

THIRTY-THIRD REPORT
PUBLIC ACCOUNTS COMMITTEE
(1980-81)

(SEVENTH LOK SABHA)

**DELAY IN DEVELOPMENT AND MANUFACTURE OF
AN AIRCRAFT AND MANUFACTURE OF DEFECTIVE
CARTRIDGE CASES FOR AN AMMUNITION**

MINISTRY OF DEFENCE



Presented in Lok Sabha on.

Laid in Rajya Sabha on....

LOK SABHA SECRETARIAT
NEW DELHI

April 1981/Chaitra 1903(S)

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Accounts Committee.

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26	1.83	15	Insert 'to' after	taken over
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47		16	considerable	considerably
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57	2.28	5	car ridge	cartridge

CONTENTS

	PAGE
COMPOSITION OF THE PUBLIC ACCOUNTS COMMITTEE	(iii)
INTRODUCTION	(v)
REPORT	5
APPENDIX : Conclusions and recommendations.	47

PART II*

Minutes of sittings of the Committee
held on 30-10-1980 and 18-3-1981.

*Not printed (One cyclostyled copy laid on the Table of the House and five copies placed in Parliament Library).

PUBLIC ACCOUNTS COMMITTEE
(1980-81)

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INTRODUCTION

1. The Chairman of the Public Accounts Committee, as authorised by the Committee, do present on their behalf this Thirty-Third Report on Paragraphs 6 and 19 of the Report of the Comptroller and Auditor General of India for the year 1978-79, Union Government (Defence Services) on Delay in Development and Manufacture of an Aircraft and Manufacture of defective cartridge cases for an ammunition.

2. The Report of the Comptroller and Auditor General of India for the year 1978-79, Union Government (Defence Services) was laid on the Table of the House on 26 March, 1980. The Committee (1980-81) examined paragraph 6 at their sitting held on 30 October, 1981. The Committee considered and finalised the Report at their sitting held on 18 March, 1981 Minutes of the sittings form Part II* of the Report.

3. The Committee have observed that the execution of both the development and manufacturing programmes of Gnat MK-II (Ajeet) aircraft was considerably delayed. Change in the security environment during the intervening period, however, necessitated curtailment of the production as well as the retro-modification programme. The Report highlights the absence of a clear perception of the country's defence requirements.

4. For reference facility and convenience, the observations and recommendations of the Committee have been printed in thick type in the body of the Report and have also been reproduced in a consolidated form in Appendix to the Report.

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

6. The Committee would also like to express their thanks to the Officers of the Ministry of Defence (Department of Defence Production) for the co-operation extended by them in giving information to the Committee.

NEW DELHI;
April 2, 1981.
Chaitra 12, 1903 (Saka).

CHANDRAJIT YADAV,
Chairman,
Public Accounts Committee.

*Not printed. (One cyclostyled copy laid on the Table of the House and five copies placed in Parliament Library).

DELAY IN DEVELOPMENT AND MANUFACTURE OF AN AIRCRAFT

Audit Paragraph :

1.1. Based on a proposal submitted by a public sector undertaking after carrying out feasibility studies, Government approved (September 1972) the development by the undertaking of an improved version (designated as MK-II) of an existing MK-I aircraft at an estimated cost of Rs. 99 lakhs (foreign exchange : Rs. 26 lakhs). According to the Air Headquarters, the MK-II version was to be inducted in service during 1976-77.

1.2. The development work was to be carried out in four stages and was expected to take three years for completion. Delivery of MK-II aircraft was expected to commence two years thereafter. When the development work was going on, the Ministry of Defence approved (July 1973) placement of orders on the undertaking by the Air Headquarters for the manufacture and supply of a certain number of MK-II aircraft at an estimated cost of Rs. 3604 lakhs (exclusive of profit). MK-II aircraft was to conform to the "standard of preparation" to be specified after completion of the development work in four stages.

1.3. In order to extend the useful life of the existing fleet of MK-I aircraft (inducted in service in the Air Force in 1958), the Ministry accorded sanction (October 1973) to the retro-modification of a certain number of MK-I aircraft to MK-II standard at an estimated cost of Rs. 2090.40 lakhs (excluding profit). The aircraft were to be made available to the undertaking for this purpose in a phased manner from 1974-75 onwards.

1.4. *Progress on development :* Work on development project was commenced by the undertaking in October 1972 on the basis of broad parameters first indicated by the Air Headquarters in the Air Staff Requirement (ASR) issued in May 1972. On the retro-modification programme, an ASR to remove the defects in and to make improvements in MK-I aircraft was issued by the Air Headquarters in November, 1972. This was expected to help the development of MK-II version of the aircraft.

1.5. In June 1974, the Air Headquarters issued a revised ASR for MK-II aircraft, which was also made applicable to the retro-modification. As the additional requirements included in the ASR of June 1974 affected all the four stages of development, the undertaking approved in September 1975 a proposal to take up further work required concurrently with the work sanctioned earlier with a view to minimising expenditure. An additional sum of Rs. 54 lakhs (foreign exchange : Rs. 10 lakhs) for development was accordingly sanctioned by the Ministry in July 1976. Development work covered by the four stages was completed in almost all respects by the undertaking by early 1976 and the "standard of preparation" of the first and second production batch of the MK-II aircraft was specified by the Air Headquarters in February 1976 and July 1976.

1.6. In March 1977, the undertaking expressed its inability to comply with some vital requirements of the MK-II aircraft as specified in the ASR of 1974. The Air Headquarters informed (March 1977) the Ministry that if the undertaking were not able to ensure performance close to the ASR of 1974, the Air Headquarters might be compelled to review the entire acquisition programme for the MK-II aircraft.

1.7. While proposing (May 1977) the incurring of further development expenditure of Rs. 40.50 lakhs for certain additional tasks, the Air Headquarters stated that though there were serious shortcomings in the MK-II aircraft, it was not envisaged to drop the project altogether, but it might become necessary to reduce the number of aircraft to be produced. The Ministry accordingly enhanced (July 1977) the development expenditure to Rs. 193.50 lakhs (foreign exchange : Rs. 44 lakhs).

1.8. The Air Headquarters stated (October 1978) that while considering the question of short-closure of the order for manufacture of MK-II aircraft at 75.47 per cent of the numbers ordered it was agreed that the undertaking would continue with development work to improve the radius of action etc. Although improvement in the radius of action had been achieved to a certain extent, development work had not been completed in all respects (December 1979). Till June 1979, an expenditure of Rs. 261.38 lakhs had been incurred by the undertaking on the development project, against which 'on account' payments aggregating Rs. 193.12 lakhs were made.

1.9. *Delivery of aircraft* : The undertaking had agreed (March 1974) to deliver the MK-II aircraft in a phased manner from 1976-77 to 1981-82. Only 21.70 per cent of the numbers of MK-II aircraft ordered initially (July 1973) had been delivered (cost : Rs. 1352.75 lakhs) by the undertaking to the Air Force in March 1978. It was stated that these aircraft conformed to the respective "standard of preparation" laid down except to the extent of concessions agreed to by the Air Force in respect of certain modifications for which supply of parts was waited by the undertaking from the foreign supplier. No aircraft had been delivered in 1978-79 in view of non-availability of a component from the foreign supplier. An expenditure of Rs. 3734.01 lakhs was incurred up to end of July 1979 by the undertaking against which 'on account/final' payments aggregating Rs. 3634.09 lakhs had been made to the undertaking. In addition, Rs. 685.30 lakhs had been received by the undertaking in respect of supplies of parts.

1.10. 69.57 per cent of the MK-II aircraft manufactured by the undertaking were with the Air Force for flight testing and of the balance, some (17.39 per cent—cost Rs. 245.65 lakhs) were lying (September 1979) with the undertaking without use. The Air Headquarters had stated (June 1979) that the aircraft were kept in storage with the undertaking due to their being not inducted in service because sufficient number of operating personnel did not have the required experience and that certain maintenance problems were noticed during the initial use of MK-II aircraft for which remedial measures were required to be carried out on all of them. The aircraft had not been cleared (September 1979) after flight-testing for operations as there were certain shortcomings in regard to radius of action, night flying capability, etc. as specified in the ASR of June 1974.

1.11. Meanwhile, owing to delay in development and manufacture of the aircraft, certain Air Force units required to be equipped with MK-II aircraft were provided (September 1977) with certain number of imported aircraft (cost : Rs. 153.52 crores).

1.12. *Retro-modification programme* : As per agreed schedule, a certain number of retro-modified aircraft were to be delivered to the Air Force in a phased manner from 1977-78 to 1984-85. Later (November 1977) due to delay in development, the number of aircraft to be retro-modified was reduced by 25.37 per cent.

1.13. By July 1979, only 7 per cent of the number of MK-I aircraft on order had been retro-modified and test flown. Delivery of these aircraft was held up for incorporation of a certain component awaited from the foreign supplier. Retro-modification work on another 3 per cent of MK-I aircraft was held up (July 1979) for want of certain components to be supplied by their Air Force/foreign supplier. The Ministry stated (November 1979) that work on the balance 90 per cent aircraft was not to be taken up. An expenditure of Rs. 245.32 lakhs had been incurred up to the end of July 1979 on retro-modification work against which 'on account' payments of Rs. 240.33 lakhs had been made.

1.14. *Redundancy on curtailment of orders* : The Ministry stated (November 1979) that the cost of redundancy due to short-closure of orders for the manufacture of MK-II aircraft and reduction in the number of aircraft (MK-I) to be retro-modified worked out to Rs. 199.64 lakhs.

1.15. *Cost of production/retro-modification* : The cost (excluding profit) of production of MK-II aircraft had increased by 60.56 per cent (January 1977) against the estimated price in 1973. On the basis of 'on account' payments authorised by the Ministry (March 1978) for retro-modification work, expenditure per aircraft on partial retro-modification work carried out (on 10 per cent of MK-I aircraft) had increased from Rs. 15.60 lakhs to 24.53 lakhs per aircraft.

1.16. *Expenditure on the project* : Expenditure of Rs. 261.38 lakhs and Rs. 3734.01 lakhs had been incurred (upto July 1979) on the development and manufacture of the aircraft respectively, besides Rs. 245.32 lakhs on retro-modification of 10 per cent of MK-I aircraft.

1.17. The Ministry of Defence stated (November 1979) that :

though the development of MK-II aircraft as conceived in the undertaking's proposal of April 1972 was completed, there was shortfall in the radius of action ;

the main reason (according to the Air Headquarters) for reduction in the order for MK-II aircraft as well as in the retro-modification work was the incapability of the MK-II aircraft to meet all operational requirements of the Air Force in 1980's but no modification to the ASR of 1974 had been issued so far ; and

the original (1973) estimated price was based on work content visualised in the undertaking's proposal and there was considerable difference in "standard of preparation" subsequently defined for the MK-II aircraft. The cost escalation of aircraft was due to general escalation in labour and material cost between 1973 and 1977.

1.18. *Summing up* : The following are the main points that emerge :—

An aircraft development project sanctioned in September 1972, which was originally expected to be completed in about three years' time, had not been completed in all respects (August 1979) even after nearly seven years.

Due to delay in development, the Air Force were not able to equip their units with the improved version of the aircraft from 1976-77 as planned and had to re-equip (September 1977) certain units required to be equipped with MK-II aircraft with another imported aircraft.

The number of aircraft manufactured by the undertaking (cost : Rs. 1352.75 lakhs) and accepted (March 1978) by the Air Force after relaxing certain important operational parameters, had not yet (September 1979) been cleared for operations after flight-testing.

Some of the aircraft (approximate cost : Rs. 245.65 lakhs) had been lying in storage (September 1979) since their manufacture (March 1978).

Due to reduction in the number of aircraft to be manufactured and to be retro-modified arising from delay in development of MK-II aircraft and improvements not being as expected, an expenditure of Rs. 199.64 lakhs had become redundant.

[Paragraph 6 of the Report of Comptroller and Auditor General of India for the year 1978-79, Union Government (Defence Services)]

REPORT

1.19. This Report deals with the development of an improved version of MK-I aircraft (Gnat) designated as MK-II (Ajeet) and also retro-modification of the existing MK-I aircraft to MK-II standard. The idea was not only to extend the usefulness of the existing fleet of MK-I aircraft but also to improve the fighting capability of the aircraft.

1.20. According to the Audit Paragraph, Government approved in September, 1972 the development by a Public Sector Undertaking of MK-II aircraft of an improved version of an existing MK-I aircraft at an estimated cost of Rs. 99 lakhs (foreign exchange Rs. 26 lakhs). Government's approval was based on a proposal submitted by the Undertaking after carrying out feasibility studies.

1.21. According to the Air Headquarters, the MK-II version was to be inducted in service during 1976-77.

1.22. The Committee desired to know as to when the manufacture of MK-I aircraft was taken up in India. In a note, the Ministry of Defence (Department of Defence Production) have stated that the manufacture of MK-I aircraft was taken up after signing of licence agreement with M/s. Folland Aircraft Limited, U. K. in September, 1956.

1.23. On an enquiry by the Committee as to when the MK-I and MK-II aircraft had gone into service, the Ministry of Defence (Department of Defence Production) have stated that the MK-I aircraft had gone into service in 1959-60 and a handling flight with MK-II aircraft was formed at Bangalore in April 1978.

1.24. In reply to a question as to when it was first proposed to further improve upon the capabilities of MK-I aircraft and when this improvement project was actually taken in hand, the Ministry of Defence (Department of Defence Production) informed the Committee that the proposal to improve capabilities of MK-I aircraft was conceived in early 1972. The regular development work for improving the capability of MK-I aircraft had started in October, 1972.

1.25. According to the Audit Paragraph, when the development work was going on, the Ministry of Defence approved in July 1978, placement of orders on HAL by the Air Headquarters for the manufacture and supply of a certain number of MK-II aircraft at an estimated cost of Rs. 3604 lakhs (exclusive of profits). The Committee desired to know the number of MK-II aircraft for supply of which orders were placed on HAL in July 1973 and on what considerations. In a note, the Ministry of Defence (Department of Defence Production) have stated as follows : -

“An initial order for Gnat MK-II aircraft was placed on HAL in July 1973. Gnat MK-II was basically an improvement on

the MK-I. Main considerations for placing the order were its small size, low weight and quick reaction capability. The performance of MK-I aircraft during the wars in 1965 and 1971 is an eloquent testimony to its versatility. It was proposed to exploit the inherent capabilities of MK-I Aircraft by improvements in the control system and war load."

1.26. The Committee enquired as to why a prototype of the aircraft was not initially got manufactured and tested before the placement of bulk order. The Chairman, HAL stated in evidence :

"It was only an improvement from Mark-I to Mark-II. The prototype is there only when a new product is introduced."

Feasibility studies

1.27. The Committee desired to know who had initiated the idea of setting up a Group for carrying out feasibility studies to improve upon MK-I aircraft. The Secretary (Defence Production) replied :

"This is consequent to an inter-action between the Ministry, the HAL and the Air Force that it was decided to set up a Study Group."

1.28. Asked whether there was any formal request from the Ministry to the HAL to prepare a feasibility report, Secretary (Defence Production,) replied the negative.

In this connection, the Chairman, HAL explained :

"The Gnat was found to be very successful aeroplane during the operations in 1965 and 1971. Consequent on this, the Chairman of the HAL who ultimately became the Chief of Air Staff, the then Chief of Air Staff and the Scientific Adviser to the Ministry discussed the feasibility of improving this aircraft in a formal body called the Aeronautical Research and Development Board. From those consultations this concept of developing Ajeet was evolved. After these discussions the air staff requirement was drafted and issued in 1972, which was followed by an order by the Government, after considering the costs etc. Therefore, it has Government approval on the file. The process of generating air staff requirements is basically from the point of view of both the service and the design organisation, an examination of the feasible and a statement of tasks to be done, in the context of what is seen as threat at that point of time. This is the consultation which takes place in all air staff requirement issues, whether through the medium of formal exchange of letters or through the medium of consultations and discussions. The design people would say "this is what is feasible within this environment, within this time scale and within this cost estimate. The services then determine whether this is an acceptable thing and in their perspective whether it meets the requirements. Thereafter, it goes to the Government and the Government issues orders for regulating the expenses in connection with this and the formal approval is given. This technique was really followed in this particular case."

1.29. The Committee desired to know whether for the sake of attaining self-reliance at least in one indigenously manufactured aircraft, the Air Headquarters had at any stage suggested acquisition of an improved and more modern aircraft with better striking capability. The representative of the Air Headquarters stated :

“We got this GNAT in 1958. We knew at that time clearly that the manufacturer had not developed the GNAT fully. It is on record and it is well known. We knew that we have to further develop this aircraft. The proof of this is shown in the many modifications that have taken place through the years within the Air Force and with the assistance of the HAL, when later on HAL took up the manufacture of the aircraft. It was always the intention to improve this aircraft to the maximum so that in times of stress we would get as much as we can from it. In 1965 we had some problems with the aircraft, not with the flying capability but with its armament system. These problems were resolved and improvements incorporated in Ajeet. The whole history of GNAT has been one of development and improvement.”

The witness added :

“Now if I may come to the critical areas, it was the flying control system, the hydraulic system and all the brains in the country and the scientists’ organisations with the half of the original designs of the aircraft, have been trying to cure it. The flying record of GNAT shows that we had a number of fatal accidents, where we lost some experienced pilots, which costs even more if we take into account the cost of training together with the cost of an aircraft, apart from the human aspect of it.

To continue further, there came a point of time when the air force was looking at what we can do with an indigenous aircraft and it was felt that this aircraft with modifications can continue in the air force in the 80s. These questions were debated at the Air Headquarters, the Ministry of Defence and the HAL and decisions were taken that the HAL should continue to manufacture this aircraft as Ajeet or Gnat MK-II. We had listed the improvements to be carried out, the main thing being improvement of the flying control, and the hydraulic system. Once these were attended to all the other things would fall in place, because the other things like increase in range etc. are secondary.

Lastly, GNAT was an air defence aircraft. Ajeet is meant primarily for ground attack. There was a change of role. We were not going to use Ajeet in air defence role, I do not think that was the requirement.”

1.30. The Committee desired to know the considerations which weighed with the authorities initially to procure an underdeveloped aircraft viz. MK-I despite the fact that the Royal Air Force had itself mentioned that it

was not suited for a fighting role. The representative of Air Headquarters stated :

“The Royal Air Force did not find this aircraft as meeting their requirements and it was never introduced in the Royal Air Force. We were dealing with a Company and our dealings were with them and it was in our opinion and the opinion of the people who were there in 1957-58 like the well known pilot late Capt. Suranjan Das who felt that this aircraft was a good air defence aircraft basically. It needed a certain amount of development and was given to the Aircraft and Armament Testing Unit of which I was later a Member in the capacity of an operational pilot, for putting the aircraft through its paces to try and find out what are the weak areas. Many modifications were suggested to improve the use as an air defence aircraft and the fact that it succeeded in 1965 and in 1971 only goes to prove that with the action of the Air Force and the HAL, the aircraft indeed did perform as an air defence fighter in spite of drawbacks which continued.”

1.31. The Committee desired to know about the weaknesses which still persisted with MK-I aircraft. The representative of Air Headquarters stated :

“The weaknesses are on record. They find a place in the Report of the Bouche Committee. I am not aware of the reasons why the RAF found the aircraft inadequate. We felt that the aircraft could do its job even if there were failures... If you talk about hydraulics, I am giving you an example Hydraulic failures may occur one in two or three thousand flights. This aircraft had a higher failure rate. On some of these accidents, I went as member of the Court of Inquiry. But we did not lose faith or confidence in the aircraft. We only wanted deficiencies removed. It was put down in writing in very clear terms. HAL examined the Bouche Committee Report. They brought about system improvements and that aircraft finally translated itself from Gnat-I to Gnat-II.”

No. of accidents incidents involving MK-I aircraft

1.32. In a written reply, the Department of Defence production have stated that from 1958 to 15 November, 1980, the MK-I aircraft met with as many as 613 accidents. Further, during the years 1965, 1966, 1969, 1970, 1971, 1972 and 1973, the number of accidents on this aircraft was more than 50 each year viz 66, 50, 61, 50, 51, 53, and 59 respectively. In addition to these major accidents, there were as many as 624 incidents on this aircraft during the same period.

1.33. During evidence, the representative of the Air Headquarters stated :

“Gnat aircraft flying control was a problem areas in comparison with the Hunter. Both have been in the Air Force with the same number of squadrons. If the yardstick of serious malfunctioning is taken

as the number of fatal accidents then over the same period of 18 years of operation, of the two aircraft, we lost 4 pilots in Hunters and 19 in Gnats."

1.34. At the instance of the Committee, Government have furnished copies of the Report of the Study Group headed by Air Cdr. J.J. Bouche (April 1972) which went into the Longitudinal control problems of MK-I aircraft. The Committee understand that necessary modifications have since been carried out in the Ajeet and Gnat retromodified aircraft.

1.35. The Study Group found during the course of its study that investigation into aircraft accidents involving the *LCS has been unsatisfactory for want of qualified investigators. The findings of a large number of technical defect reports were stated to be not available either at HAL or Air Headquarters. To facilitate defect investigation, the Study Group had recommended that defect reports raised by the units should contain as much information as possible. In this context it was found to be desirable for M/s HAL to prepare a questionnaire to be filled in by units and forwarded along with the defect report in respect of all accidents and incidents involving the LCS, so that information in respect of each accident was complete.

Stages of Development

1.36. According to the Audit Paragraph the development work was to be carried out in four stages and was expected to be completed within three years. The Committee desired to know the details of the four stages in which the development work was to be completed together with the time initially allocated and actually taken for the completion of each stage. In a note, the Ministry of Defence (Department of Defence Production) have stated :

"The details of the four stages under which the development work was to be completed the time initially allotted and date of actual completion are as under :

Stage	Details	Planned Schedule for completion	Actual Completion
I.	Improvements to Navigation and Communication System.	8 months from Goa-head. To be completed by May 1973.	Jan. 1973. April 1976.*
II	Improvements to hydraulics system.	18 months from Goa-head. To be completed by March, 1974.	September, 1974.
III	Improvements to Longitudinal Control system.	36 months from Goa-head. To be completed by September, 1975.	October, 1979 %
IV	Improvements to fuel system (Introduction of Internal wing fuel tanks).	3 months from Goa-head To be completed by September, 1975.	April, 1976.

*Longitudinal Control system (LCS).

*Because of additional task beyond HAL's proposal.

% Delay is because of problems on 100g Unit.

1.37. According to the Audit Paragraph, work on the development project was commenced by the Undertaking (HAL) in October, 1972 on the basis of broad parameters first indicated by the Air Headquarters in the Air Staff Requirement (ASR) issued in 1972.

1.38. In June 1974, the Air Headquarters issued a revised ASR for MK-II aircraft which was also made applicable to the retro-modification programme. As the additional requirements included in the ASR of June 1974 affected all the four stages of development, the Hindustan Aeronautics Ltd. approved in September, 1975 a proposal to take up further work required concurrently with the work sanctioned earlier with a view to minimising expenditure. An additional sum of Rs. 54 lakhs (foreign exchange : Rs. 10 lakhs) for development was accordingly sanctioned by the Ministry in July 1976. Development work covered by the four stages was completed in almost all respects by the HAL by early 1976 and the "standard of preparation" of the first and second production batch of MK-II aircraft was specified by the Air Headquarters in February 1976 and July, 1976.

1.39. The Committee desired to know the extent by which each development stage was delayed by ASR of 1974 and the reasons for slippage, if any, in the programme for the completion of each stage. In a note, the Ministry of Defence (Department of Defence Production) have stated :

"After Government approval of HAL's original proposal of April 1972 further dialogues were held with air headquarters and certain additional tasks over and above the HAL's proposal at each stage were undertaken. The extent of delays at each stage are indicated below :

Stage I — 2 years—10 months.
 Stage II—6 months
 Stage III— Nil
 Stage IV—7 months.

The reasons are as under :

Stage I :

The improvements at Stage I as conceived earlier in HAL's proposal were planned for completion on one of the Gnat MK-I aircraft. This was completed by January 1973 (4 months ahead of schedule). However, the requirement of IFF MK-10 (BAT), deletion of radar ranging, fitment of V/UHF in place of TA/RA-22 VHF set and provision of standby VHF Set (AX-3) of the ASR of 74 called for complete re-installation and wiring for the avionics equipment. It was, therefore, planned to undertake these tasks on one of the Ajeet prototypes proposed to be built from MK-I aircraft for assessment of improvements detailed at Stage-III and IV of HAL's proposal. The improvements relating to avionics equipment referred to above were completed during April 1976, when improvements in respect of Stage IV were completed on Ajeet prototypes.

Stage II :

The development work relating to improvements on hydraulic system was completed during September, 74. The delay of 6 months is due

to additional requirements of tungum tubes, extended tests on abex pump; and hydraulic system.

Stage III :

The development work relating to improvements to longitudinal control system with modified power control unit was completed in all respects in October, 1979, resulting in a delay of nearly 4 years in relation to the original schedule. The reason for the slippage was that the modified unit supplied by a foreign firm was deficient in design and failures were experienced at HAL. The firm took nearly four years to rectify a number of deficiencies, after repeated tests and trials.

Stage IV :

Improvement to the fuel system by introduction of integrally sealed wing tanks (wet wing) was planned to be accomplished by building a new wing with integrally sealed tank and then converting one of the MK-I aircraft as Ajeet prototype using this wing as conceived in HAL's proposal was accomplished in accordance with the schedule (the first prototype of Ajeet with wet wing flew during March 1975). The development work relating to improvements to the fuel system covering the various additional tasks *vide* ASR of 74 was completed during April 1976. The additional time taken, *viz.* 7 months in relation to the original target was due to increased scope of work, such as introduction of Inter-technique Plessy booster pump, type-7 fuel gauging and 30 gallon drop tanks. Thus it can be seen that shift in the original schedule due to the ASR of 74 is to the extent of 7 months. An agreed first delivery schedule from 1976-77 was accepted."

1.40. The Committee desired to know the reasons for not foreseeing the modifications made in ASR of 1974 while framing the ASR of 1972 and how these were considered vital enough to justify revamping of the entire project. In a note, the Department of Defence Production have explained :

"The difference between ASR 22/1972 and ASR 4/74 was not substantial to require any revamping of the project. It may however be added that the original proposal of HAL was not based on any ASR."

1.41. During evidence, Secretary (Defence Production) further elaborated as follows :

"Some equipment were available later, and it was brought it would be better to use them and improve performance. As knowledge grows, these improvements were considered and thought of between 1972 and 1974. There was continuous consultation between HAL and the Air Force, and there were many suggestions from HAL for improvement."

1.42. In reply to a question if the changes made in the ASR of 1974 were occasioned by the hostile environment, the representative of Air Hqrs, stated :

"I would like to submit that there is no relationship between change in ASR and change in hostile environment. Further, the changes in the ASR were minimal. We do not start by issuing an ASR. A fairly

long process is involved before issue of an ASR. There is first a Need Appreciation Paper followed by an Air Staff Target and then a Feasibility Report and then you come to the Air Staff Requirement. From ASR until the aircraft comes on the production line, may take upto 12 years. During this period of time it is not abnormal for an ASR to undergo some small changes.”

1.43. Referring to the delays in all the four stages in the context of the Department's reply that there was no substantial difference between. A.S.R 22/1972 and ASR 4/74 except the radius of action and the weapon load, the Committee enquired from the Chairman, HAL whether these delays could be attributed to lack of design capabilities in HAL. The witness stated :

“ . . . The basic factor, let me say, the critical part of the programme was the most vital change or the most vital improvement wanted by the Services and that was an improvement in the flying control system, the hydraulic system was which contributing to the controls. The other major improvement was to instal a wet wing to introduce external weapon carriage. The remaining improvements were in the nature of improvements in avionics, communication, etc. The others were not inordinately delayed, in fact hardly delayed. The other most vital thing is the longitudinal control which was also there. There also the delay did take place but the delay as I have submitted was unanticipated. It was a delay not within our control.”

The witness further added :

“Phase I included the Hobson unit. If you refer to the specification, were also given an additional task in Phase I, this was largely the question of introduction to the V/VHF. All this was done. As I said the critical part in this phase is really October 1979 because that is when the Hobson unit was finally available here for unrestricted operation. So in the process of meeting this October 1979 dateline, we tried to do as much as possible within the time scale, without worrying about calling it Phase I or Phase II. In effect we were really trying to give the Air Force the best aircraft within the overall time frame.”

He added :

“ . . . the time that was spent “waiting for”—for want of a better word—Hobson's choice—because we had no choice really was spent fruitfully in introducing better avionics and effecting further enlargements in the weapon carrying capacity. In essence the developmental delay did not reach across in a very great measure into original production programme. As per schedule set out when the project was agreed, it was for . . . aircraft to be completed in 1981-82. If this programme had continued, only a small number, . . . would spill over into 82-83 ; roughly. . . . aircraft would still have been completed within the financial year 1981-82. Admittedly there was some delay in the introduction of the type as a consequence of the delayed receipt of Hobson unit

but in the production statement to which we have referred we say that by the end of this financial year, we shall have substantially supplied. . . . aircraft with only. . . . left over to be delivered in the next financial year, 1981-82. Thus, the delay that was there was not inordinate.

Shortcomings in the MK-II aircraft

1.44. According to Audit Paragraph in March, 1977, HAL expressed its inability to comply with some vital requirements of MK-II aircraft as specified in the ASR of 1974. In March, 1977, the Air Headquarters informed the Ministry of Defence that if HAL was not able to ensure performance close to the ASR of 1974, the Air Headquarters might be compelled to review the entire acquisition programme for the MK-II aircraft.

1.45. While proposing in May 1977 the incurring of further development expenditure of Rs. 40.50 lakhs for certain additional tasks, the Air Headquarters stated that though there were serious shortcomings in MK-II aircraft, it was not envisaged to drop the project altogether, but it might become necessary to reduce the number of aircraft to be produced. The Ministry accordingly enhanced in July 1977 the development expenditure to Rs. 193.50 lakhs (foreign exchange : Rs. 44 lakhs).

1.46. The Committee enquired whether the HAL was fully equipped in technology, research, development and expertise, when it received the ASR in 1972 and 1974. The Chairman, HAL stated :

“ . . . I may submit yes. We did not have the competence to undertake development of powered flying controls to improve longitudinal/control. The unit used in the Gnat was designed and supplied by the firm Claudel Hobson of Wolverhampton. The firm had since been purchased by Lucas Aerospace a world leader in the business.

As we did not have the requisite competence in this field was relied upon the foreign supplier. Where we had competence or capability we went ahead of our own.”

1.47. The Committee desired to know why after a span of 3 years i.e. in 1977, the HAL expressed its inability to comply with some vital requirements of MK-II aircraft as specified in the ASR of 1974. The Chairman, HAL explained as follows :

“Range of the aeroplane was the item in question. The very fact that we have been able to regain the range does indicate the measure of competence.

The fact of it is ‘yes’ ; when we started with the programme there was a shortfall in a developmental situation. If I may respectfully submit, shortfalls do occur and the measure of success is in overcoming these shortfalls. Mr. W.V.G. Petes the man who developed the Gnat was an acknowledged leader. . . He made shortfalls which we have been trying to sort out.”

1.48. The Committee desired to know whether the time allotted to HAL for carrying out the development work on the aircraft was adequate. The Chairman, HAL replied ;

“The time was set by mutual consultation. People at HAL felt that they could do within this time. Most of the work that was stipulated to be done in Phase I of the development was completed almost in time except that the Hobson unit development was delayed by the foreign suppliers. The crux of it is that in any developmental situation we continue to hopefully improve continuously. While Ajeet continues in service we shall effect improvements on it. When aircraft comes back for modification, for overhaul, we develop and make modifications and incorporate them in the field.

In the second phase and subsequently. . . many items of equipment were no longer available as they had gone out of production. Also systems have been subsequently developed within the country of purchase. Those were incorporated because the Hobson unit itself took longer time. We also found better weapons and incorporated some other facilities such as carriage of additional rockets. Instead of 2X6 rockets it carries three times the rockets and, therefore, has much more punch. We have today the Ajeet carrying a load of low drag bombs which had not been thought of when we programmed development in 1972. Today, we have installed identification friend and foe which was not conceived earlier. At that time, we did not have a V/UHF communication system, today we have got it. I hope the Air Force will want that these improvements must continue.”

1.49. The Committee enquired whether the fact that it would not be possible for the HAL to comply with the low level radius of action requirements of the jet aircraft as specified in ASR 4/74 was specifically brought to the notice of Air Headquarters. Chairman, HAL explained :

“The radius was seen to be not very much below air staff requirement of 1974. When we did the flight development and found the shortcoming, we took steps to improve this and recouped the loss that had taken place. The capability of HAL to design and develop was the culmination of our efforts. Certainly, we failed in the first instance. . . We carried out further development and further experiments. Ultimately, we did succeed. This is the crux of the matter.

At the point when we informed the Air Headquarters that this was the shortfall and they became aware of that at that time, the Chief of the Air Staff very rightly recorded his concern that there was an aircraft which we had promised will do so much and was not doing it and if it would not be improved upon, then they would certainly have to review it. Humbly and respectfully, I say, we were able to demonstrate our capability by improving it.”

Terms of contract with foreign supplier

1.50. The Committee further enquired whether there was any penalty clause in the contract with the foreign supplier that could be invoked to compensate for the delay in supplying the equipment. The Chairman, HAL stated :

“When the question of improving longitudinal control of the aircraft came up, the option was to give it to Lucas. They said, “We will do it.” Under the normal terms of contract there are stipulations of liquidated damages penalty clause, etc. But it has been our experience that in such developmental contracts, it is difficult to persuade the company abroad to accept such penalty clause. They refused to accept these terms or even undertake this development work in case we insisted on these clauses. But basing on a very strong capability and basing on a very high reputation of this company internationally HAL accepted that the contract would be awarded to them and they would do the job. They made many trials ; they gave us many options; they gave us many prototypes and made many improvements.

§ . . So, we tried to persuade them and pressurise them to give us in absolute state of the apt, modern flying control with all the possible safety factors built into it. Admittedly, in getting these developments carried out, the Lucas took longer than anticipated.”

1.51. The Managing Director, Design and Development, HAL further elucidated :

“We had a lot of discussions with the Lucas designers. Apparently, the Hobson unit had certain inherent problems which we tried to demonstrate to them. When the designers came here and the specifications were worked out, at that point of time it became clear that in order to improve a particular unit, certain modifications had to be made so that the pilot cannot go beyond a certain deflection of the surface so that there was need for high fatigue life, there is no immediate danger, no safety hazard to the pilot. HAL in their own wisdom said that they would not accept any of these safety hazards. After we had gone so far, nearly three years had gone, now to drop this particular company and start a major developmental programme with somebody else would have resulted practically into the cancellation of the programme.”

1.52. The Committee further enquired if there was any possibility of making alternative arrangements for the equipment in the event of delays by the supplier as actually happened in this case, and if so, whether this was explored. The representative of HAL stated :

“If we had in the beginning thought about, perhaps, it would have been done but it would have been at a very high cost. What was recently required was that this particular unit should be one, to one, replaced with the Gnat. The idea was that we will be improving the Gnat. One to one replacement was important. The miniature size of the Gnat and the space available is so scanty. One could not do with another unit.”

The witness further added :

“There was another company called M/s Lockheed Precision of U.K. We had actually asked them to tender against these specifications. They said, “it will have to be done *de novo*.” The cost involved was very high. We were not absolutely sure at that time that one to one replacement would take place. That is why we felt that because Hobson had been already working on the particular unit, they would be able to achieve the model which we had suggested to them in a shorter time at low cost.”

Concessions agreed to by the Air Force

1.53. According to the Audit Paragraph, the H.A.L. had agreed in March, 1974 to deliver the MK-II aircraft in a phased manner from 1976-77 to 1981-82. Only 21.70 per cent of the numbers of MK-II aircraft ordered initially in July 1973 had been delivered (cost : Rs. 1352.75 lakhs) by H.A.L. to the Air Force in March, 1978. It was stated that these aircrafts confirmed to the respective “standard of preparation” laid down except to the extent of concessions agreed to by the Air Force in respect of certain modifications for which supply of parts was waited by the HAL from the foreign supplier. No aircraft had been delivered in 1978-79 in view of non availability of component from the foreign supplier.

1.54. The Committee desired to know the details of the concessions agreed to by the Air Force in the standard of preparation of MK-II aircraft and how these have affected the operational capability of MK-II aircraft. In a note furnished by the Department of Defence Production, the following are stated to be the concessions agreed to by the Air Headquarters :—

- (a) Fitment of the power control unit (old) HU type—145 in place of modified power control Unit (new) HU Type-1003.
- (b) Non-compliance of the camouflage painting scheme. A camouflage painting scheme proposed by HAL is being evaluated and it will be fitted on all aircrafts after its acceptance.
- (c) Aircrafts were accepted without full night flying facilities. HAL has now finalised a modification which will be retro-complied.
- (d) A few minor concessions for the use of Cat. ‘B’ components instead of new ones, as the ‘A’ latter were not available were also given. These items will be replaced as soon as new ones are available.

1.55. The Department of Defence Production have stated that these concessions did not affect the operational capability of MK-II aircraft.

1.56. It is seen from the Audit Paragraph that the Air Headquarters had stated in October 1978 that while considering the question of short closure of the order for manufacture of MK-II aircraft at 7.47 per cent of the numbers ordered, it was agreed that the HAL would continue with development work to improve the radius of action, etc. Although improvement in the radius of action had been achieved to certain extent, development work had

not been completed in all respects till December 1979. The Committee desired to know the latest position in regard to the carrying out of the proposed improvements and how far the HAL had been able to meet the requirements of the Air Headquarters. In a note, the Department of Defence Production have stated :

- (a) *Radius of action* :—As against the radius of action of 103 nautical miles specified in ASR 4/74 HAL was able to achieve 93 nautical miles in the first instance. Subsequently, HAL had obtained additional radius of action of 10 nautical miles with 2×33 gallon drop tanks thereby providing a radius of action of 103 nautical miles with certain restrictions.
- (b) *Night Flying Capability* :—The development work relating to night flying capability to Air Headquarters requirement has been completed.
- (c) *High rate of Gun Stoppages* :—The required improvement was demonstrated and the efficiency is further being confirmed through intensive gun firing currently in progress in the Squadrons.
- (d) *Brake Seal Failure* :—This has been resolved to the satisfaction of Air Hqrs. by replacing the seals with high temperature resistant seals.
- (e) *VHFRT Failures* :—This has been resolved to the satisfaction of Air Hqrs. by fitment of Collins V/UHF sets.
- (f) *Inventor Failures* :—This has been resolved to the satisfaction of Air Headquarters by introduction of an indigenously developed inventor by HAL, Lucknow Division.

Maintenance Problems

1.57. The Audit paragraph reveals that certain maintenance problems were noticed during the initial use of MK-II aircraft for which remedial measures were required to be carried out in all of them. The Committee desired to know the remedial measures which were required and the latest position about the carrying out of these measures. In a note, the Department of Defence Production have stated :

The remedial measures taken in respect of the maintenance problems reported and the latest position in respect of the same are given below :

- (a) *Fuel leak* :—Initially number of cases of fuel leaks were reported from Ajeet aircraft handling flights. The problems were looked into and repair schemes were evolved to overcome the problems on the aircraft that had already been produced. As a permanent solution, 9 modifications were evolved for line compliance and these were incorporated from 9th aircraft onwards on the production line. The repair scheme as well as the modifications introduced have given the desired improvement.

- (b) *Wheels & brakes* :—A number of failures of brake seals and brake units were experienced during the operations and these were attributed to high brake temperature. This problem was solved by introduction of fluoro carbon seals (high temperature seals). In addition, the reason for high brake temperature was also looked into and it was attributed to the high Rotation Per Minute (RPM) during taxiing, which is required to charge the battery. In order to prevent the total electrical failure, the existing generator will be replaced by high capacity generator, which will charge the battery at lower RPM. The introduction of this modification will reduce the brake temperature and the failure of the brakes.
- (c) *R/T failure* :—A number of cases of R/T failures were reported during the initial flights. The TA/RA 22 VHF set fitted was an item of BEL manufacture. A joint team of HAL and BEL engineers visited the Squadron and certain modifications were recommended for incorporation in the VHF selector of the communications system and the cabling of aircraft system. These recommendations were issued in the form of instructions. Further, with the introduction of V/UHF systems of M/s Collins of USA the R/T performance was found satisfactory. The aircraft under production are now being fitted with Collins V/UHF and the aircraft delivered and yet to be delivered will be retrofitted with this set.

Performance of MK-II aircraft

1.58. The Committee desired to know whether the MK-II aircraft already supplied to Air Headquarters have since been cleared after flight testing for operational service. In a note, the Department of Defence Production have stated :

“Yes, the aircraft has been inducted into squadron since December, 1979 and two squadrons have been re-equipped. It has bombing and gun firing capability HAL has also been able to acquire all the items for modifying the aircraft for carriage and delivery of 57mm rockets. . . . aircraft are expected to be modified by June, 1981 and the balance will be modified in due course. The aircraft has been cleared for operational service.”

1.59. The Committee desired to know whether the MK-II aircraft developed so far was as per ASR of 1974 in all respects and if not, what steps were being taken to bring the aircraft to the required standards. The Department of Defence Production have stated :

“The MK-II aircraft developed meets the requirements of ASR 4 of 74 except for the following :

Radius of actions :—The radius of action achieved is 103 nautical miles with certain restrictions against the requirement of 108 nautical miles.

Carriage of 68mm Rocket :—MK-II aircraft could not be cleared for carriage of 4 pods of 19 × 6mm rockets. In lieu, it has been cleared for 2 pods of 16 × 57mm rockets. Trials are being carried out for clearing 2 pods of 32 × 7mm rockets.”

1.60. During evidence, the representative of the air Headquarters stated :

“After the modifications have been made to the flying control and to the hydraulic system, the aircraft has behaved better than we expected. We had no peculiar instances that are unexplained. It is the unexplained fatal accident that worries us. If there is a defect and we know what the defect is, the defect is rectified. Improvement is not only under the tail but also in the control. All systems have behaved well and at the present moment, we are satisfied with the Mark II. We have a system where HAL pilots, Air Force pilots worked together. There is continuous interaction to improve reliability and maintainability.”

1.61. The Committee desired to know whether there had been any casualties due to failure of the new flying control system of Mark-II aircraft. The representative of the Air Headquarters replied :

“... In three years of the operation of the Gnat Aircraft, before modifications took place to make it Ajeet-II standard we had four pilots killed as a result of controls failure this being the most likely cause as concluded by enquiries. After the introduction of this particular modification to its flying controls, in the same period of three years we have had zero fatality. If you accept that yardstick, then the effect of the modification is positive.”

Import of Aircraft

1.62. The Audit Paragraph reveals that owing to delays in development and manufacture of the aircraft certain Air Force units required to be equipped with MK-II aircraft were provided in September 1977 with certain number of imported aircraft, costing Rs. 153.52 crores. The Committee desired to know whether these aircraft were imported only because of delay in production of MK-II aircraft when such imports were effected. In a note the Department of Defence Production have stated :

“The acquisition of imported aircraft was not made specifically because of delay in production of MK-II aircraft. Some of the squadrons which were to be equipped with MK-II aircraft were re-equipped with imported aircraft. The decision to induct some imported aircraft was taken in November 1975. The first of the imported aircraft arrived in country in the December, 1976.”

1.63. Clarifying the position further the representative of Air Headquarters stated in evidence:

“The import of aircraft was based on a separate decision taken by the Cabinet, quite apart from the HAL programme. This was done in 1975. The decision was approved in January 1976. These aircraft were going to come any way. In 1976 they came and we

re-equipped some of our squadrons with these aircraft in due course of time. Since the question has been asked in relation to imports, this answer was given. These aircraft had nothing to do with the Ajeet programme. They were imported as a result of a separate decision.

Retromodification of MK-I Aircraft

1.64. It is seen from the Audit paragraph that in order to extend the useful life of the existing fleet of MK-I aircraft which were inducted in service in the Air Force in 1958, the Ministry of Defence accorded sanction in October 1973 to the retromodification of a certain number of MK-I aircraft to MK-II standard at an estimated cost of Rs. 2090.40 lakhs (excluding profit). The aircraft were to be made available for this purpose to HAL in a phased manner from 1974-75 onwards.

1.65. On the retromodification programme, an ASR to remove the defects and to make improvements in MK-I aircraft was issued by the Air Headquarters in November, 1972. This was also expected to help the development of MK-II version of the aircraft.

1.66. The revised ASR, issued by the Air Headquarters in June, 1974 was also made applicable to the retromodification programme.

1.67. As per agreed schedule, certain number of retromodified aircraft were to be delivered to the Air Force in a phased manner from 1977-78 to 1984-85. However, latter in November 1977 due to delay in development, the number of aircraft to be retromodified was reduced by 25.37 per cent.

1.68. By July 1979, only 7 per cent of the number of MK-I aircraft on order had been retromodified and test flown. Delivery of these aircraft was held up for incorporation of a certain component awaited from the foreign supplier. Retromodification work on another 3 per cent of MK-I aircraft was held uptill July 1979 for want of certain components to be supplied by the Air Force/foreign supplier.

1.69. The Ministry of Defence intimated Audit in November 1979 that work on the balance 90 per cent aircraft was not to be taken up. An expenditure of Rs. 245.32 lakhs had been incurred up to the end of July 1979 on retromodification work against which 'on account' payments of Rs. 240.33 lakhs had been made.

1.70. The Committee desired to know the reason for curtailing in the first instance the orders for retromodification of MK-II aircraft and later for abandoning the proposal for retromodification of 90 per cent of MK-I aircraft. In a note, the Department of Defence Production have stated :

“During the extended period of development, one of the likely adversaries of India had acquired a large number of very high performance (supersonic) aircraft and quick reaction surface-to-air missiles. Since the operation environment had become considerably more lethal, it was felt that the MK-II aircraft would not be a viable weapons system well beyond the mid 80s because of its low survivability in

such an environment. As such it was felt that the strength of the MK-II force should be limited to four squadrons. Therefore, the initial order for MK-II aircraft was curtailed to . . . aircraft from . . . and retromodification programme was reduced to . . . numbers.

1.71. The Committee pointed out that retromodification of MK-I aircraft was far more economical and was expected to give the same capability as that of Mark-II. The Committee, therefore, desired to know as to why the retromodification of the stipulated number of Mark-I aircraft was not carried out. The Secretary (Defence Production) replied :

“This was on account of the remaining fatigue life being very limited and the wings were going to be new in the retromodification. Considering the number of Gnats that were available, the fatigue time that was left was very little, there was nothing worthwhile in the retromodification.”

1.72. The Committee desired to know as to why the question of limited fatigue life of available MK-I aircraft, which subsequently necessitated substantial curtailing of sanctioned retro-modification programme was not taken into account initially or at least at the time when the retromodification programme was reduced. In a note, the Ministry of Defence (Department of Defence Production) have stated :

“The original order of . . . Gnat MK-I to be retromodified was reduced to . . . aircraft on account of non-availability of adequate fatigue life and strike off wastage. The case for this reduction was accepted by the Government in November, 1977. This figure was further restricted to . . . aircraft because of general view taken on the operational viability of the Ajeet beyond the mid 80s. Air Headquarters became aware of the vastly improved air defence environment of one of our adversaries with the acquisition of certain highly lethal air systems between 1977 and 1979. As far as restricting the retromodifications to 10 aircraft is concerned, the relevant factors leading to this decision came to the notice of Air Headquarters between 1977 and 1979 as stated above. Hence these could not have been taken into account initially.”

1.73. The Committee desired to know the latest position about the receipt of components for retromodification of 10 per cent of MK-I aircraft as also the retromodification of these aircraft. The Department of Defence Production have stated:

“all components required for retromodification of 10 per cent of the MK-I aircraft (. . . aircraft) have been received. Nine aircraft have been test-flown after retromodification and accepted. The remaining one aircraft has also been retromodified and is in the final stage of acceptance.”

1.74. The Committee desired to know as to how the security requirements anticipated to be achieved by the placement of initial order of 1972 for MK-II aircraft and retromodification of MK-I aircraft were to be

fulfilled after curtailing the orders substantially. The Department of Defence Production have stated :

“The security requirements after curtailment of order of MK-II aircraft and retromodification of MK-I aircraft are to be mainly met through induction and indigenous production of more contemporary aircraft which can effectively counter the challenges likely to be posed by the hostile tactical air environment of the mid 80s/90s.

The horizon which demanded a review of the MK-II programme emerged over a period of time during which one of our likely adversary had armed itself with a much large number of highly sophisticated aircraft and Surface to Air Guided Weapon Systems.”

1.75. In reply to a question whether there was still any role for the MK-I/MK-II aircraft, the Department of Defence Production have stated :

“...The MK-I and MK-II aircraft will have a role particularly in areas where the air environment is expected to be less intense and less hostile.”

1.76. During evidence, Secretary (Defence Production) further elucidated the position in this regard as follows :

“India is a large country and there are more hostile environments in one direction and less hostile environments in another direction, where there is more hostile environment, this will not survive but where there is less hostile environments, then this will survive. We will change our operational tactics. And we continue to use the aircraft.”

1.77. Asked whether it meant that HAL would continue to manufacture the MK-II aircraft, the Secretary (Defence Production) stated :

“They will not continue to manufacture more but whatever has been undertaken for manufacturing has to be done by 1981-82.

Ajeet will go out of manufacture according to the present plan... In the year 1981-82, the programme of producing this will virtually come to an end.”

Redundancy on curtailment of orders

1.78. The Ministry of Defence intimated Audit in November, 1979 that the cost of redundancy due to short-closure of orders for the manufacture of MK-II aircraft and reduction in the number of aircraft (MK-I) to be retro-modified worked out to Rs. 199.64 lakhs (Provisional sanction issued for Rs. 250 lakhs in August, 1980). The Committee desired to know the details of the components which have become redundant and how these were pro-

posed to be utilised. In a note, the Department of Defence Production have furnished the following information :

“Out of the total value of components/materials obtained for development, items worth Rs. 9.68 lakhs were not utilised. In regard to production retromodification programme redundancy will be of the order of Rs. 199.64 lakhs. The details are as under :

Details	Cost of redundancy in respect of production/retromodification	Cost of surplus items in respect of development programme
	(Rs. in lakhs)	
Raw materials	21.00	1.39
Standard parts	8.00	
Castings & Forgings	0.50	
Proprietary items	33.00	7.92
Hobson unit	50.80	0.37
Ph. I mod kits	10.40	
Finished and semi-finished Parts from Air craft Divn.	7.30	
Finished and semi-finished components of HAL (ID)	68.64	..
	199.64	9.68

The redundant bought out materials are proposed to be used for the development/production programme of Ajeet Trainer aircraft to the extent possible. The raw materials can however, be used for other development/production projects as well.”

Secretary (Defence Production) stated in evidence :

“In any development project, there is a certain amount of redundancy. However, in this case, the redundancy in practice was found to be very much reduced. HAL has found alternative uses for materials worth Rs. 95 lakhs. The redundancy has come down from Rs. 200 lakhs to Rs. 105 lakhs. There is, of course, some redundancy, but that, we feel, is part of any development programme. The foreign components will be used as over-all spares etc.”

Expenditure on the Project for development, manufacture and retromodification of aircraft

1.79. It is seen from the Audit Paragraph that expenditure of Rs. 261.38 lakhs and Rs. 3734.01 lakhs had been incurred up to July 1979 on the development and manufacture of the aircraft respectively besides Rs. 245.32 lakhs on retro-modification of 10 per cent of MK-I aircraft.

1.80. Further, the cost of production (excluding profit) of MK-II aircraft had increased by 60.56 per cent till January 1977 against the estimated price in 1973. On the basis of 'on account' payments authorised by the Ministry in March 1978 for retro-modification work, expenditure per aircraft on partial retro-modification work carried out on 10 per cent of MK-I aircraft had increased from Rs. 15.60 lakhs to Rs. 24.53 lakhs per aircraft.

1.81. The Committee desired to know the estimated and actual expenditure on development and production of MK-II aircraft as well as retro-modification of MK-I aircraft together with the reasons for increase in expenditure. In a note the Department of Defence Production have explained the position as follows :

Development

Sanction for Development of Ajeet were progressively sought for different tasks. The amount sanctioned so far is as under :

S. No.	Task	Amount Sanctioned (Rs. in Lakhs).
1.	Hal's proposal of 1972 Stage (I to IV)	99.00 (Sanctioned <i>vide</i> F. 9(1)/72/D (HAL-I) dt. 22-9-1972.)
2.	Tasks due to ASR of 1974	54.00 (Sanctioned <i>vide</i> F. 43/II/75/D (HAL-I) dt. 23-7-1976.
3.	Tasks subsequent to issue of ASR of 1974	40.50 (Sanctioned <i>vide</i> F. 43/11/75/D (HAL-I) dt. 11-7-1977.
4.	Tasks consequent to the recommendations of the specialist Committee set up by IAF, extended development efforts due to shortfall in Radius of action and the design deficiency in the development of modified power control unit and the need to try the various armament stores.	126.50 (Sanctioned under consideration.
	Total estimated expenditure for development	320.00 lakhs

Against the latest estimate of Rs. 320.00 the expenditure, provisional as on 31.8.80 is Rs. 310.62 lakhs. The reasons for increase in development expenditure in relation to the first sanction at the time of launching the project are as under :

- (a) Increased scope of development work in relation to the programme earlier conceived at the time of launching the project and subsequent to the issue of ASRs 22 of 72 and 4 of 74. The development.

work on the project has gone up 3 fold in relation to the earlier programme due to ASR 22 of 72 and 4 of 74 and subsequent addition of tasks till as late as 1978-79. Additional requirements have significantly improved the operational capability. The total development activity on the project was not defined at one point of time and progressive addition of tasks and concurrent undertaking of the same had a significant impact on the development expenditure schedule as well as ultimate target set for the delivery of production aircraft.

- (b) The additional development effort was due to unanticipated investigation and additional tasks such as shortfall in radius of action and design deficiencies in the new power control unit, the development of which was entrusted to a foreign firm. Consequent to those developments, considerable effort in the nature of investigations/development were required to be undertaken resulting in increased expenditure.

Production

Production of MK-II and Retromodification

Government have so far approved three fixed quotations for production of MK-II aircraft and one fixed quotation for retromodification of MK-II aircraft. The details are as under :

(i) *Production of MK. II aircraft*

1st quotation at Rs. 51.27 lakhs per aircraft ; 2nd quotation at Rs. 54.59 lakhs per aircraft; 3rd quotation at Rs. 69.38 lakhs per aircraft.

(ii) *Retromodification of MK-I aircraft*

Nos. of MK. I aircraft to be retromodified (Ph. II) at a cost of Rs. 31.09 lakhs.

An expenditure of Rs. 5001.00 lakhs was incurred by HAL against production of MK.II aircraft and retromodification of MK.I aircraft upto 30.6.1980 against which 'on account' payments aggregating to Rs. 4806.00 lakhs have been received by HAL.

The increase in expenditure is due to escalation during the period and due to changes in standard of preparation. The earlier indications given in 1973 were only tentative estimates and not detailed ones."

1.82. Explaining the reasons for increase in cost of production, Chairman, HAL stated in evidence :

"If you look at the cost in terms of constant rupee value, constant dollar value or whichever currency you wish, between the period 1972 and 1979 prices the world over have nearly doubled.

So the Cost increase is not really the cost increase in the context of cost over-run but it is a reflection of loss in the buying power of

the money plus the value of improved avionics which has been added. I would only submit that the Ajeet today is perhaps the single most economic aeroplane in this performance class anywhere in the world. Today, even the price of a Hawk jet trainer, is of the order of Rs. 3.5 crores to Rs. 4.0 crores. The Ajeet with this sort of price, is an economical proposition. It is not a cost over-run situation. It is the price of materials going up, the price of labour going up, the price of equipment going up. The price as stated was the price projected at the prevailing indices of prices in 1972."

Delay in induction of MK-II aircraft

1.83. It is seen from the Audit Paragraph that some of MK-II aircraft were kept in storage with the HAL due to their being not inducted in service because sufficient number of operating personnel did not have the required experience. The Committee desired to know the number of aircraft kept in storage with the HAL and the reasons for not taking appropriate steps to train the required no. of personnel in time. In a note the Department of Defence Production stated :

".....MK-II aircraft were taken over from M/s HAL in March, 1978. Of these six aircraft were allotted to the MK-II handling flight. The balance aircraft were handed back to M/s HAL for storage and incorporation of certain work like camouflage paintings etc. It was stipulated that the first MK-II Squadron would be formed only after sufficient experience on technical and operational aspects had been gained in the handling flight. All the . . . aircraft were taken over ensure that squadrons were re-equipped expeditiously after built up of initial experience. Further, since the aircraft had been produced against a specific Air Force requirement for which bulk of the payment had already been made, there was no great merit in not taking them on charge. HAL had accepted to bring all these aircraft, to the extent possible, to our ASR and had also agreed to store and maintain aircraft kept with them at their cost. Out of the . . . aircraft, only four aircraft are presently with HAL under storage and on these aircraft latest mods have been incorporated. Air Force had enough confidence that the outstanding problems relating to the aircraft would be successfully resolved and hind-sight now clearly suggests that this trust was justified.

There was no delay in building up the required competence and experience for absorbing MK-II aircraft. Handling flight was formed in April 1978 and the required pilots and technicians were trained well in time for running the first squadron.

Sufficient personnel (aircrew and technicians) have been trained and no difficulty is envisaged in the re-equipment of Squadron with MK-II aircraft."

Perspective Plan for Research and Development

1.84. During evidence the Committee desired to know the extent of arrangements presently existing in HAL for updating the technology from time to time in the field of avionics, the existing arrangements for research and development and the extent to which HAL was dependent on foreign experts. Chairman, HAL stated:

“The point is that before a new project becomes a reality of before we even conceive of a new aircraft project, if the programme is not to be unduly prolonged—and when you conceive of a new aircraft—you must have at your command, upto date basic a technology. These basic technologies can, of course, be developed during the course of the project, but than the project becomes unduly long. I am not relating this to HAL but I am relating it to the total scientific environment that we do not make adequate investments as a nation in developing technologies ahead of the requirements which will then be fed into new projects, whether they are projects for aeroplanes, manufacture of cars or bullock-carts. But the point is that we should be really making investments in developing techniques and technologies which will be fed into our futuristic projects. Now, we have instituted areas where we are studying what are the points which are weak in the field of aviation. We want to go ahead and make the investments in advance on projects so that these technologies are there.”

The witness further added :

“Suppose we want to make an aeroplane in the nineties. It is not going to be made out of the same materials as we are using today. These will be made out of carbon-reinforced plastics which will have boron reinforcements plastics and all sorts of other products. These are new materials. These are new technologies, new science. Unless we invest money into these, unless we know what strength they give, how can we go ahead? We have to know what sort of things we shall be using and how they behave. We are planning to do it now. These are the areas of essential weakness. This covers not only the field of structures but also the control system. If we have the capability, we need not have to go and look for the powered control system. We do not have the capability, within the country to do it but all these are time-consuming and expensive operations. I think in this particular context of design and development, it is the human being behind the machine or behind the laboratory or behind the experiment which is ultimately the factor for success or failure. So, our endeavour for the next two, three or five years is going to be in building our human resources, training them and in the process garnering technology. We have proposals before the Board of Directors of HAL. We have already sought the support of Government, indeed of all the Services to support us in this, and I would be failing in my duty if I did not not say that we have had a very ready response. I think that the response

that we are getting in these forums is increasingly and exceedingly encouraging. Once we have got these issues established, we shall be talking in terms of light combat aircraft. We are looking at the permutations and combinations of the cost technology. Various trade offers, power systems are in the process of establishing targets which will then become the basis for discussion with the Air-Headquarters, and we shall then come up with a proposal as to what we feel we can do in this time-frame, and what it would cost. Possibly this will do, but we would like, further improvements in this area also, and analyse what will be their cost, what will be the effect in terms of time and so on. We shall then come up with a proposition before the Government to do this and then proceed with the technology that we have to develop and to keep alive the project. The second part of it, that is, ensuring the success of the Project alone is not enough because our infrastructure, or industrial infrastructure or manufacturing infrastructure is inadequate today. Today we do not make the basic raw materials that go into these aeroplanes or the heavy forgings which go into them. We do not make them, or we do not have the technology for making a number of advanced systems. Now, we are addressing ourselves to this. We have proposals before the Government to authorise the setting up of such an infrastructure for forging, for casting that will make use of India raw materials and make them usable as aircraft materials. We are in the process of setting up a new plant for making some more of the advanced systems which will bring about an improvement. So, there is an attempt. The point is that we are trying to compress possibly three decades into one the area of aero space in its totality is so vast that we can perhaps only at this point of time start to make a substantial beginning."

1.85. The Committee desired to know the steps being taken by the Department of Defence Production to augment the R&D in HAL capability of HAL in preparing perspective plans for the next 20 years in order to increase the effectiveness of the country in defence. The Secretary (Defence Production) stated :

" It is a matter of concern to us. The R&D in HAL and for the matter in many Defence Production units has been minimum. I can say, there is no R&D at all in many Ordnance Factories although they are producing 500 crores worth of components. R&D facility in R.D.O. is available. I am talking of in-house R&D. Unless it is there it is difficult to ask the Ordnance Factories to increase production. Essential R&D is important. I think it should be possible to do so in the future. So far as HAL is concerned, they have already taken a decision at the Board level to have substantial amount of money for R&D. A perspective plan has been prepared by HAL. Perspective plans are being prepared by Ordnance Factories. I hope that the Corporation (HAL) will be able to give them the leadership they require.

1.86. Asked about the reaction of the Government with regard to augmenting the facilities for research and development in HAL, the Secretary (Defence Production) stated :

"We have taken a decision that on the HAL more and more money will be invested in research and development. And Government will approve of it."

The witness further stated

“..... We are in the process of making a perspective plan; we are in the process of deciding the optimum money which would be invested for the next 10, 15 or 20 years in the different public sector undertakings in the Defence Production Department. It is another matter as to how much of it will be actually utilized. But we are prepared to consider optimally how much investment should be made, taking into account the requirements of threat perception and other things. It depends on the Government to decide how much investment can be made in defence, in the total perspective of investment in the country.”

Future Plans of HAL for manufacture of Aircraft

1.87. The Committee desired to know whether there was any planning for meeting the requirements of aircraft in 1980s and what developmental efforts were being made to meet the challenges of 1990s. In a note, the Department of Defence Production have stated:

“The combat aircraft for the 1980s for the IAF are MiG—21FC, MiG—21 MF, MiG—21 BIS, MiG—23 BN, Jaguar and Ajeet. These will be supplemented by Marut, Sukhoi, Hunters and Canberras for some period. The MiG—21 family of aircraft will still be in squadron service in 1990s. This will be supplemented by the Jugars and MiG-23BN. Air Force are considering a long term requirement plan, taking into account the available assets, and infrastructure for manufacture within the constraints of effectiveness of the aircraft under production in the changing environment of operations and the maintainability of the aircraft.”

1.88. The Committee desired to know the specific future plans of the Government for indigenous production of aircraft in the context of the more powerful aircraft coming in and particularly for utilising the capacity and capability possessed by HAL. The Secretary (Defence Production) informed as follows:

“This is our concern at the moment. We are trying to develop a new engine and new air frame for developing a lot of aircraft.”

1.89. The Committee further enquired whether the Ministry of Defence had specifically written to HAL that it should get ready for the manufacture of a particular type of aircraft and to go ahead with the preparation of a feasibility Report. The Secretary (Defence Production) stated :

“We are having a constant discussion and the matter is very much the concern of the Government. We share the concern of the Committee. It is time that the HAL develops its greater capability on this. Financial constraints are there. Even then they will do that within the financial constraints.”

1.90. Asked whether any concrete plan of action had been assigned to HAL, as a manufacturing company, the Secretary (Defence Production) informed :

“.....I am unable to give you the answer that the decision has been taken. The planning that the Air-Force has done, the planning that HAL has done and the evaluation that is going on is in relation to our desire to have our own light combat aircraft, our own engine, our own airframe, our own helicopter, our own systems—all this is going on. We will be able to give you an answer very soon. As of today I am unable to give you a definite answer that we have issued an order to that effect.”

The witness added :

“.....The Air Force is now doing a perspective planning needed in all the parts of our defence force, including Navy and Army. They are preparing a perspective plan. Air Force is also doing it.....The G.T.X. engine is under development. The light combat aircraft specification is being prepared.

We have got another project in view. i.e., advanced light helicopter. We have held meetings. As soon as the evaluation is over, we will direct HAL to manufacture them.”

1.91. The Committee enquired whether the Air-Headquarters who were the appropriate agency to plan for meeting future requirements of the Air Force has submitted any suggestions regarding their future requirements of aircraft to the Ministry of Defence. The representative of the Air-Headquarters stated :

“The Air force is doing the following :

It takes stock of what it has got. It takes stock of what the enemy is likely to get or produce. It takes stock of position outside. We have an idea, after talking with our own scientists and technologists, as to what we can do.The subject has been discussed with HAL and the Ministry of Defence/Finance (Defence). We put down in writing the type of aircraft we need. Now a light combat aircraft means that the aircraft will be light compared to a contemporary aircraft but it does not mean that the aircraft will be inferior in performance. I would submit that the scientific Adviser formed this Committee. We have an Air Force representative from the Plan Branch on this. They have gone with the representatives, if I remember correctly, including HAL and others to discuss with people who are in this business abroad. I do remember that the subject matter has been discussed in Britain, in France

1.92. Government approved in September, 1972, the development by Hindustan Aeronautics Limited (HAL) of an improved version of MK-I (GNAT) aircraft designated as MK-II or Ajeet, at an estimated cost of Rs. 99 lakhs, with a foreign exchange component

of Rs. 26 lakhs. The decision was based on a proposal submitted by HAL after carrying out feasibility studies. In July 1973, the Ministry of Defence approved placement of orders on HAL by the Air Headquarters for manufacture and supply of certain number of MK-II aircraft at an estimated cost of Rs. 36.04 crores. In October 1973, Government approved yet another proposal for retro-modification of certain number of MK-I aircraft to MK-II standard at an estimated cost of Rs. 20.90 crores with a view to extend the useful life of the existing fleet of MK-I aircraft. Originally the development work was to be completed in about three years, time and the MK-II aircraft were expected to be inducted in service during 1976-77.

1.93. The Committee find that the execution of both the development and manufacturing programmes was considerably delayed. The newly designed MK-II aircraft were inducted into squadron service only in December, 1979.

1.94. The proposal to improve upon the capabilities of MK-I aircraft was conceived in early 1972, and regular work on the project was started in October, 1972. Surprisingly, even though the developmental work on the project had not made much headway, the Ministry of Defence approved placement of bulk orders without first asking for a prototype so as to satisfy themselves that it conformed to all the requirements. The Committee are not convinced with the argument advanced by the Chairman, HAL that 'it was only an improvement from MK-I to MK-II. The prototype is there only when a new product is introduced'. The fact of the matter, as admitted by representative of the Air Headquarters, is that whereas Gnat is an air defence aircraft, Ajeet is meant primarily for ground attack. To quote, "There was a change of role. We are not going to use Ajeet in air defence role. I do not think that was the requirement". Considering that Gnat MK-I aircraft was itself an undeveloped aircraft and its whole history "has been one of development and improvement", it is obvious that such a major change of role should have impelled the authorities concerned to proceed in the matter with caution.

1.95. It would, on the other hand, appear that the parameters of the development programme were not clearly spelt out with the result that the Air Staff Requirements (ASR) of May 1972 in respect of MK-II had to be revised and a fresh ASR issued in June, 1974 wherein certain additional tasks were assigned to HAL. It is unfortunate that the Ministry of Defence should have placed bulk orders for an aircraft which was still under development and which was intended to play an altogether different role than its predecessor in service without being themselves clear of the precise nature of the developmental tasks that were required to be done.

1.96. The Committee find that over and above the amount of Rs. 99 lakhs sanctioned for the development programme in September 1972, funds to the tune of Rs. 94.5 lakhs were sanctioned in July 1976 and July 1977 for tasks provided in the ASR of 1974 for MK-II.

A further sanction of Rs. 126.5 lakhs is stated to be under consideration for tasks consequent to the recommendations of the specialist Committee set up by IAF, extended developmental efforts due to shortfall in radius of action and designed deficiency in the development of modified control unit etc. Thus the total estimated expenditure on the development programme has shot up to Rs. 320 lakhs as against Rs. 99 lakhs envisaged earlier. That successive sanctions had to be issued to deal with the tasks laid down in the ASR of 1974 does not square up with the Ministry's contention that "the difference between the ASR 22/1972 and ASR 4/1974 was not substantial." In actual fact, "the development activity on the project was not defined at one point of time." The Ministry have admitted that "progressive addition of tasks till as late as 1978-79 has had a significant impact on the development expenditure/schedule as well as ultimate target set for the delivery of production aircraft." The Committee thus find that the Ministry of Defence did not take a comprehensive view based on a clear perception of the defence requirements based on changed situation.

1.97. The Committee find that a critical area where improvement was needed was the longitudinal control system with modified power control. The modified 'Hobson' unit was supplied by a foreign firm—Lucas Aerospace, was deficient in design and it took nearly four years for the firm to rectify the deficiencies after repeated tests and trials. As there was no penalty clause in the contract with the firm, the HAL had no option but to wait for the item which was completed in all respects only in October, 1979.

The Ministry have explained that in such developmental contracts, it is difficult to persuade the foreign company to accept penalty clause.

1.98. The Committee observe that after sustained efforts, HAL have been able to develop MK-II aircraft to the specifications prescribed in ASR 4/74 except for a minor shortfall in the radius of action. It has however not been possible to clear the aircraft for carriage of a set of rockets and the permissible weapon load has been restricted.

1.99. The Committee further note that after carrying out modifications in the flying control and hydraulic systems, the performance of the MK-II aircraft has been found to be quite satisfactory. Nevertheless the number placed on order with HAL has been reduced drastically and no further aircraft of this type would be needed during the extended period of development, on account of a perceptible change in the security environment. It has now been realised that "the MK-II aircraft would not be a viable weapons system well beyond the mid 80's. The Committee have however been informed that the MK-II aircraft would continue to have a role in areas "where the air environment is expected to be less intense and less hostile."

1.100. The Committee find that the retro-modification programme designed to bring the MK-I aircraft to MK-II standard was also cur-

tailed severely : An expenditure of Rs. 2.45 crores has thus far been incurred as against the estimated cost of Rs. 21 crores (approx) on the entire retro-modification programme.

1.101. The Committee are not quite convinced with the argument advanced by the Representative of the Department of Defence Production during evidence that the decision of giving up the work on retromodification of 90 per cent of the proposed MK-I aircraft was on account of the remaining fatigue life being very limited and the wings were going to be new in the retro-modification. Apart from the fact that the reply is at variance with the explanation furnished earlier in writing that the production as well as the retro-modification programme was curtailed because of the changed security environment, it is to be noted that according to the original proposal the retromodified aircraft were to be delivered to the Air Force in a phased manner from 1977-78 to 1984-85. Obviously, such a phased programme involving an expenditure of Rs. 21 crores must have taken into account the fatigue life of the MK-I aircraft. The Committee therefore consider that instead of embarking straight-way on the production of MK-II aircraft on a large scale, it would have been prudent to have first gone in for the retro-modification of MK-I aircraft as such a course would have been far more economical specially when the retro-modified aircraft were expected to give the same capability as that of MK-II.

1.102. The Committee understand that certain maintenance problems noticed during the initial use of MK-II aircraft have been by and large resolved. However, in order to prevent failures, the existing equipment will be replaced by improved equipment. The Committee hope that in view of the limited period of viability of these aircraft, the necessary improvements would be incorporated without delay.

1.103. The Committee view with concern that the Gnat MK-I aircraft have been involved in a number of accidents/incidents since their induction in squadron service. Technical defects in the airframe have been responsible for the largest number of accidents and incidents followed by Engine failures, defects in the control systems and in the tyres."

1.104 The committee understand that a study Group headed by a senior officer was appointed by Government in October 1971 to investigate the longitudinal control problems on the Gnat aircraft and find a solution for them. The study Group's recommendations are stated to have been by and large accepted and implemented.

1.105. The Committee observe that during the course of its enquiry, the study Group found that investigation into aircraft accidents involving the Longitudinal Control system had been unsatisfactory for want of qualified investigators and that the findings of a large number of technical defect reports were not available either at HAL or Air Headquarters. The Committee consider this to be a serious matter. They recommend that necessary steps should be taken immediately to provide qualified investigators and the system of maintenance of investigation records should be spruced so up as to facilitate ready reference as and when needed.

1.106. The Committee understand that the cost of redundancy due to short-closure of orders for the manufacture of MK-II aircraft and the reduction in the number of MK-I aircraft to be retromodified has been worked out to Rs. 199.64 lakhs. In addition the total value of components/materials obtained for development but not utilised is Rs. 9.68 lakhs. Thus the total redundancy is of the order of Rs. 209.32 lakhs (Provisional sanction issued for Rs. 250 lakhs in August, 1980). Of this, the proprietary items and the Hobson unit account for redundancy of the order of Rs. 92 lakhs. The Committee were informed during evidence that HAL has found alternative uses for materials worth Rs. 95 lakhs. The Committee desire that alternate uses should be found for the remaining items as quickly as possible so that the element of redundancy is reduced to the minimum extent.

1.107. The Committee note that out of the first batch of MK-II aircraft handed over to the Air Force by HAL in March, 1978, six were allotted to the MK II handling flight and the rest were handed back to the HAL for storage because it was stipulated that the first MK II squadron would be formed only after sufficient experience on technical and operational aspects had been gained in the handling flight. As stated earlier, the MK II were inducted into squadron service as late as in December, 1979. As pointed out in the Audit Paragraph the Air Headquarters had stated (June 1979) that the aircraft could not be inducted into service *inter alia* for the reason that sufficient number of operating personnel did not have the required experience. The Ministry have, however, stated that "there was no delay in building up the required competence and experience for absorbing MK II aircraft. Handling flight was formed in April 1978 and the required pilots and technicians were trained well in time for running the first squadron". The Committee find that it took nearly 20 months for the Air Force authorities to induct MK II aircraft into squadron service after formation of the handling flight. Apparently, the training of pilots and technicians was not given sufficient priority and the aircraft had to be kept in storage for a considerable time. The Committee hope that this kind of lapse in an important-area will not occur in future.

1.108. Considering the fast growing technology in the field of aeronautics/aerospace in the world, the Committee feel that India cannot afford to be left behind in this important area. Fortunately HAL has already got the necessary infrastructure and is now in a position to extend its field of activity and can improve its capabilities further. The Committee would, therefore, like the Ministry of Defence to prepare a perspective plan to meet the requirements of the Air Force during the next 10 years and assign specific tasks to HAL without delay. The Committee recommend that adequate funds should be made available by Government for R & D effort in the field of aircraft development that would feed into the futuristic projects to be assigned to HAL.

MANUFACTURE OF DEFECTIVE CARTRIDGE CASES FOR AN AMMUNITION

Audit Para

2.1. In paragraph 6 of the Report of the Comptroller and Auditor General of India, Union Government (Defence Services) for the year 1973-74, mention was made of the shortfall in production of ammunition 'X' in factory 'A' and defective manufacture of its shell in factory 'B' thereby resulting in import of another type of ammunition (in lieu of type 'X') at a total cost of about Rs. 6.42 crores during October 1968 to July 1971.

2.2. For the manufacture of ammunition 'X' in factory 'A', factory 'C' supplied 53,320 numbers of cartridge cases during April 1967 to July 1971 and factory 'D' supplied 2,095 numbers in 1969-70 and 2,97,473 numbers during 1971-72 to 1978-79. In August 1973, the user units reported unsatisfactory performance of ammunition 'X' on firing as the cartridge cases supplied by factory 'D' had developed cracks and splits at the mouth. Later (July 1974) when major defects of the cartridge cases were reported by the units, samples of cracked and empty cases were sent, (October 1974) to the Controller of Inspection (Metals) who, after metallurgical test, reported, (December 1975) to the Controller of Inspection (Ammunition) that the failure of the cartridge cases was due to stress corrosion which was stated (1977) to have developed during storage as the correct manufacturing method or process schedule was not followed.

2.3: On receipt of intimation from the Inspectorate of Metals in February 1976 regarding cracks and defects in the cartridge cases factory 'D' adopted remedial measures in May 1976. Factory 'D' intimated (March 1977) the Director General Ordnance Factories (DGOF) that its process schedule was based on the one forwarded to it by factory 'C' which did not supply to it the manual indicating the correct manufacturing method. Later factory 'D' found (June 1977) on an examination of the manual since supplies (March 1977) to it by factory 'C' that the process schedule sent by factory 'C' was not based on the manual and had certain omissions. In December 1977, at the instance of the Ministry of Defence the DGOF set up a Board of Enquiry to investigate into the cases and circumstances leading to the defective manufacture of cartridge cases by factory 'D' and to fix responsibility. The report of the Board of Enquiry which was due for submission by 20th February 1978, was still awaited (November 1979).

2.4. Meanwhile after a firing trial was conducted in April 1977 with ammunition X held in the depots and assembled with cartridge cases manufactured in 1971 to 1976 the Director of Inspection (Armaments) stated (May 1977) that the cartridge cases produced by factory 'D' during 1971, 1972 and 1973 would need replacement. Ammunition 'X' assembled with cartridge cases of 1974, 1975 and pre July 1976, however gave satisfactory performance during the firing trial but since these cartridges cases were liable to stress corrosion with passage of time, it was recommended (June 1977) that these might be utilised at the earliest possible moment and that at the annual inspection of the ammunition, ten rounds from each year manufacture viz 1974, 1975 and pre July 1976 might be subjected for check firing to consider their further retention in service. In pursuance of the above recommendation the Director of Ordnance Services placed (October 1977) an indent on the DGOF for replacement of cartridge cases of 33,000 numbers of ammunition 'X' available in the depots and assem-

bled with cartridge cases supplied by factory 'D' during 1971 to 1973. As stress corrosion and subsequent cracks in the cartridge cases produced by factory 'C' were also reported (August 1978) the DGOB was requested (November 1978) to arrange replacement of the cartridge cases of another 11,829 numbers of ammunition 'X'. The estimated cost for replacing 94,829 cartridge cases was Rs. 2.70 crores. The result of annual inspection of ammunition 'X' assembled with cartridge cases of 1974, 1975 and pre July 1976 was not known the Ministry of Defence stated (December 1979) that owing to technological limitation the stresses which remained in the cartridge cases owing to non-observance of the correct process schedule and later aggravated in storage in the depots could not be detected during inspection/acceptance.

2.5. For the replacement work, an indent for import of 50,000 brass blanks for manufacture of new cartridge cases placed (March 1978) by the DGOB on a supply mission abroad was covered by a contract concluded (January 1979) with firm 'M' at a total cost of Rs. 83.42 lakhs to be delivered during April 1979 to July 1979. The supplies were awaited (September 1979). Meanwhile factory 'A' had replaced 22,883 defective cartridge cases (out of 94,829 numbers) till September 1979 by supplies from factory 'D'.

2.6. The case disclosed the following main points :

—Although defects in the cartridge cases were notified in August 1973 immediate investigation to locate the causes was not made. It was only after major defects were noticed in July 1974 that metallurgical test of the cartridge cases was undertaken to ascertain the causes and remedial measures were taken in May 1976. 94,829 numbers of ammunition 'X' were considered unsuitable for use pending replacement of their cartridge cases; the estimated cost of replacement was about Rs. 2.70 crores.

—A Board of Enquiry set up in December 1977 to investigate the matter and submit the report by February 1978 had not submitted its report till November, 1979.

[Paragraph 19 of the Report of the Comptroller and Auditor General of India for the year 1978-79 Union Government (Defence Services).]

REPORT

2.7. The Audit para points out that in August 1973, the user units on firing reported unsatisfactory performance of ammunition 'X' manufactured at Factory 'A' with cartridge cases supplied by factory 'D' and factory 'C' in various lots from 1967 to 1979. The cartridge cases supplied by factory 'D' had been developed cracks and splits at the mouth. The Committee wanted to know whether the causes of the defects in the cartridge cases were got investigated immediately on receipt of information about defects in August 1973 and if so, what were the findings and what action was taken thereon. The Ministry of Defence, in a note, have stated:

“The defects were investigated by the Controller of Inspection (Met), Ishapore and Inspectorate of Metals, Katni who reported that cannelluring (grooving) of the cartridge cases during production was being done after mouth annealing which introduced stresses which later led to stress corrosion cracking. A suitable change in the process of manufacture was, therefore, implemented during May, 1976 to incorporate an additional mouth annealing operation after cannelluring to avoid similar defects recurring in future production.

The defects were reported to AHSP (Authority Holding Sealed Particulars) and the DGOF (Director General Ordnance Factories). The DGOF did take suitable remedial measures.”

2.8. The Audit para further states that when major defects of the cartridge cases were reported by the Units in July, 1974, samples of cracked and empty cases were sent (October 1974) to the Controller of Inspection (Metals) who, after metallurgical test reported (December 1975) to the Controller of Inspection (Ammunition) that the failure of the cartridge cases was due to stress corrosion which was stated (1977) to have developed during storage as the correct manufacturing method of process schedule was not followed. The Committee enquired about the causes for delay in investigating and submitting the report on major defects by the Controller of Inspection (Metals). The Ministry of Defence have stated:

“Before the receipt of reports regarding major defects observed in the ammunition by the user units during 1974, the investigation had already been conducted during September, 1973 to ascertain the reasons for such defects occurring. The failure had been attributed to “stress corrosion cracking”, Inspectorate of Metals, Katni and Ordnance Factory, Katni had been advised to keep a strict control on the hardness at the mouth region and also to ensure that the cannellure region gets effective LTA treatment. The remedial measures already introduced by way of incorporating an additional LTA Operation on comple-

tion of all manufacturing operations coupled with the increase in oaking time of the existing LTA were considered adequate safeguards and satisfactory solution to prevent cracking of cartridge cases Type II.

Remedial measures having already been taken in this particular instance a higher priority was accorded to work pertaining to tests/analysis of the running out-turn production, production trials, testing of samples of various trade supply items against orders from Deptt. of Defence Supply (DDS), Director General, Ordnance Factories (DGOF). In the order of priorities the instant defect investigation work from the metallurgical point of view thus got lower priority. A certain amount of delay, was, therefore, caused in the investigation of defects and submission of reports by Controller of Inspection (Mat.), Ishapore.

In his first investigation report submitted during September, 1973, CI (Mst), recommended effective LTA treatment over the cannellure region of the cartridge case whereas in the second investigation report submitted during December 1975, CI(Mat) recommended a full mouth annealing after the cannelluring operation.

It will be pertinent to mention here that CI(Mat) was aware that the remedial measures adopted during 1972-73, although considered adequate by all technical considerations, had not provided fool-proof remedies against failure of cartridge cases as certain instances of failures were still being reported. It was after studying all these failures in detail that a consensus on recommending a "full annealing" treatment was reached.

"Low temperature Annealing" is meant to relieve residual stress whereas a "Full Annealing Treatment" is meant to reduce the hardness and normalise the structure. In Type II cartridge cases adverse combinations of normalised structure (residual stresses relieved) to avoid stress corrosion in storage and higher hardness to provide adequate strength during firing are required. In view of these two diversified requirements, it, therefore, becomes difficult without long term trials to reach a conclusive opinion as to which heat treatment to provide at which stage. It is not worthy that the production process adopted during the early stages of the commencement of production had also recorded satisfactory performance both at firing-proof as well as the laboratory tests meant to detect both at firing proof as well as the laboratory tests meant to detect the probability of cracks occurring during the proof/storage. It was on account of these considerations that the investigations were considerably delayed lest the recommendation to overcome one defect result in any other defect being encountered."

2.9. Factory 'D' stated to have adopted remedial measures in May, 1976 on receipt of intimation from the Inspectorate of Metals in February, 1976 regarding cracks and defects in the cartridge cases. This factory also intimated (March 1977) the DGOF that its process schedule was based on the one forwarded to it by factory 'C' which did not supply to it the manual indicating the correct manufacturing method. However, factory 'D' found later (June 1977) on an examination of this manual supplied to it by factory 'C' in March 1977 that the process schedule sent by the latter factory was not based on the manual and had certain omissions. Explaining the reasons why factory 'C' did not pass on the manual indicating the correct manufacturing method to factory 'D' for its guidance, the Ministry of Defence have stated:

These two types of identical cartridge cases used for 'X' ammunition and 'X' APDS Ammunition. These cartridge cases differ from one another only to the extent that cartridge case Type II has cannellure at .18" to .28" from mouth whereas the cartridge case Type I does not have. Process schedules for undertaking indigenous production for both these cartridge cases were obtained from the Government of U.K. under a licence agreement during the year 1962.

The indigenous development of cartridge cases (Type I) was first undertaken at Ordnance Factory, Ambernath (OFA) on the lines of process schedule followed in U.K. As a result of successive trials to establish the indigenous production of this cartridge case, a series of deviations/modifications were necessitated to suit the existing facility of plant and machinery and qualitative availability of indigenous raw materials. A hybrid process schedule was then evolved for the manufacture of cartridge case Type I making use of the guidelines available in the U.K. manual modified to suit the locally available conditions with the help of our own expertise developed in the specialised field of armament technology over a number of years.

"After regular indigenous production of Type I cartridge case was established at Ordnance Factory Ambernath (OFA), development of indigenous production for other cartridge case of similar type was also undertaken. Since the two work identical except for the cannellure which was to be provided in the case of one and that too at the last stage, a reference to the production manual for afresh was not considered necessary as it would be a repetitive process to first follow the U.K. manual and then carry out modifications to the process to suit the local conditions which course of action had already been gone into while establishing production of the first cartridge case. In fact, the locally designed process schedule having already been adopted for implementation, even the existence of U.K. process schedule was forgotten with the passage of time. This resulted in this schedule being followed for production of another cartridge case also when the same was undertaken at Ordnance Factory, Ambernath except that the additional cannelluring operation as required was inserted. OFA successfully produced, over 55,000 Nos. of cartridge cases.

also following their own production schedule without any difficulty in satisfactory performance at laboratory tests as well as firing proof.

When the production of these cartridge cases was to be first attempted at Ordnance Factory Katni during 1968 with the help of Ordnance Factory, Ambernath, OFA forwarded copies of their own production schedules to OF Katni, manufacture according to which was already being successfully undertaken by OFA. OF Katni also initially started development work on manufacture of cartridge case Type I and in fact produced some small development batches of these cartridge cases. Ordnance Factory, Katni also subsequently switched over to the manufacture of the second cartridge cases on similar lines as adopted at Ordnance Factory, Ambernath.

During the proceedings of the Board of Enquiry, appointed to investigate into the reasons for defective manufacture of the second cartridge case, most of the witnesses examined from OF Ambernath have stated they were not even aware that the Birtley (UK) process schedule for cartridge case even existed at OFA. It was, therefore, as a result of mere inadvertence that OFA supplied OF Katni the copies of process schedule evolved by them and not those of U.K. process schedule which only the subsequent events taught that they were more accurate."

2.10. The report of the Board of Enquiry set up by the Director General, Ordnance Factories in December 1977 to investigate into the causes and circumstances leading to the defective manufacture of cartridge cases by factory 'D', which was due for submission by 20 February, 1978 was submitted in August 1980. The Board of Enquiry observed *inter alia*:

"Whenever there is Licence Agreement for collaboration and manufacture of a new ammunition or weapon, generally DGOF or currently the O.F. Board is the recipient of all documents transferred under the agreement. At present the facilities available at O.F. Board Headquarters for dealing with such documents by way of receiving them, accounting them, cataloguing them, preserving them and also forwarding them to various consignees such as AHSPs and Factories, are far too inadequate. It is very essential to create a separate cell adequately staffed for this purpose who will be able to make more effective use of those documents and make them available to the consignees at the appropriate time."

"There is considerable delay in the investigation of failures from the time the failure occurs. The Agencies who are to send samples for investigation should have acted with greater speed and reached

the samples to CI Met in 1974 itself, in which case possibly the production schedule could have been set right much ahead of April, 1976, when remouth annealing was introduced.”

2.11. The main findings/conclusions of the Board of Enquiry are as under:

- (i) Absence/omission of remouth annealing operation after canneluring in the process schedule developed by O.F.A. and subsequently followed by O.F. Katni. This operation was provided for the original ROF, Birtlye Production Manual. It did not find place in OFA process schedule due to inadvertence.
- (ii) The higher hardness in the cannelure region was overlooked as the same was not specified in the drawing. The desirable hardness gradient mentioned in the drawing was not given much importance as the subsequent fitment condition of the cartridge case with the shell was not known
- (iii) The process schedule followed for manufacture of pilot lot was not recorded in respect of metallurgical operation stages and critically examined.
- (iv) No particular individual is responsible for this.
- (v) As regards the value of loss, financial loss to the extent of Rs. 74,10,760/- has already occurred in repairing of the rounds by replacing fresh cartridge cases upto March '80. The ultimate loss will depend on how many rounds are going to be replaced in the long run. The unit cost of repair works out to be Rs. 195.03 p.
- (vi) Remedial measures to avoid such loss have already been taken by introducing, remouth annealing operation after canneluring in the process schedule of manufacture both at O.F. Katni and OFA.”

2.12. Regarding action taken on the findings of the Board of Enquiry, the Ministry of Defence have stated that remedial action has been taken to avoid failure of the second cartridge cases and implemented with effect from May 1976. The production from May, 1976 onwards is, therefore, considered satisfactory.

2.13. Though the Director of Inspection (Armaments) had stated (May 1977) that the ammunition 'X' assembled with cartridge cases of : 974, 1975 and pre-July 1976 gave satisfactory performance during the firing trial, he had recommended (June 1977) that these might be utilised at the earliest possible moment as these cartridge cases were liable to stress corrosion with passage of time. He had further recommended that at the annual inspection of the ammunition, ten rounds from each year of manufacture viz., 1974, 1975 and pre-July 1976 might be subjected to check firing to consider their further retention in services. Asked about the results of check firing of ammunition done as per recommendations of the Director

of Inspection (Armaments) the Ministry of Defence have replied that trial firings carried with ammunition assembled with cartridge cases of 1974 and pre-July 1976 manufacture gave satisfactory results.

2.14. Asked how many cartridge cases were declared as a result of such trials for replacement and their cost, the Ministry have stated that the total number of rounds requiring change of defective cartridge cases is 99,985 and the cost of each case is Rs. 196.95.

2.15. The Audit Para has pointed out that Factory 'A' had replaced 22,883 defective cartridge cases (out of 94,829 numbers) till September 1979 by supplies from factory 'D'. The Committee, therefore, enquired whether the remaining defective cartridge cases had been repaired and if so, what was the actual expenditure incurred on replacement of all such cartridge cases. In a note, the Ministry of Defence, have stated:

"Army Hqrs. had during October 1977 placed an indent on the Director General, Ordnance Factories (DGOF) for repair of 83,000 Nos. of rounds assembled with Cartridge cases of 1971, 1972 and 1973 manufactured at Ordnance Factory, Katni. During November 1978, Army Hqrs. placed a further indent on the DGOF, Calcutta for undertaking repairs of another 11,829 Nos. of a particular type of rounds filled with Cartridge Cases of Ordnance Factory, Ambarnath (OFA) manufacture. The Audit Para has, therefore, mentioned the total figure as $(83,000 + 11,829) = 94,829$.

So far (August '80), a quantity of 45,475 cartridge cases has been repaired. The actual expenditure incurred on replacement of these 45,475 cartridge cases is Rs. 8,591,972.00. The cost of repair per unit is about Rs. 189.00".

2.16. The Committee enquired whether it would have been advisable to put the year-wise range of production to test during practice firing as a matter of drill. The Ministry of Defence have replied:

"As a matter of drill, test firing of all ammunition is already being done. Ammunition, indigenously produced, is tested by actual firing by DI (Arm). Ammunition is accepted by the Army only after this has been cleared as serviceable by DI (Arm). As per the present policy, for operational consideration, the oldest stock of ammunition is issued for training to the units so that regular turnover of ammunition stocks can be carried out.

In view of these reasons it is not considered advisable to put the year-wise production to test during practice firing by units."

2.17. The Committee further enquired if the supplies of 50,000 brass blanks for manufacture of new cartridge cases indented on a foreign firm had since been received and what the reasons for delay were. The Ministry of Defence have stated:

"Supplies of the brass blanks ordered by High Commission of India, London on M/s. Trefimetsux France during January 1979, were to be made during April 1979 to July 1979. The first consignment

of about 76 Tons of these blanks had been despatched during September 1979. Certain defects were noticed in this consignment on receipt in India. These were investigated by the Chief Engineer of the supplying firm and corrective action taken. There was, thus, a certain amount of delay in despatch of further consignments.

Complete supplies of these blanks have since been received from abroad."

2.18. Indigenous development of cartridge cases, Type I used for 'X' ammunition and 'X' APDS ammunition was first undertaken at Ordnance Factory, Ambernath (OFA), on the lines of process schedule obtained from the Government of UK under licence agreement during the year 1962. As a result of successive trials, a hybrid process schedule was evolved for the manufacture of cartridge case making use of the guidelines available in the UK manual modified to suit the local conditions with the help of expertise developed in the specialised field of ammunition technology in the country over a number of years. After regular indigenous production of this cartridge case was established at OFA, development of indigenous production for cartridge case Type II which was identical to Type I except for the cannellure at .18" to .28" from the mouth to be provided in the case of Type II and that too, at the last stage, was also undertaken. However, for establishing production of cartridge case Type II a fresh reference to the manual (obtained from UK Government) was not considered necessary as, according to the authorities in-charge of production at OFA, "it would have been a repetitive process to first follow the U.K. manual and then carry out modifications to the process to suit the local conditions which course of action had already been gone into while establishing indigenous production of Type I cartridge case. In fact, the locally designed process schedule for this case having already been adopted for implementation, even the existence of U.K. process schedule was forgotten with the passage of time."

2.19. Consequently, when the production of these cartridge cases was first attempted at Ordnance Factory, Katni during 1968 with the help of OFA, the latter forwarded only copies of their own production schedules to OF Katni but did not supply to it the basic manual indicating the correct manufacturing method. OF Katni unaware of the background of development of the production schedule supplied by OFA switched over to regular production of Type II cartridge cases after initially doing some development work on manufacture of cartridge cases Type I and supplied 2,095 numbers of these cases in 1969-70 and 2,97,473 numbers during 1971-72 to 1978-79 for manufacture of ammunition 'X' in Ordnance Factory, Khamaria. In August 1973 the user units reported unsatisfactory performance of ammunition 'X' on firing as the cartridge cases supplied by this factory had developed cracks and splits at the mouth. OF Katni after taking remedial measures suggested by Controller of Inspection called for original UK manual indicating the correct manufacturing method. Thus, it was only on an examination of the

manual supplied to it by OFA in March 1977 that OF Katni found that the process schedule supplied by OFA was not based on the manual and had certain omissions.

2.20. The Board of Enquiry which examined the matter came to the conclusion that the remouth annealing operation which was provided for in the original ROF, Birtley Production Manual did not find place in the process schedule of Ordnance Factory, Ambernath due to 'inadvertence' and that no particular individual was responsible for this lapse. It was also pointed out that the facilities available at OF Board Headquarters for dealing with such documents by way of receiving, accounting, cataloguing and preserving them and also forwarding them to various consignees such as the Authority Holding Sealed Particulars (AHSP) and the Ordnance Factories were far too inadequate.

2.21. The Committee take a serious view that such vital documents as licence agreements with foreign firms and the process schedules attached thereto are not being preserved with the care and caution that is called for, so much so that in this case even their existence was forgotten with the passage of time. The Committee would, therefore, like to be informed of the remedial measures taken by the Ministry of Defence to ensure that such costly lapses do not recur.

2.22. The Committee observe that after the user units had reported in August 1973 unsatisfactory performance of ammunition 'X' manufactured with cartridge cases supplied by OFA and OF Katni which had developed cracks and splits at the mouth, the defects were investigated by the Controller of Inspection (Metals), Ishapore and Inspectorate of Metals, Katni. The Controller of Inspection (Metals), in his first investigation report submitted during September 1973, recommended effective 'Low Temperature Annealing' (LTA) treatment over the cannellure region of the cartridge case. However, when major defects in the cartridge cases were reported by the user units in July 1974, samples of cracked and empty cases were sent to the Controller of Inspection (Metals) who after carrying out metallurgical test reported (Dec. 75) to the Controller of Inspection (Ammunition) that the failure of the cartridge cases was due to stress corrosion which had developed during storage as the correct manufacturing method or process schedule was not followed.

2.23. The Committee find that it was in the second investigation report submitted during December 1975 that CI (Metals) recommended a full mouth annealing after the cannelluring operation. The Committee further learn that on receipt of intimation from the Inspectorate of Metals in December 1975 regarding cracks and defects in cartridge cases, OF Katni introduced suitable changes in the manufacturing process in May 1976.

2.24. From the sequence of events brought out above, the Committee have come to the conclusion that a serious matter like defects in the cartridge cases and their investigation by the CI (Metals) was

handled in a very casual manner. They consider the delay of about 2½ years from August 1973, when unsatisfactory performance of ammunition 'X' on firing was noticed, till February 1976 when the second report was submitted by CI (Metals), to be excessive.

2.25. The Committee find that the CI (Metals) was aware that remedial measures adopted during 1972-73 had not provided fool-proof remedies against failure of cartridge cases as certain cases of failures were still being reported. The Committee are not, therefore, convinced with the argument put forth by the Ministry that since remedial measures had already been taken, the instant defect investigation work from the metallurgical point of view was given lower priority. The Ministry's contention does not also square up with the findings of the Board of Enquiry "that the agencies who are to send samples for investigation should have acted with greater speed and reached the samples to CI Met in 1974 itself, in which case possibly the production schedule could have been set right much ahead of April 1976 when remouth annealing was introduced". The fact, therefore, stands out that both the DGOF and the CI (Metals) did not act promptly to get the defects investigated and rectified expeditiously.

2.26. Yet another disturbing aspect of the matter is the leisurely way in which the enquiry in this case was conducted. The Report of the Board of Enquiry set up in December 1977 to investigate the causes and circumstances leading to the defective manufacture of cartridge cases by OF Katni and to fix responsibility was due for submission by 20 February, 1978. It was, however, received only in August 1980 i.e. after delay of 2½ years. The reasons why it took the departmental Board of Enquiry so long to give their report need to be explained. The Committee would also be interested to know the action taken by the Ministry of Defence on the suggestions contained in the report.

2.27. The Director of Inspection (Armaments) had recommended in May 1977 that though the ammunition 'X' assembled with cartridge cases of 1974, 1975 and pre-July 1976 gave satisfactory performance during firing trials at the annual inspection of the ammunition, these might be utilised at the earliest possible moment as these cartridge cases were liable to stress corrosion with the passage of time. The Committee would like to be informed of the position of utilisation of these cartridge cases and whether any more defective lots have come to notice.

2.28. The Committee understand that the total number of rounds requiring change of defective cartridge cases is 99,885. Out of these, a quantity of 45,475 cartridge cases had been repaired upto August 1980 and the total expenditure incurred was Rs. 85.92 lakhs. The Committee apprehend that the expenditure likely to be incurred on the repairs of remaining cartridge cases would be equally heavy. They would, therefore, like to be informed of the latest position regarding repairs of the remaining cartridge cases and the expenditure incurred thereon.

2.29. In view of the heavy expenditure having to be incurred on the repair of cartridge cases and on import of 50,000 brass blanks having been ordered at a cost of Rs. 83.42 lakhs, the Committee would like the matter to be investigated with a view to fix responsibility for the lapse that had occurred at various levels and kept informed of the action taken.

NEW DELHI,

March 2, 1981

Chaitra 12, 1903 (Saka)

CHANDRAJIT YADAV,

Chairman,
Public Accounts Committee.

APPENDIX
CONCLUSIONS AND RECOMMENDATIONS

Sl.No.	Para No.	Ministry/Department concerned	Conclusion/Recommendation
1	2	3	4
1.	1.92	Defence Department (of Defence Production)	Government approved in September, 1972, the development by Hindustan Aeronautics Limited (HAL) of an improved version of MK-I (GNAT) aircraft designated as MK-II or Ajeet, at an estimated cost of Rs. 99 lakhs, with a foreign exchange component of Rs. 26 lakhs. The decision was based on a proposal submitted by HAL after carrying out feasibility studies. In July 1973 the Ministry of Defence approved placement of orders on HAL by the Air Headquarters for manufacture and supply of Certain number of MK-II aircraft at an estimated cost of Rs. 36.04 crores. In October 1973, Government approved yet another proposal for retro-modification of certain number of MK-I aircraft to MK-II standard at an estimated cost of Rs. 20.90 crores with a view to extend the useful life of the existing fleet of MK-I aircraft. Originally the development, work was to be completed in about three years time and the MK-II aircraft were expected to be inducted in serviced during 1976-77.
2.	1.93	Do.	The Committee find that the execution of both the development and manufacturing programmes was considerable delayed. The newly designed MK-II aircraft were inducted into squadron service only in December 1979.

5.

1.96

Defence (Department of
Defence Production)

The Committee find that over and above the amount of Rs. 99 lakhs sanctioned for the development programme in September 1972, funds to the tune of Rs. 94.5 lakhs were sanctioned in July 1976 and July 1977 for tasks provided in the ASR of 1974 for MK-II. A further sanction of Rs. 196.5 lakhs is stated to be under consideration for tasks consequent to the recommendations of the specialist Committee set up by IAF extended developmental efforts due to shortfall in radius of action an design deficiency in the development of modified control unit etc. Thus the total estimated expenditure on the development programme has shot up to Rs. 320 lakhs against Rs. 99 lakhs envisaged earlier. That successive sanctions had to be issued to deal with the tasks laid down the ASR of 1974 does not square up with the Ministry's contention that the difference between the ASR 22/1972 and ASR 4/1974 was not substantial." In actual fact "the development activity on the project was not defined at one point of time." The Ministry have admitted that "progressive addition of tasks till as late as 1978-79 has had a significant impact on the development expenditure/schedule as well as ultimate target set for the delivery of Production aircraft." The Committee thus find that the Ministry of Defence did not take a comprehensive view based on a clear perception of the defence requirements based on changed situation.

45

6.

1.97

Do.

The Committee find that a critical area where improvement was needed was the longitudinal control system with modified power control. The modified 'Hobson' unit was supplied by a foreign firm—Lucas Aerospace, was deficient in design and it took nearly four years for the firm to rectify the deficiencies after repeated tests and trials. As there was no penalty clause in the contract with the firm, the HAL had no option but to wait for the item which was completed in all respects only in October, 1979.

The Ministry have explained that in such developmental contracts, it is difficult to persuade the foreign company to accept a penalty clause.

1	2	3
7.	1.98	Defence (Department of Defence Production)
8	1.99	Do.
9.	1.100	Do.
10.]	1.101	

The Committee observe that after sustained efforts, HAL have been able to develop MK-II aircraft to the specifications prescribed in ASR 4/74 except for a minor shortfall in the radius of action. It has however not been possible to clear the aircraft for carriage of a set of rockets and the permissible weapon load has been restricted.

The Committee further note that after carrying out modifications in the flying control and hydraulic systems, the performance of the MK-II aircraft has been found to be quite satisfactory. Nevertheless the number placed on order with HAL has been reduced drastically and no further aircraft of this type would be needed during the extended period of development, an account of a perceptible change in the security environment. It has now been realised that "the MK-II aircraft would not be a viable weapons system well beyond the mid 80's." The Committee have however been informed that the MK-II aircraft would continue to have a role in areas "where the air environment is expected to be less intense and less hostile."

The Committee find that the retro-modification programme designed to bring the MK-I aircraft to MK-II standard was also curtailed severely. An expenditure of Rs. 2.45 crores has thus far been incurred as against the estimated cost of Rs. 21 crores (approx.) on the entire retro-modification programme.

The Committee are not quite convinced with the argument advanced by the Representative of the Department of Defence Production during evidence that the decision of giving up the work on retro-modification of 9 per cent of the proposed MK-I aircraft was on account of the remaining fatigue life being very limited and the wings were going to be new in the retro-modification. A part from the fact that the reply is at variance with the explanation furnished earlier

in writing that the production as well as the retro-modification programme was curtailed because of the changed security environment, it is to be noted that according to the original proposals the retro-modified aircraft were to be delivered to the Air Force in a phased manner from 1977-78 to 1984-85. Obviously, such a phased programme involving an expenditure of Rs. 21 crores must have taken into account the fatigue life of the MK-I aircraft. The Committee therefore consider that instead of embarking straightway on the production of MK-II aircraft on a large scale, it would have been prudent to have first gone in for the retro-modification of MK-I aircraft as such a course would have been for more economical specially when the retro-modified aircraft were expected to give the same capability as that of MK-II.

The Committee understand that certain maintenance problems noticed during the initial use of MK-II aircraft have been by and large resolved. However, in order to prevent failures, the existing equipment will be replaced by improved equipment. The Committee hope that in view of the limited period of viability of these aircraft, the necessary improvements would be incorporated without delay.

The Committee view with concern that the Gnat MK-I aircraft have been involved in a number of accidents/incidents since their induction in squadron service. Technical defects in the airframe have been responsible for the largest number of accidents and incidents followed by Engine failures, defects in the control systems and in the tyres."

The Committee understand that a Study Group headed by a Senior Officer was appointed by Government in October, 1971 to investigate the longitudinal control problems on the Gnat aircraft and find a solution for them. The Study Group's recommendations are stated to have been by and large accepted and implemented.

Defence (Department of
Defence Production)

11. 1.102

Do

12. 1.103

Do

13. 1.104

14. 1.105 Defence (Department of Defence Production)

The Committee observe that during the course of its enquiry, the Study Group found that investigation into aircraft accidents involving the Longitudinal Control System had been unsatisfactory for want of qualified investigators and that the findings of a large number of technical defect reports were not available either at HAL or Air Headquarters. The Committee consider this to be a serious matter. They recommend that necessary steps should be taken immediately to provide qualified investigators and the system of maintenance of investigation records should be spruced up so as to facilitate ready reference as and when needed.

15. 1.106

Do.

The Committee understand that the cost of redundancy due to snort-closure of orders for the manufacture of MK-II aircraft and reduction in the number of MK-I aircraft to be retro-modified has been worked out to Rs. 199.64 lakhs. In addition, the total value of components/materials obtained for development but not utilised is Rs. 9.68 lakhs. Thus the total redundancy is of the order of Rs. 209.32 lakhs. Of this, the proprietary items and the Hobson unit account for redundancy of the order of Rs. 92 lakhs. The Committee were informed during evidence that HAL has found alternative uses for materials worth Rs. 95 lakhs. The Committee desire that alternate uses should be found for the remaining items as quickly as possible so that the element of redundancy is reduced to the minimum extent.

16. 1.107

Do.

The Committee note that out of the first batch of MK-II aircraft handed over to the Air Force by HAL in March, 1978, six were allotted to the MK-II handling flight and the rest were handed back to the HAL for storage because it was stipulated that the first MK-II squadron would be formed only after sufficient experience on technical and operational aspects had been gained in the handling

flight. As stated earlier the MK-II were inducted into squadron service as late as in December 1979. As pointed out in the Audit Paragraph the Air Headquarters had stated (June 1979) that the aircraft could not be inducted into service *inter alia* for the reason that sufficient number of operating personnel did not have the required experience. The Ministry have however stated that "there was no delay in building up the required competence and experience for absorbing MK-II aircraft. Handling flight was formed in April 1978 and the required pilots and technicians were trained well in time for running the first squadron." The Committee find that it took nearly 20 months for the Air force authorities to induct MK II aircraft into squadron service after formation of the handling flight. Apparently, the training of pilots and technicians was not given sufficient priority and the aircraft had to be kept in storage for a considerable time. The Committee hope that this kind of lapse in an important area will not occur in future.

17

1.108

Defence (Department of
Defence Production)

Considering the fast growing technology in the field of aeronautics/aerospace in the world, the Committee felt that India cannot afford to be left behind in this important area. Fortunately HAL has already got the necessary infrastructure and is now in a position to extend its field of activity and can improve its capabilities further. The Committee would therefore like the Ministry of defence to prepare a perspective plan meet to the requirements of the Air Force during the next 10 years and assign specific tasks to HAL without delay. The Committee recommend that adequate funds should be made available by Government for R & D effort in the field of aircraft development that would feed into the futuristic projects to be assigned to HSL.

18

2.18

Do:

Indigenous development of cartridge cases Type I used for 'X' ammunition and 'X' APDS ammunition was first undertaken at Ordnance Factory, Ambernath (OFA), on the lines of process schedule obtained from the Government of UK under licence agreement during the year 1962. As a result of successive trials, a hybrid process schedule was evolved for the manufacture of cartridge cases making use of the guidelines available in the UK manual modified to

suit the local conditions with the help of expertise developed in the specialised field of armament technology in the country over a number of years. After regular indigenous production of this cartridge case was established at OFA, development of indigenous production for cartridge case Type II which was identical to Type I except for the cannellure at .18" to .28" from the mouth to be provided in the case of Type II and that too, at the last stage, was also undertaken. However, for establishing production of cartridge case Type II a fresh reference to the manual (obtained from UK Government) was not considered necessary as, according to the authorities in-charge of production at OFA, "it would have been a repetitive process to first follow the UK manual and then carry out modifications to the process to suit the local conditions which course of action had already been gone into while establishing indigenous production of Type I cartridge case. In fact, the locally designed process schedule for this case having already been adopted for implementation, even the existence of UK process schedule was forgotten with the passage of time".

19 2.19

**Defence
(Department
of Defence
Production)**

Consequently, when the production of these cartridge cases was first attempted at Ordnance Factory, Katni during 1968 with the help of OFA, the latter forwarded only copies of their own production schedules to OF Katni but did not supply to it the basic manual indicating the correct manufacturing method. OF Katni unaware of the background of development of the production schedule supplied by OFA switched over to regular production of Type II cartridge cases after initially doing some development work on manufacture of cartridge cases Type I and supplied 2,095 numbers of these cases in 1969-70 and 2,97,473 numbers during 1971-72 to 1978-79 for manufacture of ammunition on 'X' in Ordnance Factory, Khamaria. In August 1973 the user units reported unsatisfactory performance of ammunition 'X' on firing as the cartridge cases supplied by this factory had developed cracks and splits at the mouth. OF Katni after taking remedial measures suggested by Controller of Inspection called for origi-

Inspection (Metals) who after carrying out metallurgical test reported (Dec. 75) to the Controller of Inspection (Ammunition) that the failure of the cartridge cases was due to stress corrosion which had developed during storage as the correct manufacturing method or process schedule was not followed.

The Committee find that it was in the second investigation report submitted during December 1975 that CI (Metals) recommended a full mouth annealing after the canneluing operation. The Committee further learn that on receipt of intimation from the Inspectorate of Metals in December 1975 regarding cracks and defects in cartridge cases, OF Katni introduced suitable changes in the manufacturing process in May 1976.

From the sequence of events brought out above, the Committee have come to the conclusion that a serious matter like defects in the cartridge cases and their investigation by the CI (Metals) was handled in a very casual manner. They consider the delay of about 2½ years from August 1973, when unsatisfactory performance of ammunition 'X' on firing was noticed, till February 1976 when the second report was submitted by CI (Metals), to be excessive.

The Committee find that the CI (Metals) was aware that remedial measures adopted during 1972-73 had not provided fool-proof remedies against failure of cartridge cases as certain cases of failures were still being reported." The Committee are not, therefore, convinced with the argument put forth by the Ministry that since remedial measures had already been taken, the instant defect investigation work from the metallurgical point of view was given lower priority. The Ministry's contention does not also square up with the findings of the Board of Enquiry that "the agencies who are to send samples for investigation should have acted with greater speed and reached the samples to CI Met in 1974 itself, in which case possibly the production schedule could have been set right much ahead of April 1976 when remouth annealing was introduced. The fact, therefore, stands out that both the DGOF and the CI (Metals) did not act promptly to get the defects investigated and rectified expeditiously.

23 (Department of
Defence Production)

2.23

Do.

2.24

Do.

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