

Procedure for
Design, Development and Production
of
Military Aircraft and Airborne Stores
DDPMAS-2002
(Supersedes DDPMAS-75)



Department of Defence Research and Development
Department of Defence Production and Supplies
Ministry of Defence
Govt of India

DDPMAS – 2002

FOREWORD

The last two decades have seen significant expansion in the design, development and production activities relating to military aircraft and airborne stores in India. With increasing accent on self reliance, indigenisation activities in this field have also multiplied with more and more Public Sector Undertakings, Private entrepreneurs and small scale industries contributing in this field.

The activities in the design, development and production of military aircraft and airborne stores have so far been regulated largely by the Ministry of Defence document DDPMAS – 75 which came into effect in 1975. The industry, users and regulatory agencies joined together to revise this document to include all their combined experiences to make the document current and more appropriate to meet present needs. Their efforts have culminated in the present document DDPMAS – 2002 superseding DDPMAS – 75.

DDPMAS – 2002 is conceived to be a live document with provision for updates. The amendments will be issued formally by CEMILAC, with the approval of a high level committee empowered for the purpose.

All design, development and production activities related to military aviation shall comply with the provisions stipulated in this document.



(Subir Dutta)

Secretary (Defence Production & Supplies)
17 May 2002



(Dr VK Aatre)

SA to RM & Secretary Defence (R&D)
17 May 2002

DDPMAS 2002

Suggestions for improvement of this document in the form of additions, deletions or changes should be addressed to:-

**The Secretary
Joint Airworthiness Committee
Centre for Military Airworthiness & Certification
Ministry of Defence (R & D)
Maratha halli Colony Post
BANGALORE 560 037**

**Procedural Document on
“Design, development and Production of Military Aircraft and
Airborne Stores”
(DDPMAS-2002)**

The Ministry of Defence document “Design, development and Production of Military Aircraft and Airborne Stores – 75 (DDPMAS-75)” was issued in 1975. Many agencies involved in military aviation sought to incorporate several changes to DDPMAS-75. This document was revised incorporating all these suggestions. The revised draft of DDPMAS was issued in November 1998.

The task of finalising the revised DDPMAS was entrusted to the Joint Airworthiness Committee consisting of the following members.

Shri JK Sharma	Group Director (Systems) (CE since Oct 2001)	CEMILAC, Chairman
Cmde T Mohan Ram	DNAM	NHQ (Since Retd)
Gp Capt NS Athrey	CRPO	ASTE
Col K Jayaprakash	Director	Army Proj Team
Shri S Mukundan	Addl Director	ALISDA, DGAQA
Shri AK Mani	Addl Gen Manager	HAL
Shri SA Hakeem	Addl Gen Manager	HAL
Cmde KC Ponnaiyan	O i/c	NASDO
Cdr R S Kubal	O i/c	NASDO
Lt Col A S Sidhu	Test Pilot	APT
S. Neelakantan	Group Director (TC & S)	CEMILAC, Secretary

The co-opted members of the JAC are as follows:

Shri R N Padhy	Addl Director	DGAQA
Shri S K Velusamy	Dy Gen Manager (DL)	HAL
Shri R K Mittal	Chief Manager	HAL

The revised DDPMAS was discussed in detail by the members and co-opted members of JAC in nine meetings spread over 30 months. Wg Cdr Rakesh Sharma, CTP (FW) of HAL had also participated in the discussions as an invited member.

The draft was further discussed amongst Dr KG Narayanan, Chief Adviser DRDO, Shri NR Mohanty, Chairman HAL, Shri MV Sundaram, DGAQA, Gp Capt KN Kumar, CRPO, ASTE, Lt Col NK Venkatesh, Army Project Team, Shri JK Sharma, Chief Executive (Airworthiness) and agreed by all

CONTENTS

<i>List of Annexures</i>	<i>iii</i>
<i>Procedure for Amendments</i>	<i>iv</i>
<i>List of Abbreviations</i>	<i>v</i>
<i>Preface</i>	<i>1 –3</i>

Section	Chapter	Title	Pages
Section – I		Definitions	4 – 8
Section – II		Process of Development	9 – 14
Section – III		Design, Development and Production of Aircraft, Aero Engines and Major Airborne Equipment	15 – 65
	Chapter 1	Prototype and Development Phase	15 – 38
	Chapter 2	Pre production, Production and In-service phase	39 – 56
	Chapter 3	Licence Projects	57 – 62
	Chapter 4	Bought-out aircraft	63 – 65
Section – IV		Indigenous Development and Production of Airborne Equipment, Raw materials and AGS Parts	66 – 77
Section – V		Flight Testing	78 – 89
	Chapter 1	Development Flight Testing	78 – 84
	Chapter 2	Flight Testing by User Services	85- 89
Annexures	A to V		90- 139

LIST OF ANNEXURES

- A:** Format for Project Definition Study for Aircraft
- B:** Responsibilities of Chief Resident Engineers/Regional Director
- C:** Responsibilities of Chief Resident Inspectors
- D:** Responsibilities of CSDO/NASDO/MAG(Avn) in the development of Aircraft and Equipment.
- E:** Facilities/Information Required by CSDO/NASDO/MAG(Avn) at Contractor's work
- F:** Certificate of Design for Aeronautical Stores
- G1:** Certificate of Flight Trials – Aircraft
- G2:** Certificate of Flight Trials - Helicopters
- H:** Defect Investigation Report
- J:** Drawing Office Procedure followed by Design Bureau
- K(i):** Local Modification Committee - Details of Modification Proposed
- K(ii):** Advance Modification Information
- L:** Mod Leaflet Format
- M:** Format of Index of Modifications
- N:** Application for concession on Modification/Change Notices
- O:** Application to Inspection Authority for Concession/Production Permit
- P:** Application for Type Approval
- Q:** Type Approval Letter
- R:** Declaration of Design and Performance
- S:** Request for Change in Configuration
- T:** Hardware / Software Delivery Note
- U:** Responsibilities of CEMILAC
- V:** Requirements to be submitted by Developing Agency for Clearance of Airborne Equipment Imported from Abroad

List of Abbreviations

ADA	Aeronautical Development Agency
ADE	Aeronautical Development Establishment
ADGAA	Additional Director General, Army Aviation
AFIO	Approval of Firm's Inspection Organisation
AGS	Aircraft General Standard
AMI	Advance Modification Information
ARDE	Aeronautical Research and Development Establishment
ASR	Air Staff Requirements
ASTE	Aircraft and System Testing Establishment
BRD	Base Repair Depot
CAD	Computer Aided Design
CDR	Crash Data Recorder/Critical Design Review
CE	Chief Executive
CEMILAC	Centre for Military Airworthiness and Certification
CG	Coast Guard
CG	Centre of Gravity
CIDS	Critical Item Development Specification
COD	Certificate of Design
CRE	Chief Resident Engineer
CRI	Chief Resident Inspector
CRPO	Chief Resident Project Officer
CSDO	Central Servicing Development Organisation
CTP	Chief Test Pilot
CVR	Cockpit Voice Recorder
DASE	Directorate of Armaments and Safety Equipments
DDP	Declaration of Design and Performance
DDPIL	Design, Development, Production and Inspection of Electronic Equipment
DGAQA	Directorate General Aeronautical Quality Assurance
DGCA	Director General, Civil Aviation
DI	Defect Investigation
DMIS	Directorate of Management and information Service
DOA	Directorate of Aeronautics
DOD	Department of Defence
DODP	Department of Defence Production
DP & S	Defence Production and Supplies
DRDO	Defence Research and Development Organisation
ED	Equipment Depot
EMC	Electro Magnetic Compatibility

EMI	Electro Magnetic Interference
EMP	Electro Magnetic Pollution
ETDC	Electronic Testing and Development Centre
FAR	Federal Aviation Regulations
FDR	Flight Data Recorder
FMEA	Failure Mode Effect Analysis
FMECA	Failure Mode Effect and Criticality Analysis
FOC	Final Operation Clearance
FTA	Fall Tree Analysis
FTI	Flight Test Instrumentation
GA	General Assembly
GE	Ground Equipment
GOI	Government of India
GSE	Ground Support Equipment
GSQR	General Staff Qualitative Requirements
GTRE	Gas Turbine Research Establishment
HAL	Hindustan Aeronautics Limited
HQrs	Head Quarters
HSI	Hardware Software Integration
IA	Indian Army
IAF	Indian Air Force
IN	Indian Navy
IOC	Initial Operational Clearance
IRS	Interface Requirement Specification
ISQR	Inter Services Qualitative Requirements
IV&V	Independent Verification and Validation
JSG	Joint Services Guide
LCC	Local Concession Committee
LMC	Local Modification Committee
LRU	Line Replaceable Unit
LSP	Limited Series Production
LTC	Local Technical Committee
LTCC	Local Type Certification Committee
MAG(Avn)	Maintenance Advisory Group(Aviation)
MOD	Ministry of Defence
MTBF	Mean Time Between Failure
MTBR	Mean Time Between Repair
NASDO	Naval Aircraft Servicing Development Organisation
NAY	Naval Aircraft Yard
NDT	Non Destructive Tests
NFTC	National Flight Test Center

NSQR	Naval Staff Qualitative Requirements
OAT	Outside Air Temperature
OCRI	Office of Chief Resident Inspector
OEM	Original Equipment Manufacturer
PAT	Production Acceptance Test
PDP	Project Definition Phase
PDR	Preliminary Design Review
PERT	Program Evaluation Review Technique
PIDS	Prime Item Development Specification
PQT	Production Quality Test
PSU	Public Sector Undertaking
QC/QA	Quality Control/Quality Assurance
QCSR	Quality Control System Requirements for Industry
QR	Qualitative Requirements
QTP	Qualification Test Procedure
R & D	Research and development
RCMA	Regional Centre for Military Airworthiness
RD	Regional Director
RFC	Request For Change
RMS	Repair Maintenance and Service
SB	Service Bulletins
SCT	Structural Coupling Test
SDD	Software Design Document
SDP	Software Development Plan
SI	Servicing Instructions
SIT	System Integration Testing
SLA	System Level Algorithms
SOFT	Safety of Flight Test
SOO	Special Order Only
SOP	Standard of Preparation
SOW	Statement of Work
SQPP	Software Quality Program Plan
SRS	Software Requirement Specification
STI	Special Technical Instructions
STR	Structure
TBO	Time Between Overhaul
TETTRA	Technical Type Training School
UON	Urgent Operating Notice
VTOs	Visiting Technical Officers

P R E F A C E

1. This document describes the procedure to be followed on following occasions:
 - (a) (i) Design and Development of aircraft, aero-engine, air armament or any other airborne stores/ systems.
 - (ii) Modifications to airborne stores/systems already in service use in its in-service phase requiring an approval of the Type Certifying Authority.
 - (b) During Limited Series Production, pre production and production of the items so developed and for release to service as well as for continued airworthiness in service use.
 - (c) During licence production/overhaul or for bought out aircraft, aero-engine or any other airborne store.
 - (d) Cases of indigenisation not requiring approval of the Approving Authority for airworthiness stated in Section IV Para-1, will not attract the provision of this document.
2. The objective of the procedures called for in this publication, is to ensure that the services are provided with an acceptable aircraft/airborne equipment, stores from the point of airworthiness, safety, demonstrated performance and effectiveness of weapon.
3. In the process of development and production of an aircraft, aero-engine or any airborne stores/system, various organisations of the Ministry of Defence have distinct responsibilities. Department of Defence Production and Supplies, Hindustan Aeronautics Limited (HAL), Aeronautical Development Agency (ADA), National Flight Test Centre (NFTC), Directorate General of Aeronautical Quality Assurance (DGAQA), Centre for Military Airworthiness and Certification (CEMILAC) and other concerned Directorates of R & D are some of them. The Ministry of Defence looks after planning aspects while the DGAQA is responsible for the quality assurance of stores during development and production. CEMILAC is the Certification Authority and progresses the development clearance and certification in consultation with agencies involved at appropriate stages of development. Aircraft and System Testing Establishment (ASTE) and Central Servicing Development Organisation (CSDO) of the IAF are responsible for acceptance of the Aircraft and its system for the IAF.

NASDO is responsible for acceptance of aircraft and its system for Indian Navy. Director General of Army Aviation and Maintenance Advisory Group (Aviation) are responsible for acceptance of aircraft and its system in the Indian Army.

4. Section- I deals with the definition of terminology used in the publication.
5. Section II gives brief note on the process of development in respect of development projects on aircraft, engine, airborne equipment/store, raw materials and standard parts.
6. Section III discusses the Procedures for the design, development and production of aircraft and airborne systems. Procedures to be followed during the prototype and development phase, pre-production and production phase, and procedures to be followed for licence projects and bought out aircraft are dealt in great detail in this Section. Various organisations involved in the military aviation and their responsibilities in the certification and acceptance of military aircraft are also given in this Section.
7. Section IV deals with indigenisation of airborne equipment, AGS parts and raw materials used in any one of the service aircraft, aero engine or air borne stores. The development and production of such airborne equipment and raw materials and the procedures to be followed are described in Section IV.
8. Section V discusses the Flight testing of prototypes as a prerequisite for their technical acceptance. Section V also discusses the flight testing of equipment on an already certified aircraft.
9. The procedure outlined herein is normally applicable for the airborne stores developed by any agency whether it be in public sector, private sector, Government R & D agency, Base Repair Depot of IAF, Naval Aircraft Yard of IN etc. In the case of development work to be undertaken in private sector, the instructions of Department of Defence Production and Supplies would be applicable for all aspects other than airworthiness and certification requirements.
10. The Design, Development, Production/Quality Assurance of airborne electronic equipment/ stores will be carried out as per DDPII- 2000 Procedures. The clearance of such items for installation in military aircraft would, however, follow the procedures stipulated in this publication and Joint Services Guide JSG: 755:2001.

- 11.** Where development is being done on a proprietary basis it will be assumed that the feasibility and project definition phases are over. No contract for development would be involved. Rest of the development procedure remains the same.
- 12.** This document is not applicable for un-manned aircraft and missiles unless such UAVs and missiles are carried on manned aircraft.
- 13.** This document supersedes DDPMAS-75.

SECTION I
DEFINITIONS

Contents	Page No.
Airborne Stores	5
Airworthiness	5
Design and Development Agency	5
Design Authority	5
Contractor	5
Certification Authority for Design and Development	6
Approving Authority for Quality Assurance	6
Regional Centre for Military Airworthiness	6
Chief Resident Engineer/Regional Director	6
Chief Resident Inspector	6
Technical specification	6
Certificate of Design	6
Type Record	7
Type Approval	7
Provisional Clearance	7
User Acceptance	7
Design Approved Agency	7
Quality Assurance Approved Firm	8
Development contracts	8
Production/ Limited Series production	8
ASR/NSQR/GSQR/ISQR	8
Minor and Major Airborne Equipment	8

SECTION - I

DEFINITIONS

Airborne Stores

1. Airborne stores includes all aircraft, helicopters, engines, systems as well as items of equipment, material etc., used in the development/production of aircraft, aero-engines, systems, equipment, armament stores, flying clothing etc.

Airworthiness

2. Airworthiness is the continued capability of the aircraft/equipment to perform satisfactorily and fulfill mission requirements, throughout the specified life in the prevailing environments with acceptable levels of safety and reliability. The acceptable levels to be mutually agreed between users, designers and the certification authority

Design and Development Agency

3. Design and Development Agency is an agency undertaking design and development of an aircraft, aero engines, systems, software, equipment, materials etc. The Design and Development agency may be a public sector undertaking, Government R&D Organisation, R&D Laboratories, agencies created by Government of India from time to time for such purposes or private sector firms.

Design Authority

4. Design Authority is the Design Department of the above stated Development Agency or any design approved agency or R&D establishment, which is responsible for the detailed design and development of the Aircraft/ Engine/ Systems/ Software/ Components/ Material.

Contractor

5. Main contractor : Main contractor is the development and or production agency who is entrusted with the total responsibility for development and/or productionisation of the Aircraft/ Engine/ systems/ software/ equipment/ components /materials etc.
6. Sub - Contractor : Any agency including PSU, Private sector, R & D institutions etc., identified by the main contractor for the development and/

or manufacture of a specific airborne store. The sub contractor is responsible to the main contractor.

Certification Authority for Design and Development

7. The approving authority for airworthiness and certification of all airborne stores for Military application is the Chief Executive, Centre for Military Airworthiness and Certification.

Approving Authority for Quality Assurance

8. The Approving Authority for Quality Assurance during development/manufacture is Director General, Aeronautical Quality Assurance.

Regional Centre for Military Airworthiness

9. Regional Centre for Military Airworthiness is an unit of CEMILAC which progresses, on behalf of CEMILAC, all aspects of technical clearance of the airborne stores during design and development, production and In-service phase. In such places where no establishment of RCMA exists, such authority may be delegated to Visiting Technical Officers (VTOs) of CEMILAC.

Chief Resident Engineer/ Regional Director

10. The heads of RCMA's are designated as Chief Resident Engineers or Regional Directors.

Chief Resident Inspector

11. The Chief Resident Inspector is the resident representative of Director General of Aeronautical Quality Assurance (DGAQA) to ensure Quality Assurance of the stores during Design, Development and production phases.

Technical Specification

12. Technical Specification is a document laying down design and performance characteristics of the stores. The technical specification shall contain full details of the equipment, standard of the main store, the specifications/standards followed in the design and manufacture, the environmental conditions, interface and integration requirements besides performance and functional requirements.

Certificate of Design

13. The Certificate of Design is the document which certifies that the store complies with all the requirements laid down in the technical specification with the exceptions quoted therein.

Type Record

14. Type Record is a document giving a description of the store, its functional and performance characteristics, summary of strength and other calculations along with reserve factors, environmental envelope of operation and storage of the store, results of all tests including environmental, functional and performance tests, weight data, list of applicable drawings and includes the Certificate of Design. It includes all documents and specifications approved by CEMILAC, information on dimensions, materials and processes necessary to define the structural strength of the aeronautical product. It should also indicate instructions for continued airworthiness of the product, operating limitations and other information for the safe operation of the product.

Type Approval

15. Type Approval is a certificate issued by the Approving Authority, i.e. CE, CEMILAC to the effect that the store under reference meets all design specifications and test requirements laid down by CEMILAC. The type approval is issued after the Design Authority/Main Contractor submits a full type record with all relevant documents, to the satisfaction of CEMILAC.

Provisional Clearance

16. A provisional clearance could be issued by one of the RCMAs for a limited period, pending issue of final approval by CEMILAC. A provisional clearance is issued to the effect that the store under development meets all the laid down specifications and test requirements with the exceptions stated there in. The provisional clearance is issued because documentation is pending, or because some of the long cycle life tests (such as fatigue tests) are pending or because of the necessity to obtain from flight tests some results which can not be obtained from ground tests. There is no difference between a provisional clearance and a type approval in so far as the safety of the aircraft or airborne store is concerned.

User Acceptance

17. Acceptance of an airborne store for service use and end use requirements will be the responsibility of the services.

Design Approved Agency

18. Design Approved Agency is an agency whose design/development department has been approved by Chief Executive, CEMILAC as competent to carry out Design, Development, Modification, Indigenous Substitution of a particular class of stores/ material/equipment, and/or formulate Statement of Work (SOW), Prime Item Development Specification

(PIDS), Critical Item Development Specification (CIDS), software related documents, Test phase related documents, etc.

Quality Assurance Approved Firm

19. Quality Assurance Approved Firm is a firm whose quality assurance organisation has been approved by DGAQA as competent to carry out quality assurance during manufacture/ overhaul/ repair/ storage of aircraft/aero-engines and its associated equipment and accessories and other aircraft stores. The terms and conditions for approval are given in DGAQA, Ministry of Defence document “Approval of Firm’s Inspection Organisation/Department” and also “Quality Control System Requirements for Industry”, JSS 0254-01 April 1983.

Development Contracts

20. This is a contract placed on a Development Agency for development of an aeronautical store on the basis of Service requirements.

Production/Limited Series Production

21. Production refers to bulk manufacture at the production agency or Limited series Production (LSP) carried out either at the development agency or at the production agency. This also refers to the overhaul or repair of the aircraft, engine or airborne stores.

ASR/NSQR/GSQR/ISQR

22. The ASR/NSQR/GSQR/ISQR is a document which describes in qualitative and quantitative terms, requirement for an equipment or system of IAF, Indian Navy, Indian Army and Inter Services respectively.

Minor and Major Airborne Equipment

23. Airborne equipment are classified as Minor and Major Equipment. Classification into major and minor equipment, critical, non-critical shall be decided by the Main Contractor in consultation with RCMA. Minor items are those which do not affect the Safety and Interchangeability aspects of the Aircraft Maintenance and Operation. Proprietary items which are being imported which constitute only forming and machining operations may also be considered as Minor Equipment. Electrical Black Boxes, Electro-Mechanical Hydraulic, Pneumatics, Components, Brake Pads etc. shall be considered as major items.

SECTION II
PROCESS OF DEVELOPMENT

Contents	Page No.
General	10
Service Requirement	10
Feasibility Study	10
More Precise Staff Requirement	12
Project Definition	12
Project Definition Acceptance and Govt. Approval of Expenditure	12
Development Contract	12
Design and Development Progression	13
Acceptance of Type Record	13
Project Management	13
Provision of Funds	13
Transition from Development to Production	14

SECTION - II

PROCESS OF DEVELOPMENT

General

1. Most of the projects are initiated on specific requirements of User Services. There may, however, be a few instances in which the Design Authority, on their own, develop an airborne store to a specification which might be of interest to users. The sequential process where projects are initiated either by the user services or by the Design Agency, with a specific requirement is considered herein.

Service Requirement

2. The ASR/NSQR/GSQR/ISQR are projected by the Air Force, Navy, Army or the Inter Services in a draft form or as a Qualitative Requirement. Preliminary discussions are held between possible development agencies, such as DRDO, manufacturing organisations likely to be involved in production of the item, Department of Defence Production and Department of Defence. Where there is a likely repercussion on other services, due to the introduction of such an equipment then, the representatives of the services concerned should be associated in the discussions. After these discussions the draft SR/QR is reissued as ASR/NSQR/GSQR/ISQR. Such requirements are scrutinised further by Department of Defence Production and Supplies who would indicate the need for a feasibility study to be undertaken by the Development Agencies/ Contractors.

Feasibility Study

3. On request from the Department of Defence, feasibility study is undertaken by the Development Agencies/ Contractors/ DRDO. Feasibility Study is a study undertaken to establish whether it is practicable to meet the ASR/NSQR/GSQR/ISQR and identify the scientific and technical issues as well as to acquire an appreciation of the cost and time to complete the project.
4. The feasibility study shall contain the following data :
 - (a) Conceptual design, preliminary design, major areas of concern, plans to reduce risks in development. Alternate design proposals (where possible) considered to meet the service requirements to be

indicated together with preference and reasons thereof. A brief description to be given on the proposed airframe design configuration and principal aircraft/weapon systems.

- (b) Preliminary technical and performance data shall be such as to enable technical evaluation of practicability of achievement of the operations / specification requirements. In the case of aircraft projects, estimated aerodynamic data, weights and power plant characteristics, shall be indicated. Estimates are to be supported by reference to published Technical Reports or norms developed by the contractor which have been used for the estimation.
 - (c) Comparative data on design configuration, performance etc., for contemporary aircraft/engine for similar designs to be made available, if such data are available in published literature.
 - (d) Preliminary estimates of human, capital (buildings, machinery, equipment and test facilities) and financial resources required to undertake the project. Resources presently available and extent of increase, if any. An indication of time to execute the project.
 - (e) An indication of time and cost for preparation of detailed Project study.
 - (f) Extent to which ASR/NSQR/GSQR/ISQR can be met.
 - (g) In order to enable obtaining an idea about cost of introduction of the weapon system into the service, an estimate of the programme cost should be made jointly by the development agency and the user services. The programme cost should indicate details on number of aircraft required such as, Service Squadron, Training Squadron, Maintenance allowance, attrition allowance, development aircraft, development cost, investment cost for production aircraft, spare parts, test, ground equipment tools, etc., operating cost including that of maintenance of ground equipment etc.
5. The feasibility study will be scrutinised by user for conformity to the ASR/NSQR/GSQR/ISQR. The techno economic aspects of the feasibility study will be scrutinized by the Ministry of Defence, the Department of Defence Production and Supplies and the Department of Defence (R&D) wherever necessary. In respect of Avionics Stores also, similar procedures would be followed with due consideration given to the document on

procedure for Design, Development, Production and Inspection of Electronic Equipment (DDPIL-2000). The clearance of such items for installation in Military aircraft would however, follow the procedure stipulated in this document and Joint Services Guide JSG:755:2001.

More Precise Staff Requirement

6. Based on the feasibility studies submitted by various development agencies, more precise staff requirements are evolved by service HQrs if considered necessary.

Project Definition

7. After evaluating the feasibility study and the technical specifications, developed upto then a decision is taken by the user services and Ministry of Defence, in consultation with all concerned, whether a Project Definition phase is required to be undertaken. A Project Definition contract is placed with selected firm(s) or development agency to obtain a thorough examination of the scientific and technical problems involved in developing a new aircraft and its weapon system or any other aeronautical stores. The contractor or design authority is required to supply a detailed technical specification including development plan in terms of money, man power and time and to indicate the means and cost of production. The project Definition will identify mile-stones in development and decision points when the question of development and subsequent production would be reviewed, with a view to go ahead. The data for the project definition could be called for in the format at **Annexure `A'**. The Ministry would obtain views of IAF/IN/Indian Army, CEMILAC and DGAQA, before taking final decision on the project.

Project Definition Acceptance and Government Approval of Expenditure

8. Project definition report will be examined by the Ministry of Defence, DRDO, Department of Defence Production and Supplies and the user. The user service after detailed scrutiny will submit its report to MOD. The MOD in consultation with all would consider and decide on the acceptance of the project definition and secure the decision of the Government regarding the project and placement of Development Contract.

Development Contract

9. A development contract will then be placed on behalf of the Government by MOD with the Development Agency/Contractor. The contract will stipulate the cost and time frame of development, number of prototypes etc., and indicate decision points in the development programme when 'go ahead' for pre production models and production models would be given by the

concerned Service Headquarters. The division of responsibility between the development agency and production agency is clarified in Section-III, Chapter-2, Para-10.

Design and Development Progression

10. The design and development phase, starts after placement of Development Contract. Detailed procedure to be followed during design and development phase is dealt in Section-III. It is sometimes very difficult to precisely state when the design and development phase starts. The requirements to be complied during design and development phase have however been indicated clearly and it will be the responsibility of the Development Agency to keep CEMILAC and DGAQA, the Users' representatives, CSDO, NASDO of Navy, ASTE and MAG (Avn) associated during development as called for in the publication. A project management team shall be formed by the main contractor for progressing the Design and Development.

Acceptance of Type Record

11. On completion of development trials, the Type Record of the store is accepted by CE, CEMILAC. The airworthiness and effectiveness of store will have to be ensured right through production and in service phase. The procedure to be followed for maintenance of airworthiness, defect investigation, modification etc., are covered in Section-III.

Project Management

12. This publication does not include procedures relating to Project Management and the follow up of performance of development agency in regard to schedules like development or production time, cost etc. Suitable and appropriate organisation for management of technical coordination of projects relating to aircraft and airborne stores would be formed by Government.

Provision of Funds

13. With a view to facilitate sanction of the expenditure by the Government for new aircraft/equipment induction, the Service Headquarters and the concerned department of Ministry of Defence should respectively provide for the cost of such new induction and the development cost in their respective budgets.
14. Normally the feasibility study will be undertaken by the concerned agencies from their own funds. After the project definition study is accepted by the Government, development contract will be placed on the selected development agencies/contractors by the concerned department of the

Ministry of Defence or service headquarters after providing for the necessary funds. After the development has been accepted by the service headquarters as successful, the funds for the production programme will be catered for by the respective service headquarters.

Transition from Development to Production

15. Any development project will pass through a phase of transition from development to production. The various aspects of this phase such as nomination of Production Agency, Close association of Development and Production Agencies, preparation of budgetary quotations, issue of letter-of-intent and placement of firm order etc., are covered in Section – III, Chapter-2.

SECTION III

CHAPTER 1

PROTOTYPE AND DEVELOPMENT PHASE

Contents	Page No.
Initiation of Project	17
Feasibility Study	17
Progression of Certification	17
Technical Specification	18
Project Definition Phase	19
Preliminary Design	19
Detail Design	20
Drawing Office procedure	20
Test and Analysis	20
Software Development	21
Integration Testing	21
Design Changes	21
Design Standard of Preparation	21
Certificate of Design	22
First Flight Clearance and Flight Tests	22
Agencies and Process of development	22
Foreign Collaboration	22
Design Approval of Development Agency (Design Approved Firm)	23
Airworthiness Groups	23
Quality Assurance Approval	24
Chief Resident Engineer/Regional director	24
Chief Resident Inspector	24
Association of IAF, IN and Army during Development	24
CSDO/MAG (Avn)	24
Responsibility for Design	25
Responsibility for Quality Control	25
Division of Responsibility between the Contractor and CEMILAC	25

Configuration Control	26
Configuration Control Procedure	27
Actions by Vendor Agencies supplying HW, SW or both in Config Control	27
Actions by Management Agency in Configuration Control	28
Configuration Management Plan	28
Technical Reviews	28
Preliminary Design Review	29
Critical Design Review	29
Customer Furnished Equipment / Customer Specified Equipment	29
Bought – out Item	29
Mock-up and Working Rigs	30
Ground Tests	30
Weight and CG	32
Provision of Drawings, Models and Associated Data	32
Schedule of Equipment	32
Maintenance Aspects	32
Ground Equipment	32
Standardisation	32
Publication of Test Results	33
Design Standards for Prototype Aircraft	33
Prototype Notes	33
Defects during Development	33
Acceptance of Design	33
Type Record	34
Acceptance of Type Record	34
Documentation required for first flight clearance and for Type Approval	35
Release of New Type of Aircraft to the Services	37
Steering Committee	37
Technology Demonstrators	37
Aircraft Armament Stores and Weapon Systems	37
Airworthiness Certification of Military A/C and Airborne Systems (Flow Chart)	38

SECTION - III

CHAPTER - 1

PROTOTYPE AND DEVELOPMENT PHASE

Initiation of Project

1. As already stated in Section-II a project is normally initiated on Service Staff or Qualitative Requirements specified by the Services. The different stages of development leading to certification are shown in the flow chart at Fig.1 and detailed description of these stages are given in paragraphs 1-19. CEMILAC/RCMAs shall be involved throughout the entire development beginning with the Services Staff Requirement/Qualitative requirement and continues till the retirement of the aircraft, engine, airborne stores, weapon systems etc. This chapter, however, gives only the procedures and requirements to be followed and met during the design and development phase. The requirements given are generally those pertaining to aircraft. These can, however, be suitably modified for engine, airborne systems, aircraft armament or weapon systems etc. The provisions of this document, however, are not applicable for UAVs and missiles unless such UAVs and missiles are carried on manned aircraft.

Feasibility Study

2. On request from the Ministry or the users, a feasibility study is undertaken by the Development Agency or the contractor as detailed in Section-II.

3. Progression of Certification

On receipt of design and development order from Government of India, the contractor shall advise CEMILAC whether he would approach CEMILAC for clearance and certification after completing all design activity or would approach CEMILAC for concurrent design and certification. The certification approach would thus be specific to the option exercised by the contractor. The option should be exercised at the beginning of the project. The methodologies of certification for each of these options are described below.

(a) Certification commences after completion of all design activities

For adopting this method, the contract with GOI shall be explicit in regard to

- The performance parameters
- Technical publications to be submitted
- Build standard of the airborne stores
- Certification norms to be followed (DEF STD, MIL STD, FAR etc.,)

- The test plans and procedures
- List of deliverable documents to be submitted to CEMILAC
- Time schedules including time slot for certification activities
- Cost of certification
- List of sub contractors

After completing all design and testing activities, the contractor shall submit all applicable documents. CEMILAC might take considerable time within the time allotted for certification for verification and evaluation of the documents. The contractor must be prepared to repeat some analysis or tests on demand from CEMILAC. After CEMILAC is satisfied that all performance parameters and certification norms as per the contract have been met, they would issue the clearance/certification. In this route, the certification activity commences after completion of all activities by the design and development agency.

(b) Concurrent Certification approach

In this method, CEMILAC is associated with the project, from the beginning of the project itself i.e., from the requirement stage itself and all design and development activities are progressed concurrent with certification activities such as design evaluation, analysis and test activities. The procedures for this approach are as described in this document.

(c) Association between CEMILAC and DGCA

It would be beneficial to associate DGCA officers with CEMILAC for design evaluation during various stages of certification. The association between CEMILAC and DGCA may be of great value, especially in the certification of aeronautical products that are common to military as well as civil use.

Technical Specification

4. Contracts for prototype and development of aircraft are normally placed after acceptance of the Project Definition by the Government. Detailed technical specification by the contractor firm is the starting point for progression of activities in regard to design and development of aircraft, engines and major airborne equipment.
5. The Technical Specification is that which lays down the design and test requirements of a general nature. As the technical specification is made at the beginning of the project, it may not fully describe the designer's intention. There may also arise a need to revise the Technical specification as the development progresses because of various reasons such as inability to implement the initial design concepts or changes in the user's

requirement. Such inadequacies in the technical specification are overcome by issuing amendments to the technical specification through a well defined configuration control procedure. At the earliest opportunity, the original technical specification and all subsequent revisions are combined to correctly describe the product.

6. The detailed technical specification must be agreed amongst CEMILAC, users and the design agency and shall contain the following but not limited to.
 - Design and performance characteristics
 - The environmental requirements
 - Applicable specifications and standards followed
 - Interface and Integration requirements
 - Input/Output requirements to be met
 - Hardware/Software requirements
 - Results of the tests/analysis carried out during feasibility study phase

Project Definition Phase

7. The designer spells out his intentions clearly during the project definition phase. In this phase, the designer/main contractor identifies the major systems/equipment that are intended to be used in the prototype keeping in view the user's qualitative and quantitative requirements and the technical specification for the aircraft/engine/airborne stores. The aircraft weight classification, its sizing, aerodynamic configuration, distribution and location of various equipment and sub-systems etc., are identified during this phase. There may be a need to carry out preliminary wind tunnel tests for arriving at the aerodynamic configuration of the aircraft. The project definition phase is a prelude to the preliminary design phase.

Preliminary Design

8. During the preliminary design phase, design parameters are established for configuration, performance, flying qualities, stores management, weight and CG, compliance to users requirement, trade-off in the design etc. This also takes into consideration inputs from several tests such as wind tunnel tests for aerodynamic configuration and sizing. Mock up studies for cockpit management, ergonomics, vision requirements etc., are also carried out during this phase. Specifications for various equipment, sub-systems and systems that are to be used in the aircraft/engine/airborne store are also finalised.

Detail Design

9. This phase has the greatest impact on the safety and airworthiness. The detail design of all components, subsystems, systems including their process parameters are carried out during this phase. This phase is also

concurrent with analysis carried out on the structural integrity and systems through FMECA, FTA, Hazard Analysis, risk analysis etc.

Drawing office Procedure

10. The drawing office procedure to be followed during development and subsequent pre-production and production phases are given in Chapter-2 of Section III.

Test and Analysis

11. Concurrent with the design phase analysis and testing of several components, subsystems and systems are undertaken. This is done either to refine the design further, or as a preliminary input to the detailed design or for proving the system after the design of the particular system is frozen. This phase also includes simulation exercises, software verification and validation and ground tests. The test schedules including the instrumentation required for the tests shall be finalised between Design Agency and RCMA in consultation with DGAQA. Some examples of the work carried out during the various phases of test and analysis are given below. The list is, however, not exhaustive.

- Analysis:** Safety Analysis
Hazard and Risk Analysis
Failure mode effect analysis
Failure mode effect and criticality analysis
Reliability and maintainability analysis
Structural strength analysis including fatigue strength evaluation
- Simulation** Model verification
Adequacy of visuals
Minimum test finalisation
Criticality simulation
- Software V & V:** SRS
Software testing
Code walk through
Object code verification
Validation of critical points
- Ground Tests: on** Components/ Equipment/LRU
Sub-Systems/ Systems
Structural Coupling
EMI/EMC/EMP, Lightning
Structural Strength
Structural Integrity
Environmental Conditions
Integration

Software Development

12. The software development, its certification and quality assurance are not included in this publication. A separate procedural document on software development will be issued. The software certification approach for each of the following would be defined in the proposed document:
 - a) Indigenously developed systems
 - b) Systems developed abroad to Indian specification.
 - c) Off the shelf imported systems, existing off the shelf imported system modified to suit our requirement.

13. The approach on the certification of the system where the software is housed is based on the criticality of the system as described below:
 - (a) Critical system
 - (b) Essential system
 - (c) Non essential system

14. The entire documentation starting with the Software Requirement, Specification, Software functionality document, Software testing , Software IV & V, HSI etc., would be described in the proposed document. The proposed document would also include the following.
 - (a) Configuration control for the software during development and during the life cycle maintenance of the software.
 - (b) The methodology to deal with embedded software.

Integration Testing

15. The various sub-systems are integrated during this phase and system integration testing including hardware-software integration is carried out in accordance with the test procedures approved by RCMAs.

Design Changes

16. The testing and analysis might reveal the need for changes to the design. This is a continuous process until the design is finally proven satisfactory.

Design Standard of Preparation

17. After satisfactory completion of the analysis and testing including integrated testing, the design standard of the prototype aircraft or airborne system is finalised by the design agency and coordinated by RCMAs. The SOP shall accurately define the product and shall include the drawing standard, various LRUs, equipment used, etc.

Certificate of Design

18. A certificate of Design, signed by the Chief Designer or an equivalent official, authorised to sign such documents by CEMILAC is then submitted to RCMA. The COD certifies compliance with the requirements of the specification and gives the product definition. The COD is to be submitted separately for each of the major sub-systems and systems and for the aircraft as a whole. The format for the COD is given in **Annexure 'F'**.

First Flight Clearance and Flight Tests

19. The clearance for the first flight is issued by RCMA after finalising the detailed flight test programme. The flight testing commences with the issue of the flight clearance certificate. Procedures for flight testing are given in Section V.

Agencies and Process of Development

20. Various agencies involved during the design and development phase, their responsibilities in this phase, development involving a foreign collaborator, requirements to be met by the main contractor/Design Agency etc., are detailed in the succeeding paragraphs.
21. A project may be undertaken by Public Sector Undertaking, Laboratories of R&D Organisation of Government or non-Government Institutions or by private sector. The procedure for acceptance and type approval of the store will be same irrespective of the fact whether the store is developed by a Public Sector, Private Sector, or Government R&D Establishment.

Foreign Collaboration

22. A possibility exists wherein an aircraft project or airborne stores development is undertaken as a collaborative effort between Indian Agencies and a Foreign collaborator. In such a situation, there may be two possibilities :
- a) The design and development of airborne stores in totality would be the responsibility of the collaborator. Such development may consist of work packages of the foreign collaborator and work packages of Indian agencies
 - i) The complete airborne stores would be certified by the Indian certification authority. The work packages of the foreign collaborator could be certified in the country of origin by the competent approving authorities of that country and would be accepted by Indian certification authorities for the total certification of the said airborne stores. If the work packages of the foreign collaborator is not certified in his country, then such work packages have to be approved by the Indian certification

- authority viz., CEMILAC as per the provisions contained in this document.
- ii) The said airborne stores would be certified by the competent certifying authority of the foreign collaborator's country. The said airborne stores would include work packages of the Indian agencies. The work packages of Indian collaborator could be certified by CEMILAC and would be accepted by the competent certifying authority of the country of foreign collaborator for the total certification of the airborne stores.
 - b) The design and development of airborne stores in totality would be the responsibility of the Indian Agencies. Such development may consist of work packages of the foreign collaborator and work packages of Indian agencies. The airborne store would be certified by the Indian Certification authorities. In such a situation, the work package of the collaborator can be certified by the certification authority of the country of the foreign collaborator. If this work package is not certified in that country, then it shall be certified by the Indian certification authorities as per the provisions contained in this document.
 - c) In both the scenarios, the acceptance of the certification of work packages/aircraft will have to be reciprocal and mutually binding between the Indian and Foreign Collaborator's Certification Authorities.

Design Approval of Development Agency (Design Approved Firm)

23. CEMILAC will grant approval to the development agency subject to their meeting with CEMILAC requirements. The Design and Development agencies should be competent to design and be prepared to ensure compliance with all specifications and other requirements governing the design and development, testing and modification of that class of store. The extent of Approval, i.e. classes of work for which the firms are approved will depend on their experience, facility and design staff. Those desirous of seeking design approval must apply to CEMILAC as per the procedure laid down in CEMILAC document No. CEMILAC/5342/1 dated June 1999. The responsibilities of CEMILAC are given in **Annexure – 'U'**.

Airworthiness Groups (AWG)

24. CEMILAC may approve setting up of Airworthiness groups in CEMILAC approved design and development agencies for progression of airworthiness certification on behalf of CEMILAC. The procedure for approval and responsibilities of Airworthiness groups shall be as per CEMILAC document CEMILAC/TC/03 dt: Sep 2000 and its amendments from time to time.

Quality Assurance Approval

25. The Directorate General of Aeronautical Quality Assurance (DGAQA) may grant approval to the Quality Assurance Organisation of development/manufacturing agencies subject to their meeting with DGAQA requirements. These agencies should be competent to ensure satisfactory Quality Assurance during development and manufacture in accordance with documents AFIO and QCSR issued by DGAQA.

Chief Resident Engineer/Regional Director

26. Where a contractor has received Design Approval for certain classes of aircraft stores, CEMILAC will open a RCMA or authorise any other RCMA to attend to technical and development clearance of the store on behalf of CEMILAC, during its development, production and in-service phase of the life of aircraft. The RCMA so created may be headed by a Chief Resident Engineer or a Regional Director. The details of responsibilities of the Chief Resident Engineer/Regional Director heading RCMA are given in **Annexure-'B'**.

Chief Resident Inspector

27. Where a contractor is engaged in the development/manufacture/overhaul/repair of aircraft/ aero-engine/ associated equipment, DGAQA may position Chief Resident Inspectors for ensuring Quality Assurance of the stores. The broad details of responsibilities of Chief Resident Inspectors are defined in **Annexure-'C'**.

Association of IAF, IN, Army and Coast Guard during development

28. In addition to RCMA and CRI, the ASTE of IAF would be associated during development to ensure user acceptance during development. Indian Navy Indian Army and Cost Guard would be similarly associated during development in respect of Naval Air Projects, Indian Army projects and Coast Guard projects respectively.

Central Servicing Development Organisation/Maintenance Advisory Group (Avn)

29. CSDO/MAG(Avn)/NASDO will provide on behalf of the Air Force/Army/Navy advice and recommendation about servicing and maintainability aspects from the earliest stages of design. CSDO/MAG (Avn)/NASDO will provide teams of specialist personnel who may be resident at certain aircraft firms, to study the development of new types of aircraft and equipment to assist their smooth entry in to service. Detailed responsibilities of CSDO/MAG(Avn)/NASDO are placed at **Annexure-'D'**. The facilities/information required by them are indicated in **Annexure-'E'**.

Responsibility for Design

30. The main Contractor is solely responsible for the design, development, construction and ground-and-flight tests of the aircraft/engine or airborne store to the requirements/specification. In case of Trial Installation of airborne stores, an aircraft would be made available for flight tests by the IAF/Indian Navy/Indian Army/Coast Guard/HAL as applicable. As for overall development flight test schedule is concerned, this will be specified by RCMA in consultation with the sponsoring agency/main contractor. RCMA is fully responsible for the adequacy of tests prescribed before clearing an equipment for development trials/use. This would also apply to clearances given by RCMA for part systems of major weapon systems, aircraft or aero engines. It would be the responsibility of RCMA and CEMILAC that the stores/equipment/aircraft involved, meet the design standard/requirements laid down for military aircraft. While giving concessions RCMA must ensure level of safety equivalent to that provided in the design requirement. These concessions should be properly documented giving proper justification. Wherever necessary, concurrence of service HQ would be obtained before granting concessions.

Responsibility for Quality Control

31. The contractor firm would primarily be responsible for instituting adequate quality assurance provisions for fulfilling the quality requirements of the development projects/manufacture/repair/overhaul in conformance to the drawings/test schedules. Such a QA arrangement should adequately conform to Quality Management System invoked from time to time and as specified in the applicable documents of DGAQA like Quality Control System Requirement for Industry (QCSR) and Approval of Firm's Inspection Organisation (AFIO). The Contractor firm will be responsible for veracity of the information supplied by it to the representatives of Type Certifying Authority. The responsibility of the contractor/firm also includes the sub-contracted portion of work, if any. Such sub-contracting arrangements are to be duly communicated to the CRI concerned.

Division of Responsibility between the Contractor and CEMILAC

32. In view of the overall responsibility for certification of the product being that of the CEMILAC, the CE, CEMILAC reserves the right for its officers to exercise such supervision as are detailed herein in the discharge of this responsibility.
33. The contractor shall prepare and forward to RCMA a list of all new items of equipment which he proposes to develop for the aircraft.
34. When the contractor places or accepts a sub-contract for any major design and development, he shall notify the RCMA and OCRI, of the nature of the work and the technical requirements supplied.

35. At all times during the design, development, construction and test, the contractor shall make available to RCMA all ground and flight test reports. The contractor shall also provide the drawings, design calculations etc, whenever necessary.
36. The aircraft contractor is responsible for the design of the entire aircraft including the various systems and installation of Engine, Avionics items, Mission computer, software package, Radio Flying control, Oxygen, Cabin conditioning, Electrical System, Armament System etc., on aircraft. The aircraft contractor is responsible for the airworthiness of any item/component/system that is used in the aircraft even if such a system is either supplied or specified by the user.
37. The main Contractor or development agency is also responsible for the store as a whole including any items sub-contracted by them and which have been designed indigenously or adapted to suit the store. The main contractor shall use only items of stores, materials and processes called in the approved drawing. In case use of unapproved components are unavoidable, the main equipment/store so built will be subjected to type test. In the event of satisfactory results RCMA may accept these components in the build standard of that particular series of equipment. This acceptance will be valid as long as these components are obtained as per specification and source of supply is not changed. Any change in these will invalidate the approval. The use of Commercial Off The Shelf (COTS) items in electronic equipment are governed by JSG:755:2001

Configuration Control

38. Configuration defines the functional and physical characteristics of the hardware, software or a combination of both. This would mean either the existing or planned characteristics and are contained in the related technical documentation. If any changes are proposed on the above configuration, then the proposal for the changes should be thoroughly evaluated. The implementation of the approved changes in the configuration should be fully documented.
39. During development, change can be expected in any one of the following.
 - a) Software standard of one or more subsystems
 - b) Hardware changes in one or more subsystems
 - c) Combination of both (a) and (b) above.

There is thus a need to establish unambiguous norms to control the configuration of the software and hardware of the subsystems, that will absorb all the changes that take place during development with the rig test

standard as the basic reference, so as to arrive at the precise standard of preparation for the system.

40. Configuration Control Procedure

The procedure should provide for a gradual evolution of the system by taking it through a cycle of rig and flight tests, changes to the system to overcome deficiencies and incorporation of additional requirements, followed by further tests. The following control points in this process can be identified.

- a) Production of flight-worthy models to meet the requirements of the test schedule and producing DDPs (ref. **Annexure – ‘R’**) for the same to establish the base line standard of hardware.
- b) i) Development, documentation and production of SW for management and peripheral computers.

ii) SW simulation to establish the base line standard of software correlated to the hardware standard established at (a) above.
- c) Production of subsystem, system and interface circuit diagrams to establish the circuit configuration related to a) and b) above.
- d) Production of an integration rig test schedule and demonstration of the test parameters.
- e) Identification of a Flight Development standard of hardware, software and platform to establish the base line standard for the first development flight.

- 41 .** It will thus be seen that the configuration control in this process of change and development is dependent on actions by a number of agencies. The responsibilities of these agencies for the actions involved in the process of hardware /software configuration control till the achievement of prototype are discussed in the following paragraphs.

Actions by Vendor Agencies supplying HW, SW or both in Configuration control

- 42.** The vendor agencies should, to start with define the base line standard which will be related to the DDP. All successive changes to this base line standard should be identified through a request for change (RFC). This can be originated either by the vendor agency concerned or agency undertaking integration and management of development. A format placed at **Annexure – ‘S’** could be utilized to identify and record such RFCs. The

sum total of such RFCs would assist in the definition of the design standard of the individual LRUs. It could be noted here that the RFC provides for organisation of the request and recording the vendor agencies action thereon and the final acceptance or rejection by the management agency. The vendor agencies would also be required to spell out implications on aircraft wiring, EMC, requirement of rig tests, effect on software standard etc. as indicated in the RFC format.

Actions by Management Agency in Configuration control

43. The receipt of the delivered hardware / software should be recorded on an appropriate format at the Management / Integration agency. A suitable format is placed at **Annexure – ‘T’**. The integration tests could then be carried out and any changes required could be raised through an RFC. The hardware / software modifications would have to be tested again on the rig for simulation before releasing it for development flight tests, after clearance by RCMA. The RFC could be used to monitor the progress of development flight testing by the management agency.
44. The changes to the approved configuration are approved or disapproved by the Configuration Control Board consisting of the following members:
- (a) Project Director
 - (b) Chief of Design
 - (c) Rep. of Chief of Production
 - (d) Rep. from Quality Assurance
 - (e) Rep from CRI
 - (f) Rep from RCMA

Configuration Management Plan

45. The design and development agency must issue a configuration management plan listing all the configuration items which need to be monitored. Configuration Management Plan should also define the implementation of the configuration changes.

Technical Reviews

46. During the development of any aircraft, engine or equipment, technical reviews must be carried out at an appropriate stage of the project to determine the technical progress of the project related to its technical requirements. Such reviews are carried out on both software and hardware items. The following two reviews should mandatorily be carried out.

Preliminary Design Review (PDR)

47. PDR is a formal technical review of the basic design approach for a configuration item and or for a functionally related group of configuration items. The PDR shall be held after finalisation of the following:
- (i) Hardware development specification
 - (ii) Software top level design document
 - (iii) Software test plan
 - (iv) Hardware test plan

All the documents necessary for the review should be given to each member at least 15 days prior to the date of the PDR meeting. The PDR shall be chaired by a competent official who is not part of the project. The PDR shall include amongst others, reps of the academic institutions, sister R&D organisations, RCMA's / CEMILAC and DGAQA.

Critical Design Review (CDR)

48. The CDR shall be conducted on lines similar to the PDR. The CDR board would also be constituted on the same lines as that of PDR board. The critical design review shall be conducted to ensure that the detail design solution and engineering drawings satisfy the technical requirements of the hardware development specifications and software top-level design document. The CDR shall be held on each configuration item prior to its fabrication or coding release. The necessary document for the review should be forwarded to all the members at least 15 days prior to the date of the meeting.

Customer Furnished Equipment/Customer Specified Equipment

49. It is quite possible that the customer viz, the Services insist on using an equipment identified by them or specified by them. In some cases services might procure and furnish such equipment for installation on the aircraft, engine or system. In such cases the responsibility for ensuring its performance, life etc will be that of the services. The Design and Development agency should however evaluate the equipment and bring out the short falls if any, in terms of functional, performance, environment parameters and the life of the equipment and their effect on the aircraft, engines or systems where such equipment are used. The Design and Development agency should inform the concerned service HQ of such short falls and the implications of using such equipment.

Bought – out Items

50. If the main contractor or development agency proposes to use any equipment or item imported from foreign vendor, then data as per **Annexure - 'V'** should be obtained by the main contractor/development agency and forwarded to RCMA. The clearance for installation or use of the

item or equipment will be given by RCMA after ensuring that the item/equipment meets all airworthiness requirements and specification requirements.

Mock-up and Working Rigs

51. The broad requirements for the mock-up would be advised by RCMA, CSDO, NASDO, MAG(Avn), Army Project Team and ASTE. The contractor shall make a preliminary mock-up of a new type of aircraft as soon as possible. The mock-up will be used to settle matters such as ergonomics, vision, instruments etc., before manufacture of full mock-up. The cockpit layout of mock-up of IAF aircraft would be accepted by ASTE on behalf of Air Headquarters and cockpit layout of mock-up of Naval/Army aircraft would be accepted by Indian Navy/Indian Army. Institute of Aviation Medicine shall be involved in all matters of ergonomics and cockpit management including visual displays. Alternate to metal mockup, digital electronic mock up shall be considered as an equivalent option for the purposes of ergonomics, instruments, layout studies, installation/removal assessment and accessibility evaluation.
52. The full mock-up shall be dimensionally accurate and shall cover the engine installation and all congested areas in sufficient detail, to enable servicing aspects of the aircraft to be considered, before the layout is finalised.
53. In addition to the mock-up, for each of the systems, such as Hydraulics, Cabin conditioning, Pneumatic, Electrical, Oxygen Weapon etc., the contractor shall make a rig so that the functional tests can be made to demonstrate whether the system satisfactorily meets the design requirements.
54. The rig shall be made available in serviceable condition till acceptance of the type record. If these are required during production also, then the detailed requirement of the Rig regarding the servicing and maintenance aspects could be discussed with RCMA, CRI and CSDO/MAG (Avn)/NASDO and finalised in respect of individual systems. The specifications for the rig shall be cleared by RCMA and the clearance of the rig as per the specification shall be done by CRI, DGAQA.

Ground Tests

55. The contractor shall conduct such ground tests as are necessary to ensure compliance with the aircraft specification. A programme and plan of tests to be made, detailed test schedules including the instrumentation for the tests, acceptance criteria for all tests etc., shall be prepared by the main

contractor in conjunction with the RCMA, and CRI. The tests can be conducted after RCMA accepts the test schedules. Where special tests are required, those may be referred to specialised R&D labs, if necessary. Based on the finalised test schedule, the main contractor shall prepare and issue the test procedure document to be followed during the conduct of test. The main contractor shall also prepare a test rig acceptance document. The contractor shall obtain the acceptance of RCMA for the technical specification of the test rigs. The test rigs designed to meet the accepted specification will have to be approved by CRI to the effect that the rigs meet the standards laid down for such tests and meet all drawing and other requirements. The test schedule should normally contain the following.

- (a) Details of the items to be tested
 - (b) Standard of preparation and drawing applicability of the item to be tested
 - (c) Objective and aim of the test
 - (d) Details of the test equipment, rigs etc., used. Calibration of test equipment and instruments and their records
 - (e) Test Procedures/Test order/Test Specification
 - (f) Measurements to be taken and instrumentation required
 - (g) Pass / Fail criterion
 - (h) Number of samples to be tested
 - (i) If more than one test is to be carried on the same sample, then the sequence of the tests to be conducted.
- 56.** Whenever any ground test is to be carried out, RCMA, CRI, and wherever applicable CSDO/NASDO/MAG(Avn) shall be notified in advance by the main contractor, to enable them to witness the test. The tests would be witnessed and the test reports thereof coordinated by CRI. Whenever the tests are carried out at approved laboratories such as DRDO, ETDC, HAL etc., if CRI is unable to provide full coverage owing to any constraints, then CRI may resort to alternate coverage plans based on their past experience on similar items, significance/criticality of test concerned etc.
- 57.** The RCMA may accept the test results based on the report submitted by either the CRI or the Design and Quality Control department of the main contractor duly coordinated by CRI.
- 58.** Ground tests should be completed before undertaking flight tests. If for any reason flight tests are required to be undertaken before completion of ground tests, the scope of mandatory tests required to be completed before commencement of flight tests shall be discussed with CEMILAC and their concurrence shall be obtained. All such mandatory ground tests as per design standards should be completed before undertaking flight tests.

Weight and CG

- 59. The contractor shall maintain an analysis of weight and CG of the constituent parts of prototype and production aircraft.
- 60. The limits of weight and CG of the aircraft shall be defined by the main contractor. RCMA shall examine the same.
- 61. The contractor shall carry out the weighing in the presence of a representative of CRI.

Provision of Drawings, Models and Associated Data

- 62. The contractor shall supply to the RCMA, drawings of structure and other systems, software details, reports on wind tunnel test, ground test and flight test and any other report/document, as required by RCMA for according clearance. These informations shall be treated as proprietary by RCMA and shall be utilised for the purposes of certification of particular store.

Schedule of Equipment

- 63. A Schedule of Equipment shall be prepared by the main contractor indicating clearly contractor supply, contractor fitment, user supply and user fitment. These shall have been agreed upon by the users. At an appropriate stage of the project a draft equipment list shall be submitted to the users.

Maintenance Aspects

- 64. The CSDO, MAG (Avn), IAF and IN shall be associated from the early stages of design, to study and suggest accessibility and maintenance aspects. Such an association would also facilitate planning for smooth induction of the aircraft into service.

Ground Equipment

- 65. Ground Equipment and rigs which are to be delivered to the users against specific RMS orders needs approval by DGAQA. Other ground equipment need not be approved by DGAQA if no RMS orders are placed.

Standardisation

- 66. The contractor shall make use of standard components as used in contemporary aircraft/airborne stores manufactured in the country. Even in regard to AGS parts effort shall be made to use parts for which manufacturing facilities have been established in the country. The aircraft shall be capable of being maintained as far as possible with standard tools. Additionally, the main contractor shall be responsible for codification of the standard parts as per guide lines issued by MOD/Dte. of Standardisation.

Publication of Test Results

67. The CE, CEMILAC reserves the right to circulate for Government of India purposes, data contained in any of the reports, tests relating to the design of the aircraft that may be undertaken on the Government's behalf.

Design Standards for Prototype Aircraft

68. RCMA should ensure by a suitable procedure that the design standard of prototype aircraft is brought up to date from time to time to ensure compliance of safety and operationally important modifications.

Prototype Notes

69. It shall be the responsibility of the contractor to prepare Prototype Notes for operating and maintaining the aircraft in airworthy condition during flight trials. The notes shall contain all information necessary for handling and servicing of the aircraft during prototype flying.

Defects during Development

70. Copies of the defects during development phase shall be raised in a format similar to the format at **Annexure 'H'** by contractor and shall be sent to RCMA and CRI. Investigation will be carried out by a team of specialists representing the Contractor, RCMA and CRI. The final remarks in respect of design matters will be given by RCMA and those in respect of Quality aspects would be given by OCRI. The findings/recommendations of the investigation will be utilised for resolution of the problem/further product improvement. Periodically the compilation of defects, their analysis, and the corrective actions taken shall be prepared by the development agencies and a copy of the same shall be given to RCMA and CRI.
71. The main contractor shall inform Air Headquarters/CEMILAC, ASTE, Naval Headquarters, CSDO, Army Headquarters on any major defects/incidents, encountered during the development phase within seven days of their occurrence. The RCMA may keep informed specialist R&D establishments like ADE, GTRE, ARDE etc., in respect of important defects on aircraft, related to their equipment.

Acceptance of Design

72. The contractor shall submit for acceptance of the Type Record after satisfactory compliance of requirements of drawings, flight test and production specifications. The Type Record for the store shall include individual Type Records for systems and equipment, which are obtained on sub-contract.

Type Record

- 73.** The Type Record shall comprise :
- (a) Service Requirement/Qualitative Requirement.
 - (b) Design Specification.
 - (c) A Certificate of Design, signed by the Chief Designer (or equivalent) certifying compliance with the requirements of the specification, with the exceptions quoted therein. If the firm is not the Design Authority for the store, the Certificate of Design for the Store shall be countersigned by the Main Contractor or by the Design Authority. The form of Certificate to be used is given in **Annexure-'F'**.
 - (d) Description and/or drawings covering :
 - (i) the functioning of the item, general assembly drawings including equipment installation on the aircraft and complete listing of all equipment, rotables and role equipment.
 - (ii) Master Record Index/ Drawing Reference Index No., and Issue No.
 - (e) Summaries of assumptions on which the design is based. For an aircraft these shall include the basic aerodynamic assumptions.
 - (f) Summaries of calculations/Stress records.
 - (g) Weight and CG
Note : This shall include a statement of the weight of the complete store. Wherever possible this should be the measured/actual weight and CG shall be computed using this data.
 - (h) Test Reports
Note : This shall include reports of strength, fatigue and type tests, including any ground/flight tests, endurance and reliability tests and demonstrations of servicing requirements, together with explanatory remarks on any tests which have not yet been completed.
 - (j) All subsidiary Type Records where applicable.
 - (k) Instructions on continued airworthiness, service bulletins, mods, compliance statement document etc.

Acceptance of Type Record

- 74.** RCMA will be notified by the contracting firm that the Type Record is ready for acceptance. The RCMA will receive the same and examine for the

correctness and completeness of data/information. If satisfactory, the RCMA will arrange to send these to CEMILAC and after consultation with them accept the Type Record.

75. When RCMA has accepted the Type Record, the RCMA will notify the firm accordingly in writing and inform them for additional copies of the Type record. The main contractor would also send the copies of the Type Record to DGAQA. Main contractor is responsible for distribution of any subsequent amendments.
76. In cases of stores which are developed by a Sub-contractor, a copy of the Type record and certificate of Design from Sub-contractor shall be sent to RCMA through the main firm. The main firm shall accept the Type record when they are satisfied that the item meets the requirements of CEMILAC. The main Contractor after acceptance of the Type Record shall notify the sub-contractor accordingly and ask for a number of the COD from the sub-contractor. If the sub-contracting firm is not design approved, then main contractor should counter sign the COD and send the same to RCMA for the scrutiny who would follow the above mentioned procedure for acceptance of the type record and take further action accordingly. The main contractor shall be responsible for the completeness and correctness of the type record. After the main contractor accepts the type record from the sub contractor, he shall include this in the main type record as a subsidiary type record. The main contractor is responsible for all subsequent amendments thereof, keeping the main and subsidiary type records up to date. A copy of the Type Record in respect of stores developed by sub-contractors shall be sent to DGAQA by main contractor.

Documentation required for first flight clearance and for Type Approval

77. The main contractor/Design Agency has to submit the following documents to RCMA/CEMILAC for the first flight clearance and subsequent Type Approval. The list given is for aircraft. Suitable lists have to be similarly made for helicopters, engines, systems etc.

For First Flight Clearance

- a) Technical specification
- b) General Assembly drawing and lay out/installation drawings of all major systems including those showing system interfaces
- c) Process specification, if any
- d) Procurement specification in the case of all bought out equipment/items and their approval standard
- e) Environmental specification and environmental map of the entire aircraft

- f) Analysis reports for various systems/equipment/LRU including stress analysis reports
- g) Ground test schedule and Reports for all Systems/equipment/LRU including structures, wind tunnel tests, EMI/EMC etc.,
- h) Aircraft integration procedure and integration test schedules
- i) Test reports of all the ground tests carried out for functional, performance, strength/load and environmental verification of all sub-systems, systems/equipment/LRU and reports of interface and integration tests
- j) Software requirement specification, software testing report, software verification and validation reports.
- k) FMEA/FMECA and reliability estimates
- l) Safety/hazard and risk analysis reports
- m) Weight and CG report with weighing procedure.
- n) Investigation/Analysis of all the failures during ground testing and the rectification/improvements to the system
- o) Build Standard of the prototype/Technology Demonstrator including standard of preparation and performance estimates related to this SOP
- p) Quality assurance procedures
- q) Acceptance test procedures
- r) Draft operating notes (Pilots notes)
- s) Draft servicing/maintenance manuals
- t) Flight test programme and flight test schedule including FTI
- u) Compliance statement document against applicable design standards
- v) Compliance statement document against user requirements.
- w) CIDS, SDP, SDD, SLA, IRS, SQPP, SIT, HSI Documents.
- x) LRU design analysis reports, simulation results of circuits of LRUs etc.,
- y) Cabling documents

For Type Approval

In addition to the above, the following documents shall also be submitted to RCMA for recommending type approval

- a) Flight Test reports
- b) Comparison of performance achieved with those specified in ASR/NSR/GSQR/ISQR
- c) Acceptable SOP for productionisation and production acceptance schedules.
- d) Reliability established actual flight tests
- e) Type record of aircraft and equipment

Release of New Type of Aircraft to the Services

78. When contractor's and official flight trials have reached a suitable stage, the RCMA issues a Provisional Flight Clearance Certificate. This is a formal notification that the aircraft is technically cleared for service use and permits delivery to the services. The release to Service Certificate should contain the Standard of Preparation, Flight Limitations etc.

Steering Committee

79. A Steering Committee is normally constituted by Government to review the progress in the development and manufacture of major development projects, with a view to remove any technical or administrative bottlenecks which may arise in connection with the projects. Such a steering committee as and when constituted should be representative in nature.

Technology Demonstrators

80. There may a need at times for the government to place orders for the development of a technology demonstrator as a prelude to actual prototypes. The technology demonstrators are not released for service use but only serve as a means of proving certain technologies. The procedure outlined above shall generally be followed in respect of technology demonstrators also. As the purpose is to prove or demonstrate the technologies, the main contractor/design agency can be vested with some of the functions/authorities exercised by CEMILAC. Such approval can only be given by CEMILAC. Similarly, DGAQA may also vest some of their functions in the area of QA to the main contractor. When a national project on a multi work centre concept is undertaken for such technology demonstrators, CEMILAC might accept some deviations to the procedure outlined in this chapter to suit local conditions and practices. Such deviations include constitution of Local Configuration Control Board, Central Configuration Control Board etc., which can evaluate changes to the design or shortfalls in design, their effect on overall safety before clearing the same for flight trials.

Aircraft Armament Stores and Weapon Systems

81. The procedure outlined in this chapter and in other chapter are applicable in respect of development and production of aircraft armament stores and weapon systems also. The detailed requirements might vary in view of the explosive nature of the stores and such requirements can be suitably adapted by the Design Agency/main contractor in consultation with the concerned RCMA and DGAQA.

AIRWORTHINESS CERTIFICATION OF MILITARY AIRCRAFT AND AIRBORNE SYSTEMS

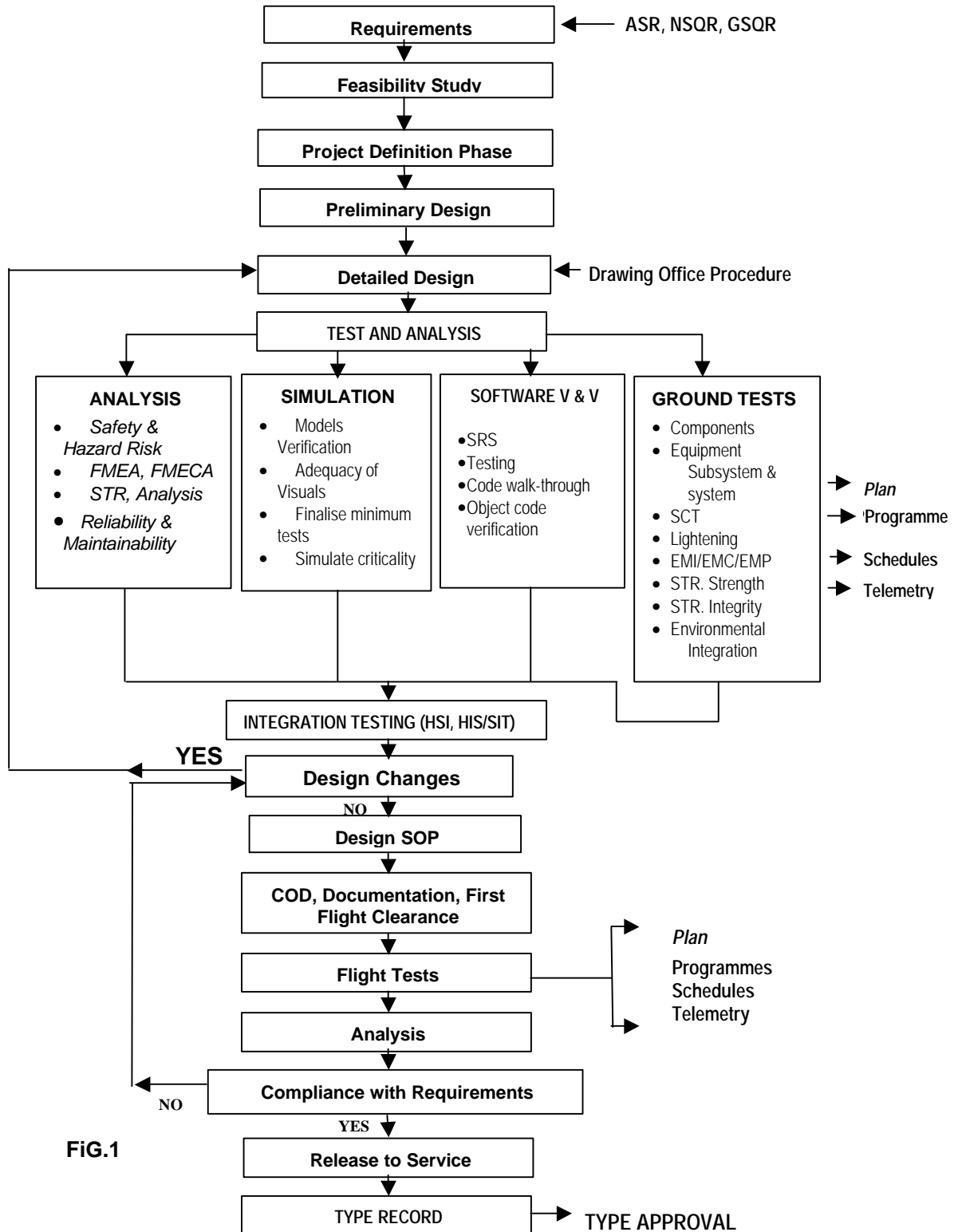


FIG.1

SECTION III

CHAPTER 2

PRE-PRODUCTION, PRODUCTION AND IN-SERVICE PHASE

Contents	Page No.
Control of Drawings and Modifications	41
Drawing Office Procedure	41
Development Drawings	41
Master Record System for Drawings	41
Sealing of Drawings	42
Transition from Development to Production	42
Concurrent Certification Concept	43
Letter of Intent	43
Monitoring of Production Progress	44
Alterations/Amendments	44
Modifications	44
Design Office Procedure for Introducing Alterations/Amendments	45
Procedure for Introducing Modifications-Local Modification Committee	45
Constitution of Local Modification Committee	45
Terms of Reference of Local Modification Committee	45
Miscellaneous Notes on Introduction of Modification	47
Modification Proposal Proforma/Advance Modification Information (AMI)	48
Minutes of Local Modification Committee Meetings	49
Modification Leaflets	49
Local Technical Committee	49
Index of Modification	49
Introduction of Modification by Services	50
Amendments to Publication	50
Interchangeability Requirements	50
Spares	50

Packaging	50
Design Standard of Production Aircraft	51
Production, Ground and Flight Tests	51
Production Quality Tests (PQT)	52
Service Instructions during in-service phase	52
Salvaging of items with minor deviations	52
Production Permit on Production Aircraft	52
Concessions	53
Configuration Control	54
Lifing of Aircraft, Engine, LRUs and Components	54
Maintenance Manuals	54
Defects in Service	55
Review of failures and Defect Investigations	55
Database on Defects, Incidents, Trend analysis of Defects/Failures	55
Overhaul of Aircraft	56

SECTION-III

CHAPTER – 2

PRE-PRODUCTION, PRODUCTION AND IN-SERVICE PHASE

Control of Drawings and Modifications

1. The manufacturing and repair drawings and alterations/amendments, modifications shall be controlled as per procedure outlined in this Chapter.

Drawing Office procedure

2. The contractor shall evolve in consultation with RCMA a detailed Drawing Office Procedure by which, issue and amendment of drawings, specifications etc., are controlled during development and production stages.
3. The guidelines on the drawing office procedure to be followed by the contractor is given at **Annexure- 'J'**.

Development Drawings

4. During development stage CAD facilities shall be utilised. When the same are not available, recourse could be made to temporary drawings. Electronic medium facility should also be used for indexing, storage and updation of drawings during development and production phases.

Master Record System for Drawings

5. The Master Record System proposed to be adopted shall be such as to enable verification of the set of drawings whether it is complete and up-to-date, adjust the set of drawings to take into account of the design changes to work back and ascertain their status at any previous stage of design.
6. The complete set of master records shall comprise :
 - (a) A set of general arrangement and detailed drawings
 - (b) A set of all schedules calling for parts described in the drawings, Ready made articles and service supply items.
 - (c) An Index of approved modifications on amendment sheet.
 - (d) An Index of component schedules
 - (e) An Index of subsidiary master records.

Sealing of Drawings

7. The drawings shall be considered as sealed when the design of the store adequately meets the requirements of the specification and the drawings accurately define the Design Standard. The method of sealing shall be agreed by contractor with RCMA and CRI. Irrespective of the procedure adopted by the contractor, at the completion of sealing, the cover sheet of the Master Record shall be signed as approved by a senior member of the contractor's design organisation and counter signed by RCMA.
8. The changes to the drawings subsequent to sealing or issue of drawings for production purposes, shall be made in accordance with an amendment or modification procedure.
9. The copyright in drawings or other documents shall be the joint property of the main contractor and the sponsoring agency paying for development. However, no third party should be allowed to use the said drawings for any modifications without the consent of the contractor and agency paying for the development of the drawings. This will be without prejudice to requirements of drawings which CEMILAC or its representative requires in connection with examining the technical acceptability of the store.

Transition from Development to Production

10. The transition from development to pre-production/production would largely depend on the status of development of the aircraft/equipment/store. While in the case of equipment, such a stage can clearly be defined, it will not be possible in case of aircraft or major weapon system. In such cases, at a pre-determined stage of the development programme for the aircraft or the system, the Department of Defence Production and supplies would arrange a conference with Service Headquarters, CEMILAC and DGAQA and the Development Agency to discuss the scope of clearance for pre-production/production programme. In some cases the development agency and production agency may be different. In such cases, a very close association of these two agencies is considered essential, so as to ensure successful development and production of the airborne store. Selection and nomination of production agency, in such cases, will be done as per the existing procedure at an appropriate stage, by the Department of Defence Production, in consultation with the concerned department of MOD. During the development phase, the development agency will discuss the project and transfer the detailed technical information to the production agency, to enable them to extend advice regarding materials/components/engineering process/ methods/standards to be used in the production of the airborne store. During the early production phase, the development agency will advise the production agency regarding the design/development problems faced, to ensure smooth transition from development to production.

Whenever transfer of Type Approval of stores from a development agency to a production agency is involved, unless both the agencies are the same, before production is commenced, the stores shall be subjected to full Type Approval Tests for ensuring compliance with the laid down specifications. Changes to the procedure can be agreed to by CEMILAC on specific request.

Concurrent Certification Concept

11. While complete development and full type approval tests including the flight trials may span considerable length of time in order to induct the newly developed aircraft/equipment/ store at an early date to the services, concurrent certification concept may be followed. Based on Limited Environmental tests and Safety Of Flight Tests (SOFT) limited flight clearance may be issued by RCMA for development flight tests without compromising on safety issues. On satisfactory completion of these flight tests and successful completion of all qualification tests of LRUs, RCMA may issue an Initial Operational Clearance (IOC) for the aircraft with the concurrence of users clearly defining the capability/performance of the article/system at that stage and limitations, if any. Limited series production for aircraft may be initiated by the concerned user service based on this clearance. A Final Operational Clearance (FOC) would be issued by RCMA after completion of the development and satisfactory type approval tests/full flight trials. Clearance of LRUs/ Components for installation on the production aircraft/engine should only be after completion of full qualification tests on the LRUs/Components.

Letter of Intent

12. When it has been established that a stage in development programme has been reached for issuing initial clearance/final clearance for pre-production/production of airborne stores, the manufacturers should be in a position to submit a budgetary quotation for the supply of airborne stores including spares, accessories, documents and other items which may be required against order in the pre-production/first production run. The manufacturer should submit a production plan for supply of airborne stores including spares, accessories and documents indicating capital costs involved and the time frame. Based on this budgetary quotation, the Service Headquarters would issue a letter of intent to the manufacturers. The letter of intent may seek guarantee from the Development Agency that rectification of any defects and completion of any phase of development trials would be accomplished to the satisfaction of the user service. As soon as the necessary trials are completed, the manufacturers should provide a firm quotation and delivery dates for the pre-production/production series. On receipt of the firm quotation, the Service Headquarters should convert the letter of intent into firm order by placing a formal indent.

Monitoring of Production Progress

13. The Department of Defence Production would monitor and review at periodical intervals the progress of production, bottlenecks and slippages in production. For this purpose meetings will be arranged by the Department of Defence Production wherein representatives of all concerned Service Headquarters, DGAQA and CEMILAC, main contractor and Design Agency will be invited to participate.

Alterations/Amendments

14. An alteration/amendment is a design change which **does not**
- a) Affect the safety, operational use, reliability or other specification or design requirements of a store.
 - b) Involve significant changes in production or changes which affect stores already produced.
 - c) Affect the cost, the delivery programme of the store or standard of spare parts
 - d) Affect the interchangeability of the store.

The following design changes only will meet the above criteria and can be covered under Amendment/Alteration:

- a) Minor dimensional corrections which do not affect the strength i.e. changes to bring the drawings in line with shop practice and to eliminate drawing errors as well as those which call upon minor manufacturing changes.
- b) Improved method of dimensioning or deletion of redundant dimensions which do not materially affect the part from the point of view of assembly or function.
- c) Minor changes like correction of rivet length, drawing reference, deletions or additions of unimportant notes or corrections of erroneous pictorial views shown.
- d) Corrections in the material schedule which do not seriously affect the cost and the material procurement etc.

Modifications

15. Design changes falling **outside the scope** of alteration or amendment will fall under the category of modifications.
16. Modification may be decided upon at any time during the manufacture of aircraft at works or subsequent to the delivery of airborne store to the customer. They may be introduced by the Design Department as development modifications to the design, affecting any one of the above

mentioned factors or at the request of the customer to meet his special operational or maintenance requirements.

17. Where the categorisation as “Alteration/Amendment” or “Modification” in respect of a particular design change is difficult to be decided, these shall be discussed with RCMA before any decision is taken.

Design Office Procedure for Introducing Alteration/Amendments

18. A suitable procedure shall be evolved by the contractor by which alterations/ amendments are introduced. A typical example of the procedure is shown at **Annexure- ‘J’**.

Procedure for Introducing Modifications - Local Modification Committee

19. A Local Modification Committee provides a forum for discussions on technical and associated matters and to take decisions regarding introductions and applicability of modifications. The Local Modification Committee is formed by Government, when the development is in an advanced stage and the pre-production or production orders are placed. The terms of reference of the LMC are defined in para 24 below.
20. The Local Modification Committee is not concerned with design matters not involving production or matters of purely manufacturing nature not involving design.
21. Design matters not involving production, or matters of purely manufacturing nature not involving design are dealt with directly by RCMA and CRI respectively.

Constitution of Local Modification Committee

22. The LMC will be constituted by the Government. An LMC may be formed at a contractor’s works, which has the design responsibility for the modifications.
23. The LMC will consist of members from RCMA, CSDO, NASDO, MAG(AVN), Air/Naval/Army/CG Headquarters, CRI, CDA, Contractor’s representatives in Design, Production Engineering, Methods Engineering and Quality Control. Chairman of LMC will be the CRE/RD of the concerned RCMA.

Terms of Reference of Local Modification Committee

The terms of reference of the Local Modification Committee will be:

- a) To determine the feasibility and assess justification or other implications of introducing a modification in view of the committee’s close liaison with the firm.

- b) To take decisions with regard to the manufacturer's request for alteration to drawings, changes in specification of materials, manufacturing process.
- c) To decide applicability and the point of embodiment of the modification, to recommend manner of retro-compliance and effect on spares.
- d) To accord technical and financial approval to a modification proposal if found to be acceptable, subject to the financial limits of the LMC.
- e) To accord technical approval and to recommend financial approval by concerned service HQrs in respect of modifications whose cost is beyond the financial powers of LMC

f) Classification of Modifications:

(i) Contractor's Classifications:

Class 'A': Class 'A' modifications are those essential for safety and the absence of which involve, or may have already involved the grounding of aircraft, or impose an unacceptable operational limitation of flying or use of other equipment. They must be embodied before acceptance irrespective of any delay in the delivery of the aircraft/aero engine/equipment concerned and regardless of the scrapping of existing parts.

Class 'B'. This applies to high urgency modifications, required to reduce danger to personnel or to obviate operational limitations or serious maintenance shortcomings. Parts required will be made available as soon as practicable and will be embodied in production at the earliest opportune time. Delay in delivery of aircraft / aeroengine / equipment concerned in order to advance the embodiment in production and the scrapping of existing parts may be authorised by the appropriate authority at Service Headquarters. These modifications will be embodied by contractors during repair or reconditioning and are to be embodied during repair or reconditioning carried out at service repair depots.

Class 'C'. This applies to modifications of the same kind as in class 'B' but not having such a high degree of urgency. This classification does not allow delay in delivery of production but scrapping of existing parts is permissible when authorised by the appropriate authority at Service Headquarters so as to allow embodiment at an earlier point in production than would be the case if all existing parts were used up first. These modification will be embodied by a

contractor during reconditioning and will also be embodied during repair in so far as this can be done without my further stripping than is called for by the repair work concerned. The same conditions are to apply to reconditioning and repair at service depots.

Class 'D'. This applies to improvements of less importance than class 'B' or 'C' which will be embodied in production line when parts already made are used up. Delay in delivery is not permitted. They may be embodied during repair or reconditioning when stocks of unmodified parts are exhausted.

Special Order Only (SOO). The term special order only (SOO) is applied to modifications which are applicable only to a specified number of aircraft/aeroengine/ equipment or to specific types of servicing equipment.

(ii) Service Classifications:

Class 1 modification promoted essentially by considerations of safety. Class 1 modifications are compulsory and are to be embodied immediately.

Class 2 modification of high priority promoted by operational or servicing considerations. Class 2 modifications are to be embodied in aircraft, stores and equipment to the extent and within the prescribed time schedule determined by the appropriate authorities approving the modification and specified in the modification leaflet.

Class 3 modifications representing simple improvement capable of easy embodiment by IAF/IN/IA/Coast Guard and may involve scrapping of unmodified parts.

Class 4 modifications implementing design improvements of lesser importance. Embodiment in aircraft, aeroengine, stores and equipment in use will be undertaken when stocks of unmodified spares are exhausted.

Special Order Only (SOO). Modifications necessary to satisfy limited operational needs.

Miscellaneous Notes on Introduction of Modification

25. The following are some additional guidelines for progression of modifications

(a) Where a particular modification would affect airborne stores at another firm, the LMC shall ensure that the other firm is consulted. This is

particularly important when discussion affects a sub-contractor at whose works there is an LMC which is concerned in this matter. In such an event the other LMC shall be given prior intimation so that, if desired, the representative of that LMC may also attend the meeting.

- (b) Chairman of the LMC may co-opt any other member from the contractor or user services where required.
- (c) When an airframe modification proposal involves introduction of new items of airborne equipment, the LMC at the aircraft firm shall ensure that such items have been approved by Air /Naval/Army HQrs for the particular application and is also type approved
- (d) Modifications arising out of specific request from operating units, shall be considered by LMC after obtaining concurrence of Air/Naval/Army HQrs. A draft cost proposal proforma indicating the financial implications, aircraft from which this mod can be introduced on production, retro-embodiment, redundancy etc., along with LMC's recommendation shall be sent to Directorate of Engineering at Air/Naval/Army/CG HQrs and CSDO/NASDO/Army by the main contractor.
- (e) If the cost of the modification is beyond the financial powers of LMC, main contractor shall obtain the financial approval from user service HQ for embodiment of the modification
- (f) RMS orders should be placed by Service Headquarters for embodiment of modification within a period of three months from the date of LMC approval.
- (g) Suitable procedure shall be evolved for following up equipment modification. If the modification is of an important nature, an airframe mod number shall be given and the mod progressed. If the equipment is common to other aircraft operated by IAF/IN/Army/CG, views of Air/Naval/Army/CG HQrs should be obtained before incorporating the mod. If the Airframe/Engine LMC considers that it is essential to introduce any modification on the equipment used on such airframe/engine, the LMC at equipment firm shall be so advised by the main contractor and RCMA at the main contractor. The equipment contractor/firm shall immediately place before the equipment LMC the proposals for the modifications.

Modification Proposal Proforma/Advance Modification Information (AMI)

26. Every modification put up for consideration by the LMC shall be submitted in format indicated in **Annexure- 'K(i)'**. An Advance Modification information as per format at **Annexure- 'K(ii)'** must be issued by the Design Agency to RCMA, CRI and CSDO (Dett)/MAG (Avn). This has to be technically cleared by RCMA before the modification can be considered by the LMC.

Minutes of Local Modification Committee Meetings

27. Minutes of LMC Meetings shall be circulated by RCMA amongst others to CEMILAC, DGAQA, Directorate of Engineering (Air HQrs), Director of Projects, ASTE, Director of Ground Electronics and Systems (where necessary) and Coast Guard HQrs. Matters relating to the Naval aircraft will be circulated to Director, Naval Air Material/NHQ. In case of Army aircraft the same will be circulated to MAG (Avn) MGO (Avn) and ADGAA(AA-6) at Army HQ.

Modification Leaflets

28. A Mod Leaflet as per format at **Annexure- 'L'** shall be prepared by the contractor for each modification introduced irrespective of whether the mod is complied by the contractor or user. The mod leaflet shall be duly co-ordinated by RCMA. Mod leaflets are to be prepared even in respect of modifications introduced by the Services. The Mod leaflet is the only document which would give exact details of work done, effect on publication, status prior to introduction of Mod, effect on spares etc.

Local Technical Committee

29. There may arise a need to introduce modifications proposed by the licensor on license built airborne stores or bought out airborne stores used on the aircraft. The licensor or Original Equipment Manufacturer (OEM) may not, however, give full details of the modification but give only such minimum details that are sufficient to submit a proposal to the LMC. In such cases, a Local Technical Committee can be constituted by the Chairman of LMC at the contractors works with RCMA as the chairman and members from CRI, contractors design department, production and quality departments, to evaluate the proposals of the licensor. LTC has to evaluate the modification in the absence of the detailed drawings and documentation. Those modifications that have been recommended by the LTC need to be considered by the LMC.

Index of Modifications

30. An Index of Modifications shall be prepared by the main contractor and circulated to Air HQrs, operating units, ASTE, Navy, Army, CSDO, NASDO, MAG (Avn), Coast Guard and various concerned agencies after obtaining the co-ordination of RCMA. The index of modifications shall be as per format at **Annexure-'M'**. The index of modifications is the only document which would give applicability as well as compliance status of modifications on various aircraft. This document must be kept updated once in a year by the main contractor. The (user) modification complied by the user must be

intimated by the user services, to the contractor as and when completed to enable the contractor to update the index.

Introduction of Modifications by Services

31. Minor modifications not affecting strength, safety, reliability, interchangeability, system functioning and operational effectiveness can be carried out by the user services. In such cases, summary of modifications shall be advised to RCMA, DGAQA, Contractor, CSDO, NASDO, MAG(Avn) and Users.

Amendments to Publication

32. Design department of the main contractor is responsible to supply the customer, amendments to all related publications consequent to introduction of the modification. This shall be ensured before introduction of modified aircraft/engine/equipment into service use.

Interchangeability Requirements

33. The interchangeability requirements to the aircraft parts shall be achieved on the first aircraft of a development project or production contract or as stated in the specification.

Spares

34. Based on the technical information provided by the manufacturer, viz. technical manuals, part lists and manufacturer's recommended list of spares, the Maintenance Authority of the Service concerned will, in consultation with the manufacturer, formulate as soon as possible and include in the indent for the supply, their best recommendations for the range, and the quantity of the spares for the first two years of maintenance of the aircraft and to enable their manufacture with the first production run. The indent for the first production run will also cover the initial supply of spares but for the subsequent supply of spares, the Indenting Authority would place separate indents on the manufacturer. It is the responsibility of the manufacturer to deliver spares to the Indentor concurrently with the deliveries of the main equipment in matched quantities. With regard to the aircraft which are likely to be declared obsolescent, for which the manufacturer could stop the line of production, the Indenting Authority will have to place the indents for spares, well in advance so that the manufacturer makes provision for the supply of spares, till the airborne store is finally phased out of service.

Packaging

35. Packaging, wherever applicable, must be considered as soon as Service HQrs have approved the prototype and clearance for pre-production/production run has been given. If the user asked for special

packaging, the development agency at this stage, will finalise the package specifications, make prototype of the package and test the same. Main Contractor shall obtain the approval of RCMA for such packaging. The requirements of special packaging will be included in the Indent by the Indenting Authority and the manufacturers will supply on payment. If no special packaging is specified in the indent, the manufacturers will supply only the trade packaging for the agreed mode of dispatch.

Design Standard of Production Aircraft

36. Depending upon the modification standard, design standard of production aircraft will be updated for a batch of aircraft by RCMA from time to time. RCMA may consult the Main Contractor and user while updating the Design Standard of a batch of aircraft.

Production, Ground and Flight Tests

37. Each production aircraft of a type shall undergo identical standards of ground and flight tests before acceptance. The tests shall be detailed in a schedule of tests, prepared by the contracting firm, in coordination with RCMA and CRI. The Production Flight Test Schedule should also be discussed with ASTE. In respect of Naval and Army aircraft the production flight test schedule should be discussed with Indian Navy and Indian Army. Users should give their comments on the draft flight test schedules proposed for acceptance or further discussion by the designers and the flight test department of the main contractor.
38. The schedule of ground test shall be included in the set of drawings of the aircraft and their associated LRUs as tests necessary for inspection and acceptance purposes.
39. When an amendment is made to the schedule, the issue number will be raised and the change shall be co-ordinated by RCMA
40. The ground test in accordance with the schedules, shall be demonstrated to the satisfaction of CRI. If any production aircraft does not meet the requirement of tests, the subject matter should be referred in the concession proforma at **Annexure- 'O'** to RCMA and CRI, for acceptance. If certain flight tests are omitted because of weather, non-availability of equipment or written instructions from RCMA, it shall be clearly stated in the aircraft documents that such tests have not been made. In the case of aircraft failing to meet the minimum standard for its type, the matter may be stated in the flight clearance proforma. Necessary concession, in format at **Annexure- 'O'** should be sent to RCMA through CRI.

Production Quality Tests (PQT):

41. Apart from the Type Approval/Initial Qualification tests, there is a need to specify Production Quality Tests(PQT)/Line Qualification Tests for all the aircraft components and equipment. Modalities for production and line qualification tests may be worked out jointly amongst Design, Production, QA agencies and CRI.

Service Instructions during in-service phase

42. It may be necessary in the course of production and in-service phase of stores, to issue the following type of instructions.
- ◆ Urgent Operating Notice (UON)
 - ◆ Servicing Instructions (SI)
 - ◆ Special Technical Instructions (STI)
 - ◆ Service Bulletins (SB)

Such instructions are issued to ensure maintenance of the airworthiness standard of aircraft. These instructions shall originate from the contracting firm duly co-ordinated by RCMA. UONs are normally issued by the contractor firm duly co-ordinated by RCMA and flight test department of the contractor firm. These are to be promulgated immediately by Service Hqrs. The SBs are issued either by the licensor in the case of bought out equipment used on the aircraft or the contractor firm. STIs and SIs are issued by the Service Headquarters based on the draft forwarded by contractor firm duly coordinated by RCMA.

Salvaging of items with minor deviations

43. The main contractor shall maintain a "Minor deviation" register listing components with minor deviations. These components with minor deviations can be used on the aircraft/engine/LRU only with prior approval of CRI. Salvaging of items with minor deviations is allowed only for non-serially numbered items. If the items are serially numbered then the procedure outlined in Para 44 apply.

Production Permit on Production Aircraft

44. All deviations from laid down standards or repair schemes on the serially numbered components on the production aircraft and airborne stores, shall be advised by the contractor to CRI and RCMA for acceptance in format at **Annexure- 'O'**. Such deviations and repair schemes can be incorporated only after acceptance by RCMA/CRI. Application for concession in respect of all deviations from the laid down standards and repair schemes on the production aircraft and airborne stores shall be made to CRI, who in turn may refer it to RCMA if required. Once a deviation is referred to RCMA for

grant of Concession/ Production Permit, his decision shall be treated as final.

Concessions

- 45.** There may be occasions when it may not be possible to comply some of the modifications, Service Bulletins or other service instructions due to various reasons. Concessions for non compliance of such modifications and service instructions have to be accepted by the concerned Service HQrs and/or RCMA before the aircraft can be cleared for service use. Granting of concessions depends upon the classification and criticality of the modification and service instructions. No concession can be granted for Class A/1 modifications or flight safety instructions. RCMA's can grant concessions of Class D/4 nature which are non critical. Concessions of Class B/2 and C/3 nature and flight safety instructions have to be discussed in a Local Concession Committee before they can be accepted by either Service HQrs or RCMA.
- 46.** A Local Concession Committee shall be formed at each contractor firm for discussion on the non compliance of modifications and service instructions. The LCC shall be chaired by the Regional Director/CRE and shall have members from CRI, Design and Quality Departments of the contractor firm and user representative. The terms of reference of the LCC are as follows:
- a)** To examine all concessions for non-compliance of modifications of Class B/2 and C/3 nature
 - b)** To examine all concessions for non-compliance of service instructions affecting flight safety
 - c)** To examine the reasons for non-compliance
 - d)** To determine the period for which concession can be granted if concession is acceptable.
 - e)** To accept or reject concessions for non-compliance of modifications of C/3 nature or equivalent instructions.
 - f)** To recommend acceptance or reject concessions for non-compliance of modifications of B/2 nature or equivalent instructions.
- 47.** The LCC is not authorized to grant concessions of Class B/2 modifications but can only recommend acceptance to Service Headquarters. The LCC can accept concessions of Class C/3 modifications. The LCC can also reject concessions of Class B/2 and C/3 modifications and equivalent service instructions. The final acceptance of concessions for non compliance of modifications of Class B/2 nature can only be decided by Service Headquarters based on the recommendations of LCC.

48. Concessions on non-compliance of modifications, SI/STI on manufacturing projects shall be referred to RCMA through CRI for concurrence in format at **Annexure- 'N'**. Concurrence on operational aspects should be in consultation with user.

Configuration Control

49. Configuration defines the functional and physical characteristics of the hardware, software or a combination of both. This would mean either the existing or planned characteristics and are contained in the related technical documentation. If any changes are proposed on the above configuration, then the proposal for the changes should be thoroughly evaluated. The implementation of the approved changes in the configuration should be fully documented. During production phase also, the configuration changes should be managed as detailed in paragraph numbers 38 to 45 of Sec III Chapter 1.

Lifing of Aircraft, Engine, LRUs and Components

50. A Lifing Committee shall be set up at each contractors firm with RD/CRE as chairman and CRI, Chiefs of Design and Quality Control of the Main contractor and Rep of User as members. The Contractor shall, at a suitable stage of the project, forward recommendations on Lifing of stores to RCMA and CRI. The RCMA would arrange discussions/ meetings to consider and review the recommendations. The final recommendations in the form of a minutes of meeting would be forwarded by RCMA to Air/Naval/Army/CG HQrs for promulgation. The lifing committees at airframe/engine contractor firms shall take into due consideration the recommendations of the lifing committee at the equipment firm for all equipment used on such airframe/engine. Generally, the life recommended for the equipment by the equipment lifing committee shall be accepted by the airframe/engine lifing committee. In some cases, there may be need for discussions for resolution of disputes amongst the two lifing committees which shall be arranged by the main airframe/engine contractor firm.

Maintenance Manuals

51. Prior to introduction of the aircraft or engine or any other airborne stores or weapon systems, the contractor firm shall draft the maintenance manuals for maintenance of the stores in service. The periodicity of servicing, the type of servicing, requirements for special test equipment etc., shall be advised to Service Headquarters. Service Headquarters, in turn, shall issue the maintenance schedules for maintenance of stores during the in-service phase. The draft of the maintenance manuals and recommendations for maintenance schedules shall be forwarded by the main contractor to CSDO (Dett)/NASDO/MAG (Avn), RCMA and CRI for their comments. These shall be finalised incorporating the comments of these agencies.

52. A detailed schedule shall also be prepared by the contractor firm for the overhaul of the airborne stores. The periodicity of the overhaul, scope and extent of work during the overhaul, details of the tests including the flight tests, if any, for production acceptance etc., shall be laid down by the contractor firm and shall be accepted by RCMA and CRI after due verification.

Defects in Service

53. Copies of reports of defects and premature withdrawals occurring at the user units shall be sent to the Contractor, RCMA, CRI and User ED or Liaison Cell. The Service Headquarters shall decide on the methodology for defect investigations in consultation with the contractor, CEMILAC and DGAQA from time to time. In the present system, investigations are carried out by the Contractor in the presence of representatives of RCMA, CRI, User ED or Liaison Cell. The final remarks in respect of design matter are indicated by RCMA. The final remarks in respect of Quality related issues are indicated by CRI (Copy of proforma at **Annexure-'H'** will be adopted). The details of the defect and its analysis are to be intimated to Air/Naval/Army/CG HQrs, CSDO, NASDO and MAG(Avn). Defects noticed during production/repair/overhaul phase shall also be dealt with in similar manner. The main contractor shall raise the defect report in such cases which shall be investigated by a team of specialists from main contractor, RCMA and CRI.

Review of failures and Defect Investigations

54. Defect investigations are carried out to ensure that the causes of the defects are properly identified to introduce remedial measures. To ensure that these actions are properly carried out, a review of the defect investigations carried out at the contractor's firm is necessary. Such a defect investigation review committee shall be formed at each contractor firm with Quality Chief of HAL as Chairman with RCMA and CRI, representatives of Quality Department, Production Department and Design Department of the contractor firm as members. The committee shall meet at least once in a month for analysing all defect investigations and review of the necessary remedial measures.

Database on Defects, Incidents, Trend analysis of Defects/Failures

55. A database of all defects and incidents reported by Service Headquarters shall be maintained by the contractor firm. The contractor firm shall also carryout, periodically, a trend analysis of all the defects/failures that have been investigated by the contractor firm. Copies of such trend analysis shall be circulated to Service Headquarters, RCMA, CRI, CEMILAC and DGAQA.

RCMA and CRI in coordination with the contractor firm shall initiate appropriate remedial measures to overcome defects.

Overhaul of Aircraft

- 56.** The procedures given in this chapter for production of airborne stores are also applicable for the overhaul of the airborne stores. These relate to the drawing office procedure, SOP of the overhauled aircraft, introduction of modifications, alterations/amendments, deviations and production permits, concessions, LMC, LCC, procedures for defect investigations, their database and analysis, review of defects etc.

SECTION III
CHAPTER 3
LICENCE PROJECTS

Contents	Page No.
Introduction	58
Production	58
Initiation of Project	58
Agencies for Production	58
Design Approval	59
Approval of Quality Assurance Organisation	59
Control of Document	59
Transition from Licence Agreement to Production	59
Production Quality Tests	60
Monitoring of Production Progress	60
Production Phase	60
Manufacturing Deviations	60
Modification	61
Procedure for Introducing Modifications	61
Local Modification Committee	61
Standard of Preparation (SOP) of Production Aircraft	61
Production, Ground and Flight Tests	61
Non Incorporation of Modifications, SBs and other SIs, LCC	61
Service Defects and Investigation	61
Lifing of Aircraft, Engine, LRUs and Components	62
Indigenous Substitution	62
Flight Tests	62
Major updates or Weapon Integration on Licence built Aircraft	62

SECTION-III
CHAPTER-3
LICENCE PROJECTS

Introduction

1. Government of India may, from time to time, enter into agreements with foreign companies for licence manufacture of a particular product in India. This chapter deals with the procedure to be followed in this context. The foreign company will be referred to as "Licensor" and the Indian organisation to be designated as the executor of the licence agreement for and on behalf of Government of India, will be referred to as "Licencee".

2. ***Production***

Production in this chapter means manufacture, repair and overhaul.

3. ***Initiation of Project***

3. Representatives of CEMILAC and DGAQA may be included in any negotiation by Govt agencies, PSUs and non-Government agencies, for entering into Licence Agreements for production of aircraft/aero engines/airborne stores. The transfer of type record of the equipment and major components from the country of origin to CEMILAC shall be negotiated along with the terms and conditions of the licence projects. It will be incumbent as far as possible upon these agencies viz., Govt agencies / PSUs / Non government agencies, to arrange for the transfer of type record or any technical information (including those of proprietary in nature), the basis for service life/total technical life (flying hours) and calendar life (calendar years) from their collaborator as deemed essential by CEMILAC and user.
4. Data on Reliability and the fatigue life of the aircraft/major systems or equipment/LRUs, the basis of life, load spectrum considered for fatigue life, the tests carried out and the assumptions made in support of determination of fatigue life etc., are to be obtained wherever possible as part of the certification data package.

5. ***Agencies for Production***

5. The Licensed Production Projects of Airborne Stores can be taken up by Public Sector, Private Sector or any Laboratories of Research & Development Organisations of Government, Semi-Government or Private Institutions by award of a contract by Government of India and designated

as the executor of the licence agreement . The agency so awarded with the contract will be called the licensee. This procedure will be similar to all irrespective of the agencies.

Design Approval

6. Design approval of the licensee's firm may be granted by the Chief Executive, CEMILAC after having satisfied himself with regard to the organisation, design development potential, the qualification, experience/background of personnel engaged in such activities and the facilities for such work available in the licensee's firm. The request for such approval shall be made by the licensee to CEMILAC. The terms and conditions for such approval shall be laid down by CEMILAC separately.

Approval of Quality Assurance Organisation

7. Director General of Aeronautical Quality Assurance may grant the Approval of licensee firms Quality Assurance department based on satisfactory organisational set-up and facility. Terms and conditions for such approval are separately laid down by DGAQA from time to time.

Control of Documents

8. After finalisation of the licence agreement and prior to undertaking the production, all the documents received by the licensee from the licensor should be properly listed in a Master Record and released to CEMILAC and DGAQA. The documents required by CEMILAC and DGAQA out of the supplied documents listed in the Master record, shall be provided by the licensee. The licensee shall also make arrangements to obtain and provide such documents that may be required by CEMILAC and DGAQA, even if they are not listed in the Master Record.

Transition from Licence Agreement to Production

9. The licensee should furnish the details regarding production plan, source of supply of raw-material, tooling, inspection equipment, nature and place of training of personnel concerned with production and inspection of the store to CEMILAC and DGAQA as and when required. If so desired by CEMILAC and DGAQA, the licensee shall arrange for the training/familiarisation of the personnel from these two agencies at the licensor's works, expenditure for which shall be included in the licence agreement. DGAQA may carry out an audit on the adequacy of the facilities set up by the licensee in this regard.
10. Depending upon the technical data available in the type record, master record of documents and importance of the air borne stores, CEMILAC in consultation with DGAQA and Service Headquarters may call for additional or special category tests on a few number/batches of air-borne stores manufactured in India by the contractor.

Production Quality Tests

11. Production Quality Tests (PQT) for all Airborne stores shall be carried out as laid down in the licensors' documents. In the absence of such requirements in the licensors' documents, the same shall be evolved based on the existing standards/specifications. Alternately, the modalities for Production Quality Tests could be evolved jointly between the Design, Production and QA agencies and carried out periodically.

Monitoring of Production Progress

12. The Department of Defence Production and supplies would monitor and review at periodical intervals, the progress of production and delivery schedules.

Production Phase

13. At suitable phase of production, CEMILAC may place his resident representative as Chief Resident Engineer/Regional Director to exercise control over design/ development activities and airworthiness of the product. Alternately, he may make necessary arrangements for his representatives to periodically visit the firm as visiting technical officer.

14. Director General of Aeronautical Quality Assurance may place his resident representative as Chief Resident Inspector to exercise control through surveillance and monitoring functions over the QA activity of the firm during production. Alternately, he may make necessary arrangements for his representative to visit the licensee firm periodically to exercise such control.

Manufacturing Deviations

15. During the production, Quality Assurance authority will ensure that the product is in accordance with norms and standards laid down in the documents. The product with deviations from the laid down norms and standards shall be liable for rejection. However, such product may be accepted or salvaged in accordance with the procedure laid down in successive paragraphs and in accordance with the provisions of Para 43 of Sec III, Chapter 2.
16. Deviations on the manufactured components and assemblies involving Quality aspects shall be disposed off by the CRI, DGAQA.
17. Deviations, which in the opinion of CRI are likely to affect the airworthiness of the product, shall be referred to RCMA in form of Concession/Production Permit in the format placed at **Annexure – 'O'**. Once a deviation is referred to RCMA for grant of Concession/Production Permit, his decision shall be treated as final.

Modification

18. Modification in licence production projects shall comprise all changes introduced by the licensor in the form of mod leaflets, bulletins, change notices or any other form. These changes may be with regard to the change in Design, Materials, Processes, Drawings, Technologies, Repair Schemes, Instruction on Inspection, Specifications and Standards. In addition to the above, such changes introduced by the licensee firm to facilitate production, maintenance and quality or as improvement in the design and flight safety, shall also form the part of the modification. All the modifications, SBs and other instructions, introduced by the licensor on licence projects should be put up to the LMC for a decision even if the licensee firm considers that the modifications need not be introduced.

Procedure for Introducing Modifications

19. The procedure for introducing modifications on licence built aircraft is the same as that followed for indigenously designed, developed and manufactured aircraft. The procedure for introduction of modifications is given in para 19 to 30 of Chapter 2 of this Section.

Local Modification Committee

20. The modification as defined above shall be processed by the Local Modification Committee in accordance with Para-19 to 30, Section-III, Chapter-2.

Standard of Preparation (SOP) of Production Aircraft

21. RCMA shall lay down the SOP for each batch of production aircraft in accordance with provisions of paragraph 36 of Section III, Chapter 2.

Production, Ground and Flight Tests

22. Each production aircraft of a type shall undergo identical standards of ground and flight tests before acceptance in accordance with the provisions of paragraphs 37 – 40 of Section III, Chapter 2.

Non-Incorporation of Modifications, SBs and other Service Instructions, Local Concession Committee

23. Concession for non-compliance of the modifications, Service Bulletins and other Service Instructions can be processed through the Local Concession Committee as described in paragraphs 45 to 48, Chapter 2, Section III.

Service Defects and Investigation

24. The defect investigations of all defects reported by the users shall be carried out in accordance with the provisions of paragraph 53 of Chapter 2, Section III. The recurring defects and premature withdrawals shall be reviewed by the Review Committee in accordance with the provisions of paragraph 54 of Chapter 2, Section III. The defect investigation report will be raised similar to the format shown at **Annexure- 'H'**. A database on all defects, and the

remedial measures instituted shall be maintained by the contractor and RCMA in accordance with the provisions of paragraph 55 of Section III, Chapter 2.

Lifing of Aircraft, Engine, LRUs and Components

25. A Lifing Committee shall be set up at each contractor firm with RD/CRE as chairman and CRI, Chiefs of Design and Quality Control of the licensee firm and Rep of User as members. The lifing committee shall periodically review the lifing policy of aircraft, LRUs and components which should normally be based on the feedback data obtained from the user services. The RCMA would arrange discussions/ meetings to consider and review the lifing policy. The final recommendations in the form of a minutes of meeting would be forwarded by RCMA to Air /Naval/Army HQrs for promulgation. The lifing committees at licensee firm shall take into due considerations the recommendations of the lifing committee at the equipment firm for all equipment used on such airframe/engine. Generally, the life recommended for the equipment by the equipment lifing committee shall be accepted by the airframe/engine lifing committee. In some cases, there may be need for discussions for resolution of disputes amongst the two lifing committees which shall be arranged by the main airframe/engine licensee firm.

Indigenous Substitution

26. During the licence production, the licensee may develop indigenous substitute of items in the wider interest of Defence Production. Such activities shall be initiated by the Design Department at the licensee's firm and as such shall be treated as Design and Development activity and dealt with in accordance with the provisions of Sections-IV of this document.

Flight Tests

27. During licence production, necessity may arise to conduct flight tests in connection with approval of modification, indigenisation/third country substitution, life development etc., in addition to production acceptance tests. In such cases, RCMA after having satisfied itself of adequate ground tests and experiments shall lay down flight test requirements, which shall be carried out in accordance with the provisions of Section-V as applicable.

Major updates or Weapon Integration on Licence built aircraft

28. It becomes necessary, during the life time of the aircraft, to introduce many weapons and weapon sub systems on the aircraft. It may also become necessary to update the aircraft with several changes to its original standard of preparation. Such changes may be undertaken by Indian agencies with or without foreign assistance. In all these cases, airworthiness clearance from CEMILAC needs to be obtained. The procedures outlined in Sections III and IV, as applicable, should be followed whenever such updates are proposed.

SECTION III
CHAPTER 4
BOUGHT-OUT AIRCRAFT

Contents	Page No.
Association of CEMILAC and DGAQA	64
Modifications	64
Revalidation of Approvals by Civil Approving Authority	64
Indigenisation of Equipment	65
Major upgradations/Weapon Integration on Bought out aircraft	65

SECTION-III

CHAPTER-4

BOUGHT-OUT AIRCRAFT

Association of CEMILAC and DGAQA

1. As in the case of License built aircraft, aero engine or any other airborne stores programmes, CEMILAC and DGAQA may be associated in the negotiations during purchase of any aircraft, aero-engine or airborne stores to ensure that the certification requirements are met and to ensure that the certification documents and type records, all details about fatigue test, fatigue life, EMI/EMC map, vibration and environmental map, reliability data etc., are transferred whenever possible along with the product. Approved Design agency should also be involved in this process. The requirements as given in paragraphs 3 and 4 of Chapter 3, Section III are applicable for bought out aircraft, aero-engine and airborne stores also.

Modifications

2. It may sometimes be necessary to carry out modifications on bought out aircraft airframe, equipment or aeronautical stores, which are in use with the Services in addition to those introduced by the manufacturer of the bought out aircraft. The procedure for obtaining technical clearance from CEMILAC in regard to modifications affecting structural strength and systems safety and reliability, is similar to those outlined in Section-III, Chapter-1. The procedure will apply whether changes are carried out by Public Sector, Private Sector, Government R&D agencies, IAF, Indian Navy and Indian Army. The user services can introduce modifications not affecting the structural strength, reliability, safety, system functioning, operational effectiveness in accordance with existing instructions on the subject.

Revalidation of Approvals by Civil Approving Agency

3. On certain occasions, it may be necessary to consider aircraft, aero-engines, major airborne equipment Type-cleared by Civil Agencies, for use in Services.
4. Since the operating envelope and conditions of operation may be different for Service use, the Civil Certificate issued for aircraft, engines or major airborne stores may require revalidation by the CEMILAC. The procedure to be followed would be advised on specific reference to CEMILAC.

Indigenisation of Equipment

5. In certain cases it may be necessary to indigenously develop equipment in lieu of those used on the bought out aircraft. Such indigenously developed equipment shall have to be Type approved by CEMILAC in accordance with procedures outlined in Section III and Section-IV as applicable. Where the proposed indigenously developed equipment is likely to affect the Air Staff Requirement/Naval Staff Qualitative Requirements/General Staff Qualitative Requirements/Inter Services Qualitative Requirements of aircraft or its equipment, acceptance of Services shall be obtained prior to undertaking the development.

Major upgradations/Weapon Integration on Bought out aircraft

6. It becomes necessary, during the life time of the aircraft, to introduce many weapons and weapon sub systems on the aircraft. It may also become necessary to upgrade the aircraft with several changes to its original standard of preparation. Such changes may be undertaken by Indian agencies with or without a foreign collaborator. In all these cases, airworthiness clearance from CEMILAC needs to be obtained. The procedures outlined in Sections III and IV, as applicable, should be followed whenever such updates are proposed.
7. Weapon integration using several new or even existing armament stores on aircraft with services is a continuous process. As this affects overall safety of the aircraft, this should be considered as a development programme and the approval of CEMILAC is necessary. The procedures for clearance of such airborne stores or weapon systems is outlined in Section III. RCMA (AA), Pune is the designated RCMA for undertaking the clearance work in respect of weapon stores. RCMA (A/C), RCMA (Helicopters), RCMA (Nasik) and RCMA (Kanpur) are the aircraft and helicopter RCMA's which will undertake all clearance work in respect of all systems of all helicopter and aircraft normally dealt by them.

SECTION IV
INDIGENOUS DEVELOPMENT AND PRODUCTION OF AIRBORNE
EQUIPMENT, RAW MATERIALS AND AGS PARTS

Contents	Page No.
Initiation of Project	67
Specification, Qualitative Requirements, Service Requirements	67
Major and Minor Airborne Items	67
Classification of Components	68
Categories of Items Indigenised	68
Items for which Licence Agreement is Available	68
Items for which Technical Specifications, QTP and PAT are available	69
Items for which only Technical Specification is available	69
Raw Materials	69
Standard Parts	70
Use of COTS in Electronic Items	70
Items for which no Technical Information is available	70
Procedure for Indigenisation under LTCC	70
Formation of LTCC	71
Terms of Reference of LTCC	71
Approval of Non critical items	71
Test Schedule and Test	71
Association of the Quality Assurance Authority	72
Observation of User Evaluation Agency	72
Procedure for Indigenisation	72
Sealing of Drawings	75
Promulgation of Type Approval	76
Quality Assurance	76
Withdrawal of Type Approval	76
Control of Drawings and Modification	76
Renewal of type Approval	76
Stores Developed Abroad Specifically to Indian Specification	76
Acceptance of Deviations	77
Approval of Proprietary Materials or Process	77
Defects	77
Raw Material/ Component Approval	77

SECTION-IV

INDIGENOUS DEVELOPMENT AND PRODUCTION OF AIRBORNE EQUIPMENT, RAW MATERIALS AND AGS PARTS

Initiation of Project

1. The Development of airborne equipment, raw materials, processes and AGS parts can be undertaken by any agency i.e. Public Sector, Private Sector, Government Agencies, ADA, IAF/IN/IA etc. In general, where an item of raw material, AGS parts, airborne equipment or component is manufactured to defined drawings, material specification and processes; and approval by certifying Authorities elsewhere are available, a fresh Type Approval may not be necessary. If the item cannot be produced exactly to the specification, the approval of the CEMILAC should be obtained. In cases where the item developed would not affect safety, reliability, maintenance, interchangeability and operational effectiveness, the Services may, in certain cases, permit the use of such items on aircraft after the same have been approved by LTCCs constituted in BRDs/NAY as brought out separately in para 14. Occasions may arise when the Airborne Equipment, Raw Materials or Standard Parts, which were hitherto bought out from a foreign source and used on the aircraft or the main equipment may have to be designed and developed within the country for the sake of self-reliance, to obviate obsolescence etc. This Chapter deals with the detailed procedures for development, prototyping, testing, evaluation, approval and production of such items being indigenised. The procedure outlined is applicable for the stores developed by the Public Sector, Private Sector, Government Agencies or the Services.

Specification, Qualitative Requirements, Service Requirements

2. As has earlier been mentioned, the project for development of airborne equipment, raw materials etc., could be initiated on specific requirements by the user services or the Design Authority on their own can initiate development of an airborne store to a specification which might be of interest to users. In the former case the detailed Air Staff/Naval Staff/General Staff Requirements/Inter Services Requirements or Qualitative Requirements would be provided by the user services. Qualitative Requirement is a document stating the minimum performance required of the equipment, the environment in which the equipment could be used and the impact on other systems.

Major and Minor Airborne Items

3. Airborne items are classified as Minor and Major Equipment. Classification into major and minor equipment, critical, non-critical shall be decided by the

Main Contractor in consultation with RCMA. Minor items are those which do not affect the Safety and Interchangeability aspects of the Aircraft Maintenance and Operation. Proprietary items which are being imported which constitute only forming and machining operations may also be considered as Minor Equipment. Electrical Black Boxes, Electro-Mechanical Hydraulic, Pneumatics, Components, Brake Pads etc. shall be considered as major items.

Classification of components

4. All components taken up for indigenous development shall be classified in to the following categories based on the criticality and functional importance.

Flight Safety Critical: The failure of components, systems or items endanger the safety of the aircraft or crew.

Mission Critical: The failure of the components, systems or items result in aborting the aircraft mission

Non critical : The failure of components does not endanger the safety of the aircraft and crew nor does it result in aborting the mission.

The approach to certification and type approval including the extent of testing would depend on the criticality of the component.

Categories of Items Indigenised

5. For the sake of convenience and also to clearly define various procedures, the airborne items which are to be indigenised could be divided into the following four categories.

- (a) Items for which a licence exists for indigenously manufacturing the same.
- (b) Items for which Technical Specifications, Qualification Test Procedure (QTP) and Production Acceptance Test (PAT) requirements are available.
- (c) Items for which only Technical Specification is available.
- (d) Items for which no technical information is available.

Items for which Licence Agreement is Available

6. In such cases where the Licensor provides all Technical Information, Drawings, Material Schedule, Details of Tooling, Manufacturing Process, Acceptance Standards etc., the following procedures and as those given in Sec III, Chapter 3 shall be followed for the indigenous manufacturing and acceptance of such items :

- a) The Quality Control Department of the Main Contractor, who is the approved Licence Manufacturer, shall ensure that items are manufactured, assembled using the specified materials, consumables and Manufacturing Process, Validate the Items with reference to the test schedule/test specification and accept these items.
- b) Wherever the Licensors themselves specify the requirement for testing and validating first off Components/Assemblies, the same may be carried out as per the Licensor's acceptance test schedule.
- c) The list of such items so indigenised shall be intimated to RCMA and DGAQA.

Items for which Technical Specifications, QTP and PAT are available

7. For those items for which Technical Specifications, Qualification Test Procedure, Production Acceptance Test requirements are available, the main contractors themselves may take up development of such items after consultation with RCMA. Results of the tests would be compiled as a Type Record and submitted to CRE/RD concerned for issue of Provisional Clearance, if necessary and Type Approval thereafter. The batch acceptance of the store shall be as per the PAT. When materials are indigenised under this category, the materials so indigenised shall be permitted for fabrication of all types of components whenever called for in the original specification or drawings. If items are being indigenised to the licensers drawings, technical specification and QTP, Type Approval may be necessary in some cases but certificate of design may not be necessary.

Items for which only Technical Specification is available

8. Although many items can fall under this category, raw materials and standard parts only are discussed in the following paragraphs. The principle of indigenisation described in these paragraphs is the same for all components whenever only technical specification is available. Standard parts includes AGS parts also.

Raw Materials

9. Metallic materials and Rubber Compounds may be developed based on available material specifications and end use details. Type test schedule shall be prepared by the main contractor in consultation with RCMA. Such Type test schedules are normally based on existing well known standards/airworthiness requirements. Batch acceptance test schedule shall be prepared in consultation with CRI, DGAQA. Results of the tests as per the approved test schedule would be compiled as a Type Record and submitted to CRE/RD concerned for issue of Provisional Clearance and full Type Approval thereafter. A copy of the provisional Clearance and full Type approval along with the copy of the Type Record giving the results of the tests as per the approved test schedule shall be sent to DGAQA by

RCMA/CEMILAC. CRI, DGAQA shall forward the production acceptance test schedule to RCMA.

Standard Parts

10. Wherever information on Material, component Drawing, Process etc. are available, the Main Contractor may develop the standard parts using the material specified. The main contractor may sub-contract these items for development to private vendors by supplying the approved raw materials. The design department in consultation with the Quality Control Department shall issue indigenisation clearance of the items after carrying out tests indicated in the drawing and/or carrying out end use functional checks. The list of the items so indigenised shall be notified by the main contractor to RCMA and CRI.
11. Wherever information on the material and component drawings are not available these shall be generated by carrying out detailed load analysis, strength tests, other operational and flight tests etc., by the main contractor/approved Design Agency. The material specification shall be arrived at after testing a sample. The component drawings shall be coordinated if so considered necessary by the concerned RCMA. In case the original material is not available, the Design Department may substitute it with an equivalent material in consultation with RCMA. Tests requirement shall be defined by the Design Agency in consultation with RCMA and DGAQA.

Use of COTS in electronic item

12. The use of COTS in electronic items shall be in accordance with the provisions of Joint Services Guide JSG: 755:2001

Items for which no Technical Information is available

13. These types of items require major effort from all agencies concerned. These items may be classified as Minor and Major Equipment. Classification into major and minor equipment, critical, non-critical shall be decided by the LTCC. The procedure for indigenisation of such components is described in the succeeding paragraphs.

Procedure for Indigenisation under LTCC

14. The items to be indigenised shall be discussed in the LTCC. It shall be formed at the works of main contractors or other agencies such as BRDs/NASDO for speedy clearance of indigenised products. One of the objectives of LTCC is to reduce the amount of documentation and development time frame of non critical items and to progress/monitor the approval of critical items. While the items classified as "Flight Safety Critical" or "Mission Critical" shall have to undergo the full extent of Type Approval

as per guide lines outlined in para 22 below, the procedure for non critical items is described under para 15 to 17 as below.

Formation of LTCC

15. The LTCC shall be constituted as follows:

Chairman : CRE/RD of the RCMA
Members : Head of Indigenisation
Rep of the Design Department of main contractor
Head of Quality Department of main contractor
Head of Laboratory of main contractor
CRI
User representative

Terms of Reference of LTCC:

16. (a) To assess and categorise the criticality of the item i.e flight safety critical, mission critical or non critical
(b) To refer the flight safety critical and mission critical items to RCMA for approval and to progress/monitor the approval of such items through RCMA.
(c) To approve the usage of non critical items as described in para 17 below.

Approval of Non critical items:

17. LTCC is authorized to approve non critical items after ensuring the following.
- (a) Ensure that the non-critical items are end specific and not generic in nature.
(b) Asses the extent of tests already carried out
(c) Advice the main contractor additional test requirements, if any
(d) Discuss test results and evaluate the product
(e) Accept usage of non critical items if the members are satisfied that adequate evaluation and testing has been carried out
(f) Ensure that the main contractor maintains a database of all the items approved by the LTCC.

Test Schedule and Test

18. Test Schedule shall be proposed by the Designer of the equipment. The test schedule shall normally be in accordance with the technical specification of the equipment. A copy of the draft test schedule shall be forwarded to RCMA and OCRI for their comments. RCMA shall examine its adequacy and suggest additional tests, if required and approve the same. Tests shall be carried out at an approved test house/laboratory. RCMA and CRI would advise whether witnessing of the tests by their representative would be

required. The final responsibility for approval of the test schedule shall rest with RCMA.

19. The test schedule should normally contain the following:
- (a) Details of the items to be tested
 - (b) Standard of preparation and drawing applicability of the item to be tested
 - (c) Objective and aim of the test
 - (d) Details of the test equipment, rigs etc., used
 - (e) Test Procedures/Test Orders/Test Specifications
 - (f) Measurements to be taken and instrumentation required
 - (g) Pass / fail criterion
 - (h) Number of samples to be tested
 - (i) If more than one test is to be carried on the same sample, then the sequence of the tests to be conducted
 - (j) Environmental Conditions

Association of the Quality Assurance Authority

20. The Quality Assurance Authority for Aeronautical Stores, namely, DGAQA shall be associated throughout the process of development of every store/equipment in connection with witnessing/carrying out tests and assessing the capacity of prospective production agencies for undertaking bulk manufacture. This would facilitate the Quality Assurance Authority in discharging their Quality Assurance Functions as called for at Para 22(s) below.

Observations of User Evaluation Agency

21. In regard to certain items of equipment it may be necessary to carry out flight tests and obtain views of the users through IAF/ IN / ARMY before formal Type Approval is given.

Procedure for Indigenisation

22. The procedure for indigenisation of flight safety critical and mission critical items is outlined in the following paragraphs.
- a) The starting point for indigenisation is the availability of the specification to which the item is to be developed. If a specification already exists as described in paragraphs 7 and 8 of this section, the same specification shall be used in the indigenisation. If no specification is available, then the main contractor or the Design Agency shall prepare a technical specification to which the item is to be developed. The technical specification shall be finalised in consultation with RCMA.
 - b) The main contractor shall identify the specialist firms/vendors for the development/manufacture of such items based on the previous

experience or after assessing their capabilities/or based on their quality approvals. RCMA/DGAQA may also suggest the prospective Vendors. Design assessment of the firm shall be carried out by RCMA/CEMILAC and quality control assessment of the firm shall be made by main contractor and if considered necessary a Quality Audit may be carried out by DGAQA. More than one Vendor may be identified, if required. The selected Firm/Vendor may be supplied with the specification already drawn including brief write-up.

- c) The vendor shall prepare the necessary drawings for the item. In some cases, the main contractor/Design Agency themselves may prepare the drawings. The drawings shall be approved by RCMA after completion of all type test requirements. Requirement for approving/coordinating the drawings can be waived off by the RCMA at its discretion if the development is undertaken by public sector undertakings.
- d) Simultaneously the main contractor/approved design agency shall prepare the necessary Type Test Schedule based on the Technical Specification in coordination with RCMA. While drawing up the Test Schedule, the availability of test facilities within the country should be taken into account. However essential tests shall be carried out irrespective of availability of facilities within the country.
- e) During the development phase of the item a close interaction between the main contractor, the Vendor, RCMA and CRI may be ensured. The Vendor shall use approved materials/components/fasteners etc. and maintain traceability. The Main contractor /Vendor shall prepare all documentation pertaining to manufacturing, assembly, wiring drawings and material schedules and submit the same to RCMA. Where use of unapproved materials/components are inevitable, the requirement stated at Sec III, Chapter 1, Para 37 shall apply.
- f) When the Vendor is ready with as many prototypes as indicated in the type test schedule, the same shall be inspected by the Quality Control Department of the main contractor and CRI for conformity to the drawings.
- g) On satisfactory completion of the prototype inspection, the items may be formally cleared for Type Tests by RCMA.
- h) The main contractor or the Vendor shall provide the programme of type tests and the name of the Test Centre to RCMA and CRI. The tests may be witnessed by RCMA Reps along with the Main Contractor's Design and Quality Control reps. The tests would be witnessed and the test reports thereof coordinated by CRI. Whenever the tests are carried out

at approved laboratories such as DRDO, ETDC, HAL etc., if CRI is unable to provide full coverage owing to any constraints, then CRI may resort to alternate coverage plans based on their past experience on similar items, significance/criticality of test concerned etc. The RCMA may accept the test results based on the report submitted by either the CRI or the Design and Quality Control Department of the main contractor duly coordinated by CRI.

- i) As far as possible tests may be carried out in the same sequence as indicated in the Type Test Schedule. Deviation if any, may be discussed in a common forum like LTCC for arriving at a decision.
- j) In case of failures of the items during type tests, the same may be analysed in co-ordination with RCMA and DGAQA. Remedial measures shall be implemented after the concurrence of RCMA and the drawings duly amended. The tests may resume after inspection by QC and DGAQA.
- k) On satisfactory compliance of the type tests, the items shall be flight evaluated if called for in the Type Test Schedule. The flight test schedule shall be drawn up by the Design and Flight Test Department in co-ordination with RCMA. User flight evaluation is required only if the item affects the performance of the aircraft, aircrew operation or display.
- l) A type record shall be prepared by the main contractor's Design Dept and submitted to the RCMA. After scrutinising the Type Record, RCMA, may issue Provisional Clearance for those items requiring airworthiness clearance as decided by LTCC for the fitment of the items on aircraft. This clearance shall be for a period of not less than one year. RCMA may also consider issuing provisional clearance considering the adequacy of tests completed at that point of time even if some of the long endurance lifing tests are not completed.
- m) The development agency should submit an application for Type Approval of the item as per format at **Annexure - 'P'**. CEMILAC shall have the sole responsibility of Type Approval for those items requiring airworthiness clearance as decided by LTCC irrespective of whether the item is developed by HAL, Private industry, Government agencies, or the services.
- n) A complete Type Record indicating the salient features of the equipment, including performance, electrical and other characteristics along with test schedules, results of tests etc., shall be forwarded along with the application.

- o) A Certificate of Design in a format similar to the one indicated in **Annexure-'F'** shall be submitted to CEMILAC along with the application for Type Approval.
- p) RCMA shall recommend to CE, CEMILAC for according type approval for the item. CEMILAC shall issue Type approval on the basis of RCMA recommendation. The Type approval shall be valid for a period not less than five years. After satisfactory completion of type approval tests and based on RCMA's recommendations, CEMILAC will issue the Type Approval as per the format in **Annexure 'Q'** certifying that the product meets the test requirements mentioned in the type record.
- q) The in service performance shall be monitored by the main contractor. In case any modification is required to obviate in service problem, the same shall be progressed as per the Modification Procedures (Section III, Chap-2) and recorded. The same modification procedure shall be adopted in case of change of design, components due to obsolescence.
- r) The Type approval shall be renewed on expiry by CEMILAC after ascertaining the in-services performance of the item from the main contractor, DGAQA and the user service. Wherever necessary, requalification of the product may become necessary by carrying out the type approval tests.
- s) The production acceptance test schedule may be prepared by the Quality Control Department of the main contractor in co-ordination with CRI. The Type Test Schedule shall be the basis for the preparation of the Production acceptance test schedule. The Quality Control Department of the main contractor shall carry out capacity assessment of their sub contractors through whom the stores are proposed to be indigenised in respect of their capability and facilities available before placement of any supply orders on them. The capacity assessment reports of their sub contractors shall be furnished by the main contractors as and when requested for by DGAQA. If required, a Quality audit may be carried on any sub contractor by DGAQA, when the stores are under bulk production. Accordingly, the QC department of the main contractor would primarily be responsible for the acceptance of the stores from the sub contractors. A copy of the production acceptance tests shall be forwarded to RCMA by CRI.

Sealing of Drawings

23. Concurrently with the issue of Type Approval, the drawings, processes and specifications shall be sealed by the CEMILAC and changes to these would be progressed in accordance with the procedure outlined in Para 27 below.

Promulgation of Type Approval

24. After issue of Type Approval, the same shall be promulgated by CEMILAC for information to all agencies. CEMILAC would periodically promulgate a list of approved items. CEMILAC shall forward to DGAQA a set of approved/sealed drawings along with complete Type Record for clearance of bulk production of the items approved.

Quality Assurance

25. The fact that the Type Approval has been issued would not mean that the products manufactured by the applicant would be acceptable. The agency manufacturing the item shall ensure that the bulk manufacture would be of same quality as items Type Approved, and for this purpose, the requirements called for by the DGAQA shall be met.

Withdrawal of Type Approval

26. If for any reason, the Approving Authority is not satisfied about the performance of the equipment or item based on the feed backs, after due investigation and consultation with Main Contractor the Type Approval earlier issued would be withdrawn. The DGAQA and the User agencies like IAF/IN/IA would be informed about such withdrawals.

Control of Drawings and Modification

27. Any minor changes to the Type Record of an equipment, material or process shall be introduced in the form of a modification or proposal for alteration to the Type Record. The Approving Authority shall be advised about these changes. After verifying that the changes meet test requirements the Approving Authority would issue an amendment to the earlier Type Approval, indicating the modification or alteration on the Type Record.

Renewal of Type Approval

28. The Type Approval shall be valid for a period of 5 years and has to be renewed by CEMILAC every five years. At the time of renewal of Type Approval, Type Approval tests may have to be carried out again if feed back data on the performance of the item from users or DGAQA warrants such repeat tests. The type tests shall also be repeated whenever there is a change in the source of manufacture, material, major design change to the component, process etc or when adequate reasons exist, by way of lapse of time, constraints of manufacture and other circumstances. An already type approved equipment shall be subjected to repeat type approval testing when the equipment is produced under licence.

Stores Developed Abroad Specifically to Indian Specification

29. Projects for development of airborne equipment, raw material etc. could be undertaken by foreign firms on specific requirements with approved tech

spec/test schedules from Indian agencies. The airborne equipment so developed may be accepted for use in India if approval for the same is accorded by certifying authorities of the country of origin. However, in the event of such approval not forthcoming from the authorities of the country of origin, type approval from CEMILAC should be obtained. The procedure for obtaining the approval of CEMILAC shall be the same as that for an equipment developed in India.

Acceptance of deviations

30. The deviations observed if any, during the course of indigenisation are to be discussed amongst representative of CEMILAC, DGAQA and the Main contractor and if agreed to, the test schedule needs to be amended accordingly. Once Type Approval is issued no changes in the formulation or in the Test Schedule shall be made without prior agreement of CEMILAC who would decide, depending upon the significance of the change, whether it warrants any change in the Type Approval letter or not. The changes for Type Approval letter would be issued by a suffix to the approval number or by allocation of a new number.

Approval of Proprietary Materials or Processes

31. In order to obtain approval for a proprietary material or proprietary process for use in the construction, operation or repair of aircraft or aeronautical equipment, the manufacturer of the proprietary material or proprietary process shall apply to CEMILAC through concerned RCMA giving information as called for in **Annexure-‘P’** as well as evidence of demand, for use of the material or process. Details of tests to demonstrate the particular use of the material shall also be forwarded.
32. Approval of CEMILAC for the proprietary material or process is contingent upon satisfactory results being obtained from tests on sample submitted for approval. The approval letter shall indicate clearly extent of approval of the process, and must be quoted on relevant drawings, contracts, and other documents, wherever the material or process is specified.

Defects

33. Guide lines of Chapter 2, Section III, should be followed for reporting and investigations of all defective items indigenously developed through vendors and approved by CEMILAC.

Raw material/Component Approval

34. Raw materials / components procured from approved sources and certified by CEMILAC/appropriate authority shall only be used.

SECTION V
CHAPTER 1
DEVELOPMENT FLIGHT TESTING

Contents	Page No.
General	79
Agencies for Flight Testing	79
User Agencies Association in Flight Testing	79
Responsibility for Flight Testing	80
Persons Authorised for undertaking Flight Tests	80
Flight Tests by ASTE/IN/Indian Army	80
Joint Flight Development Trials with ASTE/IN/Indian Army as Appropriate	81
Flight Tests by R & D Agencies	81
Flight Testing of Prototype or Technology Demonstrator Aircraft	81
Certificate of Flight Trials	81
Flight Tests	82
Installation of Flight Data Recorders	83
Flight Limitations	83
Urgent Operating Notices	84

SECTION – V
CHAPTER 1
DEVELOPMENT FLIGHT TESTING

General

1. Every aircraft under development has to undergo extensive flight testing to validate the design, to obtain the actual performance of the aircraft and to ensure its airworthiness and safety. Flight testing would also be necessary in the development of aero engines, systems and weapon integration for indigenously developed aircraft, licence built or bought out aircraft. In the course of development of new equipment or in the extension of use of an existing equipment to another aircraft, flight testing may be necessary. The tests may be necessary because the functioning of equipment is related intimately to the characteristics of the particular aircraft installation or because airborne environmental condition cannot be simulated adequately in the Laboratory. If the tests are to be carried out on indigenously manufactured aircraft, these are done as part of the main aircraft development programme and as such, will be the responsibility of the main contractor. The installation shall meet the requirements specified by the RCMA located at the aircraft firm.
2. The procedures and guidelines for flight testing of an aircraft indigenously designed and developed and for undertaking flight tests for weapon/armament or other stores integration on indigenous, licence built or bought out aircraft etc., are described in this Section. This section also covers flight testing of equipment on indigenously developed aircraft, licence built or bought out aircraft.

Agencies for flight testing

3. The flight test department of the main contractor (indigenously developing or manufacturing aircraft under licence), ASTE, APT and NFTC are the authorised agencies for undertaking flight testing. The main contractor is responsible for the flight test of the aircraft, equipment and installation designed and developed by them. NFTC is responsible for those aircraft for which they are the designated flight test agency. The Aircraft and Systems Testing Establishment is responsible for all flight tests requirements originated by IAF and DRDO and APT for requirements originated by the Army.

User agencies association in flight testing

4. ASTE will be fully associated during all flight trials on joint development projects which are carried out by main contractor such as HAL or any other agency. CSDO, NASDO, APT, MAG (Avn), Indian Navy or NFTC will be associated during such trials as and when necessary. If the aircraft belongs

to IAF, Air Headquarters would be either allotting aircraft to the developing agency or taking the action for planning of trials. In case of Naval/Army aircraft, Indian Navy/Army would be concerned with all aspects relating to the aircraft. The user service HQ may nominate agencies like MAG(AVN)/NASDO/CSDO to associate with the flight test programme.

Responsibility for flight testing

5. The Chief Test Pilot or equivalent of the main contractor will be responsible for the flight testing of all experimental, technology demonstrator or prototype aircraft being developed by the main contractor for which they are the test pilots. Similarly the head of NFTC will be responsible for the flight testing of LCA or any other aircraft for which it is the designated flight test agency. The CTP or equivalent of the main contractor/ Head of NFTC is responsible for the safety of the aircraft being flight tested by their respective agencies. The flight test schedule shall be prepared by the Design Agency and the flight test department of the concerned agency and finalised in consultation with RCMA.
6. For joint development flight testing with user service pilots, the CTP of main contractor/Head of NFTC should indicate the QRs for service pilots and the service HQs will select and approve such pilots to participate as the crew member(s) for a particular phase or entire series of flight -tests. The details of the crew are to be conveyed to the CTP of contractor prior to the commencement of flight tests. Similar procedure is to be followed, wherein the responsibility of flight tests is with Commandant of ASTE.

Persons authorised for undertaking flight tests:

7. Only test pilots/test engineers, who have successfully undergone a course in experimental flight testing are authorised to undertake flight testing of experimental, prototype or technology demonstrator aircraft under development as a flight crew member. Similarly, persons who have successfully undergone the production test pilots course are authorised to flight-test production aircraft of HAL, BRDs/NAY or any other main contractor. Non qualified persons are not authorised to be crew members in any developmental flight testing or even as passengers in multi crew aircraft during such developmental flight testing. In exceptional cases, however, the CTP/Head of NFTC can authorize in writing specific individuals (non flight-test crew) on specific flights.

Flight Tests by ASTE/IN/Indian Army

8. Any development aircraft may be offered by the main contractor to ASTE/IN/Indian Army (Flight Test Agency of user) during any stage of development for assessment. The main contractor shall ensure that ASTE/IN/Indian Army are officially intimated regarding the nature of tests so

far carried out along with flight limitations, instrumentation details etc. The aircraft shall be cleared only for specific tests within the envelope of tests carried out by the contractor. The certificate of flight trials shall be coordinated by RCMA.

Joint Flight Development Trials with ASTE/IN/Indian Army as Appropriate

9. In order to minimise cost and time, the user trials may concurrently be carried out by ASTE/Indian Navy/Indian Army as appropriate along with the development flight tests carried out by the contractor's test pilots. The test crew has to be qualified and appropriately authorised. The sharing of the joint development flight tests shall be mutually agreed by the contractor and the concerned service HQs. The procedure for flight programme, briefing/debriefing, data analysis etc will be identical to those followed for development flights by the contractor's pilots, outlined in this Section.

Flight Tests by R&D Agencies

10. It may be necessary for R&D Laboratories to carry out certain specific flight tests in the context of their R&D work. The manner in which the flight tests are planned and executed would be worked out by the concerned R&D laboratory in consultation with IAF/IN/Indian Army or main contractor as appropriate. The design agency responsible for the aircraft serving as the flying test bed will seek flight clearance from the designated RCMA for conducting flight development. The designated RCMA will examine mandatorily safety of flight issues and also performance, if so requested by the concerned R&D laboratory. For carrying out a particular flight, the certificate for safety of flight is to be issued by CRI.

Flight Testing of Prototype or Technology Demonstrator Aircraft

11. Flight testing of prototype, experimental or technology aircraft or aircraft with major system changes can be undertaken only after all ground tests have been satisfactorily completed and RCMA is satisfied that clearance can be accorded for flight testing of such aircraft. The procedure for undertaking such development flight tests are described in the following paragraphs 12 to 27.

Certificate of Flight Trials

12. Flight trials of a new type of aircraft or of aircraft in which design changes have been incorporated or where existing flight limitations are to be extended, are authorised after the appropriate Certificate of Flight Trials has been endorsed by RCMA. The format of Certificate of Flight Trials issued, shall be as per **Annexure-'G1 and G2'** or equivalent format decided by RCMA for Aircraft and Helicopter respectively. Checklist for

documentation required for flight clearance/airworthiness certification is given in Sec III, Chap 1, paragraph 77.

13. The Certificate of Flight Trials shall be completed and signed by the Chief of Design of the Contractor. Three copies of the Certificate of Flight Trials shall be passed on to the RCMA together with such documents as are considered necessary. The RCMA on being satisfied with the adequacy of the certificate, shall endorse and forward one copy to CRI.
14. In cases where a fresh issue of Certificate of Flight Trials is not warranted, day to day flight limitations can be endorsed in the flight programme and for this purpose, the day to day flight test programme shall be co-ordinated by RCMA. Bulk clearance for a series of flight tests can also be authorised by RCMA provided, there is no change in the Standard of Preparation of the aircraft being flight tested and the flight tests are undertaken to the same flight envelope cleared.

Flight Tests

15. The contractor shall make such flight tests, as are necessary to demonstrate safety, performance and functioning of the aircraft and its installation. CSDO/MAG (Avn)/NASDO is to be associated with such flight tests.
16. CRI/Internal QA is responsible for the issue of a Certificate of Safety of Flight (Form 1090) for undertaking any test flights including production acceptance flight tests at the contractor's works (ie HAL, BRDs of IAF etc) for purposes of trials /production flight/acceptance and ferry to the user units in respect of aircraft under development/overhaul/repair. The Certificate is issued after inspection to ensure that the aircraft has been constructed/overhauled/ repaired and ground tested in accordance with the applicable drawings or approved schedules.
17. In certain cases where resources available at R&D organisations would be of benefit in Flight Development work, the R&D organisations may be associated.
18. In addition to the above, the contractor shall ensure that rectification of flight snags are coordinated by CRI. The details of such rectification shall be intimated to RCMA. The contractor shall ensure that day to day flight programmes are endorsed by RCMA after rectification of flight snags,. This would be in respect of prototype/development aircraft and airborne systems including engines.

19. Copies of de-briefing notes, CVR, and Flight data records of individual flights shall be forwarded to RCMA.
20. In addition, a flight test report summarising particular aspect of the test shall be issued by the Contractor, and three copies of the same shall be sent to RCMA, who will arrange to send one set to CEMILAC. The flight test schedule for aircraft intended for IAF should be sent to ASTE and one copy of the report should be sent to CSDO. The flight test schedule intended for Indian Navy/Indian Army should be sent to Naval HQrs/Addl Director General, Army Aviation. Any special requirements of the user services shall be included in the flight test schedule.
21. Whenever the flight evaluation is carried out only by user services consequent to introduction of a major modification, the report should be sent to Indian main contractor responsible for production/repair/overhaul of such aircraft. If such flight evaluation results in a change in aircraft documentation, then the user service will send a draft amendment which will be coordinated, vetted and implemented by the prime contractor.
22. RCMA shall certify completion of each stage of flight. The flight test shall not be deemed to have been completed until every aspect of the flight test has been cleared by the Project manager of the main contractor in co-ordination with CTP and RCMA. The flight test schedule for user evaluation will be prepared by ASTE or Indian Navy/Army as appropriate.

Installation of Flight Data Recorders

23. Flight Data (Accident) Recorders/Crash Data Recorder shall be installed during development trials of new aircraft or major modifications affecting safety of aircraft. This is in addition to the Instrumentation and Special recorder required for the evaluation of the aircraft/system. The details of the essential parameters to be recorded by the FDRs/CDRs should be specified by main contractor after taking into consideration the past experience.

Flight Limitations

24. The flying limitations specified in the Certificate of Flight Trials shall be based on actual tests carried out by the contractors. The RCMA will ensure that the limitations appropriate to the category of pilots (Experimental/Production/Customer) is to be specified in the Certificate of Flight Trials (Annexures 'G1' and 'G2').
25. If at any time after a Certificate of Flight Trials has been issued, the Contractor or the RCMA becomes aware of evidence that necessitates a revision of the existing flying limitations because of the results of contractor's flight test or due to defects or for other reasons, an amended

certificate shall be issued at the earliest. RCMA shall ensure its immediate intimation to Air Headquarters, Naval Headquarters and Indian Army.

26. If as a result of an accident or any untoward incident, the RCMA considers that it would be prudent to restrict further trials pending further investigation, RCMA will advise ASTE, APT, Service Headquarters, CEMILAC, CRI and main contractor that the current Certificate of Safety of Flight Trials is withdrawn. Copies of Certificate of Flight Trials may be sent to ADE, GTRE and other R&D establishments (where applicable).

Urgent Operating Notices

27. In cases where the amendments to the Certificate of Flight Trials, because of reasons stated above, are expected to get delayed, the restrictions in flying limitations shall be advised in the form of an Urgent Operating Notice to all concerned. The Urgent Operating Notice, which is to be prepared by the contractor and approved by the RCMA, is to be intimated to appropriate flight test authority without any delay. RCMA will inform the concerned service headquarters.

SECTION V

CHAPTER 2

FLIGHT TESTING BY USER SERVICES

Contents	Page No.
Flight Testing by user Services	86
Agencies involved	86
Procedure for flight clearance	86
Flight Testing of Equipment	87
Standard of the Equipment for Flight Testing	88
Agency for Carrying out Design, Installation Tests	88
Installation and Test Requirement	88
Results and Reports on Trials	88
Technical Acceptance of Installation	88
Type Record for the Installation	89
Type Clearance of Installation	89

SECTION – V
CHAPTER 2
FLIGHT TESTING BY USER SERVICES

1. *Flight testing by user services for clearance of upgrades, weapon systems and other modifications*

The in-service aircraft are continuously upgraded for increasing their operational effectiveness. The main contractors such as HAL may not be associated in such upgrades even on the aircraft designed, developed and/or manufactured by them. In many such upgradations, foreign collaborators may be involved. This section describes the procedure for introduction of such upgrades including the flight testing of such upgrades by user pilots. Wherever Indian agencies such as HAL are involved, the provisions of Sec III are applicable.

2. *Agencies involved*

- (a) Air HQ, Army HQ or NHQ
- (b) Service flight Testing Agency such as ASTE for IAF, APT for Indian Army
- (c) CEMILAC, the certification authority
- (d) Vendors/collaborators/main contractor
- (e) DGAQA wherever applicable

3. *Procedure for Flight Clearance*

The proposed upgrades, weapon systems, installation or modification has to be approved by CEMILAC after a thorough evaluation. Such evaluation would be easier if the relevant design data and other technical documents are available prior to the evaluation. In order that the required information for certification is available, Service HQ should associate CEMILAC at the time of preliminary negotiation with the vendor/collaborator. CEMILAC should indicate their requirement for documents, drawings and test requirements at this stage itself. The requirements of CEMILAC should be included in the contract placed with the vendor. Service Headquarters should also involve main contractor such as HAL for considering the integration/interface aspects of the equipment and the aircraft. Such involvement shall be on all indigenously designed/produced aircraft. If main contractor such as HAL is involved, then the provisions of Sec III would apply. If main contractor is not involved, the following procedures would be adopted.

4. Service Headquarters generally issues a task directive for trial installation and flight testing of the proposed equipment/upgrade etc. Once the configuration and installation details are finalised for the proposed installation, the agency vested with the task of executing the trials shall interact with CEMILAC or the RCMA nominated by CEMILAC for according the clearance. RCMA shall evaluate the proposals and give the detailed requirements for testing. RCMA shall participate in all testing and trials including flight testing. After satisfactory completion of ground testing and trial installation on aircraft, RCMA shall accord a clearance for flight testing of the proposed equipment/upgrades/weapon systems etc. The agency earmarked for carrying out the flight testing for example ASTE for IAF shall include rep of RCMA as a member of the trial team, wherever necessary. After satisfactory completion of flight testing, the drawings and modification leaflet including method of compliance of the proposed modification shall be made by the user services in conjunction with the vendors/collaborators. The modification shall be technically cleared by RCMA. Approval by LMC shall be necessary for fleet modification. In the case of aircraft, designed, developed and/or manufactured by Indian Agencies such as HAL, user services shall forward details of fleet modifications to these agencies for approval of the modification and the amendments to the publications which have to be carried out by HAL.
5. Copies of reports of all evaluation and tests including flight tests shall be forwarded by user agencies to RCMA/CEMILAC at the conclusion of every stage of evaluation/tests.

Flight Testing of Equipment

6. Since considerable time and costs are involved in flight testing, it shall be ensured that as far as possible flight tests are called for only when compatibility of the equipment with the aircraft is required to be checked with the aircraft environmental characteristics. If in case, flight testing of equipment is considered necessary for Type Approval of the equipment, the necessity or otherwise for flight testing shall be discussed between the equipment designer, CEMILAC and flight test agency before undertaking trials. CSDO/MAG (Avn)/NASDO will be associated, if required. The procedure for flight testing of equipment on in-service aircraft including bought out aircraft is given in paragraphs 8 to 14. Prior to flight clearance is issued, the contractor should submit reports on calibration of test equipment and instruments.
7. In cases, where Service Headquarters propose flight test clearance of certain equipment for demonstration purpose, depending on the nature of demonstration/installation the provisional clearance for flight trials will be accorded by CRPO for the IAF/ equivalent for Indian Army and Indian Navy/

RCMA. Such demonstration would be carried out within the specified flight envelop of aircraft and equipment. Vendor supplying the particular equipment would provide necessary information on the equipment for obtaining provisional clearance which have bearing on the safety of aircraft and/or crew.

Standard of the Equipment for Flight Testing

8. The equipment shall have undergone all tests required for flight clearance of the equipment and provisional clearance for flight trial and evaluation shall have been issued prior to installation of the equipment on the aircraft.

Agency for Carrying out Design, Installation Tests

9. The installation design, ground and flight tests shall be carried out by agencies approved by CEMILAC. In cases where trial installations are carried out by users, the flight tests shall be conducted by ASTE or by suitably qualified personnel of user agencies who have been trained to undertake such activity. During all these phases, CSDO/NASDO/MAG (Avn) will be associated.

Installation and Test Requirement

10. The installation, ground and flight tests shall be to a standard acceptable to CEMILAC or its representative. The overall schedule of flight tests shall be prepared by the user agencies in consultation with RCMA. This is to ensure that the particular aspect of the equipment functioning and performance intended to be examined are adequately covered in the flight test schedule. Copies of the flight test schedule shall be circulated to ASTE/IN/Army, wherever necessary. The Government Inspection Agency i.e DGAQA should also be associated during trials.

Results and Reports on Trials

11. The agency carrying out the trials shall make available results of the trials to CEMILAC or his representative, at specified periodicity/specific event or on achievement of a milestone during the trials. A consolidated report shall also be made available on completion of tests. Copies of the trial reports shall be sent by the flight test agency to appropriate service HQrs, ASTE, main contractor, CEMILAC and DGAQA (if applicable). If trials are carried out by the user agencies on indigenously designed and developed aircraft or licence built aircraft, then copies of the report should be sent to the main contractor and CEMILAC.

Technical Acceptance of Installation

12. After satisfactory completion of the flight trials CEMILAC or his representative will provide a provisional clearance of the installation for

assessment by the user agency namely, Army, Navy and Airforce. CSDO/NASDO/MAG (Avn) will be associated with the user trials.

13. The modification leaflet for the introduction of the equipment in the fleet shall be put up for acceptance of CEMILAC or his representative after user acceptance trials of the installation. On indigenously developed or licence built aircraft fleet modification should be introduced by the main contractor through LMC procedures described in Section – III.

Type Record for the Installation

14. The Type Record for the installation of the equipment on a particular aircraft shall include the accepted ground and flight test standard in addition to the modification leaflet.

Type Clearance of Installation

15. The Type Clearance for the installation will be provided by CEMILAC after the Type Record and Mod Leaflet are acceptable to the CEMILAC.

ANNEXURE - A

(Ref : Sec-II, Para-7)

Format For Project Definition Study For Aircraft

General

1. (a) Leading particulars, Dimensional data, Crew Station Layout, Weights, Description of airframe structure and aircraft system, particulars of engine etc. (See Note-1).
- (b) Aircraft Performance Estimates for specified mission profiles and data on which based; flight envelope limitations (See Note-2).
- (c) Design requirements with which the design is complying.

Note: 1: Drawings and sketches to be supplied including three view GA drawings, major structural features, systems layout and maintenance provisions. Preliminary Maintenance Data should include information such as facilities for periodic servicing, replacement of major components, turn round time etc.

2: It would be necessary to conduct some preliminary wind tunnel testing and other design investigations for the purpose of the project study.

Design and Development Programme

2. A Design and Development Programme should be drawn up for the project, including an outlined PERT network, in which, among others, estimated man-hours and calendar period for each of the following activities should be given.

Design Work

- (a) Wind tunnel and other Design Investigations
- (b) Mock-up
- (c) Detail Design
- (d) Prototype tooling
- (e) Ground Tests
- (f) Flight Tests
- (g) Productionising drawings.

ANNEXURE-'A' (Contd.)

Development Work

- (a) Construction of Mock-up
- (b) Fabrication of Prototype jigs and tools
- (c) Fabrication and assembly of prototype aircraft
- (d) Fabrication of Test specimens
- (e) Conduct of Ground, Structural, Functional, Vibration and Fatigue Tests
- (f) Flight Test Instrumentation
- (g) Conduct of Flight Tests. *

*Note: Number of prototypes required and programme of flight development of each prototype to be indicated.

Cost

- 3. The development programme should be accompanied by an Associated Cost plan. The cost estimates should be more precise than furnished in the feasibility study including the following elements for each of the design and development phases outlined at Para-2 above.
 - (a) Capital (Buildings, Machinery, Equipment and Test facilities including foreign exchange)
 - (b) Labour and overheads
 - (c) Material costs (including foreign exchange)

Note: The phasing of expenditure to be indicated.

Preliminary Production Estimates

- 4. Estimated man-hours and calendar period for production of jigs and tools and the unit production cost should be indicated. Estimates of cost of production should be based on the requirement for aircraft given by the user.

Contractor's Proposed Project Management Organisation

- 5. A detailed proposal of the management organisation in the contractor's works should be given, which takes into account the complexity of the project.

Note 1: The above format with suitable alterations can also be used for engine/equipment design and development projects.

Note 2: The above information is the minimum required information for PDP. More information can also be given.

ANNEXURE - B

(Ref : Sec-III, Chap-1, Para- 26)

RESPONSIBILITIES OF CHIEF RESIDENT ENGINEERS/ REGIONAL DIRECTORS

Introduction

1. The Chief Resident Engineer/Regional Director is the Resident representative of Type Certification Authority for airworthiness certification i.e the CEMILAC at the contractor's works. This annexure sets out his main duties but additional information will be found in the main chapters of the publication.
2. The main duty of CRE/RD is to ensure Airworthiness through evaluation of design by a process of FMEA, FMECA, Analysis of reports, Simulation Studies, Analogy Studies, Test schedules, Acceptance test procedures, Test results etc., CRE/RD is to ensure promulgation of such actions as are necessary for maintenance of Airworthiness of aircraft in service.
3. The administration of technical supervision of CRE/RDs is vested with the CEMILAC.
4. The Chief Resident Engineers/RDs may be required to act as Visiting Officers to certain firms/organisations to attend to specific assignments in regard to type or development clearance of Airborne stores. Their functions as Visiting Technical Officers will be similar to those outlined in this Annexure.

Technical Development

5. The CRE/RD is responsible for ensuring that the firm is cognizant with, correctly interprets and applies the technical requirements.
6. In cases where there are differences of opinion between the contractor and CRE/RD regarding compliance of a particular requirement, the subject matter should be brought up to the attention of CEMILAC, Air/Naval/Army Headquarters/Ministry of Defence.
7. The CRE/RD shall evaluate design features of all military aircraft projects at the contractor's works and verify conformity to design requirements. The CRE/RD is also responsible to ensure compliance of design and test requirements required for technical clearance of the stores by the CEMILAC.

ANNEXURE - 'B' (Contd.)

8. The CRE/RD shall approve the Development and Qualification Test Schedule and specify the Test and Analysis requirements for clearance of airborne systems and stores.
9. The CRE/RD shall witness where necessary, ground tests and verify adequacy of loading and testing conditions. Where loading and testing are inadequate, he shall advise the contractor for revision of testing to the appropriate loading and test conditions.
10. The CRE/RD shall analyse flight results and examine adequacy. Additional tests should be called for where necessary. CRE/RD shall attend the debriefing meeting where necessary.
11. The CRE/RD shall submit technical appreciation reports to Headquarters, CEMILAC periodically on evaluation of design features, ground and flight tests carried out.
12. The CRE/RD shall arrange to collect and maintain Type Records, including test reports on wind tunnel, structural, mechanical and system tests, bench test, proving trials and flight tests. One set of these shall be forwarded periodically to CEMILAC.

Production Phase

13. The CRE/RD shall be Chairman for Local Type Certification Committee, Local Concession Committee and Lifting Committee.
14. The CRE/RD shall examine the acceptability or otherwise concessions referred to by CRI, when strength, safety, interchangeability etc are affected.
15. The CRE/RD shall examine modification proposals put up by the contractor in respect of projects under his control, call for the tests required, technically accept mods and act as Chairman of the Local Modification Committee constituted for the various projects. In the discharge of this responsibility, he shall take all necessary action to ensure acceptance of the mod by User services prior to his formal technical clearance and prescription in the standard of preparation.

ANNEXURE - 'B' (Contd.)

- 16.** The CRE/RD shall examine and approve all draft SIs, STIs, Urgent Operating Notices, Urgent Servicing Notices, Service Bulletins, Lifting Policy that are required to be issued for the maintenance of airworthiness standard of aircraft manufactured at the contractor's works.
- 17.** The CRE/RD shall define periodically the design standard for production/overhaul aircraft; examine and approve changes to ground and flight test schedules; examine cases of concession put up by the contractor for non-compliance of modifications, SIs, STIs, Urgent Operating Notices, Urgent Servicing Notices, Repair Schemes etc., during manufacture and overhaul of aircraft manufactured by the contractor.
- 18.** In respect of aircraft in Service use, the CRE/RD shall maintain day to day contact with Service Headquarters on matters arising from technical and operational experience of such aircraft and take action as considered necessary to ensure maintenance of airworthiness.
- 19.** The CRE/RD shall participate and ensure adequacy of investigations on defects and incidents carried out by the contractor on design aspects.
- 20.** The CRE/RD shall also examine tests carried out on components indigenously developed at the contractor's works and forward to CEMILAC, his recommendations for Type Approval.
- 21.** The CRE/RD shall satisfy himself of the adequacy of production ground and flight test schedules. He will approve the ground and flight test schedules and their amendments.
- 22.** During certain phase of production of aircraft/airborne stores the main contractor may propose to indigenise or substitute from other countries material and components. On receipt of such proposal from contractor, it is the responsibility of CRE/RD to approve the specification/drawing of the material/component and lay down test requirement for approving the same.
- 23.** All Defect Investigations carried out during development phase shall have member from RCMA.

ANNEXURE - C

(Ref : Sec-III, Chap-1, Para-27)

RESPONSIBILITIES OF CHIEF RESIDENT INSPECTORS

Introduction

1. The Directorate General of Aeronautical Quality Assurance is the organisation under the Dept. of Defence Production and Supplies in the Ministry of Defence responsible for Quality Assurance and Acceptance of Aircraft/Aero-engines/Aeronautical Stores manufactured/ overhauled/ repaired at various Divisions of Hindustan Aeronautics Limited and for such stores manufactured at Ordnance Factories and in private sector, besides other responsibilities. The inspection of aeronautical stores for the Services is generally based on the principles laid down in AvP/DEF STAN-83 and AvP/DEF STAN-84.
2. Chief Resident Inspectors are therefore located by Headquarters, DGAQA to carry out Executive Quality Assurance functions at firms established for the purposes of manufacture/overhaul/repair of aero-engines/aircraft/ associated equipments. The primary function of the CRIs is to verify by adequate inspection, testing, quality audits and effective supervisory inspection control over the firm's Quality Assurance organisation, that all supplies and equipment delivered under the Ministry of Defence contracts / orders, which designate DGAQA as the Inspection Authority, conform to the stipulated requirements. The responsibilities are broadly defined as follows:
 - (a) Exercise control over the Quality Assurance Organisation of the firm and report to Headquarters of any fall in standard of the firm's Quality Assurance Organisation/Staff.
 - (b) To satisfy himself through physical supervision that the firm's Quality Assurance staff have carried out comprehensive Quality Assurance at all stages from the raw material stage to the final delivery of the product and introduce such checks and procedures as considered necessary from time to time.
 - (c) Introduce stages of physical Quality Assurance which should be comprehensive and cover Quality Assurance right from the incoming raw material and stores to the finished product and final assembly stage. They are to be reviewed periodically for ensuring better supervision over the firm's Quality Assurance organisation. Wherever the CRIs stages of Quality Assurance have been communicated to the firm, the firm's Quality Assurance responsibility

ANNEXURE -'C'(Contd.)

should be permitted. If there is need to deviate, it should be done in consultation with Chief Resident Inspector only.

- (d) To ensure that all deviations to stipulated requirements are properly authorised and recorded. Wherever there are deviations of major nature affecting safety or strength or interchangeability or other operational aspects, he shall refer the case to CRE/RD for his decision. Deviation affecting operational aspects shall be referred to Air/Naval/Army HQrs/RCMA for decision.
- (e) Report to Headquarters, details of new design projects or manufacturing methods or processes which may affect the established inspection procedure and raise critical observations thereon.
- (f) Assist Headquarters, DGAQA in the indigenous substitution activity.

Prototype Development of Stores and Trials Installation Inspection

- 3. Whenever a new aeronautical store is developed under a contract, for which DGAQA is the Inspection Authority, the CRI is associated with all phases of development and testing of stores from the initial stages, for progressive appraisal and for making critical observations of engineering features especially from maintenance, servicing and inspection point of view. Such report from CRIs would be given consideration by CRE/RD before according the Type Approval.

Release of Aircraft for Test Flights (Form-1090)

- 4. CRI is responsible for the issue of a Certificate of Safety for Flight for undertaking any test flights at Contractor's works, for purposes of trials/acceptance and ferry to the user units in respect of aircraft under development/ manufacture/overhaul/repair. The Certificate is issued after inspection to ensure that the aircraft has been constructed/overhauled/repared and ground tested in accordance with the applicable drawings or approved schedules and that the requirements of the contractor have been complied with.

Certification of Contractors Advice and Inspection Note

- 5. All stores manufactured/overhauled/repared under the Ministry of Defence contracts are accepted and so certified by CRIs on the Contractors Advice and Inspection Note. This certificate forms the basis of all contractual transactions.

ANNEXURE -'C'(Contd.)

- 6. Defect Investigation**
- CRI will be associated with investigations of defects reported during development and in service and at the manufacturers works/overhaul agencies and make suitable recommendations as per laid down procedures.

ANNEXURE - D

(Ref : Sec-III, Chap-1, Para-29)

RESPONSIBILITY OF CSDO/NASDO/MAG (Avn) IN THE DEVELOPMENT OF AIRCRAFT AND EQUIPMENT

1. CSDO, NASDO and MAG (Avn) act as the agent of the Air Force, Navy and Army respectively, in providing advice and recommendations about the servicing and maintainability aspects of service technical equipment, from the earliest stages of design. This unit provides a team of specialist personnel who may be resident at certain aircraft factories and specialist firms to study the development of new types of aircraft and equipment, to assist their smooth and efficient entry into the service.

2. CSDO/ NASDO/MAG (Avn) is to advise and make recommendations on :
 - (a) Reliability and maintainability.
 - (b) Servicing policies to support a new aircraft or equipment when it is introduced into service; the safety aspects of servicing including armament safety.
 - (c) The extent of servicing and the repair to be applied in service.
 - (d) The problems experienced by operating units relating to servicing.
 - (e) Drafting servicing schedules.
 - (f) Recommendations on provisioning of spares.
 - (g) Requirements for standard and special type ground support equipment.
 - (h) Technical approval for particular items of ground support equipment when required.
 - (j) The design and installation requirements for electronic servicing centres and similar support facilities.
 - (k) Trade skills and training requirements.
 - (l) The contents of appropriate Air Publications.
 - (m) Acceptance of NDT equipment
 - (n) Aircraft Engineering Documentation

ANNEXURE – E

(Ref: Sec-III, Chap-1, Para- 29)

FACILITIES/INFORMATION REQUIRED BY CSDO/NASDO/ MAG (Avn) AT CONTRACTOR'S WORKS

In discharging its responsibilities, CSDO/NASDO/MAG (Avn) shall require the following facilities/ information as appropriate for the store concerned, to be supplied by the contractors :

- (a) To attend servicing and engineering examinations, trials and conferences.
- (b) To have access to drawings, mock-ups, engineering models, working rigs, prototype and production stores.
- (c) Draft Modification leaflets and drawings and Draft Mock-up installation drawings.
- (d) Prototype/Preliminary Servicing Schedule.
- (e) Recommended list of servicing spares, manufacturers minimum equipment list (as applicable) in respect of contractors and sub-contractors fabricated items.
- (f) Recommended component life between reconditioning and estimated life to scrap, both in respect of contractors fabricated and bought out items.
- (g) Maintenance and Overhaul Manuals, spare parts catalogue in respect of all equipment, including those brought out by the contractor giving information as at (d), (e) and (f) above.
- (h) Ground and Test Equipment and Tools (Standard and special to type) necessary to carry out all the servicing operations, in the form of a fully descriptive draft list.
- (j) Draft copies of Appendix-A : "Schedule of Equipment for Aircraft" as required to be issued by the manufacturers.
- (k) Defect analysis and hence componentwise, systemwise and complete aircraftwise reliability reports.
- (l) Methods for defect diagnosis and fault location with the components and the system.
- (m) Commonly observed defects on systems and components with details of recommended rectification, man-hours involved in installed and un-installed conditions.
- (n) Servicing Manual of ground equipment and test equipment

ANNEXURE - 'E'(Contd.)

Note : Description of Maintenance methods should include :

- (i) Procedure to be followed.
- (ii) Tools, GE., Test Equipment required
- (iii) Components and consumable stores required.
- (iv) Brief of description of the system
- (v) Removal and installation procedure
- (vi) Level of Servicing required
- (vii) Including engineering documentation and NDT aspects

ANNEXURE - F

(Ref: Sec-III, Chap-1, Para-18, 73 and Sec-IV, Para-22 (o))

CERTIFICATE OF DESIGN FOR AERONAUTICAL STORES

Title of Store (See Note-1) :
Contractors Type No. :
Development Contract No. :
Description :
Service Nomenclature & ref. no. :
Ref. Technical Specification :
Approval Test Report No.(a) :
Conditions of Use (See Note-2) :

We, ... (Nature of Design firm)
hereby declare and certify :

- (i) that the aforementioned store is defined and accurately described by the above particulars and that it complies with the full requirements/experimental flight requirements (See Note 3) of Specification No Issue No Amendment list No.(s) which has already been approved by (See Note 4) subject to the exceptions and/or qualifications listed below (See Note 5).....
- (ii) that all relevant design data, reports of specified tests, drawings and drawing lists have been completed and are a true record of the design and testing of the store to date.
- (iii) that if any statement on this certificate becomes inaccurate the certificate will be suitably amended and issued.

ANNEXURE - 'F' (Contd.)

Signed (See Note-6)

Signed.....

For (Name of the Firm)

Date

Countersigned (See Note-7)

For

Date.....

Notes :

- (1) If the submission is to obtain approval to start flight tests of experimental equipment, the bracketed word "(Experimental)", should be inserted after the title of the store.
- (2) If there has been no testing, but the tests are specified enter "Not tested" against the appropriate heading. When testing is not specified enter "Not applicable".
- (3) Strike out the words which are not applicable.
- (4) Enter the name of the unit of CEMILAC. If the submission is to obtain approval to start flight tests of experimental equipment, enter also the name of the approved aircraft firm responsible for operation of test aircraft.
- (5) If there are no exceptions or qualifications, this should be stated.
- (6) The Certificate should be signed by a Chief Designer and by a responsible senior member of the firm's Design/Development staff.
- (7) If the Design firm is not approved for the work covered by the certificate, it must be countersigned by the main contractor or by a Design Authority agreed by the Ministry of Defence.

ANNEXURE – G1

(Ref : Sec- V Chapter 1 Para - 12)

CERTIFICATE OF FLIGHT TRIALS - AIRCRAFT

The flying and other LIMITATIONS of
..... are detailed herein :

1. Centre of Gravity Range :

2. Flight Envelope :

For Flight Envelope (Subsonic), Refer Fig-1.

For Design Speed and Mach Number Limits with Altitude, Refer Fig-2.

For Values of Load Factor for Supersonic case Refer Fig-3.

3. Maximum Limiting Speeds : `Clean' Aircraft

(a) Max. Speed for `Clean' aircraft with controls in `Power'

(b) Max. Speed for `Clean' aircraft with controls in `Manual'.

(c) Max. Speed for selecting controls from `Manual' to `Power' or from
`Power' to `Manual'.

(d) Max. Speed for extending Airbrakes:

(i) With controls in `Power'

(ii) With controls in `Manual'.

(e) Max. speed for operating flaps to Take-off position,
including Combat-selection of Flaps.

(f) Max. speed for operating Flaps to `Landing' position.

(g) Max. speed for raising or lowering undercarriage.

(h) Max. speed with undercarriage locked `Down'.

4. Maximum Limiting Speeds for Carriage & Release of External Stores

The speed Limits should be separately stipulated for flying with controls in
`Power' and in `Manual'.

Carriage

Release

5. Minimum Speeds - `Clean' Aircraft

Buffet :

Minimum Speed (U/C & Flap : UP) :

Minimum Speed (U/P & Flaps : DOWN) :

ANNEXURE -'G1' (Contd.)

16. **Pressure Error Correction**
17. **Use of AVTAG (JP-4) Fuel**
18. **Gun Firing**
19. **Ejection Seat**
 - (a) Ejection Limits :
 - (b) Thigh Length and Sitting Height :
20. **Engine Limitations**
21. **Category of Pilot:**

This Certificate does not constitute any authority to fly unless accompanied by a current Certificate for safety for flight (F-1090) issued by CRI, DGAQA.

Chief Designer
Contractor's Firm

Chief Resident Engineer/Regional Director
RCMA

ANNEXURE -'G2' (Contd.)

- ii) Sideward
- iii) Rearward
- b) Never exceed speed
- c) Maximum auto rotational forward speed
- d) Maximum speed with door kept open/removed
- 8. Maximum operational altitude**
 - a) Maximum altitude for take-off and landing
 - b) Maximum altitude for flying
 - c) Zero speed hover out of ground effect ceiling.
- 9. Maximum normal acceleration - (without external stores)**

	<u>Instantaneous</u>	<u>Sustained</u>
a) Positive		
b) Negative		
- 10. Maximum angle of side slip at various speeds.**
 - a) V min P
 - b) V cruise
 - c) V NE
- 11. Maximum bank angle**
- 12. Turn on spot**

	Maximum rate of turn	Altitude/Speed
- 13. Maximum mast moment**
- 14. Controls margin**

	$d\alpha$ (%)	$d\beta$ (%)	$d\delta$ (%)	$d\theta$ (%)
a) VH	--	--	--	--
b) V_{ne}	--	--	--	--
c) Left sideward Flight	--	--	--	--
d) Right sideward Flight	--	--	--	--
e) Rearward Flight	--	--	--	--
f) Hover	--	--	--	--
- 15. Maximum rate of climb**
 - (i) Vertical
 - (ii) Oblique

ANNEXURE -'G2' (Contd.)

- 16. Landing on inclined surface**
 (i) Slope
 (ii) Landing direction
- 17. Maximum tyre inflation pressure**] (In the case of wheeled version)
- 18. Maximum oleo pressure**]
- 19. Limitations with External Stores and underslung loads**
 Item MaxSpeed Max'g' MaxBankAngle SideSlip
 a) Armament Stores
 b) Underslung loads
 i) High density loads
 ii) Low density loads
- 20. Engine limits (ISA, S/L)**
 Rating Power TGT (°C) Torque NG ANG
 -- -- -- -- -- --
- 21. Single engine performance - (Where more than one engine is used)**
 a) Maximum level speed
 b) Minimum level speed
 c) Maximum rate of climb
- 22. Engine relight envelope**
 Max Altitude Speed OAT
 -- -- --
- 23. Engine manual handling**
- 24. Use of AVTAG (JP-4) and JP-5 Fuel**
- 25. Transmission Limits**
 Rating Power Torque
 -- -- --
- 26. Gun firing**
 a) Calibre :
 b) Burst length :
- 27. Pressure error correction**

ANNEXURE -'G2' (Contd.)

28. Minimum airspeed indicator reading

29. Category of Pilot

This certificate does not constitute any authority to fly unless accompanied by a current certificate for safety for flight (F-1090) issued by CRI, DGAQA.

Chief Designer
Contractor's Firm

Chief Resident Engineer/Regional Director
R C M A (Helicopters)

ANNEXURE - H

(Ref : Sec-III, Chap-1, Para- 70: Chap-2, Para-53: Chap-3, Para-24)

DEFECT INVESTIGATION REPORT

Part - I (Reference) : Incident/Accident/Snag /Explosive

Date of Occurrence :

Installation Details : (Aircraft/Main Equipment SI No.)

DIR No. : Date :

DR No. : Date :

Part - II : (Details of Defective component)

Date Component received :

Sec Ref / Voc No. Life completed since new :

Part No. Trade :

Nomenclature : TBO :

Component SI No. : Life completed since OH*

System * Main Assembly *

* Not applicable for explosives

Part - III : Brief particulars of defect including hours flown :

Part IV : Investigation : (Details of Examination including previous similar defects)

Findings/Conclusions :

ANNEXURE 'H' (contd)

Remedial Measures :

Attributable Code: U / R / D / F / E / X Tick one or more as applicable

Authorized Signatory of DI Agency Date :

Part V : Remarks By CRI, DGAQA (Quality Aspects)

Signature Date :

Part VI : Remarks By RCMA (Design Aspect)

Signature : Date :

Attach additional sheet wherever required.

Distribution :

1. DMIS, 2. HAL (CO) [For HAL items] 3. HQ, MC [For non HAL items]
4. Concerned TETTRA School 5. DASE [For Explosive items]
6. CEMILAC/RCMA 7. CRI

Attributability Code:

Lapses on the part of User	: U
Lapses on the part of Repair Agency/Manufacturer	: R
Due to features inherent in the design	: D
Failure/ageing/Corrosion/Material Failure	: F
Not established	: E
Other Reasons	: X

ANNEXURE - J

(Ref : Sec-III, Chap-2, Para-3 and Para -18)

DRAWING OFFICE PROCEDURE FOLLOWED BY DESIGN BUREAU

Sl. No.	Type of Change	Method of Introduction	Effectiveness	Dept. to Originate	Distribution copies	Remarks
1	2	3	4	5	6	7
1.	Changes introduced by Design Department on a Batch of Aircraft					
	a) Prototype drawings	Ch.Notice/ Project Slip	Aircraftwise	Design	To all Concerned	Rework Instruction for fabricated components existing or under progress are to be given normally in the change notice or change project slip. If it is not possible to indicate in the above, PS is to be Issued as noted in Sl. No. 4.
	b) Pre-production Drawings:					
	i) Part drawings	Change Project slip	Aircraft batch wise	“	“	
	ii) Other drgs. like Sub-Assy. & Assy.	Change Notice	“	“	“	
	c) Production Drawings :					

ANNEXURE 'J' (Contd.)”

1	2	3	4	5	6	7
	i) Part drawings	Change Project slip	“	“	“	
	ii) Other drgs. like Sub-Assy. & Assy.	Change Notice	“	“	“	
2.	Changes introduced by Design Dept. on Individual A/c Prototype/Pre-Production/ Production aircraft	Deviation Project Slip	Aircraft wise	Design		To all concerned
3.	Modifications to be incorporated on Propriety Items	Project Slip	Component Sl. No. wise	“	“	
4.	Rework to be done on Fabricated Component Assy/ Parts etc. necessitated because of Design Change.	“	Aircraft batch wise	“	“	
5.	Rework to be done on Aircraft because of damage during Flight/Servicing/ overhaul.	Repair Project slip preceded by concession Form No. 30-79)	Aircraftwise	“	“	Planning/ shop should arrange with inspection for raising the necessary concession. The same should be raised in duplicate and coordinated with all concerned.

ANNEXURE 'J' (Contd.)

2	3	4	5	6	7
6. Rework on Proprietary Items because of Damage/ Deviation required by Planning/Shop	Repair Project slip preceded by concession (Form No. 30-79)	Component SI number wise	“	“	Planning/shop should arrange with inspection for raising the necessary concession. The same should be raised in duplicate and co-ordinated with all concerned.
7. Shop errors/Assy. difficulties on serially numbered Components and Assemblies					
a) Major Defects/ Deviations	Concession (Form No. 30-79)	Component SI number wise	Inspection	One original copy to shop directly and prints to be taken from the other and distributed to all concerned.	To be raised in duplicate and be co-ordinated with all concerned by Inspection. Any sketches if necessary are to be issued under the particular concession No. or in a repair PS.
b) Minor/Defects/ Deviations	Defect Register	“	“	“	Co-ordination of design and CRI to be obtained by Inspection.

ANNEXURE 'J' (Contd.)

1	2	3	4	5	6	7
8.	Errors/Deviations on Components and Sub-Assys. not serially numbered	To be accepted on Salvage Ticket	-	Inspection	-	Errors/ deviations reviewed Salvage meeting. Repair Project slips to be issued by Design Depaartment whenever necessary.
9.	Non-Compliance of :					
a)	Changes/deviations/ Modifications/STI	Preparation of Statement of Concession (Form No. 30-78)	Aircraftwise	Planning	To all concerned	
b)	Ground Test Schedules	“ (Form No. 30-79)	“	Inspection	“	
c)	Flight Test Schedules	“ (Form No. 30-78)	“	<i>FT Group</i>	“	
10.	Non-Availability of Proprietary Items	Production Permit (Form No. 30-79)	Aircraftwise	Planning	To all concerned	Planning to raise production permits to use substitute parts and process it through 'Q'. Project slips to be issued where drawing deviations are necessary.

Note :

- 1 The word `CHANGE OR DEVIATION' as the case may be, must be clearly and boldly written in the centre just below the Title Block.
- 2 The Change Project Slip should be serially numbered, as Change No. 2, etc.
- 3 All change PSs, must be incorporated in the next drawing change which should be issued after the PSs, accumulate in sufficient numbers and the affected PS numbers should be mentioned in drawing change notice. When the PSs are incorporated in the drawing, appropriate entries should be made in the columns in the originals of these PSs. When additional sheets are used for the issue of a PS, the sheets should be numbered starting from the original as No. 1.
- 4 Whenever a change notice is issued on an assembly drawing, the change project slip numbers of the parts should be noted in the remarks column of the M.S. against the particular part drawing numbers and the same should be replaced by the change letter when higher issue of the part drawing incorporating the PS is available.
- 5 All deviation project slips, wherever they are issued on sub-assembly/assembly drawings, will be incorporated in the relevant drawing and equipment applicability lists.
- 6 Rework project slips do not go into the applicability standards as they do not fall under the category of design modifications but will be covered by concessions.

ANNEXURE – K(i)

(Ref : Sec-III, Chap-2, Para-26)

**LOCAL MODIFICATION COMMITTEE
DETAILS OF MODIFICATION PROPOSED**

(This gives a typical format for aircraft. Similar formats can be used for engine, airborne stores or other equipment modification also)

- I. Originator Serial No
 Mod No Class.....Date Mod proposed for
 embodiment at HAL
 Title

- II. 1 Reason for introducing Mod

 2 Trial Installation Required Yes / No
 3 Flight Trials Required Yes / No
 4 Effect or Relationship with any other Mod, STI or SI

 5 SL. NO. of aircraft on which the Mod will be first embodied

 6 Total No.of Aircraft on which the Mod will be embodied
 7 List of new Parts required per aircraft :
 Part Number Issue Nomenclature Qty per Aircraft
 8 Agency responsible to supply kit
 9 Existing Part Rendered Redundant
 Part Number Issue Nomenclature Qty per Aircraft
 10 Existing parts which can be recovered after rework
 Old Issue Description Qty. New Issue Description Qty
 Pt. No Pt No.
 11 Effect on Interchangeability of Post-Mod & Pre-Mod Spares

 12 Effect on Maintenance of Tools, Test Equipment & Ground Equipment

ANNEXURE-'K(i)' (Contd.)

- 13 Financial effect
- (a) Cost of Modification Kit per A/c : Rs
- | | Mod Kit
Pt. No | Issue Nomenclature | Qty. per
Aircraft |
|------------------------------|-------------------|--------------------|----------------------|
| (b) New Parts | | Cost | No.of A/c |
| (i) Tooling | | | |
| (ii) Materials | | | |
| (iii) Fabrication | | | |
| (iv) Proprietary Items | | | |
| (v) Man-hours for embodiment | | | |
- (c) Rework
- (i) Tooling Rs.....
- (ii) Parts Rs..... (No.of sets.....)
- (d) Total cost of introducing Mod for the No.of aircraft given in Para(6) above
- (b + c).....Rs.
- (e) Redundancy
- (i) Tooling Rs.....
- (ii) Parts Rs.....
- 14 Foreign exchange requirement.
- Whether fresh allotment required Yes / No

ANNEXURE-K(ii)
(Ref. Sec-III, Chapt2, Para 26)

ADVANCE MODIFICATION INFORMATION

NAME OF THE DESIGN AGENCY	ADVANCE MODIFICATION INFORMATION	PROJECT	MODIFICATION NO.	CLASS	AMEND. NO.	DATE
1. Title		4. Applicability	5. Requirement			
2. Reason		6. Relationship with other MODs, STI, SI, Etc.				
3. History		7. Trial Compliance report details if required				
10. Comments by Originators Remarks		8. Drawings/P.S NEW Revised Not Required		9. Other Aspects (a) New Components (e) Performance (j) EMI/EMC Ref. Part No. (f) Interface (k) Safety (b) Manf./Supplier (g) Materials (l) GSE (c) Type Approval (h) Process (d) MOD status if any (i) Testing		
Approval (Originators)	Compiled by	Checked by	Approved by	Clearance Regional Director/CRE RCMA		Sheet 1 Of 2 Sheets

ANNEXURE-'K(ii)' (Contd.)

NAME OF THE DESIGN AGENCY	ADVANCE MODIFICATION INFORMATION	PROJECT	MODIFICATION NO.	CLASS	AMEND. NO.	DATE
11. Interchangeability affected?		Yes/No				
12. Operation by Aircrew affected ?		Yes/No				
13. Operation by Ground crew affected ?		Yes/No				
14. Accessibility affected ?		Yes/No				
15. Maintainability affected ?		Yes/No				
16. Documentation affected ?		Yes/No				
17. Spares affected ?		Yes/No				
18. Equipment affected ?		Yes/No				
19. Retro embodiment man hours (Estimated)						
20 a. Weight change		20 b. Moment change		Sheet Of Sheets		2 2

NOTE : Give full details if answer to Sl.No. 11 to 18 is “yes”.

ANNEXURE - L
(Ref : Sec-III, Chap-2, Para- 28)

MOD LEAFLET FORMAT

AUTHORITY Number
..... Date
(Name & Address of Contractor/Firm)

MODIFICATION LEAFLET

Sheet No
Issue No..... ..

Title	Class
	Type

1. Reasons
2. Embodiment
 - (a) Whether retro mod is applicable:
 - (b) Compliance of retro mod (i) : Immediate
(ii) : During MR/CR
 - (c) Whether the mod is within the capability of compliance
 - (i) By user unit
 - (ii) At user unit by HAL party
 - (iii) At HAL only
 - (d) Cost of Embodiment
 - (i) Mod Kit per aircraft supplied to Air Force
 - (ii) Embodiment of Mod per aircraft by HAL team at Air Force Unit
 - (iii) Embodiment of mod per aircraft at HAL
3. Approximate Time Required
 - (i) Supply of Mod Kit
 - (ii) Embodiment of Mod on aircraft
4. Drawing Required
5. Parts and Special Tools Required
6. Modification of Spares
7. Change of Reference Nos. or Assembly No.
8. Sequence of Operation
9. Special Tests after Embodiment
10. Record Action

ANNEXURE -'L' (Contd.)

11. Disposal of Redundant Parts
12. Effect on Weight and Balance
13. Effect on Aircraft or Equipment Operation , Handling and Maintenance
14. Effect on Publications

' Amendment to be introduced to technical Data Book/Maintenance and Servicing Manual/Parts catalogue and other publications as applicable

ANNEXURE – M
(Ref: Sec – III, Chap – 2, Para – 30)

FORMAT OF INDEX OF MODIFICATIONS

AIRCRAFT / ENGINE / ROTABLE

Mod No.	Category	Description @	LMC Meeting No. at which approved	Applicability *	\$ P.O.E in Prodn. A. No. of AC / Eng / Rotable	Whether retro compliance required and if so when ? i.e Whether during O/H or at any other point	Remarks

* - Specific Mk No. of aircraft Engine or Rotable is to be indicated. As many separate columns as needed to cover all marks to be opened. @ - Description should be brief. \$ - P.O.E stands for Point of Embodiment in production.

ANNEXURE - N

(Ref. Sec III, Chap-2, Para-48)

APPLICATION FOR CONCESSION ON MODIFICATION/SIs/STIs/SBs

PART A

(To be completed by the Contractor / Firm)

- | | Sl. no. | Date |
|----|---|------|
| 1. | Name and Address of the Contractor / Firm | : |
| 2. | Name / Description of the Modification | : |
| 3. | No.of the Modification / Bulletin /Change Notice:
(Delete whichever is not applicable) | : |
| 4. | Class of Modification along with reference to
LMC Decision. | : |
| 5. | Reasons for Concession | : |
| | i) Drawing / Tech. Data not available | : |
| | ii) Modified Component/Material/Spares
not available | : |
| | iii) Tooling / Machinery not available | : |
| 6. | Action taken for overcoming the problem
stated in Para (5) above | : |
| 7. | Period for which Concession is sought | : |
| 8. | Nos. of Aircraft/Aeroengines/Airborne Stores
affected by this Concession. (Mention Serial
Nos. also wherever applicable). | : |

Signature of Contractor's Rep

ANNEXURE -' N' (Contd.)

PART B

Recommendations of CRI

1. Reference No.

[Signature]
CRI

PART - C

(To be completed by Chairman L.C.C.)

1. Decision of L C C :

2. Reference No. L C C Meeting :

[Signature]
Chairman L C C

PART - D

(To be completed by concerned Directorate of Air/Naval/Army HQrs for Class B/2 modifications).

Decision of Air/Naval/Army Headquarters :

1. Reference No.

[Signature]
Dated :

ANNEXURE - O

(Ref : Sec-III, Chap-2, Para-40, 44: Chap-3, Para-17)

MINISTRY OF DEFENCE/DEPARTMENT OF DEFENCE PRODUCTION

**APPLICATION TO INSPECTION AUTHORITY
FOR CONCESSION/PRODUCTION PERMIT**

Contractor's Ref. No.
Sub-Contractor's REF. NO.

.....
Note :

- (1) The granting of this deviation is strictly limited to this specific application and is not to be regarded as a precedent. IT IS NOT AN AMENDMENT TO THE CONTRACT AND IS WITHOUT PREJUDICE TO ANY OF THE DEPARTMENT'S RIGHTS THEREUNDER.
- (2) If the application is prepared by a sub-contractor it must be signed and submitted by the main Contractor.

.....
P A R T - I
.....

1. Main Contractor (Name and Address)
.....
2. Main Contract No.
.....
3. Sub-Contractor (Name & Address)
.....
4. Sub-Contract No.
.....
5. Description of Material, Component or Store
.....
6. Specification/Drawing No. Stress Reference etc.
.....
7. (a) Quantity/Period
.....
(b) Batch/Lot No.
.....

ANNEXURE - 'O' (Contd.)

8. Description of Deviation (including proposals for recovery)
(Continue on separate sheet if necessary)
.....

9. Reference No.of Deviations previously granted :

(a) of a similar nature

(b) For the quantity/period at item 7 above

.....

10. Reason for Deviation :
To reduce production cost error in manufacturing data.
Material specified not available.
Manufacturer's error.
To accommodate local manufacturing methods.
Any other reasons.

.....

11. If the deviation is granted, are any of the following
adversely affected ? (State YES, NO or NK)
(Not Known). If any answer is YES particulars are to be attached).

Safety
Interchangeability
Maintenance
Strength
Functioning
Life of item

.....

12. Design clearance from the contractor's design office
Agreed / Conditions attached.*
(* Delete as necessary)

Signature (Design Department) Date :.. ..
.....
Submitted by :
Signature : On behalf of :

ANNEXURE - 'O' (Contd.)

Date :

Position held :

PART - II : TO BE COMPLETED BY THE INSPECTION AUTHORITY

1. Remarks and opinion of CRI on merit application
(including confirmation of amplification of the
Statements made in Part-I, Section-11)

Reference

.....

Signature

Date

Signature of CRI

Designation/ Rank

-
2. DESIGN CLEARANCE BY CRE/RD
(Unless all the answers to the questions in Part-I, Section-11 are in the negative
and are confirmed to be so in Part-II, Section-1 above, design clearance must
be obtained from CRE/RD)

Date

Signature

Designation/Rank

Ref :

-
3. DECISION BY CRI

Date

Signature of CRI

Date

ANNEXURE - P

(Ref : Sec-IV, Para-22(m) and 31)

Form No

APPLICATION FOR TYPE APPROVAL

1. Name of the Firm :
2. Address :
 - i) Office :
 - ii) Works :
3. Item for which approval is being sought, together with the trade name , if any :
4. Governing specification of the item :
5. Description of item together with technical literature and drawing (copy of literature/ drawing enclosed) . :
6. Information regarding technical collaboration/ Licence manufacture :
7. End use of the item with particular reference to aircraft industry :
8. Details of the test carried out and Reports released by the firm to ascertain the properties and utility of the item :

ANNEXURE- 'P'(Contd.)

9. Scope and extend of approval :
sought
10. List of other items and :
specification thereof which the
form have developed/
manufactured and Organisation
to which the items have been
supplied

Signature of the Applicant

Designation :

Date :

Address :

ANNEXURE 'Q'

(Ref : Sec-IV, Para- 22(p))

TYPE APPROVAL LETTER

GOVERNMENT OF INDIA
CEMILAC
MINISTRY OF DEFENCE

TYPE APPROVAL LETTER NO. CEMILAC/

ISSUED TO :

Name of the firm

Name of item

Approval serial No

This is to certify that the under mentioned items designed and developed by

M/s

through M/s

have been tested according to Specification

test outlined by the Regional Directorate, RCMA - - - - and referred in Type

Record enclosed and meets the requirements of the specification subject to

the limitation detailed in the Type Record :

(a)

(b)

(c)

(d)

ANNEXURE-'Q'(Contd.)

2. The approval serial number quoted above must be reflected on all relevant drawing, contracts and release notes.
3. This approval is contingent upon the quality control aspects of bulk production being cleared by DGAQA, Ministry of Defence , New Delhi.
4. This Type Approval is valid up to and will have to be renewed subsequently.
5. Prior approval of CEMILAC will have to be obtained, if this approval is to be transferred to any other agency or if changes within the Type Record enclosed are effected.

Dated :

Chief Executive (Airworthiness)
CEMILAC

ANNEXURE - R

(Ref: Sec III, Chap 1, Para- 40(a))

DECLARATION OF DESIGN AND PERFORMANCE

DDP No.....
ISSUE No.....

(Name and Address of the Developing Agency)

Declaration of Design and Performance
of(Name of Equipment)
Basic number
Description

DESIGN :

- Weight :
- Overall dimension and position of c.g :
(or ref dwg., if attached)
- Design Specification reference :
- Quality Control Procedure :
- System of Wiring diagram No. :
- Installation Drawing No. :
- Modification Standard Reference :
- Test Schedule Reference :
- Test Report Reference :
- Failure Analysis Report :

ANNEXURE - S

(Ref: Sec III, Chap 1, Para-42)

REQUEST FOR CHANGE IN CONFIGURATION

(Software, Hardware or both)

No. & Date

Origin

Rig

Ground Test on A/C

Flight Test

a) Change Required in :

Subsystem

LRU

b) Software Standard

c) Description of the problem & confirmation on rig
(attach separate sheet for details, if necessary)

d) Originators proposed solution

e) Vendors views on RFC and solution

f) Hardware / Software version in which proposed to be implemented

g) Implications

(Elaborate in a separate sheet applicable implications in detail)

1. Out line

8. Weight

2. Aircraft Flight

9. Cooling

3. Aircraft Wiring

10. Safety

4. Aircraft Elec. I/F

11. Test Schedule

5. Controls

12. DDP

6. 1553B

13. Software

7. Power

14. Any other aspect

ANNEXURE – T

(Ref: Sec III, Chap 1, Para-43)

HARDWARE / SOFTWARE DELIVERY NOTE

No.....

Software Standard	Flight	Date
Hardware Standard	Rig	
Program / Hardware Title	Test / applicable documents	
Ref. No.		
Description		
Cleared on Rig		
Date		
Test Schedule Ref. No.		
For use on aircraft		
Concessions / Limitations		
Issue to aircraft approved by		
Distribution :		
Vendor		
Flight Test Agency		
RCMA		

ANNEXURE 'T' (Contd.)

Solution accepted by Project Management Organisation.

Validation

1. Model No. on which incorporated and date
2. Clearance on rig
3. System clearance on aircraft

Distribution:

1. Vendor Agency
2. Flight test agency
3. RCMA

Signature
For Project Management Organisation / Prime Agency

ANNEXURE – U

(Ref: Sec III, Chap 1, Para-23)

RESPONSIBILITIES OF CEMILAC

- a. To supervise centrally all engineering activities involved in type approval and acceptance of Prototype Aircraft, Engines, Avionics, Air-Armament, and other Aeronautical Equipment including major modifications thereof.
- b. To be the authority for approving the design, accepting the type record and according the certificate of approval of type in respect of Prototype Aircraft, Aero Engines, Air Armament and other aeronautical equipment designed to meet Armed Forces requirements.
- c. To examine and accept or revalidate the type approval, type record in respect of aircraft, aero engine, air armament and other aeronautical equipment acquired to meet Armed Forces requirements.
- d. To procure, maintain and issue technical data, specification and other particulars required for certification / design approval of aeronautical stores.
- e. To participate in aeronautical development projects, technical / evaluation trials to provide and identify requisite inputs for certification / design approval.
- f. To participate, examine and analyse accident/incident of all aircraft and evolve airworthiness directives and identify modifications / improvements there on.
- g. To advice Service Headquarters on suitability of induction of Aircraft / Aero Engines / Systems both indigenous and imported from compliance to airworthiness / certification norms.
- h. To keep abreast of latest developments in the field of Airworthiness and Certification and non invasive techniques and initiate R & D programmes to meet the current and future needs.

ANNEXURE – V

(Ref: Sec III, Chap 1, Para-50)

REQUIREMENTS TO BE SUBMITTED BY DEVELOPING AGENCY FOR CLEARANCE OF AIRBORNE EQUIPMENT IMPORTED FROM ABROAD

1. Nomenclature of the Equipment
With Part No /Drawing No.
2. Brief Description.
3. Intended usage
4. Reference Technical Specification
Standards etc (details enclosed)
5. Name of the Supplier and if it is a Design approved firm
6. Whether clearance required for development flight trials/series production.
7. a) Whether Approved /Type Certified by Civil /Military Authorities of the country of origin.
b) If yes, reference specification to which Approved / Certified(copy enclosed).
8. Conditions / Limitations of Type Approval.
9. Detailed results of type tests carried out (enclosed)
10. Installation features (drawings / reports enclosed)
11. If already installed / in service with other Aircraft / Helicopter / Engines, details thereof.
12. In case of yes in (11), achieved details of service experience in terms of life, M.T.B.F., M.T.B.R., Reliability & Maintainability levels with confidence limits.
13. Design life of the equipment (with details of test validating it)
14. If not type approved by Government Organisation in the country of origin, proposed plan of action for obtaining certification.
a) If proposed for licence manufacture in India, the name / address of the licence.

ANNEXURE 'V' (Contd.)

b) In case of yes in 14(a), details of test / clearance details for manufacture at new source.

15. Quality Assurance / Inspection Approval details

a) Is the Company supply the equipment has / have the approval of the Civil / Military authorities of the country of origin.

b) Name and rank of the release note signatory.

c) A brief outline of the Quality Assurance Program / Plan prevailing at the works of the supplier.

d) Comments on approval of the firm by DGAQA.