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HINDUSTAN AERONAUTICS LIMITED (HAL)

Design and Development (D&D) in Hindustan Aeronautics Limited (HAL)

[Based on Chapter-II of C&AG Report No. 18 of 2023]

DEPARTMENT OF DEFENCE PRODUCTION (MINISTRY OF DEFENCE)

COMMITTEE ON PUBLIC UNDERTAKINGS (2024-25)

TENTH REPORT (EIGHTEENTH LOK SABHA)

MINISTRY OF DEFENCE

LOK SABHA SECRETARIAT
NEW DELHI

TENTH REPORT

COMMITTEE ON PUBLIC UNDERTAKINGS

(2024-25)

(EIGHTEENTH LOK SABHA)

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[Based on Chapter-II of C&AG Report No. 18 of 2023]

HINDUSTAN AERONAUTICS LIMITED (HAL)

DEPARTMENT OF DEFENCE PRODUCTION (MINISTRY OF DEFENCE)

Presented to Lok Sabha on 27 March, 2025
Laid in Rajya Sabha on 27 March, 2025

LOK SABHA SECRETARIAT
NEW DELHI

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COMPOSITION OF THE COMMITTEE ON PUBLIC UNDERTAKINGS (2024-25)

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3. Smt. Mriganka Achal - Deputy Secretary
4. Shri Dhruv - Under Secretary

INTRODUCTION

I, the Chairperson, Committee on Public Undertakings (2024-25) having been authorized by the Committee to submit the Report on their behalf, present this Tenth Report (18th Lok Sabha) on 'Design and Development (D&D) in Hindustan Aeronautics Limited (HAL) [Based on Chapter-II of C&AG Report No. 18 of 2023].'

2. The Committee on Public Undertakings (2024-25) had selected the said subject for detailed examination.

3. The Committee on Public Undertakings (2024-25) was briefed about the subject by the representatives of Comptroller and Auditor General of India on 25th September, 2024 and thereafter took evidence from the representatives of Hindustan Aeronautics Limited on 24th October, 2024. The Committee also took oral evidence of the representatives of Ministry of Defence (Department of Defence Production) on 24th October, 2024.

4. The Committee (2024-25) considered and adopted the draft Report at their sitting held on 24th March, 2025.

5. The Committee wish to express their thanks to the representatives of Comptroller and Auditor General of India, Hindustan Aeronautics Limited (HAL) and Ministry of Defence (Department of Defence Production) for tendering evidence before the Committee and furnishing the requisite information to them in connection with examination of the subject.

6. The Committee would also like to place on record their appreciation for the assistance rendered to them in the matter by the Office of the Comptroller and Auditor General of India.

7. For facility of reference and convenience, the Observations and Recommendations of the Committee have been printed in bold letters in Part-II of the Report.

New Delhi;
25 March, 2025
04 Chaitra, 1947(S)

BAIJAYANT PANDA
Chairperson
Committee on Public Undertakings

PART-I

A. BACKGROUND

HAL was started as a private limited company in 1940 by a visionary founder Shri Walchand Hirachand, when it was established as Hindustan Aircraft Limited. In 1963, Aeronautics India Limited was founded by the Government of India to manufacture MiG-21 aircraft locally in India. The current form of HAL was brought into being in 1964, and Mini Ratna status was achieved in 1998. Navratna status was attained in 2007, and MahaRatna status was achieved in 2024. The company has been publicly listed since 2018.In the current landscape, HAL is ranked 31st among the top 100 aerospace and defence companies by revenue generation. Approximately USD 3.5 billion was generated last year. More than 4,000 aircraft and 5,500 engines have been produced. More than 12,000 aircraft have been overhauled cumulatively, and a workforce of around 24,000 people is maintained. HAL operates across India with 21 production centers and nine R&D centers, organized into specialized complexes. Research and development is primarily managed by the Design Complex, based in Bengaluru, with additional facilities in Kanpur, Korwa, Barrackpore, and Nashik. The Bengaluru complex produces indigenous fixed-wing aircraft, and production of the LCA Tejas is planned to expand to Nashik. The MiG Complex, located in Nashik and Koraput, focuses on Sukhoi-30 aircraft production, with engines manufactured in Koraput, Odisha. The Accessories Complex, spread across Lucknow, Kanpur, Korwa, and Hyderabad, produces the necessary systems and components, while the Helicopter Complex in Bengaluru and Barrackpore handles the production of all indigenously designed helicopters and provides ROH support for previously produced models.

2. The audit report on HAL highlights several major issues related to the Company's Design and Development (D&D) projects. These issues primarily stem from non-compliance with mandated pre-project processes, procedural lapses, delays, and cost overruns. HAL's R&D efforts, while significant in size, have faced setbacks due to inadequate planning, oversight, and adherence to the R&D manual’s guidelines. For instance, the audit revealed that out of 32 reviewed projects, 18 lacked necessary Project Feasibility Reports, and 29 did not have Detailed Project Reports (DPRs). Additionally, Technology Gap Analyses, which help identify technical shortfalls, were not conducted in 21 projects, affecting HAL's ability to bridge knowledge gaps effectively and compromising project outcomes. The report also noted delays and cost overruns in several high-profile projects. For example, the development of Project 1, a gas turbine engine with an initial completion target of September 2018, experienced a three-year delay partly due to procurement issues, resulting in an impaired cost of ₹159.23 crore. Similarly, Project 2, aimed at developing an aircraft, saw a delay of more than 20 years, with expenditures overshooting by ₹275.85 crore due to initial engine misalignments and extensive modifications needed to meet operational standards.

3. The Audit pointed out that HAL's tendency to initiate D&D projects without comprehensive feasibility studies or risk assessments often led to ineffective management

of project timelines and budget. Further, the Audit disclosed significant issues with the redesign of System 1 for Helicopter 1. HAL incurred ₹2100.68 crore in an attempt to enhance component reliability, but delays in certification prevented HAL from integrating these improvements into existing contracts, leading to a ₹221.31 crore loss. HAL also encountered challenges in securing international certification, such as from the European Aviation Safety Agency (EASA), which delayed the export potential of its helicopter models due to technical discrepancies and inadequate support for training in overseas markets. This hindered HAL's efforts to tap into the global market, an opportunity that could have bolstered its financial standing and operational credibility.

4. However, during the examination of the subject, the representatives of both the Ministry of Defence (MoD) and Hindustan Aeronautics Limited (HAL) acknowledged the highlighted procedural gaps and delays in project execution but provided explanations aimed at justifying their approach. HAL admitted that certain pre-project requirements, such as Project Feasibility Reports (PFRs), Detailed Project Reports (DPRs), and Technology Gap Analyses, were not conducted across many projects, particularly for smaller components. HAL's management argued that while these were indeed policy mandates, they focused on preparing Draft Cabinet Notes for customer-funded projects, which they claimed served a similar function to DPRs. Furthermore, HAL attributed project delays and cost overruns to technical complexities, dependency on external partners for specialized expertise, and unforeseen procurement challenges. HAL also emphasized its efforts to address these audit findings by revising its R&D manual in 2022 to provide flexibility for different project types, ensuring procedural alignment across varied development projects. In cases of non-recovery of costs, such as in the redesign of helicopter components, HAL stated that it had taken measures to recover investments through amortization over future orders, although this was met with skepticism by the auditors. The Ministry of Defence, for its part, supported HAL's stance but urged the Company to enhance compliance with mandated procedures, underscoring the need for more rigorous feasibility studies, risk assessments, and timely project closures to avoid recurrent issues. Both the Ministry and HAL expressed a commitment to improve planning and project management practices to better align with Audit Recommendation.

5. The C&AG looked into the matter thoroughly in their Chapter-II of Audit Report No. 18 of 2023 related to Design and Development (D&D) in Hindustan Aeronautics Limited (HAL) and came into the conclusion that HAL did not ensure compliance with pre-project processes and procedures mandated under R&D Policy and Manual. The delay caused by HAL in the D&D projects pertained to basic project management procedures like finalization of specifications, failure to plan and initiate procurement of materials and not taking prompt measures to address the issues faced during the execution of projects. The projects were delayed even after obtaining the approval for revised estimates and time schedules. The Committee on Public Undertakings, during the term (2024-25) selected the Chapter-II of Audit Report No. 18 of 2023 related to Design and Development (D&D) in Hindustan Aeronautics Limited (HAL), for examination and report to Parliament. The Committee during

examination of the subject heard the views of officers of C&AG, representatives of the HAL and Ministry of Defence before finalizing their Report. The detailed observations/recommendations of the Committee on the Audit Chapter have been given in bold type in Part – II of this Report.

AUDIT PARAGRAPH

(I) Chapter 2 of the C&AG Report No.18 of 2023

6. HAL's primary mandate is the design, development, manufacture, repair, overhaul, and upgrade of a range of defense equipment, including aircraft, helicopters, aero engines, avionics, and navigation systems. The company operates 11 R&D centers managed under the Design Complex in Bengaluru, each headed by a General Manager and overseen by the Director of Engineering and R&D.HAL undertakes two main types of D&D projects: customer-funded projects, sanctioned by the Cabinet Committee on Security to fulfil defense needs, and HAL-funded projects that aim to advance indigenous capabilities. To support in-house innovation, HAL allocates 10% of its operational Profit after Tax to an R&D corpus.

7. Audit noted that HAL's R&D processes are marred by various operational inefficiencies, particularly in project planning, procurement, and compliance with mandated procedures. Notably, HAL failed to adhere to the R&D Policy and R&D Manual, often bypassing essential pre-project steps. This includes the non-preparation of Project Feasibility Reports (PFRs) and Detailed Project Reports (DPRs), which are critical to ensuring the feasibility and potential success of projects. Moreover, Technology Gap Analyses, essential for identifying and addressing technical shortfalls, were conducted in only a limited number of projects. This lack of compliance with procedural mandates has contributed to inefficient project planning and significant delays in project completion. One of the report's key insights is the considerable cost overruns and delays in HAL's flagship projects, primarily due to lapses in initial assessments and coordination. For example, the Project 1 gas turbine engine development project, initially sanctioned at ₹441.41 crore, experienced delays due to procurement issues and unanticipated challenges, leading to impaired expenses totalling ₹159.23 crore. Another prominent example is Project 2, which aimed to develop an aircraft but has seen serious delays exceeding 20 years. This prolonged timeline stems from the inadequate integration of high-thrust engines, causing delays in certification and technical complications. By March 2022, the cumulative expenditure on this project had reached ₹710.08 crore, resulting in a cost overrun of ₹75.85 crores.

8. The redesign of Helicopter 1's System 1 highlights HAL's recurring struggle with project execution. HAL initiated this redesign after recurring failures of the component, with the aim of enhancing its reliability and Time Between Overhauls (TBO). However, the redesign process encountered delays, preventing HAL from implementing the improved component in the final product. Consequently, HAL incurred a financial loss of ₹21.31 crore, which was impaired in its 2020-21 financial statement. Similarly, HAL's bid to certify Helicopter 1 under the European Aviation Safety Agency (EASA) standards was delayed by over a decade due to stringent compliance requirements. This setback severely impacted HAL's ability to market the helicopter internationally, as evidenced by the write-off of ₹108.24 crore related to this certification. HAL's indigenous projects, aimed at enhancing India's defense self-reliance, also faced substantial setbacks. The Project 3 technology demonstrator, developed in partnership with IIT Kanpur, failed to meet operational

requirements for defense applications. Despite a sanctioned amount of ₹23.18 crore, the project achieved limited success, as HAL could not secure any defense contracts for this technology. Similarly, the upgrade of Aircraft 2, a licensed model under Transfer of Technology (ToT), was delayed by more than four years beyond its target date of March 2018. This delay led to the impairment of ₹153.98 crores.

(II) Audit Observations

9. A brief overview of key Audit findings is furnished below:

A. Non-Compliance with Pre-Project Procedures:

HAL failed to adhere to pre-project processes mandated by the R&D Policy and R&D Manual:

- Project Feasibility Reports (PFRs) and Project Definition Phase (PDP) Reports- were not prepared in 18 out of 32 projects reviewed (56.25% non-compliance).
- Detailed Project Reports (DPRs) were not prepared in 29 out of 32 projects (90.6% non-compliance).
- Technology Gap Analysis (TGA) was not conducted for 21 out of 32 projects (65.6% non-compliance).
- Technical Reviews were not conducted for any critical phases of the D&D projects.
- The Committee of Institutions Network (COIN) held only 14 meetings with R&D heads, against a required 42 meetings, showing a 66.7% shortfall.

B. Design and Development of Project 1 (Gas Turbine Engine):

Sanctioned Cost**: ₹441.41 crore**.

Completion Stages:

- **Stage I** (Project Definition and Design): Completed in December 2015 with an expenditure of ₹52.87 crore (delayed from the original September 2014 deadline).
- **Stage II** (Design, Prototype Development, Tests, and Certification): Ongoing as of July 2022, delayed from the original September 2018 deadline.

Issues

- Delays in construction of test beds due to delayed land clearance.
- Unplanned procurement activities and technology gaps led to further setbacks.

C. **Delay in Project 2 (Aircraft Development) Due to Engine Issues**:

Sanctioned Cost: **Initially ₹180 crore, revised twice to ₹634.23 crore**.

Timeline: Extended from the **original 60 months (July 1999 to July 2004) to 173 months (December 2013),** with ongoing delays.

Issues:

- Incorrect initial selection of Engine 1 (A Type engine), later replaced with Engine 2.
- Integration of Engine 2 required significant modifications due to poor stall and spin characteristics, leading to further delays and increased costs.
- HAL incurred a cost overrun of ₹75.85 crore with total expenditure reaching ₹710.08 crore as of March 2022.

D. **Infructuous Expenditure on Project 3 (Technology Demonstrator in collaboration with IIT Kanpur)**:

- Sanctioned Cost: **₹23.18 crore**.
- Expenditure: ₹**9.54 crore (inclusive of 2.69 crores paid to IIT Kanpur) as of March 2021**.

Issues:

- HAL developed Project 3 as a technology demonstrator in collaboration with IIT Kanpur but failed to consider market requirements, resulting in a product that did not meet defence needs and no subsequent sales. Lack of market exploration or customer requirement assessment led to the failure of the project, as the developed UAV did not meet defense standards.

E. **Non-Recovery of Expenditure on Redesign of System 1:**

Sanctioned Amount: **₹100.68 crore**.

Issues:

- Delays in redesigning and certification of a critical helicopter component (System 1) led to losses, with the entire expenditure of ₹21.31 crore impaired in the financial statements.

F. **Non-Achievement of Export Potential for Helicopter 1**:

Sanctioned Cost: ₹27.90 crore, later revised to ₹109.92 crore.

Issues:

- Significant delays due to stringent EASA compliance requirements and failure to anticipate additional tests and costs.

- Certification delayed by over 10 years, impacting HAL's ability to penetrate the European market, with ₹108.24 crore impaired by March 2022.

G. **Indigenous Development of Aircraft 1 (Upgradation of Aircraft 2):**

Sanctioned Amount: ₹84.61 crore, later increased by ₹69.37 crore in 2018.

Issues:

- HAL initiated the upgrade without a proper business plan, technology gap analysis, or feasibility study.
- The upgrade proceeded without the necessary permissions from the original equipment manufacturer (OEM), leading to potential risks and delays.
- Entire expenditure of ₹153.98 crores impaired by March, 2022.

A. ISSUES EMERGED IN AUDIT OBSERVATIONS

(I) Non-compliance to pre-project processes and procedures mandated under the R&D Policy and R&D Manual

10. The audit highlighted systemic lapses in HAL's adherence to its R&D Policy and R&D Manual, specifically regarding pre-project processes vital for evaluating project feasibility, technology gaps, and risk assessments. Key requirements mandated in the R&D Manual, such as conducting Project Feasibility Reports (PFRs) and Detailed Project Reports (DPRs), were found frequently omitted. Out of 32 projects reviewed, 18 lacked PFRs, and DPRs were absent in 29. These omissions limited HAL's ability to determine project viability and mitigate potential risks effectively, the Audit observed HAL's failure to conduct Technology Gap Analyses and risk assessments across many projects. For instance, 21 out of 32 projects were initiated without these critical assessments. HAL's R&D framework mandates such analyses to bridge technical deficiencies and align projects with customer specifications and broader defense objectives. The lack of these evaluations resulted in several projects progressing based solely on preliminary customer inputs, often without robust planning. The Committee of Institutions Network (COIN) meetings, designed for regular project oversight, were also conducted irregularly. Only 14 of the mandated 42 meetings were held which resulted into reduction of effective project monitoring. Furthermore, reports such as Risk Mitigation Plans, Lessons Learned, and Project Closure Reports were inconsistently produced, compromising knowledge transfer for future projects.

11. Ministry of Defence informed the Committee that the absence of Detailed Project Reports (DPRs) in 29 out of 32 projects, as noted in the audit findings, was attributed to HAL's differentiated approach to project documentation. While Project Feasibility Studies, DPRs, and Project Reports are routinely prepared for major platform projects, such as aircraft, helicopters, and engine development programs, HAL has adopted alternative documentation methods for customer-funded projects. In such cases, Draft Cabinet Notes serve as a substitute for DPRs, containing similar content related to project justification, technical aspects, timelines, milestones, funding, and risk analysis. Additionally, HAL's Technology and Design Policy Committee (TDPC) proposals provide comprehensive project planning for major initiatives. For smaller projects, HAL ensures that feasibility studies and project definition phases are conducted in proportion to the project's complexity and significance, thereby maintaining an appropriate level of scrutiny. The company acknowledges the audit's recommendations and has issued new instructions to all R&D Centres to strengthen documentation practices across all project categories. Regarding non-compliance with the R&D Policy and R&D Manual, HAL clarified that its Design and Development (D&D) framework is based on evolving defense requirements and involves continuous engagement with key stakeholders. Given the rapidly changing geopolitical and defense landscape, R&D priorities must be periodically realigned, impacting both timelines and cost estimates. Furthermore, aerospace systems development is inherently iterative, requiring multiple cycles of validation before technologies can be deemed viable for series

production. HAL emphasized that, while documentation gaps existed, its approach ultimately reduces foreign dependency and enhances indigenous capabilities. In response to the audit findings, HAL has taken corrective measures and issued new compliance directives to ensure greater adherence to R&D documentation protocols in future projects.

12. During the evidence, the representatives of the HAL, informed the Committee about Research and Development Manual of HAL as under:

> *"We are a Maharatna company and we have all these built-in processes. As you have seen, we have a wide-range products right from engines to aircrafts and helicopters. So, initially, when the R&D manual was made, it was made in a sort of one-size fits all. So, what happens is that we are producing electronic boxes at one end and the aircraft at the other end. So, the same processes are not applicable across all these. For example, we would do a flight review board for an aircraft. We would do with that kind of processes, which would not be relevant for an engine or an electronic box. That is where these differences came up, that is, in some cases, that particular process is not being followed. Now, in 2022, we have revised this manual and made it in such a way that enough flexibility is given that these processes can be suited to the different R&D sectors. So, for a software, it will be a different process, and for an engine, it will be a different process. So, I think, the initial R&D manual was made from an aircraft point of view. We have corrected this in 2022.*
>
> *…Sir, all the projects are approved by the Board of HAL. There are different committees. Some powers are given at the General Manager's level. Some powers are at the Director's level, and there are some powers at the Board's level. We have a Technology Development and Process Committee (TDPC), which looks at all these projects and gives the sanction."*

13. During the evidence the representatives of the Ministry of Defence(MoD), informed the Committee about their role in Research and Development activities of HAL as under:

> *"…I would like to submit that HAL does the research and development activities primarily into two different boxes. One, where the activity is Government funded. In such cases, the project development and afterwards the procurement of those products is assured by the Government. In those type of cases, the Ministry has an active role to observe and also monitor the development of product like Light Aircraft Carrier (LAC) or the Light Utility Helicopter (LUH).*
>
> *The other box is where HAL is doing research and development activity through their own fund as per the need seen by them. Those needs may come from the order placed by the Defence Forces or the anticipation by the HAL that those needs would emerge in future. That is why they start doing all those*

activities at their own. There, the Ministry does not play any active role. They do it within their own procedures and monitoring mechanisms."

14. With regard to non-compliance of the market research pre-project requirements of HALthe representatives of the MoD, during evidence informed the Committee as under:

"In cases where the Ministry itself is funding the development of the project like LCA Mark-I and Mark-II, LUH, that type of requirement need has already been assessed by the Armed Forces and backed by the decision procedure of the Ministry. That is why, after successful of the development order, the procurement order is placed. In such cases, they are not required to do the market research. They still are required to do the feasibility study - whether that is feasible or not. If they find that it is not feasible for them to develop that type of product, it is their duty to come back to the Ministry or to the acquiring authority. But the way it works, before the order is placed, consultation happens with the Armed Forces and the DRDO Wing, if they are also in the loop for developing the technology. When they come to the conclusion that a reasonable possibility is there to develop the project within the country with the required amount of indigenization, then only the order is placed. But it does not mean that all of these projects would be successful. Some of the projects do not become successful because uncertainty is always there when some new developments happen.

In cases, where they are developing products or replacement for the items which are being imported, the due diligence in terms of market research, cost competitiveness, their ability to develop the products, availability of the parts, supply chain, etc. is done by HAL. I am sure that they must be having the process within their company framework to do this type of activity"

15. HAL informed the Committee, that approximately 9 percent of its turnover is expended on R&D, which aligns with global standards set by companies such as Boeing and Airbus, who allocate between 8 and 10 percent. An amount of ₹2,826 crore was spent by HAL on R&D in the previous year. Additionally, an R&D corpus of 15 percent has been created, with 15 percent of Profit After Tax being allocated annually to ensure consistent funding availability for R&D.

16. Regarding adopting reasonable and logical pre-R&D and pre-production requirements in the HAL's manual, the representatives of the Ministry assured the Committee that:

"महोदय, वर्ल्ड की जो बेस्ट कम्पनियां हैं, जो भी मिलेगा, we will like them to adopt that and we will see that."

(II) Design and Development of Project 1

17. According to the Audit, the "Design and Development of Project 1" is a high-value gas turbine engine project aimed at enhancing indigenous capability in critical aerospace technologies. Initially sanctioned in 2012 for ₹441.41 crore, the project was structured into two stages: Stage I involved project definition and design, targeted for completion in 2014, while Stage II encompassed prototype development, testing, and certification, intended to conclude by 2018.However, significant delays arose from various operational and logistical setbacks. For instance, land clearance for constructing testing facilities was delayed due to extended approval processes with forest authorities. Even after obtaining clearance, HAL took additional time to place the work order, contributing to over three years of delay beyond the initial completion target. These delays were compounded by unanticipated requirements, such as the need to construct a test bed and procure advanced machinery for prototype testing. Additionally, challenges in procuring critical components and unforeseen issues with the Intermediate Gear Box (IGB) delayed Stage II testing, leading to a cumulative impaired expense of ₹159.23 crore. The Audit underscores HAL's lack of foresight and contingency planning, which hindered project progress and substantially escalated costs. As of the latest audit, Project 1 remains incomplete, illustrating the need for improved risk assessment and resource planning in HAL's approach to complex R&D projects.

18. When asked by the Committee the need identified by HAL for taking up the various Design and Development (D&D) projects, in its written note Ministry submitted the following information to the Committee:

> "The need identified by HAL for taking up the various Design and Development (D&D) projects is based on the following:
>
> a) Requirements projected by Armed Forces:
> - Indian Air Force through Air Staff Qualitative Requirement (ASQR)
> - Indian Army through General Staff Qualitative Requirement(GSQR)
> - Indian Navy through Naval Staff Qualitative Requirement (NSQR)
> - Joint Services Qualitative Requirement (JSQR)
>
> b) Technology Perspective Capability Road Map (TPCR), Long Term Integrated Perspective Plan (LTIPP) of Ministry of Defence
> c)In response to Request for Proposal (RFP)/ Request for Quote (RFQ)/ Task Directives, etc., received from the Customers and Govt. of India Ministry of Defence (GoI-MoD) Contracts
> d) Modification/Upgradation of existing products/platforms and services to match with the emerging requirements
> e) Technology demonstrators of leading or emerging technologies to demonstrate to the customers for future use, initiated by HAL
> f) Inter-Governmental Agreements (IGAs)
> g) Co-Development with other agencies like Defence Research & Development Organisation (DRDO)/ Aeronautical Development Agency

(ADA) / National Aerospace Lab (NAL)/ Defence Public Sector Units (DPSUs) / Private firms for meeting customers requirement

h) Projects based on Anticipated Customer Demand, Obsolescence Management, Indigenisation of Line Replaceable Units (LRUs), Alternate material, Simulators, Ground Support Equipment (GSE), Ground Handling Equipment (GHE) etc. for meeting customers requirement"

19. Further, the Ministry of Defence in a written reply informed the Committee that HAL ensures that its D&D projects are aligned with strategic defense requirements before initiation by meticulously planning and aligning all activities with the needs of the Armed Forces, studying current aerospace industry technologies, assessing market potential and obsolescence management, addressing indigenization requirements in line with the Atmanirbhar Bharat Mission, and incorporating improvements in delivered products**. (Lop 1(ii)).** Additionally, HAL emphasized that its D&D initiatives are aligned with the broader defense policy framework of the Government of India and the Integrated Long-Term Perspective Planning (LTPP) and Annual Plans of the Three Services through following:

- Initiating all the D&D projects based on Services Qualitative requirements.
- Aligning the requirement of Technology Perspective Capability Road Map (TPCR) issued by MoD.
- In general, Services Qualitative requirements define the total project requisites.

20. In addition to the above, the Ministry has further informed the Committee that HAL undertook several unplanned activities, such as procurement delays and the construction of test beds, during projects like the Gas Turbine Engine due to the challenges of developing a medium thrust-class engine for the first time. The design, manufacturing, and assembly methods were unique, and the associated niche technologies were not readily available within the country, necessitating indigenous efforts. Delays in the Full Engine Technology Demonstrator (TD) testing occurred because of issues like the delayed manufacturing of the Intermediate Gear Box (IGB) due to difficulties in developing spiral bevel gears and the late supply of critical engine components from vendors. Since the TD phase had to be successful and the configurations finalized before proceeding with procurement for the full development phase, these delays were unavoidable. Additionally, the initial program did not anticipate the need for 3D technology, and risk analysis and mitigation strategies were only considered and updated at regular intervals throughout the project.

(III) Delay in Project 2 due to incorrect selection of engine and delayed resolution of stall and spin function of Aircraft

21. Initially launched in 1999 with an estimated budget of ₹180 crore, Project 2 aimed to create an indigenous trainer aircraft. HAL initially chose an engine, referred to as "Engine 1," for the aircraft's Design and Development (D&D) phase. However, the engine lacked the necessary thrust to meet operational requirements. In 2005, HAL procured a higher-thrust replacement, "Engine 2," which required extensive modifications to integrate with the existing airframe. These changes ultimately led to further delays and cost increases. The modifications caused significant difficulties in meeting the aircraft's stall and spin requirements. HAL engaged external consultants over the years to rectify the spin issues, implementing several technical adjustments, such as repositioning the vertical tail and altering rudder parameters. Despite extensive modifications, including a prolonged timeline and added costs, these challenges delayed the certification process by over two decades. By 2022, the project had incurred expenditures totalling ₹710.08 crore, resulting in a cost overrun of ₹75.85 crore. The Audit concluded that the delay in engine selection and misalignment of early project specifications led to cascading issues, ultimately impacting the aircraft's readiness and usability.

22. During the oral evidence representatives of the Company explained the aforementioned issues to the Committee as below:

> *"in one case, the user has refused development'. This is particularly in one case, which is, the IJT HJT-36 aircraft that we have developed. We had some problems with the control system. As you are aware, these are all ab-initio designs, which we are doing it ourselves and we do not have any support. So, we do it ourselves. During the development, we were quite successful up to a certain stage. But then, there was one particular requirement of doing a vertical spin, six turns, and then, we have to recover. We had a problem there. And there was a crash but the pilot ejected. And that project went on the backfoot. We had to take help from a lab in the USA. And they gave us some suggestions how to do it and then, we rectified that.*
>
> *Sir, kindly see this video. I would like to show you that video just to bring across the complexity. This aircraft is doing a vertical dive and is going round and round. The aircraft has to do six turns. You can see at the centre that the aircraft is turning and is falling continuously. The pilot has to do such six turns and at the end of it, the pilot has to pull the stick and he has to recover. This is very critical because this is a trainer and the young pilots will be using that. Now, you can see that he has pulled it and the aircraft has become level. So, this was the problem that we could not solve earlier. Later, we had fixed the problem. This is the successful one where*

we did it, and we have solved this problem, and six turns were successfully done and now, the aircraft is able to do this complicated thing. We are still in design. By December, we will finish the certification. But this is a very major achievement.

The point that I would like to emphasis is that these are very critical and complicated things. Kindly look at this slide. You can see that the upper one is the aircraft which was earlier, and later, the vertical fin has been pushed back, and we have made changes in the wing. So, the nature of this business is technically complicated. And we do wind tunnel studies, but still there is an element of which comes up when you do the flight testing. So, the Air Force did not accept this aircraft but now, with own funding, we are going ahead. By December, we will be able to certify this aircraft."

23. The representatives of HAL further added that:

"all these R&D centres are doing that but many times, there are issues and we need to take help or we have to do iterations. That is where the delay comes in …..As I said many of the delays are because in some areas, we do not have the knowledge. We know that we have done it but there are some things which come up either in the testing or which we are not aware"

24. In this regard, the Ministry of Defence further informed the Committee that the incorrect selection of the engine in Project 2 was primarily due to the non-availability of an off-the-shelf engine that met the specific requirements of the aircraft. Developing a suitable engine from scratch would have significantly extended project timelines, so HAL opted to use the nearest available proven engine on loan for initial flight trials to validate the aircraft's design. However, this decision led to cascading delays, as the interim engine was later found incompatible with operational requirements, necessitating extensive modifications. The unresolved stall and spin characteristics were not directly linked to engine selection but rather to aerodynamic configuration and aircraft inertia. Stall and spin tests are conducted with the throttle at idle, meaning engine thrust had no bearing on these issues. HAL eventually addressed these challenges through aerodynamic reconfiguration, and the project is now on track for final certification by December 2024.

(IV) Infructuous expenditure on the D&D of Project 3

25. HAL's Board initially sanctioned ₹23.18 crore for the development of Project 3, which was designed to serve as a technological foundation for future surveillance platforms. Despite this significant investment, Project 3 failed to meet operational standards required for defense use, primarily due to its limited capabilities—such as a payload capacity of only 2.5 kg, a one-hour endurance, and a range of just 8-10 kilometers. These specifications were inadequate for defense applications, and the project lacked prior input from potential users, which led to the development of a platform that did not align with actual market needs. Due to this mismatch, HAL was unable to secure any defense contracts for Project 3, leading to a financial write-off of ₹9.54 crore as no orders were realized. Furthermore, crucial performance assessments, like the "Lessons Learnt Report," were not conducted, preventing HAL from using the experience to inform future projects. This lack of market analysis and inadequate alignment with defense standards made the expenditure on Project 3 largely unproductive.

26. In view of the above observations of CAG, HAL in a written reply has informed the Committee that before committing resources to the full-scale development of large Design and Development (D&D) projects, the Company ensures a measured approach and Project 3 was started as a pilot project, before initiating of Project 4.

27. Representatives of HAL informed the Committee regarding R&D expenditure undertaken by the Company, during oral evidence as below:

> *"today, HAL expends about 9 per cent of its turnover on R&D, which is at par with any company in the world whether it is Boeing or Airbus. They spend about between 8 and 10 per cent. हम लोग भी इतना ही पैसा खर्च करते है।हमने लास्ट ईयर में आर एंड डीपर 2,826 करोड़ रुपये खर्च किए है।*
> *To answer the hon. Member's question, this is mostly funded by HAL. It comes from the Government in terms of sanction. If it is a big project like aircraft project, it is funded by the Cabinet Committee. Otherwise, HAL funds it and we recover it through amortization.*
> *We also have created a R&D corpus of 15 per cent. Every year, we put 15 per cent of Profit After Tax into R&D corpus so that there is always funding available for R&D. One of the realities today is that the Government has allowed 74 per cent in FDI in defence, as you are aware and it can go up to 100 per cent.*
> *Earlier, we were always a ToT-led company where we would get Transfer of Technology manufacture under license. Today, if we have to survive, it has to be on our products. That is why, this fund has been created. 15 per cent of our PAT goes into that. We expect that this will go, our expenditure will go up to may be double digits in the coming year. So, on an average, we will be spending Rs.3,000 crore plus on our R&D, which is funded by HAL or by the Government."*

28. When asked by the Committee about the market surveys or potential customer assessments which were conducted prior to the D&D projects to ensure demand for the developed systems HAL submitted the following written information:

- HAL Corporate marketing department provides Market Survey information to respective Design centres periodically aligned to their expertise.
- Continuous interaction with customers/ Project monitoring teams at various levels

by HAL management also provides futuristic requirement of Armed Forces pertaining to HAL capabilities.

- In case of UAV, considering the market requirement, a pilot project was started for Project 3 which gave confidence and experience for developing Project 4.

29. The Committee have been further informed that HAL proceeded with Project 3 (UAV) as a technological demonstrator to acquire foundational expertise in Rotary UAV technology rather than as a market-driven initiative. The project was an exploratory effort aimed at positioning HAL in an emerging business sector and developing critical technology modules for future UAV platforms. While comprehensive market exploration or direct customer requirements were not obtained before initiating Project 3, the knowledge gained from this initiative enabled HAL to successfully launch Project 4, which is specifically tailored to meet the Indian Army's high-altitude operational requirements. This sequential approach allowed HAL to de-risk the development process and align future UAV projects with defense sector needs, ensuring long-term strategic benefits despite the initial absence of market validation.

(V) Non-recovery of the expenditure incurred against redesign of System 1 and Non-achievement of export potential for Helicopter 1 due inordinate delay in obtaining EASA certification

30. HAL undertook the redesign of System 1—a critical component used in Helicopter 1—following repeated instances of premature failure. These failures affected the component's reliability and the aircraft's Time Between Overhauls (TBO), compelling HAL to enhance its durability. The redesign, initiated in two phases and sanctioned with a budget of ₹100.68 crore, was expected to be financed internally and then amortized against future helicopter production orders. Despite planning for completion by 2015, multiple delays hindered the project's progress. These delays were due to late validation tests, complex design changes, and challenges with prototype development, ultimately pushing the project several years past the original schedule. By 2020, although the modified component was validated, the delay meant that HAL missed the opportunity to incorporate System 1 in the helicopter models already delivered to the armed forces, causing HAL to write off an expenditure of ₹21.31 crore as a financial loss. The audit findings highlight that HAL's inability to complete the redesign within the anticipated timeframe prevented cost recovery, underscoring a need for enhanced project and risk management.

31. HAL's efforts to obtain European Union Aviation Safety Agency (EASA) certification were delayed significantly, spanning over a decade due to stringent regulatory requirements and a lack of preparation to meet the technical standards. The delay led to missed opportunities for marketing and exporting Helicopter 1 to international clients. The cumulative impairment related to these delays amounted to ₹108.24 crore, a substantial loss for HAL given the potential revenue that exports could have generated. The extended timeline to achieve compliance not only affected HAL's international credibility but also constrained the helicopter's export growth, as HAL missed valuable entry points in foreign markets due to the prolonged certification process.

32. Representatives of HAL informed the Committee about the EASA certification as below:

> *"that EASA certification was delayed. Sir, this is the first time that we went for a European certification. हमारे जितने भी एयरक्राफ्ट्स हैं, वे सब म लट्री सर्टिफाइड हैं। CEMILAC एयरक्राफ्ट सर्टि फकेशन सर्टिफाइड करता है। So, all our products have been military certified and we have been making only military base. So, our knowledge has been of only military.*
> *When we went for EASA certification, DGCA first evaluated it and gave a certain set of observations. Later, we applied to EASA where we are paying a fee and they come and do the evaluation.*
> *When EASA came, they gave us 236 new observations. Our confidence was that wherever we develop the aircraft – Air force, Army are always using our products – by equivalence, we will show that this is already functional. But they insisted that you have to show every testing. इसमें काफी टाइम लग गया।*

They were not ready to accept our evidence क हम लोग यह ऑलरेडी स वल एक्ट के साथ कर चुके हैं। We said, please accept the evidence. But they did not agree and they asked us to repeat all these tests. For this, it has taken so much time."

33. On the same issue, Ministry in their written replies has further informed the Committee HAL faced significant delays in obtaining EASA certification for helicopters due to the comprehensive compliance demonstrations mandated by the European Aviation Safety Agency (EASA). These included extensive ground and flight testing to meet stringent safety and performance standards. During the certification process, EASA raised an additional 236 compliance issues in March 2011, which were not initially anticipated. Addressing these issues took substantial time, leading to prolonged delays. However, by January 2023, all phases of the EASA project were completed, and on July 4, 2023, the European Union Aviation Safety Agency (EASA) granted the "Restricted Type Certificate" for Dhruv (ALH) at its headquarters in Brussels. As this was HAL's first civilian certification project with EASA, the company required additional time to align with international regulatory frameworks. To prevent such delays in future projects, a Bilateral Working Arrangement (BWA) between EASA and the Directorate General of Civil Aviation (DGCA) was signed in 2021 by the Indian Government and the European Union. This agreement has facilitated speedier compliance processes, which HAL intends to leverage for future EASA certifications. The experience gained from demonstrating compliance with EASA's requirements has significantly strengthened HAL's regulatory coordination capabilities, allowing for better preparation and streamlined certification for upcoming projects. The technical challenges in meeting international standards, such as High-Intensity Radiation Fields (HIRF) and Bird Strike Tests, were also key factors in certification delays. HIRF compliance requirements emerged only in 2009, after the project's inception. Nevertheless, HAL conducted the HIRF ground test at its Bangalore facility with technical support from M/s Electro Magnetic Associates, USA, ensuring compliance. Similarly, the Bird Strike Test was successfully completed in Bangalore, meeting EASA standards. To enhance regulatory coordination and prevent future certification delays, HAL has strengthened its Airworthiness Team for Civil Certification, ensuring continuous engagement with DGCA and EASA. The knowledge and expertise gained from this certification process have equipped HAL to integrate EASA compliance requirements from the initial design stage of future projects, thereby avoiding costly delays and ensuring smoother regulatory approvals.

34. Further, in a written reply the Ministry of Defence have informed the Committee that to ensure financial oversight on both customer-funded and HAL-funded projects, HAL prepares detailed cost estimates based on project design requirements, timelines, and complexity factors derived from past projects. Project expenditures are monitored periodically at multiple levels, ensuring effective financial management. For self-funded projects, HAL seeks customer sanction either through upfront payments or amortization over production units, thereby ensuring cost recovery. In cases where no immediate orders are

received, the incurred expenditure in Design and Development (D&D) projects is retained as an intangible asset in HAL's financial records, awaiting future projects where the developed technology may be utilized. If no viable application is identified, the expenditure is impaired in the books of accounts, ensuring financial prudence. A notable example is the System 1 redesign, where HAL completed the D&D process but was unable to recover costs immediately. However, HAL has structured the cost for amortization against future helicopter orders, ensuring eventual financial recovery while maintaining a strategic focus on long-term product viability.

35. When asked by the Committee about the current plans for recovering the costs invested in projects that are delayed, impaired, or without future orders, such as Project 3 (UAV) and Helicopter redesigns, it was submitted below:

> "Project 3 (UAV) was basically a technological demonstrator project to acquire the basic technology of a Rotary UAV and was an attempt by HAL to enter an emerging business opportunity. HAL succeeded in developing technology modules required for developing RUAVs due to which it could launch Project 4 to address the requirements of the Army.
>
> - <u>Helicopter component redesign case:</u>
>
> Modification leaflet with respect to improvement on collector pinion of ALH Main Gear Box has been ratified & released to comply on all Production Helicopters and Retro compliance on all delivered gear boxes of Helicopters. This improvement is complied in all Helicopters during Servicing / repair and overhauling. The cost is being recovered during incorporation in Helicopter.

(VI) Indigenous development of Aircraft 1

36. In May 2014, HAL proposed an upgrade to Aircraft 2, initially manufactured under a Transfer of Technology (ToT) agreement with Vendor 1 and inducted into the Indian Air Force (IAF) in August 2008. The upgrade aimed to reduce HAL's dependency on the OEM, manage obsolescence issues, and enhance maintenance capabilities. Key upgrades included integrating modern systems, both hardware and software, along with indigenous Line Replaceable Units (LRUs) and advanced avionics to enhance the aircraft's training and combat potential. In September 2015, HAL's Board approved ₹84.61 crores in internal funding for the avionics upgrade, targeting a 30-month completion by March 2018, with a plan to recoup costs through amortization over future production orders. Despite these plans, the project was still ongoing as of July 2022, exceeding the original timeline by more than four years. In February 2018, HAL's Board sanctioned an additional ₹69.37 crore to continue the project. Audit observations highlighted several deficiencies in HAL's approach. Notably, the upgrade began without a business plan or structured measures to ensure the recovery of investment. Essential preparatory activities, such as Technology Gap Analysis, Feasibility Study, and DPR preparation, mandated by HAL's R&D policy, were also missing. Additionally, HAL did not secure Vendor 1's formal permission for modifications, a requirement under the ToT license agreement, which stipulated that any design changes or safety modifications must be conducted with the vendor's consent. The absence of this formal agreement exposes HAL to potential contractual risks if Vendor 1 enforces its rights upon HAL's production. By March 2022, the project faced a ₹153.98 crore impairment due to a lack of firm commitment from the IAF for orders. HAL's management justified the project, claiming that Vendor 1 was notified about the program and citing its responsibility to support the platform for a minimum of 30 years, necessitating mid-life upgrades. Although HAL engaged the IAF for budgetary quotes on 29 upgraded Aircraft 2 units, the Ministry of Defence halted the procurement due to high associated costs and issues related to engine lifecycle. The audit report issued in October 2021 awaited a formal response from the Ministry as of March 2023. (Audit Report)

37. Representatives of HAL while elaborating on the project development submitted as under:

"हमारा जो भी प्रोडक्ट डेवलप होता है उसको डेवलप होने में 10-15 साल लगते हैं। चाहे वह फाइटर प्लेन हो या हेलिकॉप्टर हो। नॉर्मली ऐसा होता है क क्यूआर में फ्यूचर प्रोजेक्शन होता है what is required ten years down the line. So, that is how, the design starts. And as we go along, अगर कुछ नया मसाइल वैपन इंटिग्रेट करना है that will get absorbed into the process as we go around. This is one of the issues that we face that as the new weapons come out, the user may say we want such and such weapon to be

integrated. जैसा नया मसाइल हो, नया बॉम्ब हो। This is an on-going process but the basic design itself बे सक डजाइन करीब 8-10 साल का होता है।"

38. Elaborating on the project, representatives of MoD further submitted as under:

> *"this para 2.27 is about Hawk-i. Hawk was the platform of BAE, if I remember correctly, and it was used by the Air Force. I discussed it with HAL and the information I have is that the HAL thought that indigenisation of Hawk-i, I means India, would be required when the refurbishment or life extension by IAF after few years of the original equipment which was purchased from the BAE. And, HAL was servicing that. That is why, they developed this technology or this product Hawk-i. The Ministry directly had no role in this. This was the decision taken by the Board of HAL on its own in 2012 or 2013, if I remember correctly."*

38. The Committee were further informed by the Ministry of Defence that the delays in Aircraft 2 and Helicopter Design & Development (D&D) projects were primarily due to expanding project scope, evolving user requirements, and integration challenges. The Aircraft 2 Avionics Upgrade was initiated as a Technology Demonstrator (TD) Project and approved by the HAL Board in September 2015, with an expected completion timeline of 30 months (March 2018). While HAL successfully completed the integration of most systems, the Electronic Warfare (EW) suite remained pending, necessitating an extension until March 2020. Additionally, the Research Centre Imarat (RCI) developed Smart Anti-Airfield Weapon (SAAW), an indigenous Head-Up Display (HUD) from the Centre for Scientific & Instruments Organisation (CSIO), and HAL's Voice-Activated Command System were added to the project, further extending the timeline. By January 2021, all systems integration under the revised scope of work was completed. However, a new requirement from the Indian Air Force (IAF) for the demonstration of a removable Counter Measure Dispensing System (CMDS) led to additional modifications. This system was successfully integrated, flight-tested, and completed by January 2022, resulting in an additional 10-month delay. Similarly, other HAL D&D projects, including Helicopter development programs, experienced delays beyond original timelines due to mid-course requirement changes, certification challenges, and integration of indigenous technologies. These delays were not solely due to inefficiencies but also stemmed from HAL's continuous efforts to incorporate advanced indigenous systems, ensuring the projects meet modern defense requirements. HAL added that the Company remains committed to improving project planning, risk assessment, and stakeholder coordination to mitigate delays in future programs.

PART-II

OBSERVATIONS/RECOMMENDATIONS OF THE COMMITTEE

OVERVIEW

1. The present Audit Para 2.1 of C&AG Report No. 18 of 2023, examined by the Committee on Public Undertakings, pertains to "Design and Development (D&D) in Hindustan Aeronautics Limited (HAL)." The Committee reviewed the audit findings concerning HAL's compliance with R&D policies, project delays, cost overruns, and procedural shortcomings in key development programs. HAL, a Maharatna company under the Ministry of Defence, plays a critical role in aerospace and defense manufacturing with 21 production centers and 9 R&D facilities across India. The audit highlights systemic lapses in HAL's adherence to mandated pre-project processes, including the absence of Project Feasibility Reports (PFRs) in 18 out of 32 projects and Detailed Project Reports (DPRs) in 29 out of 32 projects. Additionally, Technology Gap Analyses (TGA) were missing in 21 projects, affecting HAL's ability to identify technical shortfalls and mitigate risks. The report also raises concerns about delays in flagship projects such as the Gas Turbine Engine, Aircraft 2 Avionics Upgrade, and Indigenous Helicopter Development, attributing them to inefficient planning, procurement challenges, and shifting project requirements. Among the major financial concerns, the audit notes ₹100.68 crore in impaired costs related to System 1 redesign, ₹159.23 crore in cost overruns for the Gas Turbine Engine project, and ₹75.85 crore in excess expenditure on Project 2 due to initial engine selection issues. Additionally, HAL's failure to obtain European Union Aviation on Safety Agency (EASA) certification on time delayed the export potential of Helicopter 1, resulting in an impairment of ₹108.24 crore. In response, HAL acknowledged documentation and procedural gaps but justified its approach, citing flexibility in project approvals and the use of Draft Cabinet Notes for customer-funded projects as substitutes for DPRs. HAL also attributed delays to evolving defense requirements, complex integration challenges, and the need for indigenous technology development. The company has since revised its R&D manual (2022) to introduce sector-specific processes and issued compliance directives to all R&D Centers to strengthen project documentation. Before finalizing their observations and recommendations, the Committee carefully

considered the input from C&AG, HAL, and the Ministry of Defence. The Committee evaluated the evidence, project justifications, and remedial measures taken by HAL. Following thorough internal deliberation, the Committee reached the conclusions and formulated the recommendations outlined in the subsequent paragraphs.

Non-Compliance with Pre-Project Processes and R&D Policy

2. The Committee observed that HAL has not adhered to its own R&D Policy and Manual in several critical pre-project processes. A review of 32 projects revealed that 18 projects (56.25%) lacked Project Feasibility Reports (PFRs), 29 projects (90.6%) did not have Detailed Project Reports (DPRs), and 21 projects (65.6%) failed to conduct Technology Gap Analyses (TGA). These lapses indicate systemic weaknesses in planning and risk assessment, leading to delays, cost overruns, and inefficient resource utilization. Furthermore, the Committee note that technical review meetings were conducted irregularly, with only 14 out of the mandated 42 Committee of Institutions Network (COIN) meetings were held, reflecting a 66.7% shortfall in oversight. This lack of structured project governance has led to several high-value projects suffering delays and financial impairments, including the Gas Turbine Engine project, Project 2 (Trainer Aircraft), and the Indigenous Helicopter Development Program. HAL has justified that Draft Cabinet Notes were used as a substitute for DPRs in customer-funded projects, and that feasibility studies were proportionate to project size. However, the Committee find that these practices compromise the integrity of project planning and increase the likelihood of project failures. In light of the above, the Committee recommend that HAL enforce strict adherence to the R&D Policy by making the preparation of PFRs, DPRs, and TGAs mandatory for every project, regardless of funding source or scale. Additionally, if HAL or the Ministry determines that these manuals are outdated, they should be thoroughly revised to incorporate new developments, technical advancements, and internationally approved standards. The Ministry of Defence should establish a review mechanism to ensure that all pre-project processes are followed, and corrective measures should be taken in cases of non-compliance.

Delays in Project 1 (Gas Turbine Engine) Development

3. The Committee note that the Gas Turbine Engine project, initially sanctioned for ₹441.41 crore, has been significantly delayed, causing an impaired expense of ₹159.23 crore. The project was divided into two stages: Stage I (Project Definition and Design) was originally scheduled for completion in September 2014 but was delayed to December 2015, and Stage II (Prototype Development, Testing, and Certification) has been ongoing since 2018 with no completion in sight. One of the primary reasons for the delay is the failure to secure critical components on time, due to procurement bottlenecks and delayed approvals for test-bed construction. Additionally, land clearance approvals were delayed due to bureaucratic inefficiencies, adding more than three years to the project timeline. The Committee also note that HAL did not anticipate the need for 3D technology and advanced material integration, leading to multiple redesign efforts and further pushing back project deadlines. The lack of indigenous expertise in medium thrust-class engine development forced HAL to rely on external consultants, increasing costs and extending the timeline. In this project the Committee note that the project, was handled in very casual approach wherein not even thorough research was done as HAL was not sure where to buy the critical component on time and it was delayed. Therefore, the Committee recommend conducting thorough research on the project and urges HAL to establish long-term strategic partnerships with both domestic and international vendors. This will ensure the timely availability of critical components and minimize procurement-related delays. Additionally, the Ministry of Defence should allocate dedicated funding for the early-stage development of test-bed infrastructure, ensuring that essential testing facilities are in place before project execution begins. The Committee would suggest that to accelerate technological readiness, HAL should invest in advanced material research and indigenous 3D technology capabilities to reduce dependency on foreign suppliers.

Incorrect Engine Selection in Project 2 & Aircraft Stall/Spin Issues

4. The Committee observe that Project 2 (Trainer Aircraft Development), initiated in 1999 with an initial budget of ₹180 crore, has faced significant setbacks due to incorrect engine selection. HAL initially selected Engine 1, which was found to be underpowered and unsuitable for operational requirements. In 2005, HAL switched to Engine 2, a higher-thrust alternative, but this change required extensive modifications to the aircraft's structure. These modifications led to additional delays and cost overruns, pushing the total project expenditure to ₹710.08 crore, with a cost overrun of ₹75.85 crore. The Committee also note that the aircraft faced serious stall and spin issues, which were not directly linked to engine thrust but rather to aerodynamic configuration and aircraft inertia. To resolve these issues, HAL engaged external consultants and implemented modifications to the vertical tail and rudder parameters, which further extended the project timeline. As of 2024, the aircraft has still not been certified, and its operational viability remains uncertain. The Committee would like to suggest that HAL should conduct comprehensive market research and feasibility studies before selecting engines for indigenous aircraft programs, ensuring alignment with long-term operational and technical requirements. HAL should also invest in an advanced aerodynamic testing framework during the early stages of aircraft design to pre-emptively identify stall and spin issues and avoid costly modifications at later stages.

Financial Oversight and Cost Recovery Measures for System 1 Redesign

5. The Committee note that HAL incurred ₹100.68 crore in redesign costs for System 1 in Helicopter 1, but delays in certification prevented cost recovery through existing contracts. As a result, HAL had to write off ₹21.31 crore as an impaired expense, impacting financial sustainability. The project was initially designed to enhance component reliability, but multiple setbacks—including design flaws, late validation tests, and unexpected prototype development issues—pushed the timeline significantly beyond expectations. The Committee note that HAL's approach to amortizing redesign costs against future orders is highly dependent on securing new contracts, which poses financial risks if future demand does not materialize. In this

regard, the Committee would like to recommend that HAL should establish a financial risk assessment framework before initiating large-scale redesign projects to ensure cost recovery strategies are built into project planning. Also, the Ministry of Defence should integrate amortization mechanisms into procurement contracts to reduce financial exposure and ensure that redesign costs are recovered through structured payments. Additionally, HAL should strengthen its financial modelling process by securing advance commitments from potential buyers before undertaking high-cost redesign investments.

Delays in EASA Certification for Helicopter 1 and Export Challenges

6. The Committee observed that HAL's attempt to secure certification for Helicopter 1 from the European Aviation Safety Agency (EASA) was delayed by over a decade, leading to ₹108.24 crore in impaired costs and significantly affecting its export potential. Initially, HAL anticipated that its extensive military certification experience would facilitate the EASA approval process. The lack of prior engagement with international civil aviation regulators resulted in prolonged testing and documentation delays. Consequently, HAL was unable to market and export Helicopter 1 in a timely manner. The Committee further note that the extended certification timeline not only impacted HAL's financial standing but also reduced its credibility in the international aviation industry. Given the stringent regulatory landscape of civil aviation, the Committee strongly emphasize the need for HAL to integrate international certification requirements from the earliest stages of aircraft design. The Committee recommend that HAL establish a dedicated Civil Certification Task Force to ensure efficient coordination of all compliance-related activities and facilitate faster regulatory approvals. Additionally, the Committee urge the Ministry of Defence to strengthen bilateral agreements with key international certification bodies, including EASA, to fast-track approval processes for future aircraft and helicopter projects.

Project 3 (UAV Development) and Market Research Deficiencies

7. The Committee observed that HAL undertook Project 3 (Rotary UAV Development) without conducting a detailed market survey or demand assessment, leading to financial losses and lack of defense contracts. The project, initially sanctioned at ₹23.18 crore, aimed to develop a technology demonstrator for future surveillance platforms. However, HAL failed to align the project with actual defense requirements, leading to a product that did not meet operational standards. The UAV had a payload capacity of only 2.5 kg, an endurance of one hour, and a range of just 8–10 km, making it unsuitable for defense applications. Due to this mismatch, HAL failed to secure any defense orders, resulting in an impairment of ₹9.54 crore. Additionally, the Committee note that no comprehensive "Lessons Learned Report" was prepared, which prevented HAL from utilizing the project experience to improve future UAV programs. In view of the above, the Committee recommend that HAL should establish a dedicated Market Research and Demand Forecasting Division to assess potential buyer interest before investing in technology demonstrators, ensuring that projects are commercially and operationally viable. HAL should align all future pilot projects with existing defense procurement roadmaps to maximize contract potential and avoid resource misallocation. Additionally, HAL should ensure that Letters of Intent (LoIs) from potential buyers are secured before initiating large-scale UAV development projects to guarantee a clear market pathway for new products. Furthermore, the Committee recommends that as suggested by C&AG HAL should conduct mandatory post-project evaluations, including a "Lessons Learned Report", to refine project planning and risk assessment for future UAV programs.

Indigenous Development of Aircraft 1 and Additional Modifications

8. The Committee observe that HAL's attempt to upgrade Aircraft 2 (Avionics Modernization Program) faced significant delays and financial overruns due to evolving user requirements and unplanned modifications. Initially sanctioned for ₹84.61 crore in 2015, the upgrade aimed to reduce dependency on foreign manufacturers by integrating indigenous Line Replaceable Units (LRUs) and advanced avionics. However, the project was still ongoing as of July 2022, exceeding

the original timeline by over four years. HAL was forced to seek additional ₹69.37 crore in funding in 2018, raising the total cost to ₹153.98 crore, without securing firm commitments from the Indian Air Force (IAF) for future orders. The Committee also note that HAL failed to obtain formal permission from the Original Equipment Manufacturer (OEM) before proceeding with modifications, which could pose legal and contractual risks. Additionally, the IAF introduced new requirements mid-way, such as the integration of a Counter Measure Dispensing System (CMDS), which further delayed certification and testing. The Committee would suggest HAL to establish a structured pre-design consultation mechanism with the IAF and other stakeholders to finalize system requirements before initiating avionics upgrades to ensure that mid-course modifications do not disrupt project timelines and financial planning. Additionally, the Ministry of Defence should develop a long-term roadmap for avionics modernization, ensuring that R&D initiatives are synchronized with future defense requirements to prevent redundancy and cost escalation. HAL should also implement a contractual risk mitigation strategy, securing OEM approvals in advance to prevent potential licensing disputes and ensure smooth project execution.

Conclusion

9. The Committee recognize HAL's pivotal role in advancing India's defense and aerospace capabilities, contributing significantly to indigenous aircraft, helicopter, and engine development. However, the findings in C&AG Report No. 18 of 2023 highlight critical shortcomings in HAL's project planning, execution, and financial oversight. Issues such as non-compliance with pre-project documentation, procurement delays, cost overruns, and inadequate market research have led to prolonged project timelines, impaired costs, and missed strategic opportunities. While HAL has made commendable progress in strengthening India's self-reliance in aerospace technologies, systemic inefficiencies continue to hinder its ability to meet operational demands effectively. The Committee firmly believe that rigorous adherence to pre-project processes, enhanced risk assessment mechanisms, and structured stakeholder engagement are essential for HAL to achieve global competitiveness in defense manufacturing. Strengthening financial oversight, establishing robust market research frameworks, and ensuring timely compliance

with international certification standards will be crucial in positioning HAL as a leading aerospace powerhouse on the global stage. The Committee also emphasize the urgent need for HAL to transition from a reactive to a proactive R&D strategy, ensuring that technological advancements align seamlessly with national defense objectives and market requirements. In light of these observations, the Committee urge HAL and the Ministry of Defence to implement the recommendations in letter and spirit, ensuring that future projects are executed with greater efficiency, financial prudence, and strategic foresight. The success of India's defense modernization and indigenization efforts will depend not just on technological advancements but on the ability to integrate innovation with effective project management, accountability, and long-term vision. HAL's progress in these areas will not only strengthen national security but also cement India's position as a global leader in defense and aerospace manufacturing.

New Delhi;
25 March, 2025
04 Chaitra, 1947(S)

BAIJAYANT PANDA
Chairperson
Committee on Public Undertakings

APPENDIX I

COMMITTEE ON PUBLIC UNDERTAKINGS

(2024-25)

MINUTES OF THE SECOND SITTING OF THE COMMITTEE

The Committee sat on Thursday, the 25th September, 2024 from 1130 hrs. to 1220 hrs. in Committee Room No. '1', Ground Floor, Extension to Parliament House Annexe, New Delhi.

PRESENT

Shri Baijayant Panda - Chairperson

MEMBERS

Lok Sabha

2. Shri Tariq Anwar
3. Shri R.K. Chaudhary
4. Shri Chandra Prakash Joshi
5. Smt. Kanimozhi Karunanidhi
6. Shri Kaushalendra Kumar
7. Shri Shankar Lalwani
8. Shri Mukesh Rajput
9. Shri Sukhjinder Singh Randhawa
10. Shri Kodikunnil Suresh

Rajya Sabha

11. Shri Narain Dass Gupta
12. Shri Debashish Samantaray
13. Shri Arun Singh

SECRETARIAT

1. Shri Neeraj Semwal - Joint Secretary
2. Smt. Jyochnamayi Sinha - Director
3. Smt. Mriganka Achal - Deputy Secretary

REPRESENTATIVES OF OFFICE OF COMPTROLLER & AUDITOR GENERAL

1.	Shri Subir Mallick	-	Dy. C&AG (Defence & LGA)
2.	Ms. Sayantani Jafa	-	Dy. C&AG (Reports)
3.	Shri Purushottam Tiwary	-	Director General of Audit
4.	Shri Samar Kant Thakur	-	Director General (Parliamentary Committees)
5.	Shri Khalid Bin Jamal	-	Director General (Audit)
6.	Shri Rajesh Ranjan	-	Principal Director
7.	Shri Kandarp Patel	-	Director

2. At the outset, Hon'ble Chairperson welcomed the Members and the representatives of O/o C&AG and outlined the nature of four agenda items that would be taken-up by the Committee for the day. Afterwards, Chairperson invited their attention to the first agenda for the day – Briefing by Audit on Chapter 2 of C&AG Report No. 18 of 2023 pertains to Hindustan Aeronautics Limited (HAL) regarding 'Non-compliance to pre-project processes and procedures mandated under the R&D Policy' for the period covering from 2014-15 to 2020-21. Further, attention was also drawn to Direction 55(1) of the 'Directions by the Speaker' regarding confidentiality of briefing before the Parliamentary Committees.

3. In his address on the subject, Hon'ble Chairperson invited attention of the Members to important observations made in the Audit Para highlighting viz. (i) Design and Development (D&D) projects undertaken by HAL without adhering to the mandated pre-project processes, including the preparation of Project Feasibility Reports (PFRs), Detailed Project Reports (DPRs), and Technology Gap Analysis (TGA); (ii) For the audit scrutiny covering projects with a sanctioned amount exceeding ₹2,000 crore, out of 32 projects reviewed, 18 lacked PFRs, 29 did not have DPRs and TGA was not conducted in 21 projects; and (iii) Non-compliance with critical pre-project requirements resulting in delays, cost overruns and impaired assets..

4. The representatives of C&AG made a brief presentation on the subject under consideration. The presentation covered various issues involved in the Audit Report thereby highlighting the following important aspects related to the subject: -

i. Design and Development projects sanctioned by Cabinet Committee on Security (CCS) and other projects approved by the Ministry of Defence;
ii. Funding of projects undertaken to built indigenous capability in strategic defence equipment/components;
iii. Non-compliance to pre-project processes and procedures;
iv. Design and Development of 25 kiloNewton (kN) thrust Hindustan Turbo Fan Engine (HTFE) at an estimated cost of Rs.441.41 crore;
v. Delay in intermediate Jet Trainer programme due to incorrect selection of engine and delayed resolution of stall and spin function of Aircraft;
vi. Incurring of Rs. 9.54 crore infructuous expenditure on the Design & Development (D&D) of 10Kg Rotary Unmanned Aerial Vehicle;
vii. Non-recovery pf the expenditure incurred against redesign of Integrated Dynamic System of Advanced Light Helicopter resulting in impairment of Rs. 21.31 crore to HAL;
viii. Non-achievement of export potential for Dhruv Advanced Light Helicopter due to inordinate delay in obtaining European Aviation Safety Agency (EASA) certification;
ix. Stalling of upgradation programme initiated for indigenous development of Avionics for Hawk Advance Jet Trainer (AJT) Aircraft leading to impaired expenditure of Rs. 153.98 crore; and
x. Details of Action Taken Notes submitted by the Ministry of Defence on Audit's observations.

5. Thereafter, Members sought clarification on various issues pertaining to the subject including reasons behind helicopter accidents that may have impacted the exports to other nations, possible usage of Drones in sectors other than defence, reasons for not adhering to the due diligence process and fixing of responsibility, R&D Standard Operating Procedure, corrective actions taken by HAL to prevent helicopter accidents, follow-up Audit undertaken by C&AG to access improvements in the system, etc. Further, a copy of Action Taken Notes (ATNs) furnished by the Ministry was asked to be furnished to the Secretariat for perusal of the Members.

6. The representatives of O/o C&AG responded to some of the queries raised by the Members and briefed on Memorandum of Important Points (MIPs) that could be used for discussion when the subject is taken-up for subsequent discussion with the representatives of HAL and the Ministry of Defence. After deliberations, the Committee decided that, given HAL playing key role in the defence sector of the Country, the representatives of HAL and the Ministry of Defence may be called for further detailed discussion in the forthcoming sittings of the Committee next month.

7. Summing-up the discussion on the subject, Hon'ble Chairperson thereafter thanked the representatives of C&AG for their valuable suggestions/deliberations and assisting the Committee on the subject. The Chairperson also thanked the Members of the Committee for their active participation and valuable contribution made by them on the subject.

The Committee, then, adjourned to take-up next agenda item of the forenoon sittings.

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APPENDIX II

COMMITTEE ON PUBLIC UNDERTAKINGS

(2024-25)

MINUTES OF THE EIGHTH SITTING OF THE COMMITTEE

The Committee sat on Wednesday, the 24th October, 2024 from 1130 hrs. to 1250 hrs. in Committee Room '1', Ground Floor, Extension to Parliament House Annexe, New Delhi.

PRESENT

Shri Baijayant Panda - Chairperson

MEMBERS

MEMBERS

Lok Sabha

2. Shri Tariq Anwar
3. Shri R.K. Chaudhary
4. Shri Kaushalendra Kumar
5. Shri B.Y Raghavendra
6. Shri Mukesh Rajput

Rajya Sabha

7. Shri NarainDass Gupta
8. Dr. Bhagwat Karad
9. Shri Debashish Samantaray
10. Shri Arun Singh

SECRETARIAT

1. Shri Neeraj Semwal - Joint Secretary
2. Smt. Jyochnamayi Sinha - Director
3. Smt. Mriganka Achal - Deputy Secretary

REPRESENTATIVES OF OFFICE OF COMPTROLLER & AUDITOR GENERAL

1.	Shri Subir Mallick	-	Dy. CAG (Defence &LGA)
2.	Shri Saurabh Narayan	-	Director General (Defence)
3.	Shri Rajesh Ranjan	-	Principal Director of Audit (Defence-Commercial)

REPRESENTATIVES OF OFFICE OF HINDUSTAN AERONAUTICS LIMITED

1.	Dr Sunil Kumar	-	CMD (HAL)
2.	Shri N K Jain	-	Executive Director (System Audit)

2. At the outset, the Chairperson welcomed the Members of the Committee and C&AG officials to the sitting convened to examine Audit Para No. 2.1 of the C&AG Report No. 18 of 2023 regarding non-compliance with pre-project processes and procedures mandated under the R&D policy. The C&AG then made a brief presentation outlining the key issues flagged in the audit report, including procedural lapses, cost overruns, and delays in project execution, particularly in relation to critical defence projects.

[The witnesses were, then, called in]

3. The Chairperson welcomed the representatives of Hindustan Aeronautics Limited (HAL) and drew their attention to Direction 55(1) of the 'Directions by the Speaker' regarding maintaining confidentiality of discussions before the Committee. The Chairperson also acknowledged HAL's recent achievement of attaining Maharatna status, commending its contributions to India's aerospace and defence sectors. He emphasized the need for HAL to maintain high standards of accountability and efficiency in the execution of its projects.
4. Thereafter, the CMD, HAL, provided an overview of the Company's operations, highlighting its contributions to India's aerospace and defence capabilities, R&D efforts, production facilities, collaborations with international partners, and financial performance. A short corporate video showcasing HAL's achievements in indigenous aircraft and helicopter development, including the Tejas fighter jet and the Dhruv Advanced Light Helicopter (ALH), was also presented. The CMD also briefed the

Committee on the ongoing and upcoming projects, such as the development of the next-generation fighter aircraft and improvements in existing platforms.

5. The Members of the Committee sought clarifications from HAL representatives on various issues, such as delays in project execution and reasons for cost escalations, Compliance with pre-project feasibility studies and risk assessments, the role of Indo-Russian Helicopters Limited in manufacturing and technology transfer, challenges in exporting indigenous aircraft and helicopters, certification processes for new aircraft and helicopters, including the Light Combat Helicopter (LCH) and Advanced Light Helicopter (ALH), availability of spare parts and maintenance services for aircraft supplied to the Indian Air Force and other clients.
6. Thereafter, the HAL representatives responded to most of the queries, outlining their efforts to improve project timelines, streamline approvals, and enhance collaboration with regulatory agencies. They acknowledged certain delays in execution but assured the Committee that measures were being taken to address procedural inefficiencies.
7. In the end, the Chairperson thanked the representatives of HAL for their participation and directed that in respect of points for which information was not readily available, or where additional details were required, written replies should be furnished to the Committee Secretariat within ten days.

The Committee, then, adjourned.

A copy of verbatim proceedings of the sitting has been kept on record.

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APPENDIX III

COMMITTEE ON PUBLIC UNDERTAKINGS
(2021-22)
MINUTES OF THE TENTH SITTING OF COMMITTEE

The Committee sat on Wednesday, the 24th October, 2024 from 1340 hrs. to 1410 hrs. in Committee room '1', Ground Floor, Extension to Parliament House Annexe, New Delhi.

PRESENT

Shri Baijayant Panda - Chairperson

MEMBERS

Lok Sabha

2. Shri Tariq Anwar
3. Shri R.K. Chaudhary
4. Shri Kaushalendra Kumar
5. Shri B.Y Raghavendra
6. Shri Mukesh Rajput

Rajya Sabha

7. Shri Narain Dass Gupta
8. Dr. Bhagwat Karad
9. Shri Debashish Samantaray
10. Shri Arun Singh

SECRETARIAT

1.	Shri Neeraj Semwal	-	Joint Secretary
2.	Smt. Jyochnamayi Sinha	-	Director
3.	Smt. Mriganka Achal	-	Deputy Secretary

REPRESENTATIVES OF OFFICE OF COMPTROLLER & AUDITOR GENERAL

1.	Shri Subir Mallick	-	Dy. CAG (Defence &LGA)
2.	Shri Saurabh Narayan	-	Director General (Defence)
3.	Shri Rajesh Ranjan	-	Principal Director of Audit (Defence-Commercial)

REPRESENTATIVES OF OFFICE OF MINISTRY OF DEFENCE (DEPARTMENT OF DEFENCE PRODUCTION)

1. Shri Sanjeev Kumar - Secretary (DP)
2. Shri Amitabh Ranjan Sinha - Addl. FA & JS, DDP
3. Shri Rajeev Prakash - Joint Secretary (Aerospace), DDP
4. Shri Dharmendra Kumar Singh - Joint Secretary & AM (Air), DoD

2. The Chairperson welcomed the Members of the Committee, C&AG officials and the representatives of the Department of Defence Production (DDP), Ministry of Defence for the second session of the meeting. He reiterated the importance of maintaining confidentiality as per Direction 55(1) of the 'Directions by the Speaker' and emphasized the significance of the Department's role in ensuring that defence production in India aligns with national security priorities and self-reliance objectives.

3. The Secretary, Defence Production, provided an overview of the Ministry's role in overseeing projects executed by HAL and other defence PSUs. He outlined the Department's key objectives, including; strengthening India's defence manufacturing ecosystem under the Atmanirbhar Bharat initiative, ensuring timely completion of key projects such as the Light Combat Helicopter, Light Utility Helicopter, and various indigenous engine development programs, addressing procedural delays and inefficiencies in project execution and encouraging private sector participation in defence production etc.

4. Thereafter, the Committee sought clarifications on multiple aspects of HAL's performance and the oversight mechanisms employed by the Ministry such as HAL's adherence to pre-project feasibility studies, market research, and risk assessment, delays in major defence projects and reasons for missing critical deadlines, procedural lapses highlighted in the C&AG report and steps taken to rectify them, the Ministry's role in improving coordination between HAL, the Armed Forces, and regulatory agencies, the current status of technology transfer agreements and their impact on domestic manufacturing capabilities and the effectiveness of policy measures in promoting the private sector's involvement in defence production etc.

5. The representatives of the Ministry of Defence responded by detailing various initiatives undertaken to streamline coordination and reduce bottlenecks in project execution. They informed the Committee about recent policy changes aimed at ensuring greater transparency and accountability in the defence production sector. The discussion also covered efforts to modernize defence PSUs, enhance quality control measures, and strengthen supply chain management to prevent delays in production and delivery.
6. The Chairperson, while appreciating the responses from the Ministry, underscored the need for proactive measures to address the challenges faced by HAL and other defence PSUs. He directed the Ministry to submit a detailed report outlining the steps taken to improve project execution, streamline oversight mechanisms, and ensure strict compliance with R&D guidelines. Additionally, he instructed the Ministry to provide written responses for queries where further details were required within ten days.

The Committee, then, adjourned.

A copy of verbatim proceedings of the sitting has been kept on record.

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APPENDIX IV

COMMITTEE ON PUBLIC UNDERTAKINGS (2024-2025)

MINUTES OF THE THIRTY SECOND SITTING OF THE COMMITTEE

The Committee sat on Monday, 24 March, 2025 from 1530 hrs. to 1705 hrs. in Committee Room '1', Extension to Parliament House Annexe, New Delhi.

PRESENT

Shri Baijayant Panda - Chairperson

MEMBERS

LOK SABHA

2. Shri C.P. Joshi
3. Shri Shankar Lalwani
4. Shri Mukesh Rajput
5. Shri Sukhjinder Singh Randhawa
6. Shri Pratap Chandra Sarangi
7. Shri Prabhakar Reddy Vemireddy

RAJYA SABHA

8. Shri Neeraj Dangi
9. Shri Milind Murli Deora
10. Shri Narain Dass Gupta
11. Dr. Bhagwat Karad
12. Shri Debashish Samantaray
13. Dr. Arun Singh

SECRETARIAT

1. Shri Anjani Kumar - Joint Secretary
2. Smt. Jyochnamayi Sinha - Director
2. Smt. Mriganka Achal - Deputy Secretary

PART-A:

2. At the outset, the Hon'ble Chairperson welcomed the Members to the sitting and briefly apprised the Members about the following draft Reports to be considered:

(i) IFCI Limited;

(ii) Reviewing Timely Submission of Action Taken Notes (ATNs) on C&AG Paras/Reports (Commercial) by the Ministries/ Departments (APMS);

(iii) Design and Development (D&D) in Hindustan Aeronautics Limited (HAL) [Based on Chapter-II of C&AG Report No. 18 of 2023]; and

(iv) IREL (India) Limited.

3 The Committee then considered and adopted the draft Reports, without any changes/modifications. The Committee authorized the Chairperson to finalize the draft Reports on the basis of factual verification as suggested by the concerned Ministries/Departments and C&AG and present the Reports during the ongoing session of Parliament.

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