

MINISTRY OF DEFENCE

CHAPTER III

Hindustan Aeronautics Limited

Production and supply of Advanced Light Helicopter

Executive Summary

The Advanced Light Helicopter (ALH) designed and developed by the Company is a light 5.5 tonne class, multi-role, multi-mission helicopter, fitted with two Turbomeca TM 333 2B2 engines. A sum of Rs. 1,541 crore (Rs. 960 crore by the defence customer and Rs. 581 crore by the Company) was spent till September 2009 on the ALH project. Audit observed the following:

- The design and development of ALH started in 1984. The collaboration agreement entered in 1984 was terminated in 1995 even though certain systems were yet to be developed, validated and integrated. As a result, five prototypes of the basic versions which were to be certified by 1994 were actually flight tested and certified in October 2003.
- Despite more than two decades, the technical requirements finalised in 1979 by Army and Air Force were not fully achieved resulting in flying of the 74 ALH supplied by the Company to defence customers with concessions.
- Taking up Limited Series Production (LSP) of ALH (2001-2003) even while the prototypes were being flight tested (1992-2003) and certified, was premature as large number of design problems were encountered during the manufacturing.
- By not freezing the design of ALH and keeping the development stage open the Company had to accommodate the increasing demand of the customer for latest and additional requirements. This led to 363 modifications in 34 helicopters (total 74 supplied to Defence customers).
- The ALH, which was to be successor to Cheetah/Chetak was found to be unsuitable for the intended multi-role requirements due to excess weight and limited power of the engine. ALH with 'Shakti' (higher-powered engine) which was planned to be certified in December 2006 is yet to be certified even after a delay of three years resulting in postponement of delivery schedule of 20 ALH with Shakti engine from 2008-09 to 2009-10.
- Weapon system integration (WSI) version of ALH has not been developed even after a lapse of 10 years (1998 to 2009). In the absence of clear understanding of the requirements between Navy and the Company, the amount of Rs. 138 crore spent on the project has not resulted in any tangible benefit to the customer.

- The Company could not penetrate into the international market in the absence of international certificate in spite of showcasing ALH in the air shows. The Company could not successfully execute even the orders received from civil market.
- As against the envisaged indigenisation level of 50 per cent, about 90 per cent of the value of material used in each helicopter is procured from foreign suppliers.

Summary of recommendations

- Series production should be taken up only after prototypes are approved/certified and accepted by the customer.*
- Modifications desired by the customer should be with reference to a time frame and technical competency of the Company.*
- The capacity should be ramped up as to peak up production as planned.*
- The Company should quicken the process of submitting the documents and obtain the certifications early.*
- As the Company has entered the highly competitive civilian/ export markets the design/quality issues need to be resolved early to gain the confidence of the customers to remain in the market.*
- The Company should expedite efforts to get International certificate on priority to be a global player. The Company should exploit civil market by executing the orders successfully and consider options of sale technique through leasing of ALH.*
- Concerted efforts are needed to achieve the desired (50 per cent) level of indigenisation.*

3.1 Introduction

Hindustan Aeronautics Limited (Company) a 'Navratna' Public Sector Undertaking under the Ministry of Defence, is engaged in design, development, manufacture, repair and overhaul of aircraft and helicopters. The production of helicopters is undertaken at the unified Helicopter Complex (HC) at Bangalore. The organisation structure of the HC is given in *Annexure-V*.

The Company designed and developed the Advanced Light Helicopter¹ (ALH), named as 'DHRUV'. It is a light 5.5 tonne class, multi-role, multi-mission helicopter, fitted with two Turbomeca TM 333 2B2 engines. The design and development of ALH started in 1984 and the first prototype of the ALH was flown in 1992. The Company has so far (December 2009) delivered 90 ALH to customers. The total sanctioned cost of ALH project was Rs. 2,103 crore (Rs. 1,136 crore by the defence customers and Rs. 967 crore by the Company). A sum of Rs. 1,541 crore was spent till September 2009 (by defence customer Rs. 960 crore and by the Company Rs. 581 crore- *Annexure-VI*) in this project.

¹*The advanced technologies incorporated in the ALH design include automatic flight control, Anti-Resonance Vibration Isolation System (ARIS), Full Authority Digital Electronic Control (FADEC), hinge less main rotor and bearing less tail rotor and Integrated Dynamic System (IDS).*

3.2 Scope of audit

The performance audit on production and supply of ALH covers the design, development, production and supply of ALH during 2001-02² to 2008-09.

3.3 Audit objectives

The performance audit was conducted to assess whether:

- the production plan for optimum utilisation of available/planned capacity was realistic and achieved;
- the design and development with reference to customers' requirements was achieved on time and in synchronisation with the planned production;
- planning and establishment/augmentation of adequate infrastructure facilities for production was timely and effective with reference to cost and achievement of objectives; and
- the marketing performance was efficient and effective.

3.4 Audit Criteria

The Performance Audit is based on the following criteria:

- Government sanctions, Perspective, Production and Sales plans of the Company and policies framed by the Board of Directors (Board);
- Project reports/Consultant's reports;
- Regulatory documents issued by the Ministry of Defence (MoD) and Internal control procedures; and
- Feedback from the defence customers.

3.5 Audit methodology

Audit commenced after holding Entry conference with the Management in July 2009. Desk review of records was supplemented by field visits to selected customer base. Audit findings were discussed with the Management in the exit conference (November 2009).

3.6 Acknowledgement

Audit is thankful for the cooperation received from the Management of the Company which facilitated the conduct of the Performance Audit of ALH.

3.7 Audit findings

3.7.1 Production performance and capacity utilisation

The Company has so far (December 2009) delivered 90 ALH, out of which 74 ALH were delivered to defence customers and 16 ALH to other customers. The Company has orders on hand for 159 ALH from defence customers and 6 ALH from other customers to be delivered by 2015-16. The weaponised version of ALH is still under development. A

² *Period from 2001-02 was covered as actual production of ALH started from 2001-02*

statement showing the capacity utilisation of ALH with reference to confirmed orders during the period 2001-02 to 2008-09 is indicated below in **Table 3.1**:

Table 3.1*(In numbers)*

Year	Envisaged production plan	Available capacity	Orders on hand as per delivery schedule	Cumulative orders on hand	Orders on hand as per delivery schedule	Production targets		Actual production	Cumulative actual production	Back log in production (5)-(9)
						BE	RE			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1997-98 to 2000-01	48	-	-	-	-	-	-	-		-
2001-02	24	12	8	8	8	8	7	7	7	-1
2002-03	32	12	3	11	3	10	11	11	18	+7
2003-04	32	24	18	29	18	18	13	13	31	+2
2004-05	32	24	14	43	14	18	18	14	45	+2
2005-06	32	24	25	68	25	20	18	18	63	-5
2006-07	32	24	10	78	10	24	15	14	77	-1
2007-08	32	24	1	79	1	24	4	4	81	+2
2008-09	32	24	31	110	31	24	18	15	96	-14
Total upto 31 March 2009	296	--	110		110	146	104	96		20*
Future orders 2009-10 to 2015-16			139 (defence)³ + 6 (from others)		139 (defence)⁴ + 6 (from others)					

It can be seen that as against envisaged and approved production of 296 ALH by Board upto 2008-09, target set was for 104 ALH while actual production was only 96 ALH.

On a review of actual production *vis-a-vis* production plan, it was observed that though a peak production of 32 ALH was planned from 2002-03, the present available capacity was only 24, due to non-availability of dedicated jigs for 32 ALH at the critical assembly stage. Production and delivery of 20 utility version of ALH due in 2008-09, was shifted to 2009-10 since the Company was addressing the problems on Integration of Shakti Engine, interchangeable parts, Active Vibration Control system and Communication system. Further, the budget estimates were revised every year to bring them in line with the actual production. The Company had paid Rs. 43 crore liquidated damages and is further liable to pay Rs. 21 crore for delay in supplies up to 2008-09.

The following paragraphs highlight various issues leading to failure on part of the Company to achieve its expected goals/production in the ALH project.

* Out of 96 helicopters produced, 03 were in WIP, 02 met with an accident and 01 on lease to Israel was returned. Thus, the backlog worked out to 20.

³ Total future orders = 159 (139 + 20 backlog of previous years).

⁴ Total future orders = 159 (139 + 20 backlog of previous years).

3.7.1.1 Non-extension of collaboration agreement

The Government of India entered into a collaboration agreement⁵ with Messerschmitt Bolkow Blohm (MBB) - West Germany, (presently ECD⁶) in July 1984 for design, development and establishment of production facilities of ALH and entrusted the same to the Company. The Collaboration agreement provided for achievement of 13 prescribed milestones (*Annexure VII*) within seven years *i.e.* by 1991. Subsequently, the Company prepared (July 1992) Preliminary Project Report (PPR) for ALH, which indicated development of ALH including first flight and type certification of basic version before end of 1994. The PPR also revised the schedule for design freeze of utility version of ALH to December 1993 and completion of prototypes by 1994. This resulted in extension of collaboration agreement by four years up to 1995.

Audit observed that the collaboration agreement was not extended beyond 1995. At that time, certain systems like Anti Resonance vibration Isolation System (ARIS), Automatic flight Control system (AFCS), Retractable Landing Gear, *etc.*, were yet to be developed, validated and integrated. This resulted in postponement of the plan to establish production facilities. As a result, five prototypes of the basic versions which were to be certified by 1994 as per PPR were actually flight tested and certified for Military version⁷ in March 2002 and for Civil version⁸ in October 2003.

Audit also observed that even as the five prototypes were still under certification process beyond the target date of 1994, the Company sought (April 1999) approval from MOD to produce 300 ALH for Defence forces. The MoD, however, released orders for 10 Limited series production (LSP) only during 2001-2003 and the feedback received on 10 LSP delivered indicated need for improvements in ground handling, rain proofing, accessibility and door operation *etc.*

Thus, the decision not to extend the collaboration agreement beyond 1995 and going for LSP, even while the prototypes were being flight tested (1992-2003) and certified, were premature as large number of design problems were encountered during the manufacturing as admitted by the Management (December 2009).

3.7.1.2 Freezing of final design

The Global Helicopter Technology Inc (GHT) appointed (January 1996) as a consultant by the Company (at a cost of Rs. 1.88 crore) for the ALH project submitted its final report in June 1997. The consultant's report considered *inter alia* the freezing of final design as a pre-production activity for successful implementation of the project. However, the Company failed to freeze the design though it was aware of the defence customer's stipulated⁹ quality requirements. The non-freezing of the design led to 363

⁵ *The collaboration agreement was necessitated as the Company was developing the helicopter for the first time with no prior experience, to develop the helicopter with contemporary technologies available only with selected OEMs and to develop new technologies like Rotor, Transmission, Vibration Isolation Systems, etc. in-house instead of borrowing the technologies and systems.*

⁶ *Eurocopter*

⁷ *by the Centre for Military Airworthiness Certification (CEMILAC) at a cost of Rs.536 crore*

⁸ *by the Directorate General of Civil Aviation (DGCA) at a cost of Rs.89 crore*

⁹ *The defence forces had indicated their quality requirement of ALH in their Air Staff Requirement (ASR). ASR-2/79 of ALH for IAF and Army was finalised in 1979 and the requirements of Navy (NSR AO/4721/1978) in 1985.*

modifications¹⁰ carried out in 34 helicopters till date (November 2009). The Company claimed Rs. 12.11 crore and realised only Rs. 6.51 crore against Rs. 15.10 crore incurred on modifications, as there was no clarity regarding cost sharing.

The Management stated (December 2009) that for ALH it followed concurrent engineering philosophy which is in line with the present trends and due to concurrent development, large number of design related problems have been encountered during the manufacturing.

The Management's reply is to be read with the consultant's recommendation on design freezing. If the adoption of the concurrent technology concept were to be an existing trend, the consultant would not have suggested the freezing of the design. Further, freezing of the design in line with the stipulated quality requirements of its major defence customers would have facilitated immediate availability of utility version of the ALH to the defence forces. The subsequent requirements of the customers could have been accommodated in the subsequent versions of the ALH.

3.7.1.3 Creation/construction of facility

The consultant's report noted that the Company had identified the following components as critical and will produce them in the ALH production facilities when possible:

- Composite parts including rotors and composite dynamic components;
- Transmission gears and pinions; and
- Sub-assembly/final assembly operations

Despite identification of above critical components, it was observed that the Company failed to create early in-house facilities for composite parts. The Company is still dependent on a single source for composite parts and is yet to develop an alternate source.

For transmission gears/sub-assemblies, the Company delayed the decision of procurement of a Vertical Lathe Machine (Rs. 6.58 crore) for the initial grinding operation. Due to this, grinding operations were outsourced at a cost of Rs. 4.52 crore. Complete-machining operations of critical gears were also outsourced at a cost of Rs. 2.74 crore despite in-house facility.

Further, there was an inordinate delay in the creation of required infrastructure facilities for critical components/conversion of tools and jigs to numerical geometric tooling standards to meet the interchangeability requirement. This resulted in delay in creation of envisaged production capacity of 32 ALH per annum. An amount of Rs. 105 crore for tools and jigs and Rs. 40 crore for achieving interchangeability requirement was spent till September 2009. Likewise installation/commissioning of five machines (Rs. 34.12 crore) procured during 2004 was delayed by 12 to 29 months.

The Management attributed (December 2009) delay in commissioning to cycle time for proving of the machine and interchangeability to finalisation of Standard of Equipment. It further stated that infrastructure investments were not made to enhance the capacity as

¹⁰*(i) to overcome the design weakness, structural defects, manufacturing faults (ii) to introduce new equipment (iii) to replace existing component with new components and (iv) to increase the operational capability by utilizing the potential growth of the existing system.*

orders were obtained on piecemeal basis and letters of intent issued by the customer has no legal binding.

The reply is not convincing as the Company took more time in developmental aspects under its concept of 'concurrent technology' and failed to consider the infrastructure imbalances for a prestigious indigenous project taken up by it.

3.7.1.4 Problems with Anti Resonance vibration Isolation System

The Anti Resonance vibration Isolation System (ARIS) developed in-house did not meet the defence customer's desired level of vibration control. The Company tried (2003 to 2007) to address this problem through a secondary device (cost Rs. 42.86 crore), but failed to address the defence customer's requirement. Subsequently, (May-June 2009), the Company placed two development and supply orders for Second Generation Active Vibration Control System (AVCS) and Vibration Monitoring System (VMS) at a cost of Rs. 65.07 crore which were still under development and validation stage (December 2009).

The Management stated (December 2009) that since the contract with collaborator Messerschmitt Bolkow Blohm (MBB) - West Germany, ended at a point of time which was the very beginning of ARIS integration and testing, the Company re-developed the ARIS which fulfilled the basic vibratory requirements and during the process mastered the technology involved in vibration control.

The reply underscores Audit's contention that the decision to end MBB's collaboration was premature as the Company could not bind the collaborator for the systems' failure on integration and testing.

3.7.1.5 Control saturation

An ALH (J-4062) ferried out of the Company's premises on 1 February 2007 crashed during a practice at Bangalore on 2 February 2007 for display at an Air show. The cause of the accident was attributed to right cyclic saturation resulting from design deficiency¹¹. The cost of the damage was estimated at Rs. 33.42 crore. Similarly one ALH delivered to Ecuador Airforce (FAE) in March 2009 crashed in October 2009. While the domestic customer's (IAF) reaction to the design deficiency was serious¹² and questioned the Company's capabilities, reaction of FAE was awaited (December 2009). The very limitation of control saturation of ALH led to non-receipt (July 2007) of a potential export order from Chile though Rs. 10 crore was spent for demonstration and certification of ALH at Chile.

The Management stated (April 2009 and December 2009) that the complete rework of design during prototype stage was not carried out as the collaborator did not consider it

¹¹ *Loss of control, caused by the aerodynamic environment that resulted due to the combination of control inputs leading to the air crew running out of right cyclic to roll out of the left turn. This behavior of ALH is generic to type, and not a specific case attributable only to this accident.*

¹² *IAF observed that (i) Company has referred to this problem in the flight manual which is brief and lacks clarity; (ii) Company has been reluctant to address this problem in totality as it feared disruption of ALH production process; (iii) This approach of Company to safeguard its business even at the cost of a professional approach to solving the problem has serious flight safety and operational implications for the Indian Air Force (v) Company, as an industry, has rarely looked to exploiting its aircraft. It has always focused on the captive Indian Air Force for its assured market.*

necessary from the safety point of view. Control saturation is not a design deficiency but is a phenomenon that can occur during extreme manoeuvres. The precautionary notes and adequate cautions are part of the flight manual. It is in the process of incorporating control saturation warning system. The Company further accepted that the necessity for increased control margin has been discussed with Air Force and it was decided that considering the predominantly Nap of Earth (NOE) flying of light combat helicopter (LCH), it is necessary to incorporate increased right control margin on LCH.

The Company's reply leaves a doubt about the effective measures it has taken on the control saturation issue and the reaction of the customers will be known only on the field experience of the ALH to be supplied from the pending orders.

3.7.1.6 Weight of ALH

The collaboration agreement envisaged the gross weight of basic version to be four tons with Basic empty weight (BEW) of 2.240 tons. Later (1999) it was expected that TM333 2B2 engines fitted in ALH would meet a requirement of BEW of 2.550 tons. However, when pressed to field service in March 2002, ALH weighed 5.5 tons with BEW of 2.650 tons. Due to excess weight and limited power of the engine, the utility mission of 200 kg payload at six KM altitude was not achieved. Hence, the ALH which was to be successor to Cheetah/Chetak¹³, was found to be unsuitable for the intended multi role requirements due to excess weight. Thus, the utility version of the ALH was developed initially.

The Management stated (December 2009) that despite the deep background and experience of helicopters by MBB, the collaborator could not achieve the guaranteed parameter of BEW which is still an open point. Shakti engine (higher-powered engine) adequately meets the requisite payload with margins as demonstrated during the hot and high trials in August 2009.

The reply is, however, silent about the reasons for terminating collaboration agreement despite non-achievement of guaranteed parameter.

3.7.1.7 Integrated Architecture Display System

A contract (December 2003/January 2004-costing Rs. 23.27 crore) was entered with Israel Aircraft Industries (IAI) for development and production of Integrated Architecture Display System (IADS)¹⁴ which provided for freezing of the design and development after the Critical Design Review (CDR) by August 2004. However, the CDR was held only in March 2005 and the integration started in November 2005. The certification of IADS for utility version to be completed by August 2005 was completed only in April 2009, i.e., after delay of 44 months. The integration of IADS with Shakti Engine is still in progress (September 2009). Against the MoD approved cost of Rs. 31.02 crore (December 2003) for IADS, Rs. 46.46 crore were spent rendering the recoverability of additional cost of Rs. 15.44 crore doubtful.

The Management stated (December 2009) that IADS is a complex system interfacing with almost all helicopter systems on-board. There were also differences in perception of

¹³ *Earlier make of helicopter*

¹⁴ *The IADS was established to replace the ALH conventional architecture with a new integrated architecture and display system to provide an effective modern avionics system with a view to reduce crew work load, and improve safety, reliability and maintainability.*

the scope of implementation, which got evolved during detailed definition of systems post PDR resulting in incorrect assessment of work content by IAI.

The reply is not convincing as non freezing of design of ALH and non clarity over the requirements between the Company and the customers resulted in delay in development of IADS with additional cost.

3.7.1.8 Shakti engines

IAF and Army projected (1999) additional performance requirements to meet the operational needs and weaponised version of ALH. Based on this, a co-operation agreement was signed in January 2003 with Turbomeca (TM) for development of higher-powered engine Shakti, planned to be certified in December 2006 in France (at an approved cost of Rs. 110 crore of which Rs. 105 crore spent till date). Indigenous production of 320 engines was planned with the Company's work share from 16.7 per cent in phase-0 in 2009-10 to increase to 73 per cent in phase-4 by 2013. Due to its failure to set up in-house facilities for manufacture of gear boxes for the Shakti engines, the Company outsourced its requirements to TM. They were procured at a higher cost than what the Company had agreed with the customer. This will result in non recovery of differential cost of Rs. 5.50 crore.

The whole programme of development of Shakti engine has been delayed. Shakti Engine planned to be certified in December 2006 is yet to be certified even after a delay of three years resulting in postponement of delivery schedule of 20 ALH with Shakti engine from 2008-09 to 2009-10.

The Management stated (December 2009) that considering the risk and time constraint to meet the schedule; it was decided to procure gear boxes from TM. The under recovery of Rs. 5.50 crore will be made good by reducing the in-house fabrication hours after establishing the facilities.

The reply is futuristic and would be applicable for the actual gear boxes manufactured by the Company in phase I and beyond.

3.7.1.9 Certification for ALH

The Design, Development and Production of Military Aircraft and Airborne Stores-2002 (DDPMAS), provides for concurrent certification of the newly developed aircraft/equipment/store to induct it at an early date to the services. Despite more than two decades into the development and production of ALH, the technical requirements¹⁵ of defence services could not be met by the Company and all the 74 helicopters supplied to defence customers were flying with concessions. The acceptance of ALH by defence services with the concessions could be a contributing factor for the slow pace in achieving the standards by the Company and delay in overcoming the operational deficiencies.

The 20 ALH-IADS delivered to army during the period 2006-09 have been awarded only Initial Operation Clearance (IOC). Similarly, the 54 ALH with conventional cockpit

¹⁵ *Status of compliance as at December 2009-IAF- out of 30 concessions allowed, 24 complied with between April 2002 and August 2009 and 6 were pending; Navy- out of 26 concessions 20 were cleared from May 2002 to June 2004 and 6 concessions were pending including more significant like- Role clearance for Search and Rescue (SAR), Fitment of 360 degree Homer and automatic blade folding*

delivered during the period from 2001-02 to 2006-07 are also flying with Provisional Release to Service document (RSD) awarded in September 2007.

The Management stated (December 2009) that as per DDPMAS, RSD is a formal notification that the helicopter is technically cleared for service use and permits delivery to services. Obtaining type approval involving submission of large number technical documents is under progress.

Even after delivering 74 helicopter during 2001-2009, the Company has not been able to complete the technical documentation to get the type approval.

3.7.1.10 Delay in development of Weapon System Integration (WSI) versions

Defence customers observed (1986) that the ALH under development would be unsuitable in the attack role because of its weight and volume. MoD authorised (December 1998) the Company to undertake design and development of ALH- Weapon system integration (WSI) to be completed by January 2003. The development is still in progress and Company had spent an amount of Rs. 424 crore (September 2009). It was observed that issues like selection of weapons, selection of vendor *etc.*, were not addressed for timely completion of WSI integration project. Out of the pending order for delivery of 159 ALH to Army and IAF, 76 have to be delivered with WSI version. The delay in delivery has serious impact on the defence preparedness of the country.

Further, the Navy required integration of Tactical Missile System (TMS) and Anti Submarine Warfare (ASW) into ALH. For the purpose, Navy released Rs. 139.92 crore. However, it decided (September 2006) not to accept ALH in ASW role as it did not meet its requirement of Time on Task (TOT) of 2.20 hrs at 20 nautical miles. Despite this decision the project was allowed to continue and Rs. 138 crore were spent till September 2009. Thus, besides taking up valuable time and resources, it did not prove fruitful as the Company is not able to show case its competency.

The Management stated (December 2009) that operational clearance for the WSI variant has been scheduled for July 2010 and the required TOT was not achieved as Navy revised their operational and mission equipment weight and requirement of dunking cycle, crew weight *etc.*, which adversely affected the achievable TOT.

In the absence of clear understanding of the requirements, the amount of Rs. 138 crore spent on the project has not resulted in any tangible benefit to the customer as the end result is uncertain.

Recommendation No. 3.1

- | | |
|-------|--|
| (i) | <i>Series production should be taken up only after prototypes are approved /certified and accepted by the customer.</i> |
| (ii) | <i>Modifications desired by the customer should be with reference to a time frame and technical competency of the Company.</i> |
| (iii) | <i>The capacity should be ramped up as to peak up production as planned.</i> |
| (iv) | <i>Dependable alternative sources for machining operations should be explored.</i> |
| (v) | <i>Clarity of all customer requirements should be ensured before placement of development order on foreign source to avoid delay and additional cost.</i> |
| (vi) | <i>The Company should quicken the process of submitting the documents and obtain the certifications early.</i> |
| (vii) | <i>MoD needs to review the whole process of weaponisation in the Navy duly considering the progress made by the Company till date as huge public money has already been spent on this project.</i> |

3.7.2 Labour utilisation

The labour hours booking is done manually through job cards although ERP system has been implemented in the Helicopter division. GHT consultant recommended (1997) labour hours for manufacture of different versions of helicopter which were revised by a MoD nominated Committee (July 2003). The actual hours booked *vis-à-vis* the norms were as under:

Labour hours prescribed by the consultant	Labour hours fixed by the committee	Average hours booked by the Helicopter division
(a) 38,500 for the 1 st ALH	(a) Skid version- 99,500	LSP* version ¹⁶ -88,768
(b) 30,000 from 50 th ALH	(b) Wheeled version-1,11,500	SP** version -58,367

*LSP-Limited Series Production; **SP-Series Production

The Company was, thus, not able to achieve the consultant prescribed hours till date. Despite delivery of 90 ALH upto 2008-09, the Company has not gained the experience and benefit of learning curve to achieve reduction in labour hours/cost.

The Management stated (December 2009) that experience has been gained now which will benefit for 159 ALH orders and future contracts. Optimisation of labour hours will be realised in next two years.

In the light of average hours booked, the labour hour requirement needs to be reviewed *denovo*. Further, efficiency of labour can be better monitored through ERP system.

3.7.3 Pricing and profitability analysis of ALH

Pricing of ALH is based on recommendations (July 2003) of the Price Negotiation Committee (PNC)¹⁷ meeting held by the Company with IAF, Army, Navy and Coast Guard. The contract is finalised based on mutually agreed terms in the PNC. Pricing for

¹⁶ the Company has not compiled separately the hours booked for Skid and Wheeled version under LSP and SP.

¹⁷ PNC comprises of Company, customer and representative of MOD.

the civil customers is based on the market conditions. A detailed statement showing sale value, cost of sales and profit for the last five years from 2004-05 to 2008-09 is enclosed in the **Annexure VIII**.

The Audit analysis indicated that there was low margin/loss during 2007-08 and 2008-09 though there was savings in the material cost; it was offset by the increase in labour cost, reducing the profit margin. Further, the Company could not get any margin on sale to non defence customers.

The Management attributed the labour cost increase to wage revision from 1 January 2007.

3.7.4 Quality Issues

Through out the development and supply of ALH large number of quality issues like Tail Rotor blade (TRB) de-lamination, Main Rotor blade (MRB) de-lamination, frequent failure of Integrated Dynamic System (IDS), poor performance of TM 333 2B2 Engine and failure of Line replaceable Units (LRUs) were encountered and the ALH had been withdrawn for repair/modifications. For its delay in addressing the TRB issues the Company had to forego expected revenue of Rs. 16.32 crore on the lease of two helicopters to Israel and the Government of Karnataka which were not used. The Company had so far (December 2009) spent Rs. 44.08 crore to address these quality problems.

The Management accepted (December 2009) audit findings on the failure of engines as factual while for the LRUs it was stated that modifications/improvements have been implemented by respective vendors on all LRUs.

The Company should investigate into the reasons for high failures of the engines as it had to withdraw them before the original equipment supplier suggested time between overhaul of 2,000 hours.

Recommendation No. 3.2

As the Company has entered the highly competitive civilian/ export markets the design/quality issues need to be resolved early to gain the confidence of the customers to remain in the market.

3.7.5 Marketing of ALH

3.7.5.1 International Certification Process

To establish the Company as a legitimate manufacturer of aircraft for worldwide consumption, the manufacturing facilities and procedures need to be certified by international agencies. Over three fourths of all operators and almost one half of non-US operators demand Federal Aviation Administration (FAA) certification.

GHT, the consultant in its report (June 1997) opined that the lead time for certification was around three to five years. The consultant had also suggested that since the Company was not recognised as an established helicopter manufacturer, a Joint Venture alignment with a strong reputable international manufacturer to provide improved product credibility is necessary.

Board had sanctioned Rs. 28 crore in January 2009 to comply with various certification processes. The Company initiated action in February 2009 towards European Aviation Safety Agency (EASA) certification by incurring a sum of Rs. 4.26 crore. The target date of certification of the project is March 2012. Due to non availability of EASA, the Company could not get the orders from Turkey for two ALH on lease though the Memorandum of Understanding (MOU) was signed in October 2008. No action has been initiated by the Company regarding Joint Venture arrangement as suggested by the consultant (December 2009).

Even though, the Company delivered the first ALH in 2001-02 and has been showcasing them in the Air shows since 2003 (total cost on air shows- Rs. 59 crore till March 2009), in the absence of international certificates, the Company could not penetrate the international market.

3.7.5.2 Penetration into civil/non-defence market

Despite getting type certification of DGCA in October 2003 for the civil variant of ALH, the Company could sell only 16 ALH in the domestic civil market and with orders for another 6 on hand towards civil/export order. The recommendation of the consultant 'for an aggressive programme to develop not only domestic but also opportunities beyond India' has not been taken seriously by the Company despite the ALH project equipped with a dedicated Marketing wing. A separate marketing budget and specific targets for the marketing wing on commercial market penetration are needed to effectively penetrate the domestic market. The Company could not successfully execute even the orders received from civil market as indicated in the *Annexure-IX*.

Further though the lease option of ALH was considered advantageous, the Company could not capitalise on the lease transactions it ventured with the Government of Karnataka and Israel Aircraft Industries, Israel (between November 2004 and May 2005) due to problems with Tail Rotor Blade (TRB). The inability of the Company to address the issues had dampened the confidence in the market which is evident from the fact that there is no lease agreement with the Company subsequently.

Recommendation No. 3.3

The Company should expedite efforts to get International certificate on priority to be a global player. The Company should exploit civil market by executing the orders successfully and consider options of sale technique through leasing of ALH.

3.7.6 Inventory Management and Indigenisation

3.7.6.1 Dependence on Imports

The consultant recommended for indigenisation level of fifty *per cent* of purchases of raw material and bought out items by the year 2008. However, 90 *per cent* of the value of material used in each helicopter is still imported from foreign suppliers. Even though ALH is in production for 10 years, the Company has not been able to identify alternative indigenous suppliers.

The Management stated (December 2009) that (i) after the certification process, the development of alternate sources was not feasible, but is making efforts to get best prices;

- (ii) long term agreements are being entered into for new bulk orders and
- (iii) indigenisation would be completed and implemented by 2011-12.

3.7.6.2 Lack of proper control of inventory

Inventory control in Helicopter division was found to be lax. A task force constituted to make a comprehensive critical review of the inventory, based on an observation on the accounts of the Company for the year 2008-09 observed (September 2009) that (i) items valued at Rs. 7 crore in the shipping location (out of Rs. 11 crore analysed), though already been dispatched continued to be shown as part of the inventory, (ii) items valued at Rs. 2.0 crore (out of rejected items valued at Rs. 11 crore) were found to be shelf expired /duplicate entries and (iii) items valued at Rs. 9 crore (out of items valued at Rs. 12 crore) shown as lying with OEM though received back.

The Management assured in December 2009, that corrective action would be taken after receipt of the final report.

Recommendation No. 3.4

Concerted efforts are needed to achieve the desired (50 per cent) level of indigenisation.

3.7.7 Facility for Maintenance Repair and Overhaul

Against the approved cost of Rs. 54 crore (April 2006) for creation of Maintenance Repair and Overhaul (MRO) facility till date (December 2009) only Rs. 16 crore were spent indicating that necessary attention was not given to this issue. It was observed that there was delay in repair/overhaul of ALH ranging between 7 and 25 months. The customers have noted (June/August 2008) that poor serviceability has affected the availability of ALH for operational use. Although the products/services delivered to IAF/Army are governed by Fixed Price Quotation Policy (FPQ), the FPQ price and the cycle time for repair/overhaul are yet to be finalised. Against a claim of Rs. 103 crore (on 41 ALH), the Company had realised Rs. 64 crore only.

3.8 Conclusion

The collaboration agreement was closed/terminated prematurely. Non-freezing of design of ALH kept the development stage open. Despite getting the first prototype of ALH utility version in 1992, till date the Company did not meet the technical requirements of defence services, which changed too often impacting the development process necessitating large number of modifications. 74 helicopters supplied to defence customers are flying with concessions. Under its concept of 'concurrent technology' the Company failed to consider the infrastructure imbalances. Development of high-powered Shakti engine is delayed. Defective quality issues resulted in grounding and un-serviceability of helicopters for long period affecting the operational necessities of the customer. In the absence of international certification the Company could not establish its product in international market. The envisaged indigenisation level of 50 per cent, is yet to be achieved.

The matter was reported to the Ministry in February 2010; their reply was awaited (March 2010).