to induct the Advanced Jet Trainer which is critically required for smooth transition from the basic trainer to a high technology aircraft.
- Failure to procure/upgrade simulators for trainer aircraft for more than a decade deprived trainees of a safe and non-hazardous means of learning to fly these aircraft in cost effective manner.
- There was delay of more than a decade in finalization and acquisition of land for establishment of weapon training range for two Flying Training Establishments.

(Chapter II)

Operational availability and maintenance of submarines in the Indian Navy

For a Navy aspiring to have 'blue water[1]' capabilities, submarines are a crucial element. Functional roles of submarines include (a) attacking surface and sub-surface enemy vessels, (b) laying offensive mine-fields, (c) blockade of enemy ports and other lines of communication, (d) landing of reconnaissance teams for intelligence gathering and (e) special operations. Today, a conventional submarine costs around Rs 1870 crore but this may vary depending upon the type and the capabilities it possesses. The Performance Audit focused on the efficiency of the functioning of the submarine arm of Indian Navy in terms of operational availability, effectiveness of modernization, performance of systems fitted on-board after modernisation, refit activities undertaken, and the efficacy of training imparted.

The important audit findings are:

[1] A maritime force capable of operating across the deep waters of open oceans.

- Ministry could not adhere to its submarine construction / induction plan which may impact operational preparedness of Indian Navy. At present, Indian Navy holds just 67 *per cent* of the force level envisaged in its 1985 plan.
- Due to ageing fleet and prolonged refit schedules, the average operational availability of the submarines is as low as 48 *per cent.*
- Delay in concluding contract for procurement of Deep Submergence Rescue Vessel compelled Navy to remain dependent on a foreign source for rescue operations.
- The refit activity management in Navy was not efficient as 83 *per cent* of short refits and 100 *per cent* of normal and medium refits were delayed and could not be completed within the prescribed time period.
- Piece-meal modernization and upgradation of submarines at an aggregated cost of Rs 1560 crore was undertaken by Navy without the approval of the competent financial authority.
- The modernization and upgradation programme of submarines has been only partially successful as missile firing capabilities on three submarines are functioning at sub-optimal level due to erratic performance of the Inertial Navigational System of Navigational Complex procured at a cost of Rs. 108 crore. Performance of newly acquired sonars costing Rs. 168 crore has also not been found satisfactory.
- Ship Control Simulator, used for training for a particular class of submarine has remained non-operational since 2002 adversely affecting the training of submariners.

(Chapter III)

MINISTRY OF DEFENCE

INDIAN AIR FORCE

FUNCTIONING OF ADGES RADAR IN SIGNAL UNITS

CHAPTER I: Functioning of ADGES Radar in Signal Units in the Indian Air Force

The Air Defence Ground Environment System (ADGES) Radar in Signal Units form the very core of the Indian Air Defence (AD) system. This Performance Audit sought to review the functioning of radars in terms of adequacy of holding, their operation and maintenance, serviceability, upgradation and replacement of AD assets. Some of the salient findings are given below.

Highlights

- **Air Defence is critical to the nation's security. IAF, however, holds less than adequate number of surveillance radars needed for providing efficient and reliable detection capabilities for ensuring credible Air Defence.**

  (Paragraph 1.7.1.2)

- **Ministry could not ensure timely acquisition of three additional high power static radars to provide effective air surveillance over certain areas that may have become vulnerable in the changed scenario. Shortage of medium power radars needed for ground control and intercept was as high as 53 *per cent* of the projected requirement. IAF's holding of low-level transportable radars, which are assigned the role of providing early warning, was merely 24 *per cent* of the actual requirement of the Air Force.**

  (Paragraph 1.7.1.3, 1.7.1.4 and 1.7.1.5)

- **The outdated 1970-71 Plan for Air Defence still forms the basis for determining IAF's requirement for radars and other associated equipment as the Government is yet to approve IAF's revised plans of 1983-2000 and 1987-2007 despite significant changes in security scenario, technology and growing magnitude of potential aerial threats in terms of sophistication and capability. This has created a serious mismatch between availability and requirement of surveillance systems.**

  (Paragraph 1.7.1.1)

- **Constant air surveillance is essential for eliminating potential enemy threats. However, actual watch hours allotted to IAF units holding radars were much lower than the watch hours prescribed by the**

Government. The actual surveillance levels ranged between 4 to 42 *per cent* of the approved norms.

(Paragraph 1.7.1.9)

- **Ministry failed to ensure timely upgradation, replacement and modernisation of radars and associated equipment. There have been significant delays in procurement of medium power radars, as a result of which, by 2008, IAF would be compelled to operate with only 26 *per cent* of the authorised holding of these radars when large numbers of these obsolete radars become due for phase-out.**

(Paragraph 1.7.2.1, 1.7.2.2, 1.7.2.3 and 1.7.2.4)

- **IAF is still dependent on obsolete analog technology in its communication media due to its failure to procure new reliable digital technology even after nine years of assessment of the requirement. Apart from having a direct bearing on the efficiency of Air Defence operations, continued use of unreliable outdated technology also deprived IAF of recurring potential savings on account of reduced technical establishment.**

(Paragraph 1.7.2.3)

- **Signal units of Air Force, which are responsible for operation and basic maintenance of radars, have large deficiency of officers in operational and technical cadres ranging between 27 to 38 *per cent.***

(Paragraph 1.7.4.1)

- **A project for networking of low level radars and operationalisation of an automatic control and reporting centre to enhance the operational effectiveness of radars and generate viable tactical response against low flying aircraft did not succeed due to deficiencies in critical components and unserviceability of some of the equipment. Closure of the project after 19 years resulted in unfruitful expenditure of Rs 49 crore.**

(Paragraph 1.7.1.8)

- **While the performance of high power radars was exposed to risks due to life-expired generator sets and air-conditioning systems, medium power radars were affected by unserviceability of critical sub-systems, ageing, and inadequate height accuracy.**

(Paragraph 1.7.1.10 and 1.7.1.11)

- There was no formal long-term agreement with Bharat Electronics Limited (BEL) for repair, maintenance and supply of spares of radars even though IAF was largely dependent on BEL for these services. Lengthy procedures for each transaction led to inefficiencies in procurement of these services.

(Paragraph 1.7.3.1)

- Delays were evident in undertaking servicing and overhaul routines of radars and were especially acute in the case of medium power radars which would affect their performance.

(Paragraph 1.7.3.5, 1.7.3.6 and 1.7.3.7)

- Requirement of spares projected in Provisioning Reviews by repair depot was not met through centralised procurement by Headquarter Maintenance Command/Air Headquarters during 2003-07 resulting in serious shortages, adhoc procurement of spares at local levels and delays in meeting emergent requirements.

(Paragraph 1.7.3.8)

- While at one training center, resources were stretched due to increase in number of courses and training weeks per year, in another centre training resources were underutilised. Proposal to acquire a training radar was badly delayed even as training time was being expended on travel to units in the absence of dedicated training radars.

(Paragraph 1.7.4.3 and 1.7.4.4)

Summary of recommendations

- *Planning for acquisitions and deployment of AD radars may be done well in advance, both in the medium and the long term, with due government approval to effectively meet requirements of IAF.*

- *Acquisition of Medium Power Radars (MPRs) / Low Level Transportable Radars (LLTRs) and completion of development projects may be expedited so that gaps in provision of AD assets can be avoided.*

- *Utilisation of radars in terms of watch hours may be enhanced through timely replacements, upgradations and efficient product support.*

- *Ministry may ensure that all upgradation programmes of AD system are taken up without delay to avoid cost escalation and maintain operational efficiency at all times.*

- *Replacement of old and outdated radars and associated equipment may be carried out in time with a view to ensure that AD system is always current and effective.*

- *DRDO may ensure that the radars developed by it are competitive in global market in terms of price and quality.*

- *Since IAF is predominantly reliant on BEL for product support and major repairs and overhauls, of radars a standing formal agreement between IAF and BEL may be negotiated so that time consuming procedures involved in taking a case-by-case approach are avoided.*

- *Provisioning for spares and rotables should be made more efficient so that spares are available in time; and delays in overhauls, servicing and clearing Aircraft on Ground (AOG) demands are avoided.*

- *Availability of manpower at all Signal units and repair depots may be improved for smooth operation and maintenance of radars.*

- *Training facilities and infrastructure should be tailored to requirements so that resources are put to optimal use and objectives of training are achieved in a cost effective manner.*

1.1 Introduction

Air Defence (AD) is critical to the nation's security both during war and peacetime. Successful air defence is dependent upon four cardinal capabilities, i.e. detection, identification, interception and destruction, being credible and effective. The detection capability attained through Air Defence radars, is clearly the key as it activates the other three capabilities. Radars, in fact, are the eyes of an AD system without which both defence personnel and equipment would be rendered ineffective. In recent times, the importance of AD has increased manifold as detection and response times have reduced due to the growing magnitude of aerial threats in terms of sophistication and capabilities.

1.2 Radars in Air Defence Ground Environment System

The Air Defence Ground Environment System (ADGES) is an integrated network of surveillance radars, air defence control centers, air and missile bases and anti aircraft guns intended to provide an efficient and reliable defence against air attacks. This system, which functions within the IAF, came into existence in 1976 and continues to be at the heart of the nation's AD system. The radars deployed under this system are of three types i.e. High Power Radar (HPR), Medium Power Radar (MPR) and Low Level Transportable Radar (LLTR). Each category of radar differs in its role, range, height detection and mobility. Working in concert, these are designed / structured to provide the country with round-the-clock, gap-free AD cover. Deployment of AD radars at various locations in the country is aimed at providing a conducive flying environment, adequate surveillance and effective command and control of AD assets. The present inventory of these radars was acquired at an aggregated cost of Rs 1031 crore.

1.2.1 Life span and maintenance of radars

The life span of radars varies with their type, role and technology. HPRs and MPRs have a life span of about 25-30 years and 20 years respectively whereas LLTRs normally last for about 15-20 years. Original Equipment Manufacturers (OEMs) of the radars have also specified the time between overhauls (TBO) in terms of both rotation hours and years of operation. Overhaul of these radars is an activity jointly undertaken by BEL and the Base Repair Depots (BRDs)—the designated repair agencies of the IAF.

The operating units are responsible for carrying out the first ('O' level)[1] and second line ('I' level)[2] servicing of the radars. Third and fourth line repair[3] of components and rotables, are undertaken by designated Base Repair Depots (BRD) or by the OEM.

1.3 Scope of Audit

This Performance Audit broadly covers the period 2002-07 and focuses on adequacy of holding, operation and maintenance, serviceability, operational availability, upgradation and replacement of radars and other ancillary/support

[1] "O" level= Routine servicing at prescribed intervals
[2] "I" level = Minor repair
[3] Third and fourth level = Major repair and overhaul at prescribed Time Between Overhaul

systems. This audit does not cover airborne detection systems and interception and destruction capabilities.

1.4 Audit Objectives

The objective of this performance audit was to seek an assurance that:

- Plans for acquiring, upgrading and modernizing radars exist according to the assessed needs and are being implemented effectively for ensuring credible air defence;
- Operational radar units have been achieving their assigned mission and role by adhering to the prescribed norms for surveillance;
- Operation of ADGES radars and associated communication network is efficient, effective and economical;
- Repair and maintenance facilities created for ADGES radars are adequate and are being used efficiently;
- Adequate manpower is available at Signal units for smooth operation and maintenance of radars;
- Adequate training facilities for operation and maintenance exist and are being optimally used; and
- Internal Control System is adequate and effective.

1.5 Audit Criteria

Some of the important criteria used to evaluate performance were:

- Assigned operational role.
- Projected requirement of radars and auxiliary equipment.
- Desired serviceability levels of radars and equipment.
- Sanctioned establishment of operational staff.
- Projected requirement of repair and maintenance facilities.
- Annual allotment of tasks to repair agencies.
- Prescribed schedules for 1st and 2nd line maintenance.
- Targets for indigenisation.
- Norms for provisioning and procurement.

- Capacity of training facilities and training targets.
- Sanctioned strength of trainers
- Approved upgradation plans.

1.6 Audit Methodology

An entry conference was held at Air HQ on 20th April 2007 wherein the scope and objectives of audit and the broad compass of fieldwork planned were discussed with the representatives of the auditee organization. Subsequent audit examination consisted of scrutiny of documents and records at Air HQ, Signal Units and at the BRDs, analysis of data collected through issue of audit memos and questionnaires, interaction with key personnel at Air HQ, Operation and Maintenance units; and examination of audit evidence collected in course of previous local audits. Field work was undertaken at Air HQ, 15 Signal Units, four Base Repair Depots and two Training Establishments during May-August 2007 although data was collected and analysed from all existing signal and radar units. The conduct of audit was, however, constrained on account of non-availability of replies to audit queries; non-production of records relating to upgrade of HPR and improper record keeping in repair agencies.

An exit conference was held on 12th December 2007 at Air HQ wherein the main findings of audit and related recommendations were discussed.

1.7 Audit findings

Audit examination disclosed weaknesses in planning and deficiencies in performance/functioning of radar units of the IAF. In addition, modernisation and replacement activities were not commensurate with the needs of the IAF. Repair and maintenance activities also revealed significant delays and an unstructured approach towards undertaking tasks. Detailed findings are classified under the following themes:

- Radar availability and performance;
- Upgradation and modernization of Radars and associated equipment;
- Repair and maintenance of ADGES Radars;
- Deployment of manpower and training infrastructure for ADGES Radars; and
- Evaluation of Internal Control System

1.7.1 Radar availability and performance

Accurate forecasting of requirements is the first step in ensuring that adequate numbers of appropriate radars and equipment are available with the IAF. Proper planning also involves developing timely replacement and upgradation strategies. The quality of performance of available radars is dependent upon their operational availability, utilization as per prescribed norms and adherence to desired serviceability levels.

1.7.1.1 Planning

Existence of properly formulated and approved plans for timely acquisition, maintenance and replacement of radars would lead to the most optimal and effective fulfillment of AD requirements. Apart from ensuring availability of adequate funds in time, the plans would also provide a control tool so that the build-up of AD assets remains in line with overall strategic goals and objectives.

An AD Plan was first submitted to the Government in August 1961 to augment the then existing radar cover and to replace old and obsolete radar inventory. Later in 1966, a comprehensive ADGES plan was prepared and submitted to the Government, which was approved in 1970. This plan laid down a command and control structure for AD radars and provided for induction of 'x' number of High Power Static Radars (HPSR), 'y' number of Mobile Radars and 'z' number of Low Level Transportable Radars (LLTR) by 1979. It also provided for a dedicated unit of BEL at Ghaziabad for manufacture of ADGES Radar.

Subsequently, due to changes in the threat perception, requirements were revised in 1971. Later, ADGES plans were revised in 1983 and 1987 to correspond with plan periods 1983-2000 and 1987-2000 respectively. These plans projected phased build-up of assets till 2000 and beyond, consistent with the development of new concepts, state-of-the-art equipment and changes in the security environment. The plan for the period 1987-2000 was later extended to 2007. In May 2007, a "deployment" plan upto 2020 was also prepared.

Audit scrutiny revealed that none of the plans prepared after 1971 received approval of the Government. Some of the elements of the ADGES plans have, however, been sanctioned on piece-meal basis from time to time. Acquisitions and replacements have thus been few, unplanned, ad-hoc and delayed, creating

a serious mismatch between availability and IAF's requirement of radar systems.

Ministry did not furnish explanation/reasons for non-approval of the revised AD Plans submitted by IAF.

1.7.1.2 Availability of Radars

Indian Air Force (IAF) is responsible for providing Air Defence (AD) over territory, which spans 33 lakh square kilometers and frontiers running to over 15000 kilometres (kms). It is imperative that an AD system incorporates radars of appropriate types in adequate numbers and is supported through required auxiliary systems and data handling and communication systems. The Standing Committee on Defence (1999-2000) in its Seventh Report had observed that a critical system like the Air Defence radars was facing obsolescence and needed urgent modernization. The Committee felt that this situation could have been avoided if the Government had taken timely measures in the past to undertake modernization in a planned manner. The Committee, therefore, concluded that the Government had been remiss in strengthening the AD system, which plays a crucial role in protecting the country from an aggressor.

Though considerable time has elapsed since the Committee made these observations, Audit scrutiny revealed that significant shortfalls with regard to projected requirements for radars continue to persist. Besides, some radars and supporting systems had failed to deliver required functionality and thus affected credibility of the AD cover. Findings with regard to each type of radar are given below.

1.7.1.3 High Power Static Radar

These are 3-D radars, which cover aerial threats at a height of 2 kms and above and have a range of 450 kms. Units holding these radars have the nodal role of an Air Defence Detection Centre (ADDC).

The ADGES plan for the 1987-2000 period[4] had projected an additional requirement of three HPSRs beyond 2000 for providing surveillance cover to certain areas that have become vulnerable in the changed security environment. Acquisition of these additional radars was yet to be processed as of December 2007. As a result of non-procurement of the additional radars, certain important parts of the country remain without adequate high-level

[4] Subsequently extended upto 2007.

surveillance cover. Besides, existing radars are of old vintage and use outdated technology.

1.7.1.4 Medium Power Radars

These are 3-D radars, which, like the HPSR, can detect aerial threats at a height of 2 kms and above but have a range of 300 kms. The role of these radars is that of Ground Control and Intercept (GCI).

Audit examination disclosed that IAF had an acute shortage of MPRs. The extent of shortage was as high as 53 *per cent* of the requirement projected in the long term ADGES Plan (1987-2007). Such serious deficit in the availability of MPRs is bound to affect the credibility and effectiveness of the AD system in the country.

1.7.1.5 Low Level Transportable Radars

These radars typically provide cover against aerial threats operating at low levels i.e. upto a height of 2 kms and have a range of upto 150 kms. Low looking radars have acquired importance as aircraft have begun flying at low levels to avoid radars. These radars thus have the role of providing "early warning" to the controlling ADDC along with limited GCI.

The plans (1983-2000 and 1987-2007) projected a substantial increase of more than 100 *per cent* in the number of LLTRs by the year 2000 and 280 *per cent* by the year 2010. Audit examination, however, revealed that in August 2007, IAF's holding of LLTRs was even lower than the approved holding for the year 1971. IAF was holding only 24 *per cent* of its projected requirement in the 1987-2000 Plan. Though action is underway for procurement of 37 radars, these would replace the existing LLTRs on completion of their assigned life rather than cover the present deficiency. Thus, the shortfall will persist affecting the AD cover against low flying aerial threats.

1.7.1.6 Radars suited for detection of threats at high altitude

Detection of aircraft is difficult without radars specifically designed and optimized for operations and deployment at higher altitudes. The revised Plan ADGES 1983-2000 proposed induction of three high altitude MPRs after 2000 subsequent to getting 'C' make of MPR modified by BEL for high altitude operations. The long term ADGES Plan covering the period 1987-2000 reiterated the requirement for these high altitude radars. These specially adapted radars are yet to be procured and stop-gap measures consisting of positioning LLTRs have not been successful.

1.7.1.7 Maintenance reserves of radars not maintained

Though long-term ADGES plans have proposed certain reserve of MPR and LLTRs, no such reserve is available with the IAF. As such, if radars at critical units become non-operational they are replaced with radars from some other operational unit leaving the latter unit without radar. Non-maintenance of reserve radars entails critical deficiency in the AD system.

1.7.1.8 Failure to establish networks of Low Level Radars and operationalise an Auto CRC System

Indigenous LLTRs 'D' and 'E' were specially developed to detect low flying aircraft. However, at a target height of 100 meters, the detection range of these radars (40 km) was very low. The radars were, thus, inadequate for generating any viable tactical response if operating in a stand-alone mode. As such, networking of four to six LLTRs and placing them under one Control and Reporting Centre (CRC) was conceptualized.

A special group called Low Level Radar Networking Group (LRNG) created in November 1986 was initially tasked to set up a representative portion of the overall network at a cost of Rs 25 crore. The project was to be completed by November 1989 but was extended till June 1995 with an additional funding of Rs 19.75 crore. In October 1995, the LRNG was merged with Radar and Communication Project Office (RCPO) till completion of the task. The RCPO formed a CRC Development Group (CRCDG) to make one Auto CRC operational. In 1999, the Auto CRC was handed over to unit 'P'. However, due to deficiencies in critical components and unserviceability of some of the equipment taken over from CRCDG, the Auto CRC could not become operational. In July 2003, HQ WAC strongly recommended that unit 'P' be closed down as it was forcing IAF to incur losses in maintaining the Auto CRC without any operational utility. Air HQ agreed to close down the unit only in April 2005 although Government approval for the same was yet to be obtained as of December 2007. Hence, despite the fact that the Auto CRC had never been able to function optimally since installation, IAF continued to maintain the sub-optimal system and operate a full unit for over six years incurring considerable unnecessary expenditure.

The decision to close down the unit and abandon use of the only Auto CRC set up, signaled the end of the project to create multiple networks of low-level radars after spending nineteen years and Rs 49 crore. Consequently, sub-optimal low-level radars continue to be operated in a stand alone mode.

Performance of AD Radars

The performance of available AD radars was scrutinized during audit through examination of reports, returns and performance records maintained by units.

1.7.1.9 Serviceability and Availability of Radars

The average position during 2004-07 with regard to serviceability[5] and operational availability[6] of different types of radars is given in the table below.

(in percentage)

Type of Radar	Serviceability	Operational Availability
A	98.89	81.17
B	98.12	84.15
C	97.55	81.99
D	99.45	88.23
E	99.48	84.04

Audit noted that availability of various types of radars was affected due to frequent breakdowns of the existing old radars, non-availability of spares etc. Audit scrutiny further revealed that hours of watch allotted to the units for all types of radars were much below the hours of watch prescribed in the policy page of these units. The average position during 2004-07 in this regard is given in the table below:

Type of Radar	Percentage of utilisation against availability	Percentage of utilisation against authorisation
A	35.55	42.45
B	24.80	24.87
C	27.70	27.26
D	3.33	3.51
E	4.58	4.63

As regards watch hours allotted being less than the prescribed ones, Air HQ stated in October 2007 that radar utilisation is as per threat envisaged and the task is accordingly allotted. The threat being more pronounced in certain region, radar utilisation in such region is higher as compared to the other parts of the country. Further, conservation of hours is carried out as overlap cover at

[5] Availability of Radar on 24 Hours basis subject to criteria specified in various Air Staff Instructions issued by various Command HQrs/Air HQ.

[6] No. of hours for which Radars remained available for operation on 24 hours basis.

Medium/High level is available and conservation of hours of mobile radar is essential due to its shorter life and criticality during activation/war. Due to lesser threat of targets at low level during peace time, the LLTRs are generally kept in stand-by state of readiness. Also, availability of manpower has never been up to the levels as per establishment of a unit.

The reply of Air HQ is not tenable as hour of watch allotted to the units were much less (58 to 96 *per cent*) than the required surveillance levels stipulated in the policy page issued by the Ministry. The reply of the Air HQ also appears to overlook the substantial shortfalls, which are indicative of constraints in performance on account of age and obsolescence of the radars and auxiliary equipment.

Findings with regard to performance of each type of radar are given below:

1.7.1.10 High Power Radar

Audit fieldwork at two Signal Units holding high power radars disclosed shortcomings that put radar operations at risk. At one unit, there were only four DG sets as against the authorisation of six sets even though operations of radars were fully dependent on generator sets. Of the four sets, three had already far exceeded their total technical life both in terms of hours of use and completed service life. The fourth DG set which was of 1985 origin had got damaged and the unit was managing with a set taken on loan from another unit. The life expired sets are likely to be replaced only after 2-3 years. Overdue replacement of life expired generator sets at the unit is a grave threat for radar operations.

Necessity of effective air conditioning to ensure optimum performance of radar needs no emphasis. In the second unit visited by Audit, the air conditioning system was more than 12 years old and had completed more than 30,000 operation hours as against the specified life of 10 years and 20,000 hours. Unit authorities admitted that existing air conditioning system has become unreliable and uneconomical to maintain.

1.7.1.11 Medium Power Radar

To ascertain quality of performance of MPRs, Audit conducted field visits to six units and obtained information from eight units holding these radars. Audit analysis disclosed significant operational deficiencies, as discussed below:

(i) **Diminished height accuracy of radars**

Poor height accuracy of radars could lead to a totally misleading input to the interceptors. If the height accuracy falls below 60-70 *per cent*, the radar is declared as "Restricted Ops[7]". The radar in three units reported low height accuracy. In one unit, the radar reported average height accuracy between 33 and 57 *per cent* during 2003-06. In another unit, the radar was being operated "Restricted Ops" due to poor height accuracy. Average height accuracy of the radar at the station during 2005-07 was 31.34 and 26.78 *per cent* respectively.

(ii) **Unserviceability of critical sub-systems**

- In two units, Automatic Data Handling System (ADHS), which is the nerve centre of AD operations, was unserviceable causing restricted operations of radars from October-November 2000 onwards. Another unit reported that its existing automatic data handling system had completed its designated life of 20 years and was prone to malfunction. Replacement of these unserviceable systems was planned only on supply of COTS ADHS[8], which was expected only in 2008-09 as per contract agreement concluded. Till such time, operation of radars in these units would continue to remain restricted.
- Monitoring console fitted in the receiver cabin of a radar unit to facilitate online monitoring of performance of radars. In two units the monitoring consoles had been unserviceable since 1998 and 2002 respectively. Further due to unserviceability of the console of the Semi Automatic Data Handling System (SADHS), most of the prescribed checks could not be carried out and visualized. The replacement of this console was not proposed as procurement of new medium power radars was in process. As these new radars would take up to five years to materialise, existing radars in these units would remain without monitoring consoles and would operate with restrictions.
- In one unit, the antenna receiver system of the radar installed was damaged due to fire in the year 2000. Keeping in view the importance of the unit, the antenna receiver system of a radar installed at another unit was transferred to the unit. The radar at the lending unit thus remained non-operational during the period 2002-05.

[7] Operation
[8] COTS ADHS = Commercially Off The Shelf Automatic Data Handling System

(iii) Sub-optimal functioning due to ageing and poor spares support

Four units reported frequent restricted operations and breakdowns due to obsolescence, ageing and non-availability of test equipment and spares. In another unit, performance of the radar unit was adversely impacted on account of limitations of system memory and its capability to handle real time data.

(iv) High occurrence of non-operational status

In one unit, Audit noticed that the radar was non-operational on 175 occasions during the last three years (April 2004 to March 2007). The unit attributed frequent breakdowns to (a) the radar operating beyond its life of 50000 hours without overhaul, and (b) the delay in replacement of aged generator sets causing frequent tripping.

(v) Loss due to defective maintenance practice

In one unit, a fire erupted in the Diode Plate Assembly in the Transmitter Cabin of its radar in August, 2003. It was found that the fire was caused by failure and overheating of a locally repaired component. As a result of the fire, the radar became non-operational.

Audit scrutiny revealed that the need for using a locally repaired component arose because there was no spare in stock since December 1999. Failure on the part of unit authorities in raising timely demand for spares for maintaining the maximum and minimum establishment of components ultimately resulted in a loss of Rs 3.26 crore. Ministry stated in November 2005 that the amount of loss involved due to fire was Rs 87.45 lakh as only transmitter cabin was written off. Ministry's reply is not acceptable as the entire radar was withdrawn from service and became operationally unavailable.

Hence, MPRs installed in various units were found to be performing sub-optimally with low precision and frequent break-downs due to ageing and poor maintenance.

1.7.1.12 Low Level Transportable Radar

Advancement in radar detection and identification capability has compelled strike aircraft to operate at extremely low altitudes. This prompted plans for the induction of indigenously manufactured low looking radars capable of detecting low flying aircraft and providing early warning to the controlling Air Defence Detection Centre (ADDC). The performance of the indigenously

developed radar was not only unsatisfactory in terms of detection range; they also failed to work in a network mode as discussed at paragraph 1.7.1.8 above. Due to slippages in the radar development project, the IAF on one hand had to import 16 radars at a total cost of Rs 211.80 crore between 1985 and 1990, on the other hand, it had to face serious shortages of this radar necessary for maintaining a credible low level AD system.

Auxiliary Systems

1.7.1. 13 Outdated Data Handling Systems

Data Handling Systems have a crucial role in Air Defence as they receive radar data and present these in the form required by the operations staff of the radar unit. The importance of ADHS has increased several fold with the advent of supersonic aircraft and sophisticated Surface to Air Ground Weapons (SAGWs). Automation of these systems has been attempted for a long time but only with limited success. Development of various indigenous systems such as Semi Automatic Data Handling System (SADHS) and Automatic Data Handling System (ADHS) was attempted in 1970s and 1980s respectively. However, these systems do not have the capability for full spectrum, real time, automatic analysis and representation of tracts, which is critical for timely decision-making and for destroying threats. These also have a number of limitations on account of using outdated and obsolete hardware. Three Futuristic Automatic Data Handling Systems (FADHS) meant to replace SADHS, though contracted for in March 1994 at a total cost of Rs 14.80 crore, were commissioned only in July 2002, April 2004 and February 2005 respectively. These have not performed satisfactorily even after their upgradation forcing IAF to dilute their Operational Requirements (ORs). As a result, IAF holds outdated ADHS and sub-optimal FADHS.

1.7.1.14 Old and unreliable Diesel Generating (DG) sets and Air Conditioning Systems

To ensure uninterrupted supply of electricity, operation of all the radars remain fully dependent on DG sets. Total technical life[9] (TTL) of DG sets is 20 years or 48,000 operation hours whichever is earlier. Air conditioning is critical for proper functioning of radars, communication equipment and the operation complex. The TTL of air conditioners is specified as 10 years or 20,000 hours whichever is earlier.

[9] TTL= Expected year of service life

Audit however noticed that out of 26 Signal Units, 10 units held DG sets and 20 units held air conditioning systems whose actual life had exceeded their total technical life. The extent of life expired sets/air conditioners in use in HPR and MPR units was as high as 28 *per cent* in case of DG sets and 52 *per cent* in case of air conditioners .

Air HQ have deferred replacement of life expired DG sets and air conditioning systems with regard to units holding MPRs on the ground that these could be replaced along with the radars as procurement of new radars was in process. New radars are, however, expected only around 2011-12 till which time several radars would be working with obsolete auxiliary systems.

1.7.1.15 Delayed procurement of Mobile Operation Cabins for Radars

All mobile radars are used as Limited Ground Control Interception (LGCI) stations from forward locations for maximum possible defence in depth. These radars were inducted in IAF between 1985-2006. From inception, these units have not been provided with separate cabins to carry out operational functions. These units were neither scaled nor established for mobile operation cabins. A standard Mobile Operation Cabin is an inescapable operational necessity for round the clock Air Defence operations. However, Air HQ proposed the procurement of vehicle mounted Operational cabins with accessories like air conditioners, computers and furniture etc only in 2004. After obtaining necessary approvals, a contract for supply of 58 cabins was concluded with BEL in December 2006 at a total cost of Rs 43.75 crore with a PDC[10] of December 2009.

Thus, all the mobile radars functioning as LGCI are yet to be provided with Mobile Operation Cabins, which is an inescapable operational necessity. The radars are therefore, working with limitations.

Recommendations

- *Planning for acquisitions and deployment of AD radars may be done well in advance, both in the medium and the long term, with due government approval to effectively meet the requirements of IAF.*

[10] Probable date of completion

- *Acquisition of MPRs/ LLTRs and completion of development projects may be expedited so that gaps in provision of AD assets can be avoided.*
- *Utilisation of radars in terms of watch hours may be enhanced through timely replacements, upgradations and efficient product support.*

1.7.2 Upgradation and modernisation of radars and associated equipment

1.7.2.1 Upgradation of HPR

HPRs 'A' despite their age have, with periodic modifications, remained the back bone of ADGES. Though these radars undergo repair and maintenance periodically by way of Inspection and Repairs as Necessary (IRAN) and overhauls, these routines do not cater to obsolescence. Air HQ submitted a proposal to the Ministry in 1996-97 for upgradation of three radars 'A' at a cost of Rs 48 crore. The proposal for upgradation was extended in February-March 1999 to cover all the radars in the inventory of IAF, and the quote of M/s Bharat Electronics Ltd. (BEL) of Rs 143.18 crore which was valid up to March 2000 was accepted by the Ministry in principle in December 1999. However, the contract with BEL could not be finalized by March 2000 and the case remained in process till March 2002. Meanwhile, BEL submitted an escalated offer of Rs 157.51 crore valid upto April 2002. During price negotiations, BEL offered a reduction of Rs 2 crore and an item costing Rs 12.62 crore was deleted. The file wherein approval of the Ministry was obtained for conclusion of contract after deletion of the item could not be produced to Audit as it was stated to have been misplaced. As such, the operational impact of the deletion on the upgrade could not be verified during audit. Finally, a contract was concluded with BEL in July 2002 at a cost of Rs 142.89 crore. The upgradation work of the radar has since been completed in March 2007 on all the radars within the schedule time.

Audit scrutiny showed that critical upgrades were finalised more than five years after these had been proposed. Further, substantial reduction in the scope of the project was effected merely to stay within costs agreed two years ago. Delay on the part of the Ministry/Air HQ in awarding contract within the bid validity period resulted in extra avoidable expenditure of Rs 12.33 crore.

1.7.2.2 Replacement of MPR

The IAF is presently holding only 65 *per cent* of its authorized holding of Medium Power Radars (January 2008). These radars have a total technical life

of 20 years. Based on their technical life, nine of these radars would be phased out by 2008 and six by 2015. To meet the deficiency of these radars and enable replacement of life expired radars, IAF proposed procurement of 23 MPRs in June 2002 at an estimated cost of Rs 2300 crore. Acceptance of necessity was accorded by CFA in January 2004. The RFP was floated in August 2004. Although contract negotiations were concluded in 2006, the contract was yet to be finalized as of September 2007. The files relating to the acquisition could not be produced to Audit as these were stated to be under examination by the CVC[11]. During the Exit Conference, Air HQ informed that the contract has since been finalized in October 2007 and the radars would be operational within next five years. Thus, there have been delays at each stage of the procurement process, which are bound to impact the replacement schedule of radars adversely. Further, IAF will continue to operate with substantial shortages of critical radars which may compromise the adequate surveillance requirements.

Ministry also approved a development project of MPRs by Defence Research and Development Organisation (DRDO) in January 2004. Audit scrutiny revealed that the proposed development and production of MPR would be expensive, likely to take upwards of six years to materialize and would barely be indigenous. DRDO's proposal is based on procurement of the antenna sub-system assembly from a foreign firm on a single vendor basis. The cost of these sub-assemblies proposed to be acquired by DRDO exceeded the cost of the buy version of the MPR by almost Rs 10 crore per unit. The projected budgetary estimate for one Design and Engineering (D&E) model of MPR was approximately Rs 120 crore as compared to Rs 52.2 crore under buy option. Further, DRDO would be sourcing 70 *per cent* of the components from foreign vendors and would be undertaking only integration and software development to suit user requirements. Besides, DRDO's foreign partner was a bidder for the "Buy" phase of the MPR and the contract for the same was still in process.

Besides compelling IAF to stretch the life of existing radars through major overhaul and IRAN servicing, delay in induction of new MPRs will leave IAF with only 26 *per cent* non-life-expired MPRs after April 2008 for providing Air Defence. Further, acceptance of current proposal of DRDO for developing radar with sub-assemblies sourced from the foreign firm would result in procurement of a more expensive radar with little indigenous content and need to maintain two different types of radars.

[11] Central Vigilance Commission

1.7.2.3 Replacement of outdated communication media

IAF is still dependent on obsolete analog technology in its communication media due to its failure to procure new reliable digital technology even after nine years as discussed below:

In order to provide communication facilities to Mobile Air Defence elements, IAF had inducted 26 Mobile Tropo Terminals (MTTs) between 1980 and 1988. These MTTs are based on 1970's analog technology and have become unreliable over a period of time because of extensive use. Product support for these obsolete MTTs is also not available because of non-availability of spares from the OEM. Thus, maintenance and operation of these terminals has become very difficult.

A case for replacement of existing 26 MTTs with 55 new reliable and cheap Digital Mobile Relays (DMR) was initiated in 1998-99. The case was approved by Air HQ in December 1999 and sent to the Ministry which accepted the necessity in May 2000 for procurement of 55 units of DMR at a cost of Rs 22 crore. In response to the RFP floated, offers were received from various vendors in January 2003. Proposals of two bidders were cleared and field trials carried out in December 2003. After field trials it was decided to cancel the RFP in September 2004 and issue a fresh RFP. However, due to cost escalation in the intervening period, approval in principle for the acquisition was now taken at a total estimated cost of Rs 110 core in October 2005. Till February 2006 only Approval of Necessity had been accorded.
In the interim period, DRDO demonstrated a Mobile Communication Terminal (MCT) developed by it and manufactured by BEL. This was found to be suitable for meeting the requirements for DMRs of the IAF. Accordingly, the project was re-categorised by Defence Acquisition Council as "Make". RFP for 55 DMRs was issued to M/s BEL in January 2007. M/s BEL have submitted a proposal for DMR on which a final decision was yet to be taken as of March 2007.

Thus, lackadaisical approach and absence of a clear and coordinated strategy have caused prolonged delays in acquiring equipment needed to replace outdated MTTs. This has resulted in continued use of unreliable outdated analog communication media having a direct bearing on Air Defence operations and depriving IAF of recurring saving of Rs 1.70 crore

(approximately) per year at 1999 level by way of 50 *per cent* saving in officer cadre and 33 *per cent* in airmen trades.

On the other hand, digital media are being extensively used in the telecommunication sector in the country and analog systems have long been replaced. Such serious delays in replacing analog systems in the defence sector highlight inefficiencies and lack of planning in timely modernization of Armed Forces.

1.7.2.4 **Establishment of automated Integrated Air Defence network has been delayed**

IAF inventory of AD radars is a combination of several types and makes of radars. Command and control of air defence operations is exercised manually from Air Defence Direction Centres. All these radars presently operate independently and are not integrated. This imposes severe restrictions on operational capabilities of the AD system. In view of this, the need for automating Air Defence functions through an Integrated Air Command and Control System (IACCS) has been felt since 1997. The IAF projected a requirement of five IACCS in December 1998 for being deployed within the shortest time to meet the emerging threats. The Government, while acknowledging the need, formally accorded approval for acceptance of necessity in August 1999. Audit examination disclosed that the automation of Air Defence functions through IACCS, which was to be deployed within the shortest possible time, had still not been achieved even as of 2007 as discussed below:

An amount of Rs 585 crore was budgeted in the 10th plan for the procurement of IACCS. However, even after initiating procurement action in 2001, acquisition was put on hold in February 2002 due to mismatch between receipt of various ground based and airborne sensors, and the projected delivery time lines for the IACCS. In 2002, it was decided to develop the system indigenously for which a project was approved at a cost of Rs 325 crore in 2004. The project which commenced in October 2004 is being progressed for completion in four phases by 2008. Thus, a critical requirement that was projected in 1997 would take over a decade to materialise.

Recommendations

- *Ministry may ensure that all up gradation programme of AD system are taken up without delay to avoid cost escalation and to maintain operational efficiency at all times.*
- *Replacement of old and outdated radars and associated equipment may be carried out in time with a view to ensure that AD system is always current and effective.*
- *Since IAF is predominantly reliant on BEL for product support and major repairs and overhauls, a standing formal agreement between IAF and BEL may be negotiated so that time consuming procedures involved in taking a case by case approach is avoided.*
- *DRDO may ensure that the radars developed by it are competitive in global market in terms of price and quality.*

1.7.3 Repair and maintenance of ADGES radars

Repair and maintenance of ground based AD radars is a critical function on account of the need to keep radars and associated equipment in serviceable condition at all times. The criticality of this function gets further emphasised considering the advanced age and condition of almost all the radars in the inventory of IAF. Besides, radars and communication systems are in any case sophisticated electronic equipment prone to defects if mishandled or exposed to adverse operating environment. Significant audit findings arising out of examination of repair and maintenance facilities are presented below.

1.7.3.1 No standing arrangement for repair and maintenance with BEL

BEL's Ghaziabad unit was primarily set up to undertake manufacture of ADGES radars. BEL is thus the OEM of all the radars deployed under ADGES. Though BRD 'X' and BRD 'Y' have been designated as repair depots for transmitter and receiver systems respectively, they have not been provided with full fledged repair and maintenance facilities for all rotables of these radars. IAF is thus primarily dependent on BEL for comprehensive repair of all rotables of the radars. In addition, BEL is the sole source of all rotables and spares required for ADGES radars. BEL is also tasked by the BRDs to undertake repair jobs at site that are beyond the expertise of the IAF units and BRDs. Despite this overwhelming dependence on BEL, the Ministry

has not formulated any formal standing arrangement, either by way of a contract or a MOU, with BEL to ensure that repair tasks and supplies are undertaken seamlessly and without delay and payments are made using agreed pricing formulations and agreed standardised price lists for spares. In the absence of such an arrangement, lengthy and time consuming procurement procedures need to be gone through for each repair job and supply order leading to delays.

1.7.3.2 Setting up of depot level repair facilities for radar 'E'

M/s BEL submitted a proposal in April 2000 for setting up of depot level repair facilities for five systems[12] covering 294 out of a total of 332 lines of spares of radars 'E' at BRD 'X' and BRD 'Y' at a cost of Rs 14.75 crore. The contract was finally signed in February 2005 at a total cost of Rs 11.70 crore for only two systems (High Power Test Jigs and Functional Test Stations). Audit examination revealed the following deficiencies:

(i) There were considerable delays in setting up of depot level repair facilities. The proposal was approved by the Ministry in April 2001 subject to price negotiations with BEL and availability of funds. Negotiations between IAF and BEL stretching over three years were concluded in May 2004. The contract was finally signed nine months later in February 2005 with PDC of 24 months.

(ii) While installing and commissioning of repair facilities at 'X' BRD was completed in March 2007, those installed at 'Y' BRD in May 2007 may not be commissioned fully for another 15 months pending development of the ATE software for which order had not been placed as of August 2007. It was observed in audit that this software had been excluded from BEL's scope of work in the contract awarded in February 2005.

(iii) While the delay in commissioning of the repair facilities resulted in expenditure of approximately Rs 9 crore on off-loading of rotables for repair by BEL, exclusion of Hydraulic Test Facility quoted at Rs 85.16 lakh in BEL's offer compelled IAF to conclude an AMC with a private firm at a cost of Rs 87.44 lakh per year.

(iv) For the remaining 38 lines, BEL recommended factory repairs on the ground that design documents were not available with BEL, which appears to be tenuous given that the system was designed by a DRDO lab.

[12] High Power Test Jigs ATE Software and Test fixture, Test Jigs for Repair of PCBs, Functional Test Station and Test facility for Hydraulic System.

Thus, setting up of depot level repair facilities for radar 'E' has been considerably delayed. Repair facilities established/ proposed to be established do not cover three of the five systems of these radars, in the absence of which IAF would continue to be dependent on BEL for their repair.

Air HQ attributed the delays in concluding the contract to the failure of BEL to submit cost break-up details. This was not tenable as Air HQ had itself taken four years to seek these details. The proposal was submitted by BEL in April 2000 but Air HQ sought detailed break-down of the sub-systems only in July 2004.

1.7.3.3 Non-calibration of Digital Test Equipment

The performance and accuracy of main radar equipment depends upon the accuracy of test equipment. BRDs are responsible for calibration and repair of test equipment. They are required to ensure that test equipment received from operational units are promptly returned after carrying out the necessary calibration and repairs. As per prescribed routines, the calibration of test equipment is required to be tested once each year.

Audit examination disclosed that 73 Digital Test Equipment were held by ADGES Radar/Signal units procured at a cost of Rs 3.52 crore between 1995 and 2001. However, in the absence of any designated BRD and calibration plan for Digital Test Equipment, these equipment remained uncalibrated till December 2006, when 66 were got calibrated by M/s. Electronic Regional Test Laboratory Calcutta at a cost of Rs 13.21 lakh. BRD 'Y' has since been designated for this role and a calibration plan has been finalised in January 2007. Using uncalibrated test equipment may compromise the reliability and accuracy of the main radar equipment.

1.7.3.4 Plan to enhance repair capabilities of Signal Units was mishandled

A study team was constituted by Air HQ in 1999 to look into all aspects related to repairs of radar components at units. In its report, the study team recommended *inter- alia* the following:

- To reduce downtime, additional float of frequently failing Panel Control Boards (PCBs) and rotables should be provided to the units.
- Field units should be provided with certain tools and test equipment for undertaking permitted repair tasks.

Accordingly, procurement of 138 lines of spares at a cost of Rs 36.78 crore was approved in October 2001. These spares were supplied to BRD 'X' and

BRD 'Y' during 2002-03. Air HQ informed audit in March 2004 that it had been confirmed by the BRD 'Y' that all these items had been issued to concerned radar units.

Audit examination of relevant records revealed that the procured spares were not issued immediately to the Signal units for maintaining the required float as discussed below:

- Spares costing Rs 25.97 crore received by BRD 'Y' were merged with their normal stock and were being issued to the Signal Units only against demands. It was seen that BRD 'Y' was holding spares relating to 42 lines worth Rs 5.80 crore as of October 2006. This defeated the purpose for which the procurement of spares was approved by the Ministry.
- BRD 'X' also received 33 lines of spares valued at Rs 10.81 crore during 2002-03. However, 11 lines costing Rs 6.44 crore were not issued to the Signal units. Most of the other items were issued to the Signal units during 2004-05 and 2005-06 *i.e.* 2 to 3 years after their receipt.

As a consequence of the above, the overall objective of the entire exercise, which was to reduce down-time of ADGES radars and improve their serviceability by providing additional floats of PCBs/ rotables and by creating capabilities in field units could not be achieved.

1.7.3.5 Delay in 'O' and 'I' level servicing at operating units

The 'O' and 'I' level[13] servicing of radars is carried out in operating units. The stipulated downtime for carrying out servicing of HPRs and MPRs is 48 days per year, which converts into 384 hours. Test check in 18 units revealed that the time taken for servicing of radars far exceeded the prescribed norm as shown below:

Year	No. of radars serviced within stipulated downtime	No. of radars serviced in more than stipulated downtime		
	Upto 384 Hours	384 to 800 Hours	800 to 1600 Hours	More than 1600 Hours
2005-06	NIL	02	16	-
2006-07	NIL	05	10	03

Excess time taken in servicing reduces radar availability and also reflects the adverse effect of ageing of both HPRs and MPRs.

[13] 'O' and 'I' level= Routine servicing at prescribed intervals and minor repair at unit level

1.7.3.6 Delay in IRAN Servicing

Repairs on need basis are carried out for radars 'B' using the Inspection and Repairs as Necessary (IRAN) concept of servicing. IRAN servicing routine takes 12 weeks to complete. IRAN servicing is required to be taken after 50000 hours of antenna rotation. There was inordinate delay in taking up and completing IRAN servicing for the first three radars 'B' as indicated below:

Unit	Inspection date	Placement of supply orders for spares	Date of completion of IRAN servicing	Rotation hours completed at commencement of IRAN servicing	Reasons for delay
M	April 1999	Dec. 2000	Nov. 2004	63849	Mainly due to supply of spares
N	March 1999	Dec. 2000	June 2003	66106	
O	February 2004	March 2005	August 2006	65000	

IRAN servicing for the remaining five radars 'B' was planned for completion between November 2006 and October 2008. Air HQ, therefore, instructed HQMC, BRD 'X' and BRD 'Y' in July 2006 for carrying out a special review for five sets of spares in order to be able to undertake and complete the above IRAN servicing. No supply orders for spares for IRAN servicing of these five radars have been placed so far (June 2007). As such no lessons were drawn from IRAN servicing experience of the first three radars wherein considerable delay had taken place in completing IRAN servicing and an important cause of delay was the time taken in procuring spares needed for servicing. The repair agency admitted that delay in undertaking IRAN servicing of radars 'B' may adversely affect operational availability, reliability and the performance of the radars.

1.7.3.7 Delays in taking up major overhauls

Major overhaul of radars 'C' is required to be carried out after completion of 35000 hours of antenna rotation. In August 2004, the periodicity of overhaul was increased to 50000 hours of antenna rotation. Out of the six radars, two radars had by April-May 2007 completed 68544 and 57505 hours respectively. However, no major overhaul of these radars has been carried out so far. A contract for major overhaul of these radars was signed with M/s. BEL only in May 2007 at a total cost of Rs17 crore. As per the terms of the contract, overhaul would be completed only by August 2008. Due to delay in overhaul, repair tasks became necessary in 2005-06 on these radars, outside the scope of

the major overhaul. Delay in conducting major overhaul of these radars may have adverse impact on their overall operational availability.

1.7.3.8 Periodical Reviews (PRs) for assessment of requirement for spares

Provisioning is a key to procurement and to ensure availability of appropriate stores and material at required level. Provisioning involves comparing the holding of an item of equipment/spare with the anticipated requirement during a specified period to determine exact procurement quantity. Audit scrutiny of documents in a repair depot showed that:

- Against the requirement of 982 lines of spares projected in 12 Periodical Reviews (PRs) carried out in 2002-03 for the period covering 2003-07, two supply orders for 76 lines only were placed in March 2005 and May 2005 with probable date of completion (PDC) of December 2007 of which 27 and 34 lines materialised fully in 2005-06 and 2006-07 respectively.
- No supply orders were placed against the PRs carried out between 2003-04 and 2006-07.
- Five supply orders placed for 17 lines of spares in 2005-07 were based on Special Reviews (SRs) to clear AOG[14] demands of the units.
- The main reason for poor rate of conversion of PRs into supply orders was stated to be delay in vetting of PRs by HQ Maintenance Command.

The BRD stated that in view of the poor rate of conversion of PRs into supply orders, critical requirements were being met through local purchases. Requirement of units were met by repairing Cat 'D' items, cannibalization and by granting life extension.

Due to PRs not being converted into supply orders, AOG demands were also being catered through local purchase orders. Details of such orders placed against AOG demands during the year 2003-04 to 2006-07 and their supply position as of August 2007 were as follows:

[14] Demands which should be met without any delay

(Rs in lakh)

Year	Supply orders placed	Total No. of lines	No. of lines materialised	Expenditure on local purchase
2003-04	13	63	63	28.466
2004-05	24	95	95	85.990
2005-06	63	179	157	177.990
2006-07	57	105	89	115.9333

In another repair depot, all PRs were stated to have been converted into supply orders and supplies materialised fully. Sixteen Special Reviews (SRs) were also carried out during 2002-07 for 97 lines and an expenditure of Rs 2.33 crore was incurred on procurement of 345 lines to clear AOG and PHU[15] demands. Large number of SRs and emergent purchases indicate persistence of weak provisioning practices despite the depot's claim of having raised and realised requirements through PRs.

1.7.3.9 Delay in meeting AOG demands

AOG demands for spares are required to be met within 24 hours so that the equipment is repaired and made serviceable at the earliest. AOG demand satisfaction levels relating to the 2004-2007 period for 23 operating units holding HPRs and MPRs were analysed in audit. The audit analysis disclosed substantial delays in meeting AOG demands as shown in the table below:

		AOG Demand Clearance					
Year	Demands Raised	Within 24 Hours	Between 2-15 days	Between 16-30 days	Between 31-180 days	More than 180 days	Demands Pending/ Cancelled
2004-05	1583	12	647	402	389	090	043
2005-06	1728	05	518	573	469	074	089
2006-07	1550	02	351	343	464	070	320
Total	4861	19	1516	1318	1322	234	452

Only 0.4 *per cent* of AOG demands were met within 24 hours and 59 *per cent* of AOG demands could be met within 2 to 30 days whereas 32 *per cent* of the demands took one to six months to be met. Around nine *per cent* of the demands were never met as of March 2007. Inability of repair agencies to meet AOG demands in reasonable time indicates serious deficiencies in

[15] Production Hold Up

provisioning and procurement of spares and rotables leading to generally poor level of product support.

1.7.3.10 Unnecessary procurement of spares

Test checks of procurement actions undertaken by Air HQ revealed instances of unnecessary procurement of spares as discussed below:

a) Air HQ placed a supply order in February 2000 for procurement of spares for MPRs. These spares were received between 2002 and 2003. Scrutiny of tally cards revealed that certain spares costing Rs 2.80 crore were lying in stock since their receipt. On being pointed out by Audit, BRD 'X' stated in June 2007 that these spares were transferred to them by BRD 'Y' and the basis for procurement was not known.

b) Based on a PR for the period 2003-07, Air HQ placed a supply order for 55 lines of spares for a radar in May 2005. One of the items in the supply order was CFA II Tube costing Rs 3.48 crore. This item was procured and kept in stock without the depot being aware of its future use.

c) Based on a PR carried out by BRD 'Z' in October 2004, HQ MC placed an order for supply of three crankshafts at a cost of Rs 51 lakh in February 2005. These were received in October 2005. During scrutiny of the PR, it was noticed that requirement for crankshaft for the period 2005-08 was worked out as five as on 6th October 2004 against which one was held in serviceable condition and supply of one shaft was due(dues-in). The net requirement of three, for which supply order was placed, was against three repairable crankshafts. Though, these crankshafts could be repaired within two months, HQ MC procured three shafts which led to avoidable expenditure of Rs 51 lakh. BRD stated in August 2007 that the requirement was worked out erroneously without considering the three number of Cat 'D' balance.

1.7.3.11 Premature withdrawal of a radar component

As per the logbook for radar 'E', the prescribed life span of Shielded Grid (Modulator) Tube is 10,000 Extra Height Tension (EHT) hours. The cost of one tube is Rs 8 lakh. During performance audit at BRD 'X', it was noticed that 14 tubes were withdrawn prematurely between 287 hours and 1940 hours during June 2002 to April 2007. In response to an audit query regarding replacement of prematurely withdrawn tubes by BEL, BRD 'X' stated in August 2007 that the life of the component has been redefined as 500-1000 hours by BEL without specifying any reason for the same. The BRD also

informed that the reduction in life of this item was one of the most critical issues faced by IAF regarding radar 'E' and no warranty replacements have been done by the supplier so far for the prematurely withdrawn tubes.

1.7.3.12 Indigenisation of ADGES radar spares

Indigenization of spares is critical for reducing reliance on OEM/foreign suppliers. In one repair depot, against an indigenisation task of 166 rotables for the period 2002-07, the depot could indigenise only 90 rotables and could spend only Rs 25.51 lakh out of a budget allotment of Rs 72.50 lakh made for this purpose. Delay in indigenisation would result in continued dependence of IAF on OEM/foreign suppliers for supply of these spares.

Recommendations

- *Since IAF is predominantly reliant on BEL for product support and major repairs and overhauls, a standing formal agreement between IAF and BEL may be negotiated so that time consuming procedures involved in taking a case by case approach is avoided.*
- *Provisioning for spares and rotables should be made more efficient so that spares are available in time; and delays in overhauls, servicing and clearing AOG demands are avoided*

1.7.4 Deployment of manpower

1.7.4.1 Manpower deployment at Signal Units

Audit of records relating to detailing of operational personnel in the radar units, showed that there was a shortage of operational/technical manpower at both the level of officers and airmen as shown below:

Percentage of deficiency of Manpower at Signal Units

Year	Operational		Technical	
	Officers	Airmen	Officers	Airmen
2004-05	31	20	38	17
2005-06	28	20	34	09
2006-07	26	27	27	12

In the case of radars 'E', establishment was approved only in March 2007. Huge deficiency of officers in operational and technical cadres is bound to

have adverse impact on the operation and maintenance of the radars and effectiveness of air defence system.

1.7.4.2 Manpower deployment at BRDs

There was considerable shortage of technical manpower at both the BRDs during the period 2005-07 as indicated below:

BRD	2005-06		2006-07	
	Strength Sanctioned	Posted strength	Strength Sanctioned	Posted strength
BRD 'X'	100	69	100	66
BRD 'Y'	61	35	61	35

BRD 'X' stated in July 2007 that the deficit of manpower was met by putting in extra man hours during non-working hours and holidays. It was, however, difficult to conceive that such large deficiencies could be addressed only through overtime work. Further, continued deployment of limited manpower on overtime work for long durations may affect efficiency and quality of repair work undertaken.

Recommendation

- *Availability of manpower at all Signal Units and repair depots may be improved for smooth operation and maintenance of radar.*

Training Infrastructure for ADGES Radars

Operational training on ADGES radars is imparted at Air Defence College (ADC), Lucknow while training on maintenance of radars is imparted at, TETTRA School at Bangalore. Audit scrutiny was undertaken to assess if training infrastructure was adequate to support operation and maintenance of the ADGES radars and if these were being efficiently utilized. Audit findings are discussed below.

1.7.4.3 Training at Air Defence College

ADC trains officers of various branches and seniority on control and reporting procedure for the conduct of air defence operations. The college was established in 1998 with a capacity to conduct four training courses a year of a combined duration of 46 weeks. As against this, the college has been tasked with conducting nine courses a year aggregating a total of 67 weeks. The increase in number of courses and training weeks was attributed to new

courses; increase in syllabus and duration of theoretical, practical and on the job training. In response to an audit query, ADC stated that going by the AFSEC[16] norms, the college must have a strength of 13 officers as against the strength of nine officers as of date. The combined impact of increase in training tasks and shortage of instructors has put pressure on training resources and diluted the quality of training. Though the number of courses has increased and the aggregate training weeks have gone up, intake per course was less than the prescribed intake as less number of trainees were being detailed by Air HQ. This showed that training manpower and infrastructure was not adequate and was also not being optimally used.

1.7.4.4 **Tettra School (TS)**

(a) **Underutilisation of manpower**

As per policy page, the school is responsible for imparting training on Communication, Data Processing and Technology, Power, Air Conditioning and Radars. The capacity of the school has not been clearly defined in its policy page. The posted strength of instructors, man-hours actually available and consumed by instructors for practical training classes during the period January 2003 to December 2006 were as indicated below:

Year	Practical training hours available	Practical training hours utilized	Percentage of underutilisation
2003	47150	24534	48
2004	48312	43667	10
2005	47467	36470	23
2006	47890	40098	16

It would be seen that there was under utilisation of instructional man-hours for practical training ranging from 10 to 48 *per cent.*

(b) **Delay in installation and commissioning of training model Radar 'E'**

In March 2004, Air HQ placed a supply order on M/s BEL for supply, installation and commissioning of a training model radar 'E' at TS at a cost of Rs 12.18 crore. As no training radar was available with the school, trainees were being detailed to other units for practical classes resulting in loss of

[16] Air Force Standing Establishment Committee

training period. As per the supply order, the training model radar was to be delivered within 24 months from the date of supply order i.e. by March 2006 and installation/commissioning and acceptance checks were to be completed within six months of delivery of the radar. In addition, the work services for installation of training model radar were to be executed by M/s BEL as a deposit work. M/s BEL was to submit a detailed proposal for requirement of the civil works within 90 days from the date of placement of supply order. The detailed proposal was submitted by M/s BEL in October 2004 after a delay of four months. Thereafter, TS took another two years for sanctioning the deposit work. The work had been completed up to plinth level as of May 2007. Though the training model radar was ready for supply in March 2006, it could not be used as of June 2007 due to delay in completion of work services. Thus, the trainees were deprived of practical training of radar "E" at TS despite release of 95 *per cent* payment for the radar to M/s BEL along with the supply order.

(c) Non-availability of dedicated Radars at TETTRA School for training purpose

ADGES Plan 1987-2000 submitted to the Government, proposed expansion of the ADGES Training Institute to cater to various radar and communication systems planned to be inducted. Since induction of additional radars, only for training purposes was not considered feasible, it was proposed to use radar 'A' available at Bangalore for training on HPRs. It was also proposed that one each of radar 'H' and 'B', retained as war reserves, be used for MPR training. As war reserves for MPRs were not procured, no dedicated MPR is available at TS for training purpose. In the absence of dedicated radars, trainees are being deputed to radars operating units for on-the-job training which is eating into their training schedule.

Recommendation

- *Training facilities and infrastructure should be tailored to requirements so that resources are put to optimal use and objectives of training are achieved in a cost effective manner.*

1.7.5 Evaluation of Internal Control Systems

The internal control framework for the ADGES Radar set up broadly consists of rules, financial regulations and procedures generally applicable to the Defence Services and the IAF. These are supplemented by instructions, guidelines, canons, reporting and inspection arrangements formulated

specifically for application in IAF in general and by Radar Units in particular. The policy page promulgated for each unit and the ADGES Plan Directorate is also an important element of the internal control mechanism.

Audit findings given in the preceding paragraphs disclose deficiencies in planning, reporting, non-compliance with instructions regarding provisioning and procurement, and all round delays in undertaking critical acquisitions and jobs. All of these indicate weakness of the internal control system in the Ministry and Air HQ. Other specific instances of internal control weaknesses are discussed below:

- Budgeted estimates and actual expenditure on AD radar units are not visible in the estimates of the IAF. As such, the cost of operations and repair & maintenance of these radars cannot be identified /determined for purposes of cost control.
- Record keeping at repair agencies had loopholes and requirements for the same post IMMOLS[17] had become uncertain. For example at BRD 'X', Audit had sought details of 290 pending AOG demands which could not be provided as the details of AOG as on 31.3.07 could not be extracted by the depot from the front end of the IMMOLS system. Similarly, the depot was unable to provide details of 123 pending job cards in view of non-availability of this information at the front end of IMMOLS. The depot also stated that job cards were being closed at the end of the year and re-issued in the next year as a fresh card. This places a question mark on the reliability of reports of jobs allotted and achieved.
- Several AD radars have become old and obsolete and are often faced with the problem of non-availability of various spares and even expertise. Monitoring of an operational system should thus provide both the commanders and planners accurate information about the actual capability and performance of the system. Any degradation of the operational capability of a radar must get reflected in the calculation of serviceability of a radar system to present a true and realistic picture. However, no reporting procedure has been devised to ensure that this happens. Consequently, reports and returns furnished provided a more optimistic picture of serviceability of existing radars than what actually existed on the ground.
- Two units held old and non-moving inventory valued at Rs 8.07 crore since 2002-03. This besides imposing avoidable inventory costs, reflects weakness in inventory control and management.

[17] Integrated Material Management Online System

Recommendation

- *Internal control system should be scrupulously followed to ensure that systemic deficiencies in planning, reporting, processing etc. be avoided.*

1.8 Conclusion

ADGES radars are the backbone of the country's AD infrastructure. However, shortfall in availability of radars and supporting systems and the advanced age of available assets raise concerns about the capability of the AD system in handling aerial threats that are acquiring greater sophistication. The Standing Committee on Defence has in several of their reports expressed concern at delays in augmenting AD assets. On account of the age of the assets, the onus of ensuring operational availability of the assets shifts to the efficiency and adequacy of dedicated repair and maintenance facilities for the radars. Audit scrutiny has revealed deficiencies even though by and large repair agencies have undertaken allotted tasks on time and have been successful in keeping aged assets at reasonably high levels of serviceability. However, this has been made possible by low allotment of watch tasks which has ensured that use of assets is not stretched. Augmentation of AD assets both with respect to technology and numbers would thus be imperative for AD systems to effectively counter aerial threats.

The matter was referred to Ministry in September 2007, their reply was awaited as of February 2008.

MINISTRY OF DEFENCE

INDIAN AIR FORCE

TRAINING OF PILOTS

CHAPTER II : Training of Pilots in the Indian Air Force

Training of Pilots in IAF is a complex process right from their recruitment to their ab-initio, intermediate, advanced and operational stage training. The training consists of ground training, flying in simulated conditions and actual flying in basic, sub-sonic and supersonic aircraft. This Performance Audit sought to review the training of pilots in IAF in terms of requisite capability and adequate capacity to meet the required force levels. Some of the salient findings are given below:

Highlights

- IAF has not formulated any long-term training plan for pilots of fighter and other streams for developing an effective training strategy consistent with its long-term strategic objectives, desired force levels and technological changes. The interim training plans for short periods of two years have led to short sighted decisions impacting quality of pilot training.

  (Paragraph 2.9.1.1)

- The number of pilots trained in various streams during 2001-2006 was much lower than planned targets indicating that either the training targets did not take into account constraints or IAF failed to ensure adequate intake of pilot trainees through an effective recruitment strategy.

  (Paragraph 2.9.2.1)

- IAF's requirement of trained pilots will substantially increase during 2008-2018 to meet expansion needs of IAF squadrons, and fill up back log vacancies and also the vacancies arising from high attrition rates in recent years. IAF has not implemented any effective training strategy for meeting the increased intake requirements by addressing problems related to limitations of air space/runway occupancy and other infrastructural constraints.

  (Paragraph 2.9.2.2)

- The number of pilots failing to complete their training successfully was significantly higher than the assessed average wastage rates in 45 per cent of courses. There was also lack of continuity in the transition of a pilot from initial training to intermediate and advanced stages of training in terms of quality, technology and avionics of the trainer aircraft used.

  (Paragraph 2.9.3.1 and 2.9.3.3)

- **Need for improving quality of pilot training was highlighted by the fact that 42 *per cent* of 276 aircraft accidents reported during 1995-2005, were attributed to human errors.**

(Paragraph 2.9.3.5)

- **IAF lacks adequate number of state-of-the-art aircraft for imparting pilot training. HPT-32 aircraft used for Stage I training is technologically outdated and beset by flight safety hazards. In spite of the loss of 11 pilots and 15 aircraft, it continues to be used today. Further, HPT-32 does not aid in smooth transition of trainees to the next stage of training.**

(Paragraph 2.9.4.1(i), 2.9.4.1(ii) and 2.9.4.1(iii))

- **Limited availability of Kiran fleet has resulted in important training like tactical training and low level navigation being denied to cadets of various streams before trifurcation. This constraint has also resulted in insufficient inputs to the trifurcation board for assessing suitability of trainees for fighter, helicopter and transport streams.**

(Paragraph 2.9.2.4)

- **Intermediate Jet Trainer (IJT) for Stage II training will not be available in the near future. Delay in timely completion of development and induction of IJT would adversely affect the training of pilots and over-exploitation of Kiran fleet.**

(Paragraph 2.9.4.1(vi))

- **IAF took almost 25 years to induct the Advanced Jet Trainer (AJT) which is critically required for smooth transition from the basic trainer to a high technology aircraft. This was in spite of several recommendations and direct linkage of accidents to the absence of an AJT.**

(Paragraph 2.9.4.1(iv))

- **Training to helicopter pilots continues to be imparted in Chetak helicopters inducted in late sixties, depriving the pilots of training in the latest avionics and flight control systems.**

(Paragraph 2.9.4.1(vii))

- **IAF failed to procure/upgrade simulators for trainer aircraft for more than a decade thus depriving the trainees of a safe and non-**

hazardous means of learning to fly these aircraft in a cost effective manner.

(Paragraph 2.9.4.2(i) and 2.9.4.2(iii))

- **There was delay of more than a decade in finalisation and acquisition of land for establishment of weapon training range for two Flying Training Establishments. In the absence of the training range, the cadets have to travel to other locations for range training incurring avoidable expenditure of Rs 5.77 crore per year.**

(Paragraph 2.9.5.2)

Summary of Recommendations

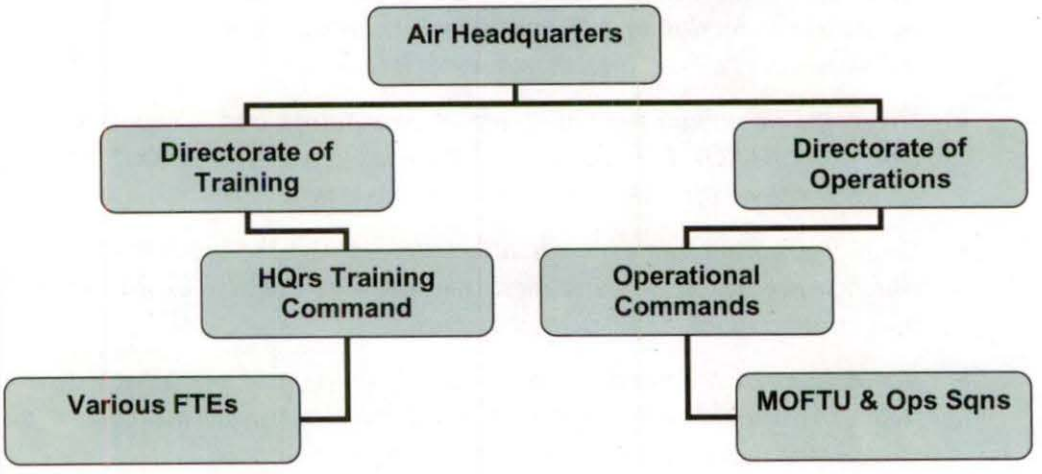
- *A Long Term Training Plan may be formulated in order that training aims are more focused and training needs are addressed more efficiently. This will involve a more thorough consideration of critical inputs like induction of AJT, ensuring availability of necessary training infrastructure, addressing shortages in intake etc.*
- *Given the important potential role of Navigators and Weapon System Operators (WSO), IAF may consider having a well-formulated training policy for them after defining their role more precisely.*
- *Stage I training requires an alternate state-of-the-art basic trainer which will not only improve quality of training but also enable smooth transition to more sophisticated aircraft.*
- *Acquisition of IJT needs to be hastened in view of the ageing Kiran fleet. IAF should ensure optimum availability of trainer aircraft for all stages of training appropriate to their operational needs.*
- *Given the importance of simulators in flying training, IAF should ensure timely induction, repair and upgradation of simulators in Flying Training Establishment and Operational Squadrons through better planning, correct assessment of requirements and effective coordination with DRDO and other designated production agencies so as to provide quality training to pilots in a cost effective manner.*
- *IAF should place demands for spares within a prescribed time-frame to stop cannibalization and avoid Aircraft on Ground (AOG).*
- *Decision making authorities in both IAF and MOD should ensure that there are no unnecessary delays in procurement of important training aids.*

2.1 Introduction

The Indian Air Force (IAF) requires pilots to fly its diverse range of aircraft, from fighter planes to transport aircraft and helicopters. Thus comprehensive professional training becomes especially crucial for providing young recruits with the expertise required for handling specialized equipment and aircraft, and also for constantly upgrading the skills of the existing pilots. Training new pilots is a complex process involving selection of trainees, theoretical training courses, initial practical training in simulators and 'live' aircraft and operational training specific to the stream in which a pilot is commissioned. This report focuses on various stages of pilot training from initial stages to the transfer of pilots to their operational stream.

2.2 Organisational Chart

The organisational structure of the establishment in IAF responsible for imparting pilot training is given below:



FTEs – Flying Training Establishments
MOFTU – MiG Operational Flying Training Unit
Ops Sqns – Operational Squadrons

2.3 Training Pattern

Training in IAF is imparted for pilots, navigators, qualified flying instructors (QFIs) and weapon system operators (WSOs). To meet the operational tasks of flying in the IAF, training of pilots is carried out at Flying Training Establishments (FTEs) coming under Headquarters Training Command (HQTC) as well as at operational commands. Details of training imparted are given in Appendix 1.

Different aspects of pilot training are covered in a span of four stages. These are as under:

- Stage I- Combined initial training for all pilots. This is followed by
  - trifurcation of pilots into Fighter stream, Helicopter stream and Transport stream.
  - direct entry cadets who were suspended during Stage I training are given an option to continue as navigators / WSOs, if found fit.
- Stage II- Intermediate Level training: This is followed by
  - commissioning as a pilot in IAF.
- Stages III and IV- Applied and advanced training: These involve training on specific stream / operational aircraft.

Stage I, II and III trainings are conducted at various FTEs and Stage IV training, which is specific to fighter stream, is carried out at MiG Operational Flying Training Units (MOFTUs).

The majority of pilot trainees come from the National Defence Academy (NDA) where elementary flying training is imparted in the last semester. Cadets who are not from NDA are given a six months Pre-Flying Training Course (PFTC) at Air Force Academy (AFA), Dundigal before they join the NDA cadets for flying training. Women pilots are trained and tested to the same standards, but are commissioned into the transport and helicopter streams only.

2.4 Scope of Audit

Performance audit was conducted during April to October 2007 and covered the three stages of training viz. Stage I (Basic), Stage II (Intermediate) and Stage III (Applied) imparted by the FTEs under the control of HQTC during the period 2001 and 2006. Stage IV (Advanced) and Operational Training (in selected Operational Squadrons) being imparted by the wings under the control of Directorate of Operation and concerned Command Headquarters were also studied. The main activities covered were:

- Planning of training activities.
- Training requirements and their fulfillment.
- Management of training resources.
- Acquisition of training aids, equipment and aircraft.

- Management, utilization, repair and maintenance of training aids and aircraft.
- Modernisation and upgradation of training facilities, aids and aircraft.

2.5 Audit Objectives

The performance audit has been conducted with the aim :

(i) to assess whether IAF is equipped with the requisite capability and adequate capacity to train pilots to meet the requirements of envisaged force levels,

(ii) to assess the economy and efficiency of utilisation of training infrastructure covering training establishments, personnel, training aids and aircraft as also financial resources, and

(iii) to evaluate whether adequate initiative for upgradation and modernization of training assets had been taken and implemented.

2.6 Audit Criteria

The following audit criteria were used to evaluate the performance:

- Existing and planned force levels of operational squadrons in terms of IAF's overall strategic plans.
- Standard trainee-trainer ratios.
- Flying tasks fixed by Air Headquarters (Air HQ)/Ministry of Defence (MOD).
- Annual acquisition plans for training assets/projects.
- Serviceability norms and usage rates prescribed by IAF/Original Equipment Manufacturer (OEM)/service providers.
- Recommendations of study groups and experts as well as projections made by users.
- Norms and schedules for repair and maintenance of aircraft.
- Tolerance rates for wastage and attrition.

2.7 Audit Methodology

An Entry Conference was held at Air HQ on 20 April 2007. During the conference, the audit scope, objectives, and criteria were discussed with IAF

and Ministry officials. Audit evidence was gathered through examination of records related to training activities, issue of questionnaires to Air HQ, HQTC, all FTEs, wings imparting Stage IV training and selected operational squadrons, and discussions with the management. Audit evidence was compared and analysed with the benchmarks/ criteria to make an objective assessment of performance. Exit Conference with IAF and Ministry officials was held on 7 December 2007.

2.8 Acknowledgement

We acknowledge the cooperation extended by Directorate of Training, and Directorate of Ops[18] at Air HQ, HQTC and various FTEs and Ops units in providing willing assistance in the conduct of the performance audit. Audit also acknowledges the cooperation and support extended by Liaison Officers at various FTEs and Ops units.

2.9 Audit Findings

Audit findings are classified under the following heads (1) Planning, (2) Training requirements and their fulfillment, (3) Quality of training, (4) Availability of training resources, and (5) Adequacy of training infrastructure.

2.9.1 Planning

Planning is a prerequisite for ensuring that training imparted follows a clear and coordinated strategy and takes into account the current and long-term needs of the IAF. This would ensure comprehensive assessment of training needs, timely provision of funds, induction of critical trainer aircraft and other equipment, optimal utilisation of infrastructure and acquisition of the required skill set by the trainee pilots of fighter, helicopter and transport streams.

2.9.1.1 Absence of a Long Term Training Plan

IAF has not formulated any Long Term Training Plan (LTTP) for its pilots keeping in view its long term strategic objectives, technological changes and developments that have taken place in the global security environment. In a Review conducted on training of pilots (Para 4 of CAG's Report No. 9 of 1992), Audit had expressed concerns over the delay in finalisation of a long-term policy for training. The situation remains unchanged even after fifteen years with Interim Plans being formulated for short periods of two years at a

[18] Operations

time. The absence of long term planning has resulted in decisions that have proved to be shortsighted, and had to be subsequently rolled back. For instance, there have been numerous changes in the location of training specific to a stream. Locations once chosen for ab-initio training[19] have been found unsuitable subsequently and had to be changed at a later date. The types of trainer aircraft to be used at different stages of training have also undergone changes without cogent reasons. To illustrate, a trainer aircraft, namely Kiran Mk IA, found suitable for Stage II training, has been shifted to Stage III since the Stage III trainer has outlived its life. This has also had an impact upon the quality of training imparted at Stage II (see Para 2.9.4.1(ii)).

In August 2007, Air HQ stated that LTTP was not formulated mainly due to shortage/non-availability of trainer aircraft and delay in procurement of Advanced Jet Trainer (AJT), and that the IAF would make an LTTP once the AJT arrives.

The reply is not tenable as IAF ought to have developed and implemented a comprehensive LTTP covering not only the projected needs for trained pilots but also the infrastructure required to be established including acquisition of trainer aircraft so as to achieve the long term strategic goals. Serious delays in acquisition of AJT itself are a manifestation of lack of a comprehensive LTTP in IAF. IAF have not explored alternatives for the defective basic trainer aircraft even after a lapse of two decades. Both the AJT and Interim Jet Trainer (IJT) projects have been running behind schedule. In the absence of a concrete training plan, IAF is unable to take stock of the actual requirement of pilots for the present and future.

Recommendation

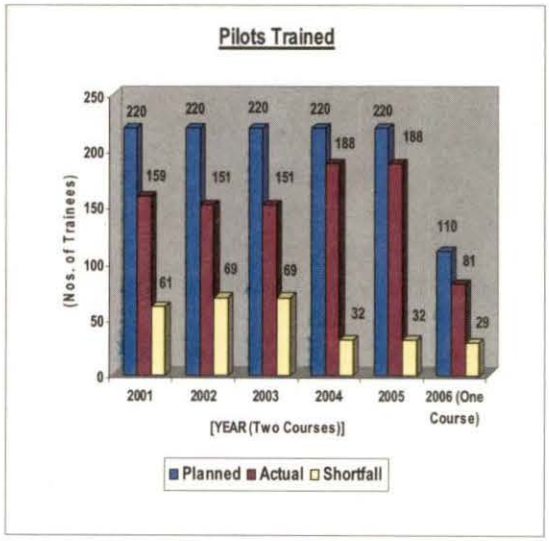
- *A Long Term Training Plan may be formulated in order that training aims are more focused and training needs addressed more efficiently. This will involve a more thorough consideration of critical inputs like induction of AJT, ensuring availability of necessary training infrastructure, addressing shortages in intake etc.*

[19] Ab-initio training covers Stage I, II and III for all the streams.

2.9.2 Training requirements and their fulfillment

2.9.2.1 Shortfalls against planned targets

IAF planned to train 220 pilots per year (in two courses) during 2001-2005 and 110 pilots in 2006 in one course. The position of pilots actually trained and shortfalls is indicated in the chart.



Audit analysis indicated that the number of pilots actually trained was much lower than planned targets. The shortfall in achieving the training targets varied from 15 to 31 *per cent*.

Audit examination disclosed that planned targets were not determined correctly on the basis of present/future requirements. As against 32 existing squadrons and 36 forecasted squadrons (12th Plan)[20], a figure of 39.5 squadrons was used as the basis for calculating requirements for training plans. Further, shortfalls carried over from previous years were not considered whilst arriving at the targeted figure.

Significant shortfalls in achieving the targets indicate that either the training targets were not fixed realistically taking into account constraints or IAF failed to ensure adequate level of intake of pilot trainees through an effective recruitment strategy.

2.9.2.2 Lack of strategy for meeting expansion needs

(a) ***Additional training requirements to fill up backlog vacancies*:** In February 2007, Government allowed filling up of 498 posts of pilots that had remained vacant on account of ban since 1998. This accretion in strength is proposed to be met by phased and increased induction during the period 2007-2011. Average annual suggested intake for this induction plan would be 325 cadets in the year 2008 and 342 cadets from 2009 onwards. However, in April 2007, HQTC indicated that a maximum of 270 trainees per year (including Naval and Indian Coast Guard Officers) could be accommodated due to limitations of air space/ runway occupancy and other difficulties. Similarly, other FTEs, where second and third stage training is being conducted also have their own constraints in catering to the increased load of trainees.

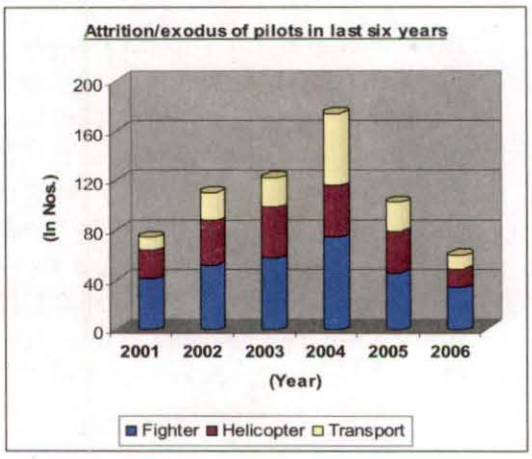
[20] 12th Plan : Year 2013-2014 to the year 2017-2018.

Air HQ stated in August 2007 that steps were being taken to overcome the shortages within the next five years. In Audit's opinion, due to the limitations in training capacities at FTEs, the proposed induction plan, which aims to overcome the shortages in a five year period, would be able to cover the requirements by 2016 only i.e. in an eight year period.

(b) ***Increase in number of squadrons***: In April 2007, the Standing Committee on Defence (2006-07) observed that the squadron level of IAF be raised to 36 at the end of the 12th Plan through the future acquisition of Medium Multi-role Combat Aircraft (MMRCA), Su-30 MKI[21] and Light Combat Aircraft (LCA). Acquisition process for MMRCA has already begun and second phase of supply of Su-30 MKI has already started. IAF is required to prepare for these future acquisitions of aircraft by training pilots capable of flying these aircraft. However, IAF has not formulated any effective strategy to meet the increased training requirement arising from the above expansion and acquisitions.

(c) ***High rate of attrition of Pilots in IAF:*** IAF's Human Resource Management (HRM) policy of 2002 emphasised the need to increase synergy between civil and military aviation so that IAF also becomes a source for providing personnel for aviation related activities in civil sector. Towards this end, the policy provided that any officer at any stage of his service career would be eligible for obtaining a civil flying licence. As a result of this relaxation, IAF witnessed a sudden spate of voluntary retirements in recent years. The HRM policy was finally reviewed in 2005 and it was laid down that officers would become eligible for civil flying licence only after completion of 16 years of service.

Audit observed that during the year 2001 to 2006, 642 pilots comprising of Fighters (305), Helicopter (189) and Transport (148) pilots have left the IAF i.e. on an average 107 pilots have left the services compared to the average intake of 167 pilots. Such high rate of attrition would necessitate high intake of trainees in near future to maintain existing force level. The training establishment of IAF is also to be geared accordingly to handle the increased intake requirements.



[21] Supply to be completed in four phases

The 16th Standing Committee on Defence in its report (2006-07), also expressed its concern at the disturbing trend of IAF pilots leaving the service to join the commercial aviation sector. The Committee in the same report stressed on the need to devise a mechanism by which pilots may not leave the service after training and induction into service.

Audit is of the view that the existing maximum capacity of 270 trainees per year (including Indian Navy and Indian Coast Guard Officers) may not be adequate enough to meet the increased requirement on account of proposed expansion in IAF, new acquisitions, need to fill up existing vacancies after lifting of ban on recruitment and vacancies on account of attrition of pilots. IAF should have developed and implemented a strategy for meeting the above increased intake requirements by addressing problems related to limitations of air space/ runway occupancy and other difficulties.

2.9.2.3 Ill-conceived plan for obtaining Commercial Pilot License

To pursue recommendations made by a Committee of Secretaries in June 2001 on utilization of trained manpower available in Defence Forces, Government decided in December 2001 to implement 'Civil Recognition of Qualifications obtained during Military Service' in conjunction with the Director General of Civil Aviation (DGCA). Training imparted in conformity with Civil Aviation Rules (CARs) as issued by DGCA would ultimately result in issue of Commercial Pilot License (CPL) to military pilots.

In 2002, AFA[22] was selected as the centre to accommodate the requirements of CPL. Further, some changes were made in the syllabus for different stages, and also the training requirements for an aircraft certified for civil airworthiness were indicated. However, doubts were expressed by AFA regarding this proposal and it was stressed that obtaining the CPL should remain an individual pursuit. It was also felt that the pilots who repeatedly failed to achieve the minimum standard in the ground examination or skill tests conducted by DGCA would be demoralized. There were also constraints in conducting the CPL at AFA. Nonetheless, from December 2002 onwards, IAF implemented the CPL courses between December 2002 and June 2005. Altogether, six examinations were conducted at AFA by DGCA and Department of Communications.

Audit observed that this exercise had an impact on military aviation training as the syllabus of Stage I training was compressed to four months (against six months) and remaining two months were earmarked specifically for CPL course at AFA. Passing of CPL was made compulsory for final merit to be

[22] Air Force Academy

awarded after completion of the course. Since this had no connection with military aviation training, the quality of training meant specifically for IAF was adversely impacted.

In August 2005, IAF was forced to review its decision and introduced a new HRM policy in which obtaining CPL is no longer mandatory and a pilot cannot apply for the CPL until he has completed 16 years of service. It is obvious that the decision of December 2001 was short-sighted which diverted IAF resources from their main objective of making and shaping a military pilot whose primary role is to protect our air space and whose skills are accordingly developed.

2.9.2.4 Trifurcation Policy

Prior to September 2002, trifurcation of trainees (separating into Fighter, Transport and Helicopter streams) was carried out after Stage II of flying training. Since September 2002, trifurcation is being carried out after Stage I itself in order to conserve the resources of Kiran aircraft and for greater economy.

Audit examination revealed that this decision was guided more by the anxiety to conserve aircraft resources rather than by the fact that trifurcation after Stage I actually yielded more positive results in term of improved quality of trainees as compared to trifurcation after Stage II. In fact, impact of this decision was examined by AFA in October 2004 to see the effectiveness of the change. It was found that trifurcation after Stage I had led to fall in performance of the trainees. AFA, therefore, suggested that trifurcation be done after Stage II so as to permit a more rounded assessment of the trainee prior to trifurcation. Further, audit observed that certain inputs like tactical flying and low level navigation required for trifurcation are not available at Stage I and to that extent selection of pilots for each stream is affected adversely.

Thus, the ultimate objective of trifurcation i.e. of identifying suitable pilots for each role is not being fulfilled due to constraints regarding availability of Kiran aircraft. These constraints are discussed at paragraph 2.9.4.1(ii) below. Further, review of trifurcation policy which was due in January 2005, has been put off till 2008.

2.9.2.5 Recruitment of Navigators

Navigators[23] are essential for the efficient functioning of IL-78, SU-30 and Airborne Warning and Control Systems (AWACS) aircrafts. However, the intake of Navigators Training School (NTS) is met through pilots who have been suspended[24], rather than making recruitment on the basis of the actual requirement of navigators. Audit observed that against the authorized intake of navigators, there has been a consistent shortfall. Between 2001 and 2006, the shortfall ranged between 25 and 54 *per cent* resulting in overall shortfall of 36 *per cent* in intake of navigator trainees. Thus, improper planning for recruitment of navigators led to low intake at NTS, which further resulted in sub-optimal utilization of infrastructure and resources. This also had an impact upon the per trainee cost, which at Rs 2.50 crore is much greater than the cost of Rs 1.61 crore as per norms. The low intake also affects the subsequent intake into the WSO courses conducted at NTS.

2.9.2.6 Induction of Weapon System Operators

WSOs play two roles i.e., Mission Planning (Ground work) and Flying (Air) besides other assigned tasks. WSOs are selected based on their willingness and efficiency after Stage III Navigation Training. An important fact to consider while planning for WSOs is that they can replace the second fighter pilot who is assigned with the task of a WSO in a twin-member cockpit like Su-30 aircraft. The cost of training a WSO (Rs 1.07 crore) is also significantly less than the training cost of a fighter pilot (Rs 9.73 crore). Audit observed that IAF does not have an extensive and exhaustive plan for induction of WSOs and it took almost eight years since the acquisition of Su-30 aircraft to select navigators for WSO training. The IAF, thus, has not only foregone the opportunity of addressing the shortage of fighter pilots but also the significant savings that can accrue. Taking into account the fact that IAF has substantial number of Su-30 aircraft, potential savings to the extent of approximately Rs 615 crore was possible if IAF were to demarcate the role of WSO clearly and formulate definite policy for their induction.

Recommendations

- *IAF may take necessary action to overcome the lack of infrastructure facilities at various FTE's to accommodate the induction of additional pilots.*

[23] Job description of a Navigator includes planning, recording and controlling the movement of an aircraft from one place to another.

[24] Pilots who are unable to learn flying, exhibit poor performance in ground subjects and are found unfit due to medical reasons.

- *Trifurcation policy needs to be reviewed and decision needs to be taken keeping quality of pilots required at the forefront rather than economy issues.*
- *Given the important potential role of Navigators and WSOs, IAF may consider having a well-formulated training policy for them after defining their role more precisely.*

2.9.3 Quality of training

2.9.3.1 Extra wastage rate in each stage of training

Based on experience and past performance, IAF has assessed average wastage rates[25] at each stage specific to each stream. Audit noticed that in majority of the courses conducted during 2001-2006, these limits were exceeded in all the streams at all stages as shown below:

Stage	Stream	Total number of courses conducted	Number of courses where deviations existed	Average Wastage Limit (in Percentage)	Actual Wastage Range (in Percentage)
I	Common to all streams	12	7	15	16.20 - 26.00
II	Fighter	12	4	10	11.60 - 14.00
	Transport	12	2	5	11.80 - 12.50
	Helicopter	12	6	10	10.90 - 19.00
III	Fighter	12	7	10	12.90 - 19.50
	Transport	12	5	5	5.30 - 1.31
	Helicopter	12	7	5	5.60 - 14.30
	Total	**84**	**38**		

Thus, in 45 *per cent* of the courses, wastages were higher than the assessed average wastage rate. The wastages were significantly higher in Stages I and III. While these wastages can be explained during the initial stages, in Audit's opinion the wastage over and above the norms at Stage III level of training do not reflect well on the efficiency of the pilot training system.

High wastages at various Stages of training puts unnecessary burden on the public exchequer. Further, after Stage II training, these pilots are already a

[25] Number of pilots who are unable to complete the training successfully at each stage due to reasons such as poor performance in ground subjects, inability to learn flying, medical reason etc.

part of the working force of the IAF and hence high wastage at Stage III have a direct impact upon the operational strength as well.

2.9.3.2 Lacuna in Training Syllabus

Although hill/mountain flying is an essential part of operational duties of helicopter squadrons, the two FTEs for helicopter training viz., Helicopter Training School (HTS) at Hakimpet and 112 Helicopter Unit (HU) at Yelahanka, are not imparting training for helipad operations in hills, high altitude flying and other relief operation tasks. This training is being given at the operational unit level only when pilots are posted to the field units after completion of Stage III training. As a result, field units are undertaking this training as on-the-job training in addition to their unit specific roles. Due to technical constraints like flying hours available, availability of aircrew, task-oriented flying etc., the training period is very long. The lack of skills required during operations is acutely felt as can be seen from an air crash in the year 2000[26] attributable to poorly trained pilots.

2.9.3.3 Lack of continuity in training

Pilots belonging to the Fighter Stream are trained on a basic trainer (HPT-32) in Stage I, Kiran Mk I in Stage II and Kiran Mk II in Stage III. For training at each Stage to be effective, it should be ensured that the training at the preceding Stage provides quality inputs which facilitate learning at later Stages.

Audit examination, however, revealed that transition from initial training to intermediate and advanced stage of training was not smooth. Initial training at present does not give the trainees any exposure to armament use, night flying or cross country flying. Besides, there is a significant jump in the quality, technology and avionics of the aircraft used, for example, from Kiran in the initial stage to MIG 21 in the later stages. Lack of continuity in training is bound to affect the overall flying skills of the pilots.

2.9.3.4 Accidents in ab-initio trainer fleet

(a) During the period 2001-2006, 33 aircraft accidents were reported in the *ab-initio* training fleet in IAF in all the three streams. Seventy nine *per cent* of these accidents were due to human error and technical defects that resulted in

[26] On 17th May 2000, one Cheetah Helicopter crashed in the mountains during reconnaissance sortie as the pilots were not adequately trained and displayed lack of skill and incorrect high altitude flying technique.

loss of three lives and 12 aircraft[27]. Accidents due to human error and technical defects clearly indicate shortcoming in training and aircraft used for imparting *ab-initio* training.

(b) IAF expert committees have cited large-scale cannibalization as one of the reasons for aircraft accidents/incidents. Hence, a recommendation was made to avoid cannibalization as a routine course of action and should be resorted to in exceptional cases after taking prior permission from the competent authorities. However, Audit observed that large-scale cannibalization was being resorted to at various FTEs and operational squadrons while carrying out first and second line servicing of the aircraft to avoid AOG.

Month	No. of items cannibalized					
	AFS, Hakimpet		AFS, Bidar	AFA	AFS, Gwalior	AFS, Yelahanka
	Kiran aircraft	Chetak Helicopters	Kiran MK-I A/II	HPT-32	Mirage 2000	AN-32
January 2007	47	17	75	30	41	35
February 2007	61	31	55	24	79	31
March 2007	75	24	69	44	23	53
April 2007	83	28	43	42	76	41
May 2007	107	45	55	31	46	52
June 2007	84	13	-	34	40	19
Total	**457**	**158**	**297**	**205**	**305**	**231**

From the above, it is clear that items are cannibalized in each month from one aircraft to another as a general practice rather than as an exception, violating the recommendations of the safety committee reports.

2.9.3.5 Air accidents due to lack of skills

Audit observed that the quality of pilot training in IAF was affected due to non- availability of adequate number of aircraft[28], non-availability of simulators, use of obsolete outdated aircraft/simulators for training, poor infrastructural support to the training establishments, lacunae in training syllabus and lack of continuity in training. These weaknesses in the training system affect the skill levels of the pilots inducted in various squadrons that may in turn lead to serious air accidents while performing operational role.

Audit observed that there was large number of accidents attributable to lack of skills, indiscipline in the air, non-adherence to Standard Operating Procedures

[27] Nine aircraft amounting to Rs 25.10 crore (in three cases losses are yet to be assessed)
[28] Para 2.9.4.1(ii) and Para 2.9.4.1(iii)

(SOPs) and supervisory lapses. Of 276 air accidents reported during 1995-2005, 116 accidents were attributed to human errors of various types as shown in the table below:

Reason for accident	Fighter	Transport	Helicopter	Trai -mer	Total	Percent -age
Disorientation	11	-	2	-	13	11
Error of judgement	9	-	1	1	11	10
Lack of situational awareness (LOSA)	8	-	2	1	11	10
Lack of skill	23	-	5	4	32	27
Supervisory lapses	-	1	3	1	5	4
Mishandling of controls	18	-	4	1	23	20
Poor airmanship	6	-	4	-	10	8
Violation of SOP	5	2	2	2	11	10
Total	80	3	23	10	116	

It can be seen that 27 *per cent* of the accidents were caused due to lack of skill, while 20 *per cent* were caused due to mishandling of controls. This clearly indicated that the quality of training imparted to the pilots needed to be more rigorous.

Recommendations

- *IAF should try and limit the wastages to within the accepted limits.*
- *High altitude flying training may be incorporated in the helicopter training at FTEs.*
- *IAF may focus on skill development of trainee pilots by identifying the weaknesses in the existing system and taking corrective measures.*
- *IAF should place demands for spares within a prescribed timeframe to stop cannibalization and avoid AOG.*

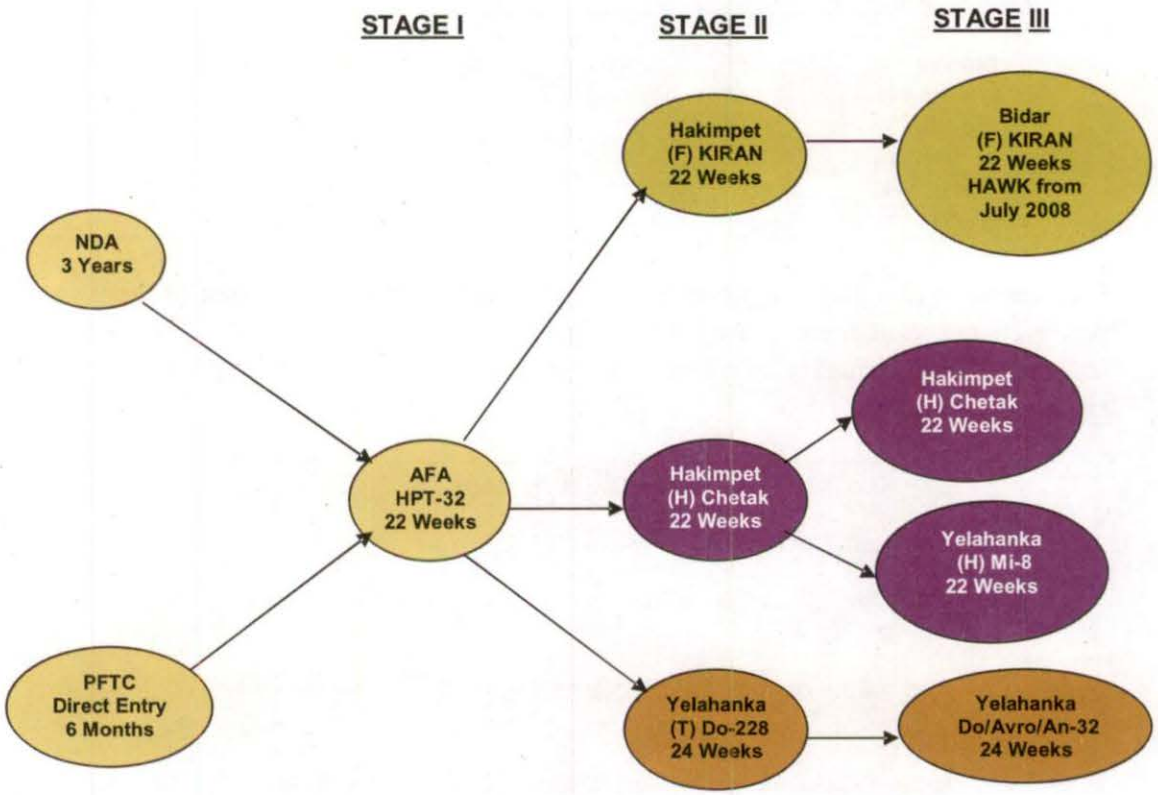
2.9.4 Availability of Training Resources

2.9.4.1 Aircraft

Aircrafts are the most vital training aid in the entire process of transforming an unskilled cadet into a proficient IAF pilot. Availability of adequate number of trainer aircraft of desired capability is essential for imparting quality training

to pilots to prepare them for any eventuality arising during peace and wartime operations. The number of aircraft has to match the number of trainees at each stage e.g. there should be sufficient number of HPT-32 aircraft at Stage I etc. In qualitative terms, the aircraft available should be capable of undertaking the exercises prescribed as per syllabus. Overall, the trainer aircraft should be compatible with the existing technological capabilities of aircraft in the operational squadrons. A Flying Training Overview is shown below to understand the name of aircraft exploited in *ab-initio* stage training:

FLYING TRAINING OVERVIEW



2.9.4.1(i) Outdated aircraft for Stage I training

HPT-32 aircraft, a basic trainer powered by a single piston engine, is used for training of IAF cadets at AFA and also for training Qualified Flying Instructors (QFIs) at Flying Instructors School (FIS). These aircraft were also used by Basic Flying Training School upto December 2005 for training of cadets of Army, Navy and Coast Guard.

The unreliability of the engine of HPT-32 aircraft was commented upon in Audit Report No.8 of 1998. Even after modifications in 2003, the aircraft is beset by a number of critical flight safety hazards with the result that trainees at the initial stage are not confident about flying this plane. A similar piston engine used by the United States Air Force (USAF) was withdrawn within five years of induction in 1999 due to similar problems. IAF, on the other hand, has been using this aircraft for the last two decades risking the lives of trainees as also impairing the quality of training imparted. Some of the important deficiencies in the HPT-32 aircraft are discussed below:

- HPT 32 aircraft does not have ejection seats and as such, in an eventuality of abandoning of the aircraft, the pilot is required to bail out manually. In such circumstances, chances of survival of the pilot become minimal. In fact, 15 aircraft have been involved in air accidents leading to the death of 11 pilots which could have been avoided with an efficient escape system.
- Due to poor instrumentation and lack of avionics in the aircraft, training is not undertaken during adverse weather conditions. Thus, even after six months of flying training consisting of 72 sorties, the trainee gains no experience of flying in adverse weather conditions, an essential requirement of Stage I training. Also, low level navigation training cannot be imparted on the HPT-32.
- Due to poor quality communication equipment, trainees are unable to respond to any radio transmission.
- In the absence of any recording equipment, it is impossible to find out if the trainee violated any flight safety norms during a solo sortie. A large portion of the training flying takes place without any objective debriefs. This is undesirable for any kind of military aviation, let alone *ab-initio* military flying training.
- An intangible problem with the HPT-32 is the lack of continuity of training with the next phase in terms of technology and aircraft capability. After basic flying training on the single engine HPT-32, the trainee undergoes Stage II and III flying training on the Kiran series

aircraft and thereafter is exposed to a supersonic advanced aircraft like Su-30, Mirage-2000 etc. This results in a big jump in terms of aircraft performance and technology. Different committees on flight safety have brought out that one of the reasons for aircraft accidents was the lack of continuity in training.

- Apart from the above, HPT-32 cannot be used to impart armament and tactical training. Performance in respect of these two aspects is essential for judging the suitability of a pilot for fighter stream. The absence of these two vital inputs leads to insufficient data for the trifurcation board to judge the capability of a pilot to become a fighter pilot.

In spite of these problems, Air HQ (August 2007) is still using this aircraft for basic training and is also exploring the possibility of extension of life of the HPT-32 fleet. Continued use for these outdated aircraft may affect the training quality and also risk the lives of trainee pilots.

2.9.4.1(ii) Unsuitable and inadequate number of aircraft for Stage II Training

Air Force Station (AFS) Hakimpet is conducting Stage II training of fighter pilots through 29 Kiran MK–I aircraft. The fact that this aircraft is not suitable for Stage II training on account of technical limitations was accepted by IAF also. In addition, the management of required aircrafts for Stage II training was not very effective and would lead to over-exploitation of the Kiran fleet. This *inter alia* may compromise flight safety standards besides affecting the quality of training imparted. The number of aircraft available for training is limited due to various reasons which are given below:

- Only 23 engines are available for fitment against the fleet of 29 aircraft i.e. six aircraft cannot be operated at any point due to lack of engines.
- Nine aircraft are on AOG[29].
- Average flying undertaken in Kiran Mk I is 3600 hours in each course. The Time between Overhaul (TBO) i.e., operational availability before the aircraft / engine is to be sent for Repair and Overhaul (ROH), of the Kiran Mk-I aircraft is 800 hours. Details of the TBO left for 29 aircraft are given below:

[29] Aircraft on Ground (AOG) refers to those aircraft which are not airworthy because of technical snags and demands have been placed on the OEM/repair agencies/equipment depots for spares/repair-work.

Less than 13 hours	14 to 200 Hours	201 hours and above
5 aircraft	10 aircraft	14 aircraft

Thus, 50 *per cent* of the fleet would be due for ROH within 200 hours of exploitation, i.e. fifteen aircraft would have to be sent for repairs and overhauls at the same time.

Hence, due to the mandatory maintenance cycle, AOG and lack of engines, AFS Hakimpet would be left with only five aircraft for imparting training as against approximately 34 number of cadets at Stage II in each course. In fact, the holding of Kiran Mk-I trainer aircraft for Stage II training may be reduced to such an extent where even the conduct of the forthcoming courses would be difficult. Further, availability of a replacement for the Kiran series, i.e. IJT, in the near future is also remote and IAF does not have any other concrete back-up plan to resolve the problem. Clearly, there is a lack of co-ordination and foresightedness in decision-making amongst different Directorates in Air HQ.

2.9.4.1(iii) Lack of required number of aircraft for Stage III training

Against the sanctioned establishment of 29 aircraft of Kiran Mk-IA, AFS Bidar is holding only 24 aircraft. However, due to reasons given below, at a time even these 24 aircraft are not available in full strength:

- Against the fleet strength of 24, only 19 engines are available for the fitment in the aircraft. Thus, effectively only 19 aircraft are available for training i.e., there is a shortfall of 34 *per cent* against the sanctioned establishment of aircraft.
- Average unserviceability of Kiran Mk-IA during the period January 2001 to December 2006 was 22.44 *per cent*. Hence, out of the strength of 24 aircraft, on an average five aircraft would be unserviceable due to AOG, snag, inspection and other reasons.

AFS Bidar stated that in view of the life extension of Kiran MK-IA and improvement in AOG status, there would be no crunch in Stage III training in the near future. In Audit's opinion, this is not tenable as availability of Kiran MK-IA is already compromised and there is a shortage of 34 *per cent* against the sanctioned establishment. Due to restrictions on the number of life extensions that can be given, unserviceability due to AOG, inspection and non-availability of aircraft due to ROH, training of Stage III would be further compromised for want of sufficient numbers of trainer aircraft.

2.9.4.1(iv) Delay in induction of AJT

The need for acquisition of Advanced Jet Trainer (AJT) was identified in 1982 by a Special Committee, headed by Air Marshal La Fontaine, as an essential element in improving the skill levels of pilots and in ensuring smooth transition of trainee pilots graduating from low speed trainers to advanced high performance fighter aircraft. Between 1990 and 1999, numerous proposals were put up for approval, three request for proposals (RFPs) were issued at different stages on the basis of the recommendations of two Special Committees set up, and Standards of Preparation i.e., staff requirements and specifications were changed keeping in mind technological advances at each stage.

Audit observed that the delay has basically been due to lack of timely decision-making. When the first RFP was issued in 1986, though proposals were received from two short-listed vendors, Government was unable to make a selection during the validity period of the offers with the result that the offers lapsed. Subsequently, the earlier staff requirements were revised and a new sanction was issued in 1993. Once again, there were numerous delays. This time, preliminary price negotiations were held with the vendor after a lapse of more than two years. Ultimately, even the new sanction could not be utilised and a third and final RFP was issued in 1999 for acquisition of 66 AJT aircraft (24 in fly away condition and 42 under licensed manufacture by HAL) with an option to acquire 24 on lease for interim training.

In pursuance of the RFP issued in 1999, Government sanction was given in 2003 and a contract was entered into with M/s BAe in 2004 at a cost of 794.58 million pounds (Rs 5633.40 crore) for the direct supply of 24 AJTs, spares, ground support equipment, training aids and materials for the remaining 42 aircraft and interim training for pilots at United Kingdom (UK) before the first delivery. Sanction was also given for creating necessary infrastructure at AFS Bidar at a cost of Rs 140 crore for operation of AJT. The delivery was to commence in September 2007 and was likely to be completed by February 2008. Training with AJT has been planned from July 2008 onwards for Stage III as a partial replacement to Stage IV training at MOFTU.

Audit scrutiny revealed that due to the delay in acquisition of the AJTs, IAF has been forced to structure sub-optimal solutions as discussed below:

- To take care of Stage IV training on a fully operational aircraft, MIG-21 FL was used which was not at all meant for such training. Due to this, the standards of operational skills and flight safety might have been adversely affected.

- IAF had to purchase second-hand MIG-21 and MIG-23 UB Trainers to cater for the shortage of Stage IV training aircraft.
- Using a MIG-21 FL is also becoming unsustainable now due to reducing strength of aircraft on account of expiry of the Total Technical Life (TTL). Three squadrons of MIG variants including one of MIG-21 FL type have been phased out in 2002-03. As a result, the task of Stage-IV training has already spilled over to four operational frontline MIG-21 BIS / MIG-21 M squadrons, which has resulted in diluting the operational flying and the total readiness of the frontline operational squadrons as they have been tasked for flying training.

Further, the Standing Committee on Defence in its 18th Report of December 2002 had noted that IAF lost 102 MIG aircraft and 39 pilots in air accidents. This caused losses of about Rs 675 crore during 1992-2002. In spite of strong recommendations made at different times, the proposal for the early induction of the AJT could not be implemented for almost 21 years. Inordinate delay in acquiring AJT, IAF compromised on flight safety and quality of training.

Any further delay in AJT induction would have serious consequences on the operational preparedness of IAF as well as on flight safety. This is especially pertinent as work services for induction of AJT are running behind schedule, as discussed later in the report at paragraph 2.9.5.5.

2.9.4.1(v) Delay in procurement of flight safety equipment for AJT

In emergencies, Electronic Flight Reference Card (EFRC) is an automatic mechanism by which actions to be taken by pilots are displayed in case of any warning on the Central Warning System (CWS). In February 2007, Air HQ concluded a contract with a foreign firm for procurement of 70 EFRC for AJT at a total cost of 7.8 million pounds (Rs 66.30 crore[30]) with supplies to be completed by December 2009. However, Audit observed that as per the present schedule, IAF would start receiving the first AJT in September 2007 and delivery of total 24 aircraft would be completed by February 2008. Thus, 24 AJTs would be flying without EFRC for periods ranging between 22 to 27 months. In August 2007, Air HQ stated that EFRC is an additional feature for which the software has to be integrated with the aircraft mission computer software and the use of EFRC is not mandatory but is desirable and a modern feature on the aircraft. Audit is of the opinion that EFRC is vital for enhancing flight safety.

[30] 1 Pound = Rs 85

2.9.4.1(vi) Delay in development and induction of IJT[31]

Due to the phase-out of Iskara* in 2005 and depletion of Kiran fleet, Air HQ initiated a case for the development of IJT. Based on the Air Staff Requirement (ASR) of Air HQ (July 1999), Government accorded approval to the proposal of M/s Hindustan Aeronautics Limited (HAL) for design and development of IJT at a cost of Rs. 180 crore. As per the approval, two prototype aircraft were to be manufactured by 2004 by HAL, tested and approved by Centre for Military Airworthiness and Certification (CEMILAC), the designated authority for giving such air-worthiness clearance. Accordingly, HAL developed the first two prototype aircraft in March 2003 and March 2004. However, air-worthiness certificate for the prototype was not given by CEMILAC on account of deficiencies in the Larzac engine. Consequently, it was decided to incorporate AL 55I engine instead of the Larzac engine in the Limited Series Production (LSP) version of IJT. Finally, a contract was concluded with HAL in March 2006 to manufacture and supply 12 LSP - IJT with AL-55I engine at a total cost of Rs 486.81 crore with the delivery schedule from March 2008 to March 2010.

Audit scrutiny revealed that IAF's decision to place a further order for LSP of 12 IJTs was not prudent since the prototype itself was yet to be proved as air-worthy. IAF stated (May 2007) that the conversion of prototypes I and II with AL 55I engine and certification of engines by Russian authorities is likely to be completed by March 2008. Reply is not acceptable as placement of bulk order for aircraft without the prototype being cleared and certified by the competent authority (CEMILAC) is irregular and against the provision of Defence Procurement Procedure (DPP). Even after the certification by Russian authorities, the newly developed engine requires to be certified by CEMILAC. Thus, IAF followed an ad-hoc procedure for obtaining the IJT as even after placing an order for production of the aircraft, they are unsure of its air-worthiness. Further, the decision of IAF to go ahead with another untested and untried engine, when the first unsuitable engine was rejected, does not appear to be sound and logical.

2.9.4.1(vii) Outdated helicopters for training

Chetak helicopters of 1967 make were inducted in IAF for imparting flying training to helicopter pilots. Training continues to be imparted even today in these helicopters without any replacement or modernization. No proposal for their replacement has been initiated in the last four decades. In September

[31] Intermediate Jet Trainer

* Iskara aircraft was used by IAF for Stage III training upto 2005.

2007, Basic Flying Training School, Allahabad (BFTS) indicated that these helicopters have poor and non-standard instrument layout and their unergonomic design adds to flying fatigue of the crew. Thus, helicopter pilots are being trained in helicopters inducted in the late sixties without the latest avionics and flight control systems. They are, therefore, deprived of quality flying training on state-of-the-art helicopters.

2.9.4.1(viii) Induction of MI-17 Helicopters

AFS, Yelahanka imparts Stage III flying training for helicopter pilots on MI-8 helicopters. However, IAF fleet is dominated by MI-17 helicopters. At present, on an average, about 50 *per cent* of trainees after completing MI-8 training are posted to MI-17 variants. They have to undergo further cross-conversion training of ten hours at the operational units on their postings. This duplication can be avoided by positioning MI-17 helicopters at Stage III level at Yelahanka.

2.9.4.1(ix) Delay in upgradation of avionics

NTS, Begumpet possesses six Avro aircraft for conducting ab-initio navigation training for flight cadets equipped with six trainee workstations and two instructor stations. These aircraft were modified as Navigator Trainers in 1970. Some of the avionics became unserviceable/ unreliable 18 years ago. Further, due to wear and tear over the last three decades, majority of the navigation equipment fitted in the classroom stations have became either unserviceable or unreliable. Besides adversely affecting training, the existing avionics fitted on the training aircraft were not compatible with the avionics on contemporary operational aircraft. Hence, in April 2003, necessity was felt for the upgradation of HS-748 navigational trainer aircraft with modern avionics/instruments. After two and a half years, a contract was concluded in March 2006 with HAL for upgradation of five navigational version Avro aircraft at a cost of Rs 33.49 crore with a PDC[32] of December 2007. As of July 2007, HAL has supplied only one upgraded AVRO aircraft. Thus, there was considerable delay in upgradation of avionics in navigational trainer aircraft compromising the quality of training to that extent.

Recommendations

- *Stage I training requires an alternate state-of-the-art basic trainer which will not only improve quality of training but also enable smooth transition to more sophisticated aircraft.*

[32] Probable date of completion

- *Acquisition of IJT needs to be hastened in view of the ageing Kiran fleet. IAF should ensure optimum availability of trainer aircrafts for all stages of training appropriate to their operational needs.*
- *Decision making authorities in both IAF and MOD should ensure that there are no unnecessary delays in procurement of important training aids.*

2.9.4.2 Simulators

Simulators are vital equipment which provide reliable alternatives to putting an inexperienced pilot on a 'live' aircraft. This has invaluable advantages in terms of flight safety and reduction of accidents. Flight training simulators are a cost effective way of providing efficient training for various flight exercises and are capable of use unaffected by environmental constraints and other flying restrictions. They are the only safe means by which pilots can practice procedures which would otherwise be hazardous and, at times, impossible to attempt in the air.

2.9.4.2(i) Non-availability of Kiran simulator in AFA

The Kiran Mk-I Flight Simulator developed by Aeronautical Development Establishment (ADE), Bangalore, a Defence Research and Development Organisation (DRDO) lab, was installed at AFA in 1987. From November 1994, ADE expressed difficulties in maintaining the computer systems due to obsolescence and in July 1996 indicated that it would not be cost effective to make any replacement/upgradation of the sub-systems. The simulator finally became unserviceable in July 2000. In November 2003, after a lapse of 22 months, Air HQ accorded sanction of Rs 10.25 crore for upgradation to be carried out in two phases[33]. Although ADE had expressed their reservations regarding upgradation of the existing simulator, the main thrust of Phase-I activities was to make the existing simulator operational at the earliest till the completion of the new simulator in Phase-II.

In August 2005, during execution of Phase I activities, ADE expressed their inability to rectify the repeated snags in the existing simulator. Air HQ therefore terminated the execution of Phase-I activity and granted permission to ADE to proceed with Phase-II for development of new simulator. By November 2005, ADE had incurred expenditure on Phase II activities to the extent of over Rs 0.97 crore besides initiating procurement worth Rs 5.17 crore.

[33] Phase I comprised upgradation of old simulator, Phase II comprised fabrication of new simulator.

Meanwhile, in March 2004, another contract was concluded by the Ministry with M/s TSL Technologies Pvt Ltd, New Delhi for procurement of 18 simulators for HPT-32 aircraft and Kiran Mk I and II aircraft with the probable delivery date as April 2005. In November 2005, an IAF team assessed the simulators offered by ADE and TSL and opined that the simulator offered by ADE was far superior to the simulator fabricated by TSL but its annual maintenance cost would be high. The IAF team further opined that the simulator offered by TSL would not only meet the requirements of *ab-initio* trainees but would also be easy to maintain. Therefore, Air HQ in a meeting held in March 2006 decided to foreclose the Kiran Simulator Upgrade project on the grounds that ADE Simulator did not meet customer's requirement.

Audit observed that IAF preferred a simulator of private firm over the far superior simulator developed by DRDO. Since a clear go ahead was given by Air HQ to ADE (DRDO) in August 2005 to proceed with phase II for development of a new simulator, it was not prudent on the part of the Air HQ to foreclose the contract midway especially when substantial expenditure had already been incurred by DRDO on the development of the simulator. This led to an unfruitful expenditure of Rs 6.14 crore. The case also highlights lack of effective coordination between Air HQ and DRDO as they could have jointly developed specifications fulfilling the actual requirements of the IAF.

Thus, IAF's decision to upgrade the existing simulator despite ADE's reservations, coupled with rejection of the new simulator offered by the ADE led to trainees at AFA being deprived of the benefits of a flight simulator for five years apart from the unfruitful expenditure of Rs. 6.14 crore.

2.9.4.2(ii) Non-installation of Simulators purchased from the private firm

In March 2004, a contract was concluded by the Ministry of Defence with M/s TSL Technologies Pvt Ltd. (TSL), New Delhi for the procurement of nine Practices Procedure Platforms (PPPs) and nine Cockpit Procedure Trainers (CPTs) at a cost of Rs 7.50 crore with the probable date of completion (PDC) of April 2005. In May 2006, extra contractual developments resulted in access being denied to TSL to any defence personnel/facility/information citing security reasons. However, the firm had already supplied all the 18 simulators to four FTEs. Four simulators supplied to one FTE have been installed and in respect of the other three FTEs installation has been suspended. Civil works carried out at the three FTEs at a cost of Rs 41 lakh are also lying unutilised for the purpose for which they were constructed. Rs 4.88 crore has already been paid to the vendor as of 2005-06. Non-installation of the simulators has deprived the cadets of the advantages of training on the simulators.

2.9.4.2(iii) Unserviceability of Jaguar simulators

Two Jaguar simulators were procured in December 1983 and April 1985 and installed at AFS[34], Ambala and AFS, Gorakhpur for continuous and conversion training[35] at squadron level. Underutilization and continued unserviceability of one simulator despite spending Rs 0.94 crore on its repair has been commented upon in Audit Reports of 1990 and 1998. The second simulator is also unserviceable since December 1998. The aircrew were, therefore, not in a position to practice various sorties as per the Operational Squadron Training (OST) and Annual Squadron Training (AST) syllabus. There were four aircraft accidents during the period 1999 to 2003 with the total cost of damage estimated at Rs 291.09 crore. Court of Inquiry (CoI) conducted also found that the non-availability of simulators was one of the contributory factors for the accidents.

Subsequently, upgradation of both the simulators was taken up by M/s Macmet Technologies Ltd, Bangalore. Though the simulator at AFS Gorakhpur was taken over after the upgradation in November 2006 at a cost of Rs 10.97 crore, effective utilization started only in August 2007. Upgradation work is yet to commence in respect of the simulator at AFS, Ambala. Further, due to un-serviceability of the Jaguar simulator at Ambala, all Jaguar pilots are being sent to Gorakhpur to undergo the simulator training and the syllabus for simulator training is also being reviewed due to the availability of only one simulator. Thus lack of timely action by Air Force to upgrade simulators not only impacted pilot training adversely, it also resulted in air accidents with colossal loss.

2.9.4.2(iv) High performance human centrifuge in IAM

The existing Human Centrifuge (HC) at Institute of Aviation Medicine (IAM) has been effectively used for the purpose of training, research and medical evaluation. This equipment is essential for pilots being trained for supersonic aircraft, as they are required to increase their gravity tolerance. Need for a new HC was felt as early as 1987 since the HC at IAM was found to be short of simulation capabilities commensurate with the performance capabilities of the aircraft in IAF inventory like Mirage 2000 and MiG-29. In April 2001, the Competent Financial Authority (CFA) approved replacement of the existing HC System with an advanced state-of-the-art modern High Performance

[34] Air Force Station

[35] Continuous training is also known an Annual Squadron Training (AST). A pilot undergoes AST to maintain his grading. Conversion training is also known as Operational Squadron Training (OST). When a pilot joins the new squadron and fly a new aircraft, he undergoes conversion training.

Human Centrifuge (HPHC) System at an estimated cost of Rs 97 crore. Finally in March 2005, Air HQ concluded a contract for the procurement of HPHC from a foreign firm at a cost of USD 15.30 million with delivery by April 2008. Thus, it took an inordinately long period of 16 years to procure this equipment even though training on the HPHC is mandatory for a fighter pilot. In the absence of new technology of HPHC, IAF continues to impart gravity tolerance training to the fighter pilots in the old vintage HC, thus, compromising the elements of aero medical training for aircrew.

2.9.4.2(v) Unserviceable Navigation Simulator

During repairs in June 2000, the interface card, outer distribution card, interface cable and computer of a navigation simulator installed by Air Force Technical College (AFTC), Bangalore got burnt and the simulator became unserviceable. As the spare interface card was not available with either AFTC[36] or NTS[37], the simulator could not be repaired and remained unserviceable till July 2004. As a result, training could not be undertaken from June 2000 to December 2004 and navigators were trained through actual flying on the aircraft, thereby incurring extra expenditure to the tune of Rs 1.80 crore per annum.

The navigation simulator after repair was inducted in August 2004 at a cost of Rs 45.33 lakh. The simulator was used primarily for training navigators who fly Avro aircraft. The cockpit avionics and classrooms of all five Avro aircraft at NTS were under upgradation, to be completed by June 2008. In June 2007, one Avro aircraft was already upgraded and another one was expected by December 2007. In view of the upgradation, there was a need to upgrade the navigation simulator as well. But NTS is yet to initiate action to upgrade the simulator, and the navigators continue to be trained on a simulator with outdated avionics and classrooms.

Recommendations

- *Given the importance of simulators in flying training, IAF should ensure timely induction, repair and upgradation of simulators in Flying Training Establishment and Operational Squadrons through better planning, correct assessment of requirements and effective coordination with DRDO and other designated production agencies so as to provide quality training to pilots in a cost effective manner.*

[36] Air Force Technical College
[37] Navigational Training School

2.9.5 Adequacy of training infrastructure

Adequate infrastructure such as runways, hangars, radars, air traffic control and weapon training ranges is essential for efficient operation and maintenance of trainer aircrafts and other training aids, and smooth conduct of pilot training.

2.9.5.1 Deterioration of resurfaced runway before prescribed time limit

The two runways located at AFS, Bidar were resurfaced during the year 1999-2000 at a cost of Rs 4.71 crore. However, the runway deteriorated after four years in 2004 even though the life of the re-surfaced runway was expected to be ten years under normal circumstances. In June 2005, HQTC tried to hold the executing agency responsible for poor work quality. It also advised either resurfacing of runway or extensive preventive maintenance, whichever was cost effective. In spite of HQTC instructions, AFS has not taken any action along these lines. Continued use of deteriorated runway by AFS is a flight safety hazard and requires timely action.

2.9.5.2 Delay in establishment of weapon training range

Flight cadets at AFS, Bidar and AFA, Hyderabad are required to go to Jamnagar twice a year for firing exercise / practice on an Air-to-Ground range. Similarly, the flight cadets of AFS, Hakimpet go to Kalaikunda in the absence of a range in the vicinity of the training establishment thereby incurring extra expenditure. This was commented in the C&AG's Report for the year ending 31 March 1992. At present, Rs 5.77 crore is being incurred per year due to the absence of adequate facilities for firing practice.

Audit scrutiny revealed that IAF has been unable to narrow down on a suitable site for the Air-to-Ground range even after 15 years of being pointing out in Audit. Instead, it could only formulate short-lived solutions to the issue. For instance, a temporary range was formed at Banswada Range in Nizamabad District of Andhra Pradesh for three FTEs located in Hyderabad and Bangalore. Due to two incidents and two accidents of aircrafts, HQTC proposed (August 1994) setting up of an Air-to-Ground Firing range at Nirna at an estimated cost of Rs 2.50 crore. After a delay of two years, in February 1996, AFS, Bidar conveyed that the area was unsuitable for firing and as a result HQTC did not take any action on the proposal.

In July 1998, an IAF team visited the range and strongly recommended that appropriate steps be taken for the acquisition of land and initiation of work services for the creation of range on priority basis. In May 1999 Air Force Station Bidar indicated that the land initially identified for Nirna range was not adequate to meet the requirement and additional land would be needed. Nevertheless, Ministry accorded approval for establishment of the range at Nirna in October 1999 which included formal approval for acquisition of 1985 acres of land. However, in November 2002, HQTC forwarded an amended Statement of Case to acquire 4,500 acres of land. But, in March 2003, AFS Bidar formed a Board of Officers (BOO) to re-assess the land acquisition. The BOO recommended acquisition of 2000 acres of land and co-ordination with all required agencies[38] for issuance of 'No Objection Certificate' for diversion of forest land to IAF. After a delay of three years, in March 2006, AFS Bidar submitted an estimate of total land acquisition costs at Rs 32.89 crore. Thus, IAF took almost 13 years to finalize the actual requirement of land for the setting up of Nirna range.

Finally funds for the required work services were earmarked only in 2006-07. However as of May 2007, the case for acquisition of private land at Nirna was still under process and Rs 23 crore required for payment to forest department is yet to be released by the Ministry as only 'in principle approval' for diversion of forest land in favour of IAF has been given in September 2006.

Thus due to indecisiveness of IAF, the project for establishment of weapon training range was delayed for more than a decade.

2.9.5.3 Delay in transfer of Airport Authority of India land and assets to IAF

AFS, Begumpet operates two hangars, five buildings, and 13 aircraft and parking bays on the land owned by Airport Authority of India (AAI). This area is presently used by lodger unit viz. NTS, Begumpet for AVRO aircraft which is being used to impart training to Navigators and WSOs. By February 1997, the tarmac as well as other facilities like hangars and buildings required repairs and capital/maintenance works to be undertaken. However, due to not handing over the site/facilities to IAF by AAI, IAF is unable to carry out any maintenance work on the tarmac and hangars which are in a dilapidated condition, since AAI continues to be the owner of the assets. In fact, the tarmac was in such a dilapidated state that it was recommended that the entire tarmac area be taken up for overhaul with permanent specifications. Even after raising the Statement of Cases (SOCs) for extra number of hangars, IAF is

[38] For instance, Horticulture and Forest authorities

unable to sanction the required work services, which has resulted in keeping all AVRO aircraft in the open, thereby exposing the aircraft to the vagaries of extreme climatic conditions. Efforts to take over the assets started in the late eighties but did not receive a favourable response from AAI. As of August 2007, AFS, Begumpet was in the process of preparing a draft Memorandum of Understanding (MOU) between IAF and AAI for the transfer of assets.

2.9.5.4 Unserviceable radars

Four types of radars are available at AFS, Bidar to provide surveillance and ground control for flying training. Audit observed that the serviceability status of these radars was extremely low. Further, due to certain problems in these radars, the entrusted role cannot be performed to satisfaction. Two radars have been unserviceable since 2005. One radar was found defective on receipt. Though it was repaired, it was not made operational. The fourth radar allotted in 2006 is undergoing repairs. Due to defective and unserviceable radars, surveillance and ground control for flying training is not being provided since 2005. This fact was agreed to by AFS, Bidar who stated in June 2007 that surveillance approaches for training purposes are not being carried out.

2.9.5.5 Civil work for AJTs

AF Station, Bidar has been chosen as the location for induction of AJT. Work services have already been initiated to make the existing runway a standard 9000 ft long runway. As the location of the existing Air Traffic Control (ATC) building does not provide a clear view of the runways, it was considered necessary to construct a modern ATC building at a location ideally suited for monitoring of traffic. Though Administrative Approval was accorded by Air HQ in March 2006 for the new ATC, the work was commenced only in March 2007 and presently only five *per cent* of the work has been completed (July 2007). Audit observed that as AJT aircraft were planned to be inducted in September 2007, the non-availability of the new ATC building would affect the monitoring of aircraft movement during training.

Recommendations

- *Nirna range should be activated to avoid recurring expenditure of Rs 5.77 crore per annum.*
- *State-of-the-art radars to be positioned immediately for effective air surveillance and ground support.*

2.10 Conclusion

Given the critical importance of a highly capable and professional work force and the significance of training in acquiring the required skill levels, this report discloses that training of pilots in IAF is being conducted under numerous constraints and the existing training establishment is not geared to effectively meet the increasing training needs of IAF. Training requirements have not been addressed optimally and effectively due to the absence of realistic and comprehensive planning and policy-making. Key acquisitions and upgradation of training infrastructure are lagging behind schedule due to poor planning and lack of timely decision-making. Flying Training Establishments are imparting training mostly with outdated and ageing aircrafts. The absence of vital training aids like simulators, Human Centrifuge etc., also had an adverse impact on the quality and cost effectiveness of the training. Large number of accidents due to human error is an indicator of the fact that training facilities in IAF needed to be upgraded and training of pilots made more comprehensive, systematic and rigorous.

The matter was referred to Ministry in October 2007, their reply was awaited as of February 2008.

Appendix I

Training Pattern

Training in IAF is imparted for pilots, navigators, Qualified Flying Instructors (QFI) and Weapon System Operators (WSO). Training pattern adopted by IAF during the period 2001and 2006 for the different streams is given below. Besides, flying related ground training is an intrinsic and important part of pilot training. Flight cadets are taught all flying-related subjects. To ensure that the best-trained pilots are inducted into the service, a strict filtration process is followed to weed out the weak trainees. A series of progress or supervisory check sorties are a part of the flying training syllabus. Similarly, periodic test in ground subjects are conducted to ensure that the Flight Cadets have imbibed the correct levels of knowledge. On an average, the filtration rates for the past three years have been about 10 *per cent.*

Pilots

Fighter Stream

Stage	Location	Aircraft	Period	Description
I	AFA	HPT 32	2001 to 2006	General handling, basic aerobatics, navigation and instrument flying, close formation, night flying
II	AFA, Dundigal	Kiran Mk IA	January 2001 to December 2005	Learn to fly a jet trainer to handle complex systems, undertake advanced exercises by day and basic exercises at night. It includes advanced aeros, x-country and tail chase.
	AFS, Bidar	Kiran Mk-I	-do-	
	AFS, Hakimpet	Kiran Mk - I	January 2006 onwards	
III	AFS, Hakimpet	ISKARA, Kiran MK II	2001 to December 2004	Learn to fly a jet trainer aircraft as a weapon platform. It includes introduction to combat, tactical flying and consolidation.
		Kiran Mk IA, Kiran MK II	January 2005 to December 2005	
	AFS Bidar	Kiran Mk IA, Kiran MK II	January 2006 onwards	
	UK	Hawk AJT	June 2004 onwards	

IV	MIG Operational Flying Training Units (MOFTU)	MIG-21 (Type 77 and Type 96)	2001 to 2006	Training is imparted to make fighter pilot fully ops. After completion of training, pilots are posted to ops sqns.

Transport Stream

Stage	Location	Aircraft	Period	Description
I	AFA	HPT 32	2001 to 2006	General handling, basic aerobatics, navigation and instrument flying, close formation, night flying
II	AFS, Yelahanka	Dornier 228	2001 to 2006	Learn to fly light transport aircraft and to handle complex systems and execute basic exercises at night.
III	AFS, Yelahanka	Dornier, AN – 32, AVRO	2001 to 2006	Learn to fly advanced exercises on light transport aircraft and consolidate on type. On completion, pilots posted to ops sqns.

Helicopter Stream

Stage	Location	Aircraft	Period	Description
I	AFA	HPT 32	2001 to 2006	General handling, basic aerobatics, navigation and instrument flying, close formation, night flying
II	Helicopter Training School, Hakimpet	Chetak	2001 to 2006	Learn to fly a light helicopter. Bifurcation to MI-8/Chetak on completion of training.
III	Helicopter Training School, Hakimpet	Chetak,	2001 to 2006	Bifurcation to twin engine and consolidation on light helicopter. Learn to fly advanced exercises. On completion, pilots posted to ops sqns.
	Helicopter Unit, Yelahanka	MI - 8	2001 to 2006	

Navigators Training

As there is no provision for direct entry of Navigators into the IAF, trainee navigators are selected from amongst the flight cadets who are suspended during Stage I to Stage III flying training. Cadets who show their willingness

for becoming Navigators are subjected to Navigation Aptitude Test (NAT) at AFA itself. The cadets so selected would be called to NTS, Begumpet for undergoing Stage I and Stage II *ab-initio* training in Navigation Stream. The trainees, after getting commissioned into IAF move to Yelahanka for Stage III training and subsequently after completion of their training are posted to AN-32 Transport Squadrons.

From July 2006 onwards, the training pattern of navigators was changed. Flight cadets, if found eligible for navigation training, would undergo Stage I Ground Training for three weeks at AFA. After the completion of Stage I ab-initio training at AFA, Stage II training is conducted at NTS. Bifurcation into Navigation (Transport) and Navigation [Weapon System Operation (WSO)] is done at the end of this stage. Navigators then proceed to Yelahanka for Stage III training.

Weapon System Operation Training

After bifurcation, Navigators selected for Weapon System Operation (WSO), undergo ground training at NTS on various fighter orientation. Then, trainee WSOs do prescribed number of flying hours during day and night at Bidar on Kiran aircraft. Total training of WSOs consist of Aerodynamics, Airframe Aero engine and Instruments, Air Defence, Electronic Warfare, Airborne interception radars and training on Weapons & Armaments.

Advanced Navigation Training for QNIs

Advanced Navigation Course (ANC) for Under Training Qualified Navigation Instructors (U/T QNIs) is conducted at NTS Begumpet. The aim of ANC is to raise the professional level of experienced navigators thereby qualifying them for employment as Squadron Navigation Leaders/Squadron Training Officers, as Qualified Navigation Instructors and Navigation Officers on the staff at Command and Air HQ level, to be considered for specialized training and for employment in navigation research and development.

Qualified Flying Instructors

Qualified Flying Instructors (QFIs) train the cadets in their initial stages of ab-intio training in various FTEs. Training for QFIs is imparted at Flying Instructor School, Tambaram (FIS) and they are trained in trainer aircraft meant for ab-initio training.

MINISTRY OF DEFENCE

INDIAN NAVY

OPEARTIONAL AVAILABILITY AND MAINTENANCE OF SUBMARINES

CHAPTER III: Operational availability and maintenance of Submarines in the Indian Navy

Submarines are potent force multipliers and are of particular relevance to India in view of its vast coastline. Indian Navy's submarine force, however, has an increasing responsibility that a steadily growing economy has cast upon it. The functional role of submarines include attacking surface and subsurface vessels, laying offensive mine-fields, blockade of enemy posts etc. This Performance Audit sought to review the operational availability of submarines, the refit activities, submarine modernization and training of the crew. Some salient findings are given below.

Highlights

- Indian Navy's holding of submarines is much below the envisaged force level. Ministry could not adhere to its submarine construction / induction plan which may impact operational preparedness of Indian Navy.

(Paragraph 3.6.1.1)

- With serious slippages in the induction plan, Navy is left with an ageing fleet with more than 50 *per cent* of submarines having completed 75 *per cent* of their operational life and some already outlived their maximum service life. If the construction plan for new submarines is not expedited, 63 *per cent* of the existing fleet would complete their prescribed life by 2012 when the first new submarine will be inducted as per the present schedule.

(Paragraph 3.6.1.2)

- Due to ageing fleet and prolonged refit schedules, the average operational availability of the submarines is as low as 48 *per cent*.

(Paragraph 3.6.1.2)

- Ship Operating Standards is a framework of exercises designed to maintain a submarine in a high state of operational readiness. Test check of 'Y' class of submarines indicated their overexploitation and non-adherence to the prescribed standards for operational patrol, tactical exercises and individual work ups.

(Paragraph 3.6.1.4)

- Submarine arm is operating without a Deep Submergence Rescue Vessel which limits Indian Navy's rescue capabilities in case of accidents/emergencies. Delay in concluding contract for procurement of this Vessel compelled Navy to remain dependent on foreign source for rescue operations.

(Paragraph 3.6.1.7)

- Timely refit and maintenance is essential for ensuring operational availability and readiness of a Submarine. The refit activity management in Navy was not efficient as 83 *per cent* of short refits and 100 *per cent* of normal and medium refits were delayed and could not be completed within the prescribed time period. The extent of delay was also significant.

(Paragraph 3.6.2.3)

- Piecemeal modernization and upgradation of submarines at an aggregate cost of Rs 1560 crore was undertaken by Navy without taking approval of the competent financial authority.

(Paragraph 3.6.3.1)

- The modernization and upgradation programme of submarines has been only partially successful as missile firing capabilities on three submarines are functioning at sub-optimal level due to erratic performance of Inertial Navigational System of Navigational Complex procured at a cost of Rs 108 crore. The performance of new sonars costing Rs 167.64 crore procured for replacement of the existing sonars on 'Y' class submarines has also not been satisfactory.

(Paragraph 3.6.3.3{i}and {ii})

- Ship Control Simulator used for training for a particular class of submarine remained non-operational since 2002 adversely affecting the training of submariners.

(Paragraph 3.6.4.1)

Summary of recommendations

- *Since the availability of the submarines with the Indian Navy is much below the envisaged force level and large number of submarines in the existing fleet have/ will become due for decommissioning in immediate future, Ministry may take all possible measures to expedite acquisition/ construction of submarines in accordance with the time line approved in Navy's 30 years submarines construction plan.*

- *Combat readiness may be maximised by achieving prescribed submarine operating standards. Waiting time for medium refits of submarines may be minimised to improve operational availability of the existing fleet.*
- *Submarines may be equipped with vital equipments which are essential for enhancing their performance capabilities. The process of acquisition of deep submergence rescue vessel may be expedited to minimise dependence on external sources for rescue operations.*
- *Ministry may take appropriate measure to minimise delays in commencement and completion of refits including medium refits by ensuring that adequate infrastructure facilities exist in Naval Dockyards/ Defence PSUs for undertaking such refits commensurate with the existing inventories and planned acquisitions of submarines.*
- *System of provisioning of spares may be reviewed with a view to ensure timely availability of necessary spares before commencement of planned refits of various submarines.*
- *The available refit facilities may be optimally utilised to avoid postponement of refit activities and waiting time of submarines.*
- *Instead of sanctioning piecemeal packages, a comprehensive modernisation plan may be drawn up with approval of CFA based on futuristic requirements and the residual life of the submarines.*
- *Fitment of a new system which directly affects the operational capabilities of a submarine should be undertaken only when the maiden system proves its efficacy at sea and should be timely and in line with the latest developments so as to avoid technological obsolescence.*
- *Training aids like simulator may be made available to impart quality training to submariners in simulated environment in a cost effective manner.*

3.1 Introduction

For a Navy aspiring to have 'blue water[39]' capabilities, submarines are a crucial element because of the varied roles they can play such as (a) attacking surface and sub-surface enemy vessels, (b) laying offensive mine-fields, (c) blockade of enemy ports and other lines of communication, (d) landing of reconnaissance teams for intelligence gathering and (e) special operations.

[39] A maritime force capable of operating across the deep waters of open oceans.

Today, a conventional submarine costs around Rs 1870 crore which may however vary depending upon the type and the capabilities it possesses.

For the Indian Navy, submarines are potent force multipliers since the long coastline of India implies a critical defensive role. The submarine arm of the Indian Navy operates from two locations viz. Western Coast and Eastern Coast. The Flag Officer Commanding in Chief (West) and Flag Officer Commanding in Chief (East) are the administrative and operational authorities for submarines through the respective Commodore Commanding Officer of Submarines (COMCOS) who are based at the respective Commands.

Between the years 1967 and 2000, Indian Navy acquired 'n' number of submarines of three different classes. At present, Indian Navy possesses 'p' number of submarines of three different classes, viz; 'X', 'Y' and 'Z'. While 'X' class submarines account for 12.5 *per cent* of the total submarine fleet and were inducted in early 1970s, all but two 'Y' class submarines were commissioned between 1986 and 1990. The last two 'Y' class submarines were inducted during 1997-2000. 'Z' class submarines accounted for 25 *per cent* of the submarine fleet and were commissioned between 1986 and 1994. The prescribed life of an 'X' class submarine is 20 years, whereas for 'Y' and 'Z' class, the life is 25 years.

3.2 Scope of Audit

Broadly, this Performance Audit aimed to examine the efficiency of functioning of the submarine arm of Indian Navy in terms of operational availability of submarines, effectiveness of modernisation and refit activities undertaken, performance of systems fitted on-board after modernisation, and the efficacy of training imparted. The audit covered performance of the existing three classes of submarines for the period 1998 to 2006.

3.3 Audit Objectives

The study sought to examine whether:

- the Indian Navy maintained the required force level of submarines and operational availability was as per standards;
- repair and refit activities were undertaken efficiently and with due regard to implications on the time and cost overrun;
- infrastructure facilities created for refit activities were adequate and exploited to the optimum level;

- modernisation of existing submarines was done in a timely manner and progress achieved was as envisaged; and
- training activities imparted to the officers and sailors were adequate including the availability and utilization of the training aids and simulators.

3.4 Audit Criteria

The following audit criteria were used to evaluate the performance:

- Envisaged force level as per perspective plan of the Indian Navy ;
- Prescribed operational availability of the submarines;
- Operational-cum-Refit Cycle as promulgated by Integrated Headquarter (IHQ) of Ministry of Defence (Navy) and the refit planning procedure formulated to monitor the refit activities;
- Policy pages on the infrastructure facilities to be created;
- Laid down modernization plan, if any, for the existing submarines;
- Projected performance of the systems modernised/upgraded on the submarines; and
- Utilization of training aid/equipment/simulators.

3.5 Audit Methodology

An Entry Conference was held on 30th April 2007 with the Ministry of Defence (MOD) along with the officers of the Navy wherein the audit scope, objectives of audit and criteria were discussed. Subsequent audit examination consisted of scrutiny of documents/records of various Directorates at Integrated Headquarters (IHQ) of MOD (Navy), shore units/submarines based at West and East Coast, collection of information through the issue of questionnaire / audit memos, and discussion with key personnel. Audit findings were issued to Navy/Ministry. The reply wherever received have been incorporated in the report.

Audit was constrained by the lack of availability of data in some cases and inordinate delay in the receipt of information from Indian Navy during the currency of audit.

3.6 Audit Findings

Audit findings are classified under the following heads (1) Operational availability and planned induction of submarine, (2) Refit and maintenance (3) Modernisation of submarines, and (4) Training aids.

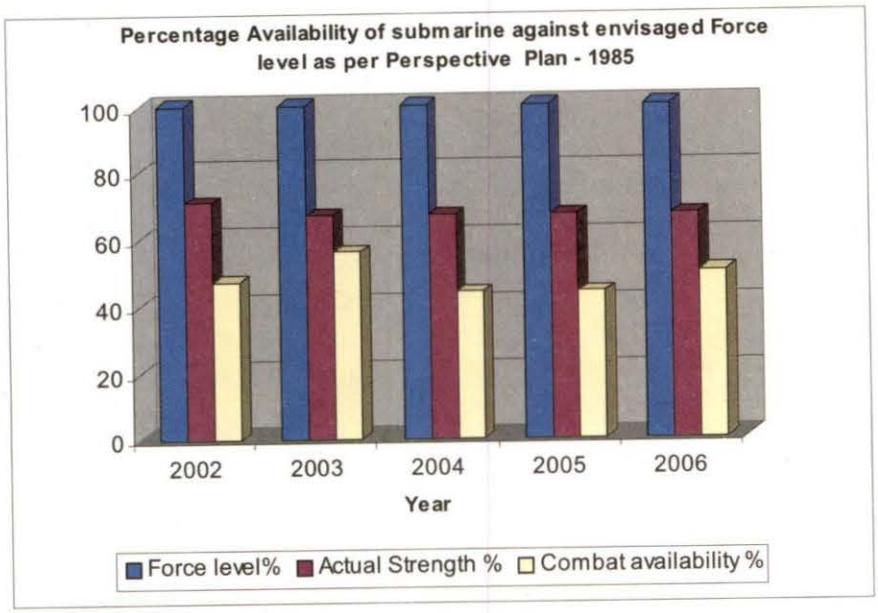
3.6.1 Operational availability and planned inductions

Audit observed depleted force level with shortfalls in the operational availability of submarines and limited achievement of operation cycles. These are discussed in detail in succeeding paragraphs.

3.6.1.1 Actual Force Levels were not commensurate with Planned Levels

The Navy Perspective Plan provides a long-term view of the anticipated operational environment in which the Navy will be called upon to perform, the capabilities they will be required to acquire and their associated costs. Navy had formulated a 15 year Perspective Plan in 1985 where in a force level of 'a' number of submarines was envisaged by 2000. Based on this plan, Competent Financial Authority (CFA) approved Navy's 30 year submarine construction plan in 1999 wherein 50 *per cent* of submarines were to be constructed by 2012 and the remaining submarines of indigenous design to be inducted by 2030.

Audit noticed a consistent shortfall in meeting the planned force levels. Six numbers of 'X' class submarines have been decommissioned during 1989-2003. Despite induction of new submarines of class 'Y' and 'Z' during 1986-2000, at present, Indian Navy holds an inventory of submarines which is just 67 *per cent* of the force level envisaged as per the 1985 Plan. Even with this depleted force level, the average operational availability of submarines during the period 2002-2006 ranged from 44 to 56 *per cent* of the available strength.



Navy is unlikely to achieve the target of acquisition of 50 *per cent* of envisaged force level by 2012, as its acquisition/construction plans for new class of submarines have fallen behind schedule. The acquisition/construction plans are so delayed that the first indigenously constructed submarine is likely to be inducted by 2012 only and the 25 *per cent* of construction plan is likely to be achieved by the year 2017. However, within this period, more than 80 *per cent* of the existing fleet would have completed their assigned life.

Hence Ministry could not ensure adherence to its submarine induction plan 1999 which may impact Navy's operation preparedness adversely.

3.6.1.2. Ageing Fleet of Submarines

'X' class of submarines account for 12.5 *per cent* of the present fleet of the submarines held by Indian Navy. These submarines of 1960 vintage, inducted during 1973-1974 have long outlived their prescribed service life. Nonetheless, these are being shown as part of the existing force level. Many of the 'Y' and 'Z' class of submarines, which constitute 87.5 *per cent* of the fleet strength, are also fast approaching their prescribed operational life. More than 50 *per cent* of 'Y' and 'Z' class of submarines have completed 75 *per cent* of their estimated operational life by the year 2007.

Audit also noticed that this has primarily happened due to delay in the acquisition of the submarines during last decade. By the time, the first

submarine of the 'New Class' is inducted in 2012, 63 *per cent* submarines available in the existing fleet would have either completed their prescribed life or would have less than one year of residual life left.

Navy stated (November 2007) that the service life of submarines is extended in view of the sound maintenance philosophy and thus there would be changes in de-commissioning dates of submarines. However this is not tenable as the new induction plans are based on the de-induction dates worked out by Navy themselves. Further the maintenance philosophy are also not strictly followed which is evident from the data of Short Refit (SR) / Normal Refit (NR)/ Medium Refit (MR) as brought out in Para 3.6.2.3 and 3.6.2.4.

3.6.1.3. Operational availability of submarines

A submarine is not available for operational use during repair, refit or overhaul. Indian Navy needs to plan its acquisition, refit and overhaul schedule well to ensure operational availability of adequate number of submarines at all times to maintain desired combat level. An analysis of operational availability of submarines during January 2002 to December 2006 revealed the following:

- The average operational availability of submarines during January 2002 to December 2006 was 48 *per cent.*
- While only 42 *per cent* of the submarines were available for the year 2005, the maximum availability of submarine was of 59 *per cent* in the year 2003
- No 'X' class submarine was available for two and half years while one 'X' class submarine was not available for the entire period of January 2002 to December 2006.
- During the period between February and October 2002 when the operational needs were high, only 44 *per cent* submarines for a period of five months and 56 *per cent* submarines for a period of one month were available for operational role.

Given their importance in the overall defence preparedness, actual availability of submarines in terms of combat readiness was, therefore, not optimal.

3.6.1.4 Ship Operating Standards (SHOPS) for submarines

Ship Operating Standards-96 (SHOPS-96) is a framework of exercises designed to maintain a submarine in the high state of operational readiness. As per these standards, the time taken by a 'Y' class submarine for the exercises

should not exceed 1000 hours per operational cycle[40]. These 1000 hours are further allocated as 50 *per cent* for operational patrols (P), 20 *per cent* for major Anti-submarine warfare (ASW) /Tactical exercises and 30 *per cent* for individual work ups (IW).

On the basis of the information provided to Audit in respect of 40 *per cent* of the 'Y' class of submarines for three operational cycles, it was observed that the norm of maximum limit of 1000 hours was exceeded in 75 *per cent* cases. These submarines spent more time on exercises exceeding the SHOP norms to the extent of 29.5 to 455.5 *per cent* during their operational cycle.

Further, significant variations were observed in the time consumed for each category of exercise performed by the submarines. Actual time spent on operational patrols was 190 *per cent*, anti-submarines warfare 790 *per cent* and individual workups 302 *per cent* as against the prescribed norms.

Submarines-wise analysis in respect of three 'Y' class of submarines disclosed that submarine 'Y-7' did not perform the operational patrols even once whereas another submarine 'Y-9' spent more time on ASW and third test checked submarine 'Y-4' utilized the entire time for individual work up during the first operational cycle. Clearly, prescribed standards were not adhered to.

Navy stated that specific deployment of submarines are based on various other factors and do not have a bearing on the submarine utilisation standards. However Audit feels that optimum utilisation of submarines as per prescribed standards should be maintained through better planning, efficient coordination and timely acquisition of adequate number of submarines so as to maintain high state of operational readiness by all the submarines.

3.6.1.5 Non-achievement of prescribed days at sea

Before a submarine undergoes its Medium Refit (MR), it has to be in operational state for a certain period as prescribed by Navy. In case of 'Y' class of submarines, the period of operational state is 108 months i.e. the submarine has to be at sea for 108 months before it undergoes a medium refit. Audit examination disclosed that in the case of five 'Y' class submarines that have undergone MR, none of the submarines achieved the prescribed days at sea. For two submarines in particular, the availability was 58 *per cent* only. Table below depicts details of shortfall in achieving the prescribed days at sea:

[40] Operational cycle is a period between two intervening prescribed refits when the submarines are in operational state.

Sl No.	Name of Submarine	Prescribed duration at sea as per OCR	Actual time spent at sea	Time spent at sea as percentage of availability	Shortfall
1	Y-1	108M	62M 20D	58	45M 10D
2	Y-2	108M	84M 21D	79	23M 9D
3	Y-3	108M	100M 3D	93	7M 27D
4	Y-5	108M	63M 1D	58	44M 29D
5	Y-6	108M	88M 8D.	81	19M 22D

M=Months, D=Days.

Note-

(i)Percentage has been worked out taking >15 days as a complete month
(ii)MR falling due after availing 108 months of Operational cycle (six ops. cycles of 18 months as per OCR 02 of 04/96).

This indicated that operational utilisation and refit of submarines was not planned and executed efficiently.

Audit further observed that while scheduled refits curtail the availability of submarines on legitimate grounds, 109 submarine-months between January 1998 and March 2006 were lost in terms of operational availability by 'Y' and 'Z' class of submarines due to other factors such as waiting for MR, and special repairs. Out of this, 71 submarine-months were lost on account of waiting for the MR. In other words, on an average one submarine was waiting for MR all the time during last five years. Given the low availability of submarines against the envisaged force level, significant wastage of submarines-months in waiting further affected their availability for operational use.

3.6.1.6 Absence of vital equipment in submarines

(a) ***Non-availability of mine saddle for 'Z' class of Submarines***

A mine saddle provides a submarine with the capacity to carry mines externally without any reduction in the quantum of armaments that can be carried by the submarine. In the absence of the mine saddle, the submarine cannot be deployed for mine laying operations, which is considered to be detrimental to the combat capability of the submarines. As two indigenously built 'Z' class submarines were in operation without this vital equipment, a contract was concluded in March 1998 with an Indian firm to design, development and manufacture of one mine saddle equipment for Rs 14.92

crore with an option to procure an additional saddle for Rs 8.98 crore after the successful trial of the first equipment. This option was valid for a period of one year from the date of signing the contract. However, the first mine saddle equipment supplied by the firm was accepted by the Navy only in April 2002 after the successful completion of the sea trials. Since it took four years for the Navy to accept the equipment, the option clause could not be exercised. In the meantime in March 2003, the equipment was damaged during a sea-sortie, primarily on account of design defect[41]. This indicates the failure of Navy to exercise due diligence while approving and accepting the equipment at all stages including design, development, and manufacture, testing and sea trials.

Navy had to incur an extra expenditure of Rs 1.75 crore to rectify the defects. Though the repaired mine saddle completed its Harbour Acceptance Trial (HAT) in January 2006, the Sea Acceptance Trial (SAT) of the repaired saddle is pending as the submarine is undergoing its MR which would be completed only by October 2008. Thus, till that time the equipment will be kept idle. Meanwhile, in September 2005, Ministry accorded sanction for the procurement of the equipment from the same firm at a total cost of Rs.11.55 crore for the second submarine even though SAT of the repaired saddle meant for the first submarine were still on. NHQ concluded a contract with the firm in November 2005 and the equipment was received at Naval Dockyard-1 in May 2007. Though the HAT of the equipment are in progress (July 2007), the SAT will be conducted only after the MR of the submarine which is yet to commence.

From the above it is apparent that these submarines are operating without this vital equipment since their commissioning in 1992 and 1994 respectively affecting their combat capability. Further, the equipment procured at a total cost of Rs 26.47 crore will be kept idle till the completion of MR of the designated submarines. Delay in acceptance of the first equipment has also resulted in extra avoidable expenditure of Rs 2.57 crore as the option clause could not be exercised in procurement of the second mine saddle.

(b) ***Inadequate air conditioning (AC) environment on Board 'Y' Class Submarines***

The air-conditioning system fitted onboard 'Y' class submarines are inadequate since the induction of the first submarine in 1986. As a result, the performance of Weapons and Sensor equipment is below par and the habitability condition of personnel onboard poor. Various measures taken by Navy like installing split ACs to augment the air conditioning have not been

[41] Dimensional differences in the case of one component i.e. 'long eye', between the indigenous mine saddle of the submarine and the original design of the imported mine saddle.

successful. Based on the design study conducted in 2003, only two submarines are being fitted (August 2007) with new AC plant for achieving the desired temperature of 25^0 C. Thus, even after two decades of induction, Navy is yet to address this problem and 'Y' class submarines are persisting with this handicap adversely affecting the performance of various equipments fitted on board.

3.6.1.7 Non-availability of Deep Submergence Rescue Vessels.

Deep Submergence Rescue Vessel (DSRV) is vital for saving the lives of submariners from a submerged submarine. Given the absence of this facility, the Indian Navy had entered into an agreement with a foreign Navy for utilization of their Navy Global Submarine Rescue Fly Away (GSRFA) Kit in 1997. Navy, in June 2000, initiated a case for procurement of two DSRVs to reduce its dependence on the foreign source for rescue operations. Parliamentary Standing Committee in its eighth report (2002) had also stressed on the acquisition of this Rescue Vessel on priority. The acquisition was accorded approval in principle by the competent authority in November 2002 at a cost not exceeding Rs 270 crore, with maintenance cost not exceeding Rs 6 crore per year for a period of 25 years and Rs 14 crore for the training of Naval personnel. However, the contract for the equipment has not been concluded even after a lapse of five years. In reply, Navy stated (August 2007) that the case was being initiated afresh as per Ministry's directive. Thus, due to delay in conclusion of the contract for procurement of DSRV, Navy has to depend on foreign source for rescue operations.

Recommendations

- *Since the availability of the submarines with the Indian Navy is much below the envisaged force level and large number of submarines in the existing fleet have/ will become due for decommissioning in immediate future, Ministry may take all possible measures to expedite acquisition/ construction of submarines in accordance with the time line approved in Navy's 30 years submarines construction plan.*
- *Combat readiness may be maximised by achieving prescribed submarine operating standards. Waiting time for medium refits of submarines may be minimised to improve operational availability of the existing fleet.*
- *Submarines may be equipped with vital equipments which are essential for enhancing their performance capabilities. The process of acquisition of deep submergence rescue vessel may be expedited to minimise dependence on external sources for rescue operations.*

3.6.2 Refit and Maintenance

The Navy's maintenance philosophy is implemented through the adoption of an "Operation cum Refit Cycle" (OCR) for each class of submarine. A submarine remains in an operational state for specified period[42], and at the end of the operational phase, each submarine undergoes a Short Refit (SR), Normal Refit (NR) or Medium Refit (MR) as per OCR schedule. The prescribed durations for SR, NR and MR of 'X' class submarines are 3 months, 12 months and 36 months respectively. For 'Y' and 'Z' class submarines, the corresponding periods are 3, 18, and 36 months and 3, 12, and 24 months respectively. As a result, ideally an 'X' class submarine is likely to be operational for 135 months (56 *per cent*) out of an approximate life-span of 240 months, a 'Y' class submarine is operational for 204 months (68 *per cent*) and a 'Z' class submarine is operational for 216 months (72 *per cent*) out of their approximate life span of 300 months.

3.6.2.1 Financial Planning

Refit activities undertaken at Naval Dockyards are met from their own resources of manpower, material and the facilities already created within the Dockyard. The spares required for the refit are being procured by different directorates as per the powers vested with them. The expenditure incurred for off loading various works related to the refits undertaken by the Dockyards due to capacity constraints are met through the allocation made to the Dockyard under the delegation of financial powers vested with the Dockyard authorities and the expenditure is controlled through respective budget head. In respect of repairs/ refits that are off-loaded to Public Sector Undertaking (PSU) yards /foreign repair yards, demands for funds are projected through budget estimates/revised estimates.

An analysis of the actual expenditure against the Revised Estimates (RE) for the period 2002-03 to 2006-07 in respect of refits undertaken at PSU and foreign repair yards revealed the following:

- In respect of PSU yards, there was excess expenditure to the extent of 31.76 *per cent* of RE in 2005-06 and a huge saving of 86 per cent in 2003-04.
- In respect of foreign repair yards, there were savings ranging between 20 to 24 *per cent* during 2005-06 and 2006-07

[42] 9 months for 'X' class and 18 months for 'Y' and 'Z' class of submarines.

Significant savings/excesses are indicative of deficient financial management of refit activities.

3.6.2.2 Adequacy of infrastructure facilities for refits

Decisions taken for the acquisition of submarines also require that adequate provisions are made for meeting their repair and maintenance needs. Audit observed that facilities created for refits of submarines are not commensurate with the number of submarines inducted in one go. This was particularly evident in the case of 'Y' class of submarines wherein N numbers were inducted during 1986-1990. As a result, the MR of these submarines became due in quick succession creating additional and sudden load on the existing infrastructure which could cater for only one MR at a time. Consequently, MRs could not be taken up as per the approved refit cycle and Indian Navy (IN) had to offload MRs of most of the 'Y' class of submarines abroad. IN incurred an expenditure of USD 215.78 million on offloading of MRs during 1999 to 2005. Audit also observed that other refits i.e., SR and NR were also delayed due to capacity constraints.

3.6.2.3 Delay in completion of refits

Audit noticed considerable delay in the completion of refits for the period 1998 to 2006. Eighty three *per cent* of SRs and 100 *per cent* of NRs and MRs were delayed. While 100 *per cent* NRs were delayed for more than six months, more than 60 *per cent* MRs were also delayed for a period exceeding six months. The extent of delay in executing refits in various categories of submarines was as shown below:

	'X' class			'Y' class			'Z' class		
	SR	NR	MR	SR	NR	MR	SR	NR	MR
Number of refits undertaken	02	01	01	15	05	05	07	02	02
Refits delayed	01	01	01	13	05	05	06	02	02
Range of Delay in completion of refit									
Refit period (months) as per norms	03	12	36	03	18	36	03	12	24
Delay upto 3 months	01	-	-	10	-	02	02	-	-
Delay of 3 to 6 months	-	-	-	02	-	01	01	-	-
Delay above 6 months	-	01	01	01	05	02	03	02	02

The delay in completion of refits was attributed to lack of expertise, non-availability of spares and technical documents, and capacity constraints etc. The delay was also commented upon in CAG's Audit Report of 1997. At that time as well, the reasons given above were cited by Navy. Even after a lapse of a decade, there has been no perceptible improvement in the situation. Delay in completion of refits further reduces operational availability of the submarines.

3.6.2.4 Delay in commencement of Medium Refits (MR)

Analysis of data on status of MR commencement and their completion against the due dates and duration as per Operation Cum Refit cycle revealed the following:

- Commencement of MRs of 'Z' class of submarines was abnormally delayed. The extent of delay ranged between two years to more than six years. MR of one 'Z' class of submarine has not been taken up though became due in August 2006.
- MRs of all 'Y' class submarines except one also commenced late. The delay in commencement was more than four years in 40 per cent cases.
- There were considerable delays ranging between 10 months to 43 months in completion of MRs taken up in India.

Although Indian Navy acquired a number of 'Y' and 'Z' class of submarines in a short span of time (1986-1990), it did not create adequate infrastructure in the naval dockyards / other PSUs to ensure timely completion of refits as per prescribed schedule. Facilities have been created to undertake one MR at ND-2. The first MR, which was taken up at ND-2 in July 1999, could be completed in five and a half years as against the prescribed period of three years. As a result, there was a cascading effect on taking up of MRs of other submarines, which became due during this period. Further, MRs of submarines could also not be taken up on time due to delay in the completion of their SRs and NRs, which has been brought out in para 3.6.2.3.

Navy stated (November 2007) that the bunched induction, break up of erstwhile USSR and incapability of PSU's also contributed for the delay.

The reply of Navy confirms the Audit contention that the process of acquisition of submarines had not been planned well, adequate infrastructure for repair and refits was not created in Naval dockyards and PSUs, and timely availability of spares was not ensured, resulting in delays in commencement and completion of MRs and significant off loading of submarines abroad for MRs.

Some specific instances of poor planning and deficient execution of refits are discussed in paragraph 3.6.2.5 below.

3.6.2.5 Poor planning and deficient execution of refits

Audit noticed tardiness in the completion of refits in most cases. These delays were due to non-availability of spares besides non-availability of the yard as a consequence of delays of earlier refits. Though refits are undertaken under a Refit Planning Program wherein the action for provisioning of machinery, spares, paints required for the refit and all other elements are considered, the refit undertaken at Indian yards were considerably delayed resulting in the non-availability of the submarine for operational activities for substantial period. This also heightened the dependence on foreign ship-builders for the refit and maintenance. Some specific cases of poor planning and deficient execution of refits are discussed below:

(i) Unfruitful NR of a 'Y' Class Submarine

Submarine 'Y-8' was inducted in December 1990 and became due for NR and MR in December 1995 and June 2002 respectively. However, due to bunched induction of submarines, delays in its earlier SRs and the necessity to maintain minimum force level, the NR could commence only in November 1999, i.e. after a lapse of four years and was to be completed by May 2001. However, the NR was completed only in January 2003; the delay of 20 months being primarily due to non-availability of spares, documentation, availability / replacement of rubber tiles etc.

Records revealed that even after the NR, the material state of the submarine continued to be unsatisfactory and operational availability was sub-optimal. Within a span of eight months, restrictions were placed on the diving depth[43] of the submarine to only 50 metres. Further, since the MR of the submarine was overdue, in March 2005, Ministry accorded two sanctions for offloading the MR-cum-Upgradation at a total cost of USD 97 million inclusive of USD 42.661 million (Rs 425.83 crore @ Rs 43.90 per 1 USD) for MR to a Russian vendor. Thus, the MR was commenced within a span of two and half years of the NR as against the prescribed gap of five years. Clearly, the prolonged execution of NR did not achieve the desired result, involved unnecessary expenditure and resulted in the sub-optimal use of the submarine.

[43] The prescribed diving depth of Y class submarines is 240 metres.

(ii) Restricted usage after completion of MR

Submarine 'Y-2' commissioned in the year 1987 had completed three Short Refits and one Normal Refit before the commencement of the Medium Refit (MR) in July 1999 at ND-2. Against the prescribed refit duration of three years, the MR was completed in a period of five years and eight months. Reasons attributed for delay in refit were non-availability of spares in time for major equipment, delay in installation of chilled water system and the undue growth of work due to fitment of indigenous sonar. Audit noticed that the submarine was unable to achieve prescribed SHOPS in spite of undergoing the refit. This was attributed to the non-acceptance of sonar equipment as on August 2007 which restricted the diving depth of the submarine and its operational commitments.

(iii) Unfruitful expenditure on the MR of an old Submarine

Submarine'X-7'commissioned three decades ago with a prescribed life of twenty years, was due for second Medium Refit in January 1993. Due to shortfall in refit capacity at Naval Dockyards, Navy examined the feasibility for offloading the refit to a Public Sector Undertaking (PSU) and in June 1997 concluded a contract for Rs.99.97 crore for the MR of the vessel. The refit was commenced in August 1997 with Dockyard Completion Date (DCD) as 21st August 2000. However, refit could not be completed as per the DCD and in September 2002 PSU forwarded a Statement of Case for the growth of work amounting to Rs.56.94 crore citing lack of expertise, non-availability of spares due to break-up of erstwhile USSR and unrealistic work package. Accordingly, a supplementary contract to the main contract was concluded in October 2003 for the additional work amounting to Rs.50.89 crore and extension of 27 months was also given.

Audit observed that:

- Even after the extension of 27 months, the refit could be completed only in December 2006. As against three year authorised for undertaking MR, the PSU took nine year and five months for the completion of the MR.
- Till date (June 2007), an amount of Rs 142.50 crore has been paid to the PSU. The liquidated damages (LD) amounting to Rs 8.30 crore will be deducted from the VIIIth stage payment. The amount of liquidated damages recoverable from the PSU may not fully compensate for the non-availability of the submarine for more than five years due to delays on the part of the PSU to complete the MR within the prescribed time.

- Before the commencement of MR, the submarine was kept under notice to MR for a period of 43 months. During this waiting period, the submarine remained unavailable to the fleet for operational use.
- The post refit performance of the submarine was unsatisfactory as the sonar / sensor equipment continued to perform poorly.
- The PSU expressed their inability to rectify various pending defect liabilities. This compelled Navy to prepone the SR to July 2007, which was otherwise due only in September 2007. Thus SR was planned without even completing the prescribed nine-month operational cycle.
- The waiting and refit period was abnormally long. The submarine was, therefore, not available since 1993-94 (for a period of 156 months) for any operational commitments. Given the fact that X-7 was to be decommissioned in 1999, it is doubtful whether Indian Navy would get value for money from the investment of Rs 142.48 crore on second MR of this ageing submarine.

Navy stated (November 2007) that expenditure incurred on the submarine cannot be termed as unnecessary in view of the material status of the submarine and to maintain the minimum force level requirement. Navy further added that date of decommissioning has no direct link with the assigned life of the submarine. But the fact remains that 'X' class submarines were to be considered for decommissioning after 20th year of their induction and though submarine 'X-7' has attained the age 33 years, of which the last 13 years were spent under prolonged refit, its continued retention in the fleet despite sub-optimal performance is indicative of poor induction/de-induction planning in submarine arm of Indian Navy. Deficient planning compelled Indian Navy to retain obsolete vessel much beyond its assigned life.

(iv) Avoidable delay in the NR of a Submarine

NR of 'X-5' submarine was commenced in September 2005 with a prescribed duration of 12 months and was completed in March 2007 after 18 months. The extended duration of NR was justified citing additional work on the renewal of paint scheme and renewal of all wet end/outboard sonar devices after commencement of the refit. However, Audit observed that the renewal of paint scheme came into force in 2003, i.e., well before the commencement of NR. Further, replacement of sonar devices was necessitated due to completion of their prescribed service life which could have been visualized before the commencement of the refit.

(v) Delay of NR due to logistic / infrastructural constraints

Submarine 'Z-4' was scheduled to undergo NR from May 1999 to April 2000. However the refit was commenced in March 2000 and completed in May 2002 by consuming 26 months as against the prescribed duration of 12 months. The major factors attributable for the delay were late receipt of paints, non-availability of spares in time and additional underwater defects and constraints in the availability of Dry Dock. Further, the non-availability of GISMOL Compound which is required for ceiling the underwater cable connectors of various systems fitted onboard also contributed to the delay.

The above facts indicated that the refit planning was deficient as availability of requisite spares and material was not ensured.

(vi) Abnormal delay in commencement of MR of a submarine

The MR of 'Y-7' submarine was due in December 2000 but it could commence only in January 2006. Audit examination disclosed that there was considerable delay in procurement of spares for the refit. There were also deficiencies in the selection and award of contract for supply of spares. NHQ rejected the bid of a vendor A on the ground that they had no export license and concluded a contract for procurement of spares from a firm B which also had no export license. By rejecting the bid of the vendor A, Navy was deprived of competitive rates entailing an extra expenditure of Rs. 39.27 lakh. Unnecessary concessions were given to the firm B in the form of non-levy of liquidated damages amounting to Rs. 12.18 lakh due to delayed supplies. A comparison of the rates accepted in respect of 98 items of spares with the last purchase price of 2002 (after allowing escalation of three *per cent per annum*) revealed that the rates accepted were higher by 34 *per cent* to 12,964 *per cent* over the last purchase price. Acceptance of higher price entailed an extra expenditure of Rs. 91 lakh.

Hence, inefficient planning and deficient execution of refits resulted in abnormal delays in commencement/completion of refits. This led to idling of submarines which adversely affected their availability to the fleet for operational use.

Recommendations

- *Ministry may take appropriate measure to minimise delays in commencement and completion of refits including MRs by ensuring that adequate infrastructure facilities exist in Naval Dockyards/ Defence PSUs for undertaking such refits commensurate with the existing inventories and planned acquisitions of submarines.*

- *System of provisioning of spares may be reviewed with a view to ensure timely availability of necessary spares before commencement of planned refits of various submarines.*
- *The available refit facilities may be optimally utilised to avoid postponement of refit activities and waiting time of submarines.*

3.6.3 Modernisation of Submarines

A general contract was concluded in December 1996 with a Russian vendor for carrying out the MR-cum-modernization of the 'Y' class submarines due to capacity, infrastructure and expertise constraints at Naval Dockyards. Under the general contract, supplementary agreements were concluded for each submarine which included fitment of 'A-Type' missile complex. In respect of 'Z' class submarines, modernization basically included upgradation / replacement of equipment to enhance the capabilities. Upgradation/replacement of this class of submarines is being undertaken at a Defence PSU.

3.6.3.1 Modernisation of submarines without taking approval of CFA

As per General Financial Rules[44], significant expenditure incurred for acquiring tangible assets of permanent nature or enhancing the utility of existing assets shall be classified as Capital Expenditure. Further, sanctioning expenditure under Capital Head exceeding Rs. 50 crore was beyond the delegated financial powers of the Ministry of Defence and the Ministry of Finance, and required approval of the Competent Financial Authority (CFA). The powers of the Ministry to sanction Capital expenditure were enhanced to Rs.100 crore in 2002. However, disregarding the laid down procedure and delegation of financial powers, the Ministry, from 1998 onwards, sanctioned the modernisation packages of nine submarines, at an aggregated cost of Rs.1559.64 crore from Revenue budget without taking approval from CFA. Each of the nine modernisation packages sanctioned exceeded the prescribed delegated financial power of the Ministry.

Audit observed that the modernisation involved enhancement of operational capability. In the case of 'Y' class submarine, the modernisation involved fitment of Tube Launch Missile (TLM) for land/sea attack capable facility which was not there earlier. Even, in the case of 'Z' class, modernisation involved replacement of equipment to enhance their capabilities. It was also

[44] Rule 79 of GFR

noticed that the case was initially processed under Capital Head for the first modernisation of 'Y' class. However, Navy later decided to pursue the case under Revenue Head ostensibly for administrative convenience. Clearly, this action was taken to avoid reference to CFA and is a violation of financial rules.

3.6.3.2 Non-fitment of equipment procured for modernisation

The MR-cum-Modernisation of 'Z' class submarines started in a sequential manner with work starting on submarine 'Z-1' in August 1998 and package for submarine 'Z-2' being approved in 1999. While approving the package for 'Z-2', Ministry (May 1999) included seven additional equipments which were not considered for 'Z-1' earlier. Stating that commonality of equipment is a must for all 'Z' Class submarines; IHQ of MoD (Navy) submitted a proposal to the Ministry in August 2002 for the additional equipments for 'Z-1'. The proposal also included a Submarine Fire Control System for 'Z-1'. Ministry approved the proposal for procurement of additional equipment in July 2003. These equipments were to be fitted during the NR of the 'Z-1' submarine which was scheduled during 2005-06. Though the equipments valued at Rs.115.29 crore have been received during the period 2005 to 2007, they are lying in stock as the NR of the submarine has been re-scheduled for the year 2009 on account of operational requirements.

While Navy stated that four equipments would be fitted during the SR scheduled in 2007 and the remaining three equipments costing Rs.91.25 crore would be fitted during the NR, the delay in fitment has resulted in the likelihood of expiry of the warranty period which is to expire between April 2007 and July 2009 as stipulated in the contract. Due to delay in undertaking NR as scheduled in 2005-06, submarine 'Z-1' would continue to lack the state-of-the-art equipments until 2010 when the NR of this submarine would be completed. Further, the equipments would be lying unused for a considerable period besides blocking of funds to the extent of Rs.115.29 crore. Besides, technological obsolescence is also an ever-present threat with sophisticated electronic equipments.

This submarine will be left with only three years to exploit these new equipments as the de-induction of the submarine 'Z-1' is due by the year 2013.

3.6.3.3 Performance of equipment fitted under Modernisation package

(i) Navigational Complex on board 'Y' Class Submarines.

The main Navigational Complex (NC) onboard the modernized 'Y' class submarines consists of four parts of which the Inertial Navigational System

(INS) is critical for missile firing. Five 'Y' class submarines were fitted with NC at an approximate cost of USD 40.1 million (Rs 180 crore)[45] between 2000 and 2004. Due to the erratic performance of INS and other limitations observed during missile firing, repairs were carried out on the system. Navy in July 2005 stated that reliability of the INS continues to remain low despite the extensive repairs undertaken by the Original Equipment Manufacturer (OEM) on three occasions at a total cost of Rs. 56.58 lakh. Audit observed that as of May 2007, out of five submarines, INS was non-operational in three. As a result, the missile firing capabilities are functioning at a suboptimal level and to that extent modernisation of this class of submarines has not achieved its objectives.

(ii) Sonar

'Y' class submarines were fitted with a sonar system of earlier vintage which required replacement with a new state-of-the-art sonar. A new sonar developed by Defence Research and Development Organization (DRDO) and productionised by an Indian PSU is a state-of-the-art indigenous digital sonar with the advantage of simultaneous panoramic coverage around the platform. Ministry approved (February 2001) procurement of four new sonars and accordingly, a contract was concluded with the PSU in March 2001 at a negotiated cost of Rs 167.64 crore. At present, three sets have been fitted on-board while the fourth is to be fitted during December 2007.

Audit observed that Ministry placed the bulk order despite knowing the fact that the new sonar was only at its developmental stage and yet to be proved on 'Y' Class platform. Further, it was noticed that the performance of the new sonar fitted on the first two submarines, is far from satisfactory and the Sea Acceptance Trials of the sonar have not yet been completed. As a result of the unreliable sonar, 'Y-2' submarine is unable to meet its operational commitments since completion of its MR in March 2005 as diving depth is restricted considerably. Submarine 'Y-1', on the other hand, has been cleared for its operational duties disregarding a Navy order which stipulates that 'Safe to Dive certificate' be issued only after the completion of SATs, thereby putting lives of the submariners and submarine at risk. In fact in January 2008, submarine 'Y-1' while on its voyage for undertaking fleet level exercise was reported to have collided with a cargo ship at "periscope depth".

[45] 1 USD = Rs 44

(iii) Fitment of air conditioning system

Air-conditioning onboard the 'Y-8' submarine has been inadequate since commissioning in 1990 affecting the performance of weapons/sonars equipment and personnel. Accordingly, a design study for upgradation of Air conditioning (AC) and associated systems was undertaken by Directorate of Naval Design (DND) in 2003 wherein it was recommended that the AC capacity be enhanced to 80 tons for achieving the desired compartment temperature at about 25^0 C. Based on the technical evaluation conducted in October 2004, the offer of M/s York, UK was accepted while the offer of M/s KPCL was rejected since it was unable to identify a suitable DC motor for the AC Plant. Subsequently, Navy concluded the contract in June 2006 with M/s York, UK at a cost of Rs 3.77 crore.

Audit observed that one month prior to the placement of the order on M/s York, based on the quotation received from M/s KPCL in May 2006, an order was placed in July 2006 for the supply of a similar AC Plant at a cost of Rs.1.97 crore for another submarine. Thus, procurement of AC Plant from M/s York at higher rate resulted in extra expenditure to the extent of Rs.1.88 crore. It was also noticed that supply order placed on M/s York covered the supply of the equipment and onboard spares only whereas the contract with M/s KPCL also included erection and commissioning of the plant. The contention of Navy that M/s York was the only firm technically qualified at the time of procurement for 'Y-8' is not tenable as Navy received the quotation from M/s KPCL in May 2006, i.e. before the sanction for AC Plant for 'Y-8' was accorded by the Ministry in June 2006 and contract negotiations held. Navy had adequate time to reconsider the procurement of AC Plant from M/s York, UK considering the wide variation in the cost of the AC Plant supplied by the Indian firm.

Hence, Navy incurred extra avoidable expenditure of Rs 1.88 crore in procurement of AC Plant for a submarine.

(iv) Unsuitable ESM System fitted onboard 'Z' Class submarines.

The Electronic Surveillance Measure (ESM) is a vital sensor in a submarine which provides passive detection of another vessel's presence. During the MR-cum-Modernisation of 'Z-2' submarine undertaken between August 2002 and March 2006, one ESM equipment was supplied at a cost of Rs.18.02 crore against a contract concluded in June 2002 with M/s Thales, France and fitted on-board the submarine during 2004-05. However, it was observed that the performance of the system fitted onboard was far from satisfactory and the

system had not proved its efficacy at sea till date (July 07). Observance of repeated defects with high levels of inaccuracy has precluded the system from being offered for SATs. Further, instead of proving the efficacy of the system at sea and accepting the equipment only after all defects had been removed, Navy placed a repeat order on the same firm for supply of the equipment for fitment onboard another 'Z' class submarine at a cost of Euro 2961865 (Rs 15.62 crore). The equipment so ordered has been received in March 2006 and is awaiting fitment.

Thus, procurement of unreliable ESM has prevented the submarine from operating at its optimum capacity. Procurement of similar equipment under a repeat order before proving the efficacy of the item delivered earlier is a clear violation of the provisions laid down in the Defence Procurement Manual.

Recommendations

- *Instead of sanctioning piecemeal packages, a comprehensive modernization plan may be drawn up with approval of CFA based on futuristic requirements and the residual life of the submarines.*
- *Fitment of a new system which directly affects the operational capabilities of a submarine should be undertaken only when the maiden system proves its efficacy at sea and should be timely and in line with the latest developments so as to avoid technological obsolescence.*

3.6.4 Training Aids/Simulators

3.6.4.1 Non-availability of Simulator

A simulator replicates the control room of a submarine and generates real time drills and emergencies that one may actually face at sea. A Submarine Control Simulator (SCS) for the 'Z' Class of Submarine was commissioned in May 1989 at a shore unit. Audit observed that since November 2002, no practical training is being conducted on the SCS as it has become unsupportable due to obsolescence and lack of product support for the equipment. Though four years have lapsed, the issue of procurement of a new simulator is pending with the Ministry. Non-availability of the simulator has adversely affected the operational training of the submarine crew as well as On-the-Job training.

Recommendation

- *Training aids like simulator may be made available to impart quality training to submariners in simulated environment in a cost effective manner.*

3.7 Conclusion

There have been significant changes and development in global security environment during last two-three decades. Though Indian Navy prepared a plan for acquisition of new submarines to effectively meet the challenges in the changed scenario, the implementation of the plan suffered from serious slippages. As a result, Indian Navy's fleet of submarines is far below the envisaged force level. Delays in de-commissioning of the existing aging fleet further affected operational availability of submarines due to low serviceability. Besides, due to lack of adequate infrastructure, refit activities have taken inordinately long periods for commencement and completion of Normal and Medium refits which further affected availability of the submarines for operational purposes. Poor planning of refit schedules led to over-lapping of different kinds of refits and non-operational status of submarines. Modernisation activities have also not been well coordinated and have been undertaken in ad hoc manner on piece meal basis. The sub-optimal performance of vital equipment procured at a substantial cost and fitted onboard during modernisation raises further concerns about the success of the modernisation plan. Lastly, the training establishment of submarine arm is poorly equipped in terms of simulators thereby impairing the effectiveness of the training.

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Dated : 21 April 2008

Countersigned

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Dated : 21 April 2008