UK Civil Aviation Authority

Part 147 Training:

Guidance on the Requirements of Training Needs Analysis for Type-Rating courses

CAP 1600

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Introduction

This publication is issued to clarify the requirements and UK CAA expectations for the acceptance of type training courses, delivered under the control of Maintenance Training Organisations (MTO), approved in accordance with the UK Part 147 standard. This publication relates to the Training Needs Analysis (TNA), supporting the definition and specification of the course**.**

Definitions

"**Shall**" and "**Must**" are used to indicate a mandatory requirement.

"**Expect**" and "**Should**" are used to indicate strong obligation.

"**May**" is used to indicate discretion.

"**Training Needs Analysis**" is the term used to describe the process of identifying a course content, required to provide a student with the requisite competence for the endorsement of a UK Part-66 licence.

"**Competency Analysis"** is the process of identifying a student's skills and knowledge, against a prescribed standard in order establish if a gap exists – these could be tests or assessments.

"**Learning Objectives**" are statements that define the expected goal of a curriculum, course, lesson, or activity in terms of demonstrable skills or knowledge that will be acquired by a student during training.

Regulatory Framework

Paragraph (d) of Section 3.1 of Appendix III to Assimilated Regulation (EU) No 1321/2014, Annex III (Part 66) specifies that type-training courses carried out in a Maintenance Training Organisation (MTO) approved in accordance with the UK Part 147 standard, shall justify their duration and the full coverage of the relevant syllabus by submission of a **Training Needs Analysis**.

This TNA should be based on several elements, such as:

the training methodology

the design of the aircraft type

its maintenance needs

the types of operation

a **detailed analysis of applicable chapters**

a **detailed competency-analysis** showing that the objectives of a theoretical element of a type-training course are fully met.

Paragraph 147.A.130(a) also specifies that the MTO shall establish procedures acceptable to the UK CAA, to ensure proper training standards and compliance with all relevant requirements of Part 147. Items defined in the Regulation under paragraph 147.A.300, Section 3 of Appendix III to Part 66, and the internal procedure to perform the required Training Needs Analysis referred above, are not an exception to this requirement.

Rationale for this CAP

Prior to the amendment of the Regulation, introducing TNAs, the UK CAA had specified the requirement of an analytical process for the creation of a training course, and a report to indicate

contents and duration. This resulted in differing approaches from the MTOs and a lack of standardisation.

UK CAA's past oversight experience highlighted that the majority of MTOs (especially those with a wide scope of type-training courses) focused mainly on the creation of the reports for themselves, often resulting in a 'copy and paste' exercise. This did not give the required attention to the analytical process which is needed to produce an effective training course.

The subsequent amendment of the Regulation, requires that a TNA is carried out to justify the duration of a course and ensure that all the elements of the syllabus, at the required level, are covered.

5. TNA Requirements in the Regulation

5.1 AMC to point 3.1 (d) of Appendix III to Part-66 'Aircraft Type Training and Examination Standard. On-the-Job Training'

Training Needs Analysis for the Theoretical Element of the Aircraft Type Training

1. The minimum duration for the theoretical element of the type rating training course, as described in Appendix III to Part-66, has been determined based on:

   generic categories of aircraft and minimum standard equipment fit.

   the estimated average duration of standard courses imparted in the UK.

2. The purpose of the Training Needs Analysis (TNA) is to adapt and justify the duration of the course for a specific aircraft type. This means that the TNA is the main driver for determining the duration of the course, regardless of whether it is above or below the minimum duration described in Appendix III to Part-66.

   In the particular case of type training courses approved on the basis of the requirements valid before Regulation (EU) No 1149/2011 was applicable (1 August 2012) and having a duration for the theoretical element equal to or above the minimum duration contained in paragraph 3.1(c) of Appendix III to Part-66, it is acceptable that the TNA only covers the differences introduced by Regulation (EU) No 1149/2011 in paragraph 3.1(e) 'Content' and the criteria introduced in paragraph 3.1(d) 'Justification of course duration' related to the minimum attendance and the maximum number of training hours per day. This TNA may result in a change in the duration of the theoretical element.

3. The content and the duration deriving from this TNA may be supported by an analysis from the Type Certificate holder.

4. In order to approve a reduction of such minimum duration, the evaluation done by the CAA should be performed on a case-by-case basis, appropriate to the aircraft type. For example, while it would be exceptional for a theoretical course for a transport category, complex motor-powered aircraft such as an A330 or B757 to be below the minimum duration shown, it would not necessarily be exceptional in the case of a General Aviation (GA) business aircraft such as a Learjet 45 or similar. Typically, the TNA for a GA aircraft course would demonstrate that a course of a shorter duration satisfies the requirements.

5. When developing the TNA, the following should be considered:

(a) The TNA should include an analysis identifying all the areas and elements where there is a need for training as well as the associated learning objectives, considering the design philosophy of the aircraft type, the operational environment, the type of operations and the

operational experience. This analysis should be written in a manner which provides a reasonable understanding of which areas and elements constitute the course in order to meet the learning objectives.

(b) As a minimum, the Training Need Analysis (TNA) should take into account all the applicable elements contained in paragraph 3.1 of Part-66 Appendix III and associated AMCs.

(c) The TNA should set-up the course content considering the Appendix III objectives for each level of training and the prescribed topics in the theoretical element table contained in paragraph 3.1 of Part-66 Appendix III.

(d) For each chapter described in the theoretical element table contained in paragraph 3.1 of Part-66 Appendix III, the corresponding training time should be recorded.

(e) Typical documents to be used in order to identify the areas and elements where there is a need for training typically include, among others, the Aircraft Maintenance Manual, MRB report, CMRs, airworthiness limitations, Troubleshooting Manual, Structural Repair Manual, Illustrated Parts Catalogue, Airworthiness Directives and Service Bulletins.

(f) During the analysis of these documents: Consideration should be given to the following typical activities:

Activation/reactivation;

Removal/Installation;

Testing;

Servicing;

Inspection, check and repairs;

Troubleshooting / diagnosis.

For the purpose of identifying the specific elements constituting the training course, it is acceptable to use a filtering method based on criteria such as:

Frequency of the task;

Human factor issues associated to the task;

Difficulty of the task;

Criticality and safety impact of the task;

In-service experience;

Novel or unusual design features (not covered by Part-66 Appendix I);

Similarities with other aircraft types;

Special tests and tools/equipment.

It is acceptable to follow an approach based on:

Tasks or groups of tasks, or

Systems or subsystems or components

(g) The TNA should:

Identify the learning objectives for each task, group of tasks, system, subsystem or component;

Associate the identified tasks to be trained to the regulatory requirements (table in Paragraph 3.1 of Appendix III to Part-66) ;

Organise the training into modules in a logical sequence (adequate combination of chapters as defined in Appendix III of Part-66) ;

Determine the sequence of learning (within a lesson and for the whole syllabus) ;

Identify the scope of information and level of detail with regard the minimum standard to which the topics of the TNA should be taught according to the set-up objectives.

Address the following:

Description of each system/component including the structure (where applicable) ;

System/component operation taking into account:

Complexity of the system (e.g. the need of further break down into subsystems, etc.) ;

Design specifics which may require more detailed presentation or may contribute to maintenance errors;

Normal and emergency functioning;

Troubleshooting;

Interpretation of indications and malfunctions;

Use of maintenance publications;

Identification of special tools and equipment required for servicing and maintaining the aircraft;

Maintenance Practices;

Routine inspections, functional or operational tests, rigging/adjustment, etc.

Describe the following:

The instructional methods and equipment, teaching methods and blending of the teaching methods in order to ensure the effectiveness of the training;

The maintenance training documentation/material to be delivered to the student;

Facilitated discussions, questioning session, additional practiced-oriented training, etc.;

The homework, if developed;

The training provider's resources available to the learner.

(h) It is acceptable to differentiate between issues which must be led by an instruction and issues which may be delivered through interactive simulation training devices and/or covered by web-based elements. Overall time of the course will be allocated accordingly.

(i) The maximum number of training hours per day for the theoretical element of type training should not be more than 6 hours. A training hour means 60 minutes of tuition excluding any breaks, examination, revision, preparation and aircraft visit. In exceptional cases, the CAA may allow deviation from this standard when it is properly justified that the proposed number of hours follows pedagogical and human factors principles. These principles are especially important in those cases where:

Theoretical and practical training are performed at the same time;

Training and normal maintenance duty/apprenticeship are performed at the same time.

(j) The minimum participation time for the trainee in order to meet the objectives of the course should not be less than 90 % of the tuition hours of the theoretical training course. Additional training may be provided by the training organisation in order to meet the minimum participation time. If the minimum participation defined for the course is not met, a certificate of recognition should not be issued.

(k) The TNA is a living process and should be reviewed/updated based on operation feedback, maintenance occurrences, airworthiness directives, major service bulletins impacting maintenance activities or requiring new competencies for mechanics, alert service bulletins, feedback from trainees or customer satisfaction, evolution of the maintenance documentation such as MRBs, MPDs, MMs, etc. The frequency at which the TNA should be reviewed/updated is left to the discretion of the organisation conducting the course.

NOTE: The examination is not part of the TNA. However, it should be prepared in accordance with the learning objectives described in the TNA.

5.2 The MTO holds the responsibility to develop and establish the content and the duration of the course, to demonstrate how prescribed training objectives are achieved.

5.3 In order for the UK CAA to establish whether the course adheres to the minimum time frames stated in the Regulation, or justifies a shorter duration, the MTO must present the results of their TNA.

5.4 The MTO must also establish a process to collect and analyse feedback from delivered courses to either validate or amend the existing TNA. This process should be transparent and auditable.

5.5 MTOs that deliver type training courses developed by the Type Certificate Holder (TCH) are only required to establish the length of the course. The Regulation allows that the content and duration of course may be supported by the TNA from the TCH. MTOs that develop training courses themselves, are required to carry out a full TNA and submit it to the UK CAA as part of the application process.

6. How to Define Learning Objectives?

The Regulation specifies that the TNA should include an analysis identifying all the areas and elements where there is a **need for training**, as well as the **associated learning objectives**, considering the design philosophy of the aircraft type, the operational environment, the type of operations and the operational experience (ref. AMC to para. 3.1(d) of Appendix III to Part-66)

Learning objectives are statements that define the expected goal of a curriculum, course, lesson, or activity in terms of demonstrable and measurable skills or knowledge that will be acquired by a student during training. Other terms such as instructional objectives, learning outcomes, or learning goals are frequently used**.**

Accurate learning objectives are essential to building a strong foundation in the development of training material. It is recognized that the definition of learning objectives is one of the most critical steps in the training needs analysis process. Well-constructed learning objectives enable training providers to define what will be delivered, trainees to understand what they will learn, and maintenance organisations and customers to determine the suitability of the training. Learning objectives help all stakeholders involved in the process to share a uniform understanding of what will be achieved at each stage of the course and by completing the type-training course.

It is best practice to define learning objectives for all levels of activities, from the overall course to the specific individual lessons. The number of levels will be dependent on the complexity of the aircraft type. Learning objectives can be divided into **Terminal** and **Enabling. Terminal** objectives define what students should be able to do at the end of the course. **Enabling** objectives are subordinate to Terminal objectives, which help to break down the learning into smaller, manageable objectives. These should define what students need to be able to do during the course to achieve the Terminal objectives.

While the **Terminal** objectives for type-training courses are already defined in the Regulation (Paragraphs 3.1(a) and 3.2(a) of Appendix III to Part 66), the MTO should define the **Enabling** objectives for individual syllabus as per Paragraph 3.1(e) considering the aircraft type training levels (Section 2 of Appendix III to Part 66) and any additional elements introduced due to type variations, technological changes, etc.

Enabling objectives should be derived from the specific course training sessions in terms of knowledge, information, and skills. At this stage, the MTO's Subject Matter Experts (SMEs) should consider what students are expected to achieve by the end of each training session and how the acquired skills, knowledge and behaviours contribute to the Enabling objectives. Enabling objectives are specific for each section of the course (e.g. aircraft sub-system) taking into account specific terminology, maintenance requirements, components installed, etc. as well as tooling, procedures, materials, aids, or facilities required for the performance of maintenance tasks (for example, "with reference to a manual" or "by checking a chart."). The different objectives are illustrated by the following examples:

Type-training theoretical element course **Terminal** objectives as per Appendix III to Part 66:

"On completion of a theoretical-training course, the student shall be able to demonstrate, to the levels identified in Appendix III syllabus, the detailed theoretical knowledge of the aircraft's applicable systems, structure, operation, maintenance, repair and troubleshooting according to approved maintenance data. The student shall also be able to demonstrate the use of manuals and approved procedures, including the knowledge of relevant inspections and limitations".

Enabling Objectives Example:

"On completion of ATA 28 (Fuel) the student will be able to:

Identify and locate the main components of the Fuel System

Describe the layout of the Fuel System, identify its subsystems and interface

Explain the operation of the Fuel System main components

Identify and explain the controls associated with the Fuel System

Identify and explain the indications and enunciators associated with the Fuel System

Describe the procedures for Refuelling/Defueling

Perform BITE procedures of the Fuel System"

For large complex aircraft types where type training courses extend over several weeks, MTOs may find beneficial defining a further level of Enabling objectives for each unit (lesson) as demonstrated by the following example:

"28-22 Engine Fuel Feed System Enabling objectives:

Identify the components and explain the operation of the B777 engine fuel feed system with regards to switch selection on the fuel panel and fuel control switches.

P5 & P8 panels

Scavenge System

Fuel Synoptic Display

Fuel Maintenance Page

Define the operation of the engine fuel feed system, indicating the function of the following components:

Spar Valve & Battery

Cross-feed Valves

Fuel Scavenge Jet Pump”

7. The TNA Process

The first stage of the TNA process is to identify the Terminal type-course objectives and the specific syllabus as defined in Appendix III to Part 66.

The next step is to develop the Enabling objectives for each of the required ATA chapters/syllabus. In some organisations, several SMEs may be involved in the drafting of objectives for the different ATA chapters, therefore the MTO should ensure that all Enabling objectives are developed in a consistent manner across the different chapters and directly relate to the Terminal objective for the type-course.

This process should be complemented by a technical analysis. Many TCHs and MTOs use a similar filtering method. This involves the analyses of the Aircraft Maintenance Manual (AMM) task-by-task, filtering the tasks using criteria such as frequency, complexity, criticality, novelty, etc., and then eliminating the redundancies (e.g. task for engine 2 is same as task for engine 1). For the final list of tasks, they determine what knowledge is required to safely perform each of the tasks. This competency-based approach supports the development of Enabling objectives (i.e. what do you need to know to safely perform the task on this specific aircraft).

An essential part of the technical analysis is to evaluate information specific to the type variations, technological changes, the operational environment, the type of operations and the operational experience, etc., to determine any additional elements that must be emphasized during training.

The technical analysis will also inform the development of practical tasks, considering the requirements set in section 3.2 (b) of Appendix III to Part 66.

The next step is to determine how much tuition time is required to achieve all Enabling objectives for each of the defined syllabus. It will inform the overall duration of the type-training course and can support a justification to the UK CAA if it’s below the required minimum tuition hours defined in section 3.1 (c) of Appendix III to Part 66.

The TNA analytical process should be defined in the MTOE, in the "Course Material Preparation" section (normally under item 2.2), or in a detailed procedure referenced in the MTOE. It should detail who is involved in the analysis, what method is used (e.g. filtering method described above), source documentation used for the analysis, validation and periodical revision processes, records, etc. The process should provide sufficient detail to allow the UK CAA to determine how type courses are developed.

The information gathered through the TNA development process will enable completion of the Course Approval Forms (previously known as SF Forms) and a TNA Report, which are required as part of the application submission to the UK CAA for type training approval. The TNA step-by-step process is depicted in the following diagram:

8. TNA Report and Course Approval Form Requirements

It is acknowledged that given the regulatory requirements for TNA and the in-depth process, the TNA document may become long and comprehensive. Therefore, to support the application process, the UK CAA expects the MTOs to complete a Course Approval Form and a TNA Report, which summarise the results from the in-depth TNA process. It must be noted that the CAA Course Approval Form and the TNA Report are not replacing the need for a full TNA. The UK CAA may request to sample the full TNA document during initial approval process or ongoing oversight.

Course Approval Forms and TNA Reports should be internally vetted by the MTO's Quality System prior to application submission to the UK CAA for approval.

Completed and UK CAA approved Course Approval Forms should be listed in Section 4 of MTOE. Approved TNA Reports may be stored separately if required. A blank TNA report template should be included in the MTOE.

9. TNA for Practical Elements

Although the Regulation does not require a TNA for the practical elements of type-courses, the MTOs should ensure that the practical training programme includes a representative cross-section of maintenance activities, relevant to the aircraft type, as per section 3.2 (b) of Appendix III to Part 66.

MTOs delivering both theoretical and practical training can either:

incorporate the practical element into the TNA analytical process required for the theory part, as described in the previous sections, and determine the practical tasks for the course (e.g. using task-filtering exercise, definition of practical Enabling objectives, etc)

or

describe the process how tasks are selected, deemed representative, and the rationale for omitting tasks (if any) in a detailed procedure referenced in the MTOE.

It is expected that the MTO will define how practical training is delivered. It should be clear what method is used to achieve each of the practical tasks. Several widely used methods are described below:

Task Practicing and Performance: The trainee participates in tasks on the aircraft / aircraft component, or on a task-trainer. Despite the technological advancements in training aids, it is expected that parts of the practical training involve this method. This approach remains an essential step for practicing the use of specialist tools, completion of tasks considering human factors, environmental and operational conditions.

Demonstration: The trainee does not perform the task but observes a task carried out by the instructor or another trainee. This is acceptable when the benefit for each trainee repeating the same task is not justified. It is recommended that the instructor allows the trainees to participate in some tasks or sub-tasks as it may represent an invaluable learning opportunity to commit/observe common errors and identify suitable corrective actions with support from the instructor.

Technical Discussion or Basic Simulation: The task does not result in the physical removal/installation of components or the alteration or activation/de-activation of the A/C systems. It involves the physical access to the component location, the visualisation of the tooling and references to the AMM. It may also include the use of specialist tooling and access equipment.

Simulation or Advanced Simulation: The student uses a dedicated maintenance simulator to reproduce the complete task in a virtual A/C environment. The simulator should be advanced enough to allow virtual interactions with the student and to observe the consequences of incorrect or missing maintenance actions. This method is mainly used for practicing troubleshooting procedures, as the access to A/C with defects may not be possible or operationally not desirable.

10. TNA Report Requirements

This section provides a summary of the required information for the TNA report, which should be part of the submission to the UK CAA for the approval of a type-training course:

- Theoretical Element
- General type-course information including:
- Type(s) and Licence Category(ies) covered by the course
- Definition and description of the course
- Pre-course required qualification(s)
- Terminal Learning Objectives for the theoretical element of the type-course (generic statements as per Appendix III to Part 66 are accepted)
- Reference documents used during the technical analyses defining the training need (e.g. AMM, Maintenance Review Board (MRB) Report, Maintenance Planning Document (MPD), Certification Maintenance Requirements (CMRs), Airworthiness Limitations, Structural Repair Manual (SRM), Airworthiness Directives (ADs), Safety Bulletins (SBs), etc...).
- Minimum attendance required
- Maximum Number of hours per training day, excluding breaks, examination, revision, preparation, and aircraft visit.
- TNA reference number, revision, and date
- Include the following content for each syllabus, ATA chapter, task, group of tasks, system/sub-system, or component where there is training need. This is dependent on complexity of the aircraft type and the structure and levels of technical analyses performed by the MTO.
- Enabling objectives
- Tuition time for each syllabus, ATA chapter, task, group of tasks, system/sub-system, or component, and overall theoretical element
- Knowledge level
- Schedule and sequence of learning (timetable) demonstrating how the required ATA chapter, task, group of tasks, system/sub-system, or component are covered during the type-course considering the section 3.1 of Appendix III to Part 66 requirements
- Aircraft visits / access to an aircraft may be replaced by a combination of training aids (including simulations), when it has been determined that it meets an acceptable standard and the enabling objectives.
- Ensure that information provided in the TNA report corresponds with information provided in the associated Course Approval Form.

Practical Element

If the same TNA analytical process was used to establish the practical element for the type-course, please outlined the following:

- Details of access to aircraft for maintenance training

- Identified practical tasks for the relevant aircraft considering section 3.2 (b) of Appendix III to Part 66 requirements
- Identified Enabling objectives for each syllabus, ATA chapter, task, group of tasks, system/sub-system, or component

Abbreviations

AD	Airworthiness Directive
AMC	Acceptable means of Compliance
AMM	Aircraft Maintenance Manual
ATA	Air Transport Association of America
CAP	Civil Aviation Publication
CMR	Certification Maintenance Requirement
CR	EU Commission Regulation
CS	EASA Certification Specification
EASA	European Aviation Safety Agency
GA	General Aviation
MM	Maintenance Manual
MPD	Maintenance Planning Document
MRB	Maintenance Review Board
MTO	Maintenance Training Organisation
MTOE	Maintenance Training Organisation Exposition
OJT	On-the-job training
OEM	Original Equipment Manufacturer
TCH	Type Certificate Holder
TNA	Training Needs Analysis
SB	Safety Bulletin
SME	Subject Matter Expert
SRM	Structural Repair Manual
UK CAA	United Kingdom Civil Aviation Authority

Training Needs Analysis – Example TNA (Using BAe 146)

This is an example for what is expected by the CAA for organisations to produce as a TNA.

BAe 146 / AVRO 146 - RJ TRAINING NEEDS ANALYSIS

B1 Theoretical Course Ref: XXX/XXX/XXX

CONTENTS

INTRODUCTION

This TNA has been used to create the course training material, which has been compiled using the manufacturers Maintenance Manual data and also incorporates relevant information obtained from Service Bulletins and Airworthiness Directives up to and including the date at the bottom of this page.

The latest revision of the AMM at the date of compilation is: **Revision XX**

CHAPTER 6-11 - GROUND HANDLING - SUMMARY

The above chapters cover all the topics associated with the general ground handling and servicing of the aircraft.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Dimensions, areas and zoning Aircraft Lifting & Shoring. Levelling and weighing the aircraft Nose leg towing and bridle towing of the aircraft. Parking & Mooring Aircraft Storage & Return to Service. Placards and Markings Aircraft Documentation	All at Level **1**	Classroom training using PDF document based presentation.	The student should be familiar with the basic elements of the subject and be able to give a simple description of the systems. The student should be able to use typical terms.	**2.00**

CHAPTER 21 - ENVIRONMENTAL CONDITIONING SYSTEMS - SUMMARY

The Environmental Control System (ECS) uses engine and/or APU bleed air for cockpit and cabin air conditioning and pressurisation. Cooling is by means of two air conditioning packs. Cockpit and cabin air temperatures may be controlled independently in either a manual or automatic mode.

Cabin pressurisation is achieved by controlling the rate at which conditioned air is allowed to bleed from two pneumatically operated discharge valves.

Depending on aircraft variant, cabin pressure control is achieved using analogue or digital principles control.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Ducts, Pipes & Fittings. Valve – Isolation Flow Control. Fan – Avionic Cooling. Fan – Flightdeck. Valve - Distribution. Valve - Shutoff Valve - Flightdeck Boost Valve - Non - Return. Fan – Galley Fan - EFIS Cooling Fan - Individual Air Outlets Filter - Cabin & Flightdeck. Altimeter – Cabin VSI & Differential Pressure. Gauge – Quad. Limiter – Altitude. Switch – High Altitude Capsule. Valve – Discharge. Valve – Outflow. Valve – Ditch Solenoid. Water Trap/Air Drier. Pack – Air Conditioning. Cold Air Unit. Condenser. Heat Exchanger(s). Valve – Fresh Air. Valve – CAU Non – Return.	All At Level **3**	Classroom training using PDF document-based presentation. .	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**6.5**

Components	Level	Training Method / Material	Learning Objectives	Time Required
Switch – High Limit Temperature. Water Extractor. Temperature Sensor. Switch – Flow/Pressure. Jet Pump. Water Injector. Valve – Mode Selector. Valve – Recirculation/Isolation. Switch – Overtemperature. Valve – Ram Air. Valve – Ram Air Non-Return. Controller – Temperature. Indicator – Duct Temperature. Indicator - Cabin. Sensor – Control Duct Temperature. Sensor – Duct Temperature Indication. Sensor – Cabin & Flightdeck. Sensor – Cabin Temperature Indication. Valve – Temperature Control. Valve – Animal Bay (ECS) Inlet/Outlet. Motor – Animal Bay Heater/Fan. Thermostats – Animal Bay. Animal Bay – Over Temperature control Sensor.	All At Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	

CHAPTER 22 - AUTO FLIGHT - SUMMARY

The Automatic Flight Guidance system is an integrated electro-mechanical autopilot and flight director, which provides auto-flight control in pitch, roll and yaw together with flight director information.
The system has four sub-systems; a two-axis autopilot, pitch & roll, flight director, yaw damper and altitude alerting.
Additionally, to the standard functions, the RJ variant has a parallel rudder facility, flap deployment compensation and a CAT 3 autoland capability.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Automatic Flight Guidance System -General Autopilot Control Panel. Mode Selector Panel. Navigation Selector Panel. Altitude Selector Panel. Pilots' Handwheel Controls- Electric Trim Switches. Synchronisation Button. Combined Cut-out & Go Around Button. Flight Director Switches. Mode Annunciator Panels. Avionics Master Switches. Autopilot Computer. Air Data Unit. Servomotors. Vertical Accelerometer. Disengage Unit. Monitor Computer. Column Cut-out Switch. Trim Switch. Safety Checks. Yaw Damper. Yaw Rate Gyro. Lateral Accelerometer. Yaw Computer Yaw Damp Actuator. Comparator Switch.	All at Level **2**	Classroom training using PDF document-based presentation.	The student should be familiar with the basic elements of the subject and be able to give a simple description of the systems. The student should be able to use typical terms. The student should be able to understand the theoretical fundamentals of the subject and should be able to give a general description of the subject using, as appropriate, typical examples. The student should be able to read and understand sketches, drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using detailed procedures. .	**7.5**

Components	Level	Training Method / Material	Learning Objectives	Time Required
Rudder Position Pick-off. Approach Monitoring System . RJ Digital Flight Guidance System (DFGS) General – Master Switches. Mode Control Panel. Thrust Rating Panel. Autothrottle Disengage Switches. TOGA Buttons. EFIS PFDs'. Control Column Switches. A/Pilot Disconnect. F/Director Synchronisation. Annunciators. Flight Guidance Computer. AP Servomotors. Position Sensors. Parallel Rudder Servomotor. Pitch Trim Servomotor. Flap Trim Compensation. Yaw Damper. Autothrottle Servomotor, Clutch & Gearbox. Flight Director. Mode Control Panel. Testing.	All at Level **2**	Classroom training using PDF document-based presentation.	The student should be familiar with the basic elements of the subject and be able to give a simple description of the systems. The student should be able to use typical terms. The student should be able to understand the theoretical fundamentals of the subject and should be able to give a general description of the subject using, as appropriate, typical examples. The student should be able to read and understand sketches, drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using detailed procedures.	

CHAPTER 23 – COMMUNICATIONS - SUMMARY

The aircraft systems providing communications facilities are designated as follows; Speech communication; a triple VHF system, and a dual or single HF system is fitted.

Data transmission and automatic calling; a selective calling (SELCAL) system, which continuously monitors the VHF and HF systems.

Service interphone; facilities providing speech intercommunication between individual members of the flight and ground crews.

Audio integrating; includes a central audio system.

Static discharging is provided on the tips of the wings and horizontal stabiliser.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Antenna. 146 – VHF Communications. VHF Transceiver. Control Unit. RJ – VHF Transceiver. Radio Management Panel. Audio Integrating Panel. Central Audio Unit. Noise Sensor. Flightdeck Speakers. Audio Selector Panel. Service Interphone – Passenger Address. – Amplifier. HF Communications – Receiver Transmitter. Antenna Coupler. 146 control Unit. RJ Radio Management Panel. ACARS – MCDU. Comms Management Unit. Printer. Static Dischargers.	All at Level **2**	Classroom training using PDF document-based presentation.	The student should be familiar with the basic elements of the subject and be able to give a simple description of the systems. The student should be able to use typical terms. The student should be able to understand the theoretical fundamentals of the subject and should be able to give a general description of the subject using, as appropriate, typical examples. The student should be able to read and understand sketches, drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using detailed procedures.	**3.5**

CHAPTER 24 - ELECTRICAL SYSTEM - SUMMARY

The aircraft electrical power system consists of three subsystems:

The AC system is a 115/200V, 3 phase, 400Hz system supplied by integrated drive generators (IDGs') mounted on the outboard main engines and a further generator mounted on the APU. External AC ground power can be connected via a socket on the front right side of the fuselage.

In the event of loss of main generators, a standby generator and a static inverter can supply some of the AC network.

DC power is obtained from transformer rectifier units (TRUs') and one or two Nicad batteries. An external DC power socket will supply the engine start busbars.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Electrical Power – General. Engine & APU Driven Generators. Standby Generator. Static Inverter. AC & DC Power – General. Ground Service Bus. 26V Bus. TRU. System Coding. Cable Identification. External Power. Contactors. Overhead Control Panel. AC System - AC Panels. Busbar Supply & Transfer. Generator Chip Detector. Temperature Control Valve. Oil Coolers. Oil Temperature Switch. Scavenge Filters. Generator Control Unit. Current Transformer. External Power Monitor Unit. Generator Inhibit Override Circuit.	All At Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**13.75**

Components	Level	Training Method / Material	Learning Objectives	Time Required
AC Bus Fail relays. Standby Generator Control Unit. Avionics Master Switches. Galley Power. DC System. TRU. Busbar Control Circuits. Battery No Charge Monitor. Battery Overheat **Nickel Cadmium Battery.** Emergency/Essential/Battery Changeover Relay. Indications & Warnings. Bus Fail Relays. DC Panels. Avionic Switching – Avionic Racks. Avionic Equipment Cooling.	**2**	Classroom training using PDF document-based presentation.	FOR LEVEL 2 The student should be familiar with the basic elements of the subject and be able to give a simple description of the systems. The student should be able to use typical terms. The student should be able to understand the theoretical fundamentals of the subject and should be able to give a general description of the subject using, as appropriate, typical examples. The student should be able to read and understand sketches, drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using detailed procedures.	

CHAPTER 25 - EQUIPMENT/FURNISHINGS - SUMMARY

Flight deck and cabin seats are typical of this size of aircraft with the cabin seats arranged as triple seats either side of a central aisle. Cabin crew seats are provided at the front and rear of the cabin. Flight deck crew seats are track mounted and are fully adjustable. A supernumerary seat is mounted on a lateral track, allowing it to be positioned on the centreline.

Galley location and composition is dependent on airline requirements, but generally a wet galley is located at the front of the cabin.

There are normally two toilet units located on the left side of the cabin.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Flight Compartment Seat - Captains & First Officers. Seat – Supernumerary. Pilots seat restraint System. Floor Rails. Passenger Compartment Seats – Passenger. Seat - Cabin Attendant. Passenger Service Units. Overhead Stowage Bins. Panels – Sidewall, Roof, Fairings & Dado. Covering – Passenger Compartment Floor. Stowage's. Galley/Buffet. Lavatory Compartments. Cargo Compartments. Linings – Cargo Bays. Emergency Equipment Evacuation Slide. Escape Rope – Flight Compartment. Emergency Locator Transmitter. Equipment Bays.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should be familiar with the basic elements of the subject and be able to give a simple description of the systems. The student should be able to use typical terms. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**0.5**

CHAPTER 26 - FIRE PROTECTION - SUMMARY

Dedicated fire detection and protection is provided for the engines and auxiliary power unit.

Bleed leak detection systems monitor the engine bleed supply, airframe ice protection and air-conditioning systems ducting.

The cargo compartments are equipped with smoke/fire detection and an extinguishing system.

Smoke detection is provided for the toilet units, with an auto extinguisher in the waste bins.

Handheld extinguishers are provided for use in the cabin and flight deck.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Equipment Bay Smoke Detection – Smoke Detection Unit. Cargo Compartment Fire Extinguishing System – Smoke Detectors. Fire Suppression Bottle - (High Rate Discharge HRD & Low Rate Discharge LRD). Cargo Electronics Units. Flight Deck Switch Panel. Flight Deck Control Unit. Extinguishant Nozzle Assembly. Wings, Pylon And Spine Overheat Detection – High Speed Resetting Detectors (H.S.R.S.). Continuous Fire/Overheat Detection (C.F.D.) Elements. Control Unit. Air Conditioning Equipment Bay Overheat Warning System – Detector – Overheat. Toilet Smoke Detection – Smoke Detector.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**3.25** *(Airframe = 2.0, Engine = 1.25)*

Components	Level	Training Method / Material	Learning Objectives	Time Required
Portable Fire Extinguishers- Halon Extinguisher. Water-Glycol Extinguisher. Toilet Fire Extinguisher System. Engine Fire and Overheat Protection – Sensing Elements. Detector. Engine Fire Extinguishing - BCF Fire Extinguisher. Pressure Relief indicator. Fire Handle & Cable Circuit. Test Panel & Indications. APU Fire Protection – Sensing Elements. Emergency Shutdown Relay. BCF Fire Extinguisher. Pressure Relief indicator. Test Panel & Indications.		Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	

CHAPTER 27 - FLIGHT CONTROLS - SUMMARY

The aileron & elevator primary flight controls are mechanically operated using servo-tab mechanisms. The rudder has a mechanical input, which is converted to hydraulic operation of the rudder surface.

Each primary flight control system has either/or mechanical/electrical operated trim systems.

The aileron & elevator cable circuits incorporate components to enable safe operation in the event of a cable jam or severance.

Two hydraulically operated spoilers augment roll control.

The tabbed Fowler Flaps are electrically signalled and hydraulically driven. There

are six electrically signalled hydraulically operated, lift spoilers.

There is a petal type, electrically signalled hydraulically operated airbrake, mounted on the aft fuselage.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Flight Controls – General Take-off Configuration Warning System. Roll Control - Aileron Control System – Main Circuit. Autopilot Servomotor. Control Column. Aileron Cable Compensator. Strut – Interconnect Detent. Non-linear Gearing Unit. Aileron & Tabs. Aileron Disconnect Unit Aileron Servomotor. Aileron Position Transmitter (FDR). Cables – Aileron Control. Sensor - Aileron Dual Surface Position. Aileron Trim Control System. Aileron Trim Gearbox Assembly. Aileron Trim Screwjack. Cables - Aileron Trim. Roll Spoiler System – Actuator – Roll Spoiler Cambox – Roll Spoiler.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**10.5** *Primary = 6.0, Secondary = 4.5)*

Components	Level	Training Method / Material	Learning Objectives	Time Required
Transmitter – Roll Spoiler Position (FDR). Roll Spoiler Springstrut. Rudder Control System – Rudder Torque Shaft. Rudder Pedal Assembly. Rudder Pedal Adjuster. Rudder 'Q' – Pot. 'Q' Feel Pitot Head. Datum & Spring Feel Strut. Rudder Actuator. Rudder Compensator. Rudder. Rudder – Position Transmitter (FDR). Sensor - Rudder Pedal Dual Position. Rudder Trim Unit. Switch – 'Q'-Pot Pressure/Static. Cables – Rudder Control. Rudder Trim Control System Rudder Trim Gearbox (Front/Rear). Rudder Trim Screwjack. Rudder Trim Damper. Cables - Rudder Trim Elevator Control System 'Q'-Pot – Elevator. Elevator Disconnect Proximity Sensor. Elevator Compensator. Elevators & Tabs. Elevator Position Transmitter (FDR). Elevator Dual Position Sensor. 'G'-Weight & Lever. 'G'-Weight Damper. Cables – Elevator.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	

Components	Level	Training Method / Material	Learning Objectives	Time Required
Elevator Flight Damper. Control Column Assembly Elevator Disconnect Unit Airspeed Switch Elevator Trim Control System - Elevator Trim Gearbox. Elevator Trim Screwjack. Elevator - Position Transmitter (FDR). Elevator – Position Transmitter (FDR). Sensor – Elevator Trim Dual Position (FDR). Microswitch Elevator Trim. Damper – Elevator Trim. Cables – Elevator Trim. Stall Identification & Warning System - Stick Shaker Motor Indicator – Pressure Pneumatic Ram. Signal Summing Unit. Valve – Non-Return. Valve – Electro/Pneumatic. Sensor – Airflow. Stall Ident. Control Relay PCB. Valve – Drain. Pneumatic Reservoir. Valve – Pressure Reducing. Valve – Motorized Restrictor. Cables – Stall Identification System. Flap Control System Flap Torque Shaft.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	

Components	Level	Training Method / Material	Learning Objectives	Time Required
Pilots Command Signalling Unit. Electronic Control Unit. Flap Control Unit. Flap Trim Corrector Unit. Sensor – Flap Dual Position. Torque Limiters – Inboard/Outboard. Flap Screwjacks. Downdrives. Solenoid - Flap Baulk Flap Position Switch Unit. Asymmetry Brake Unit. Flaps & Tabs. Flap Carriages. Struts – Flap Fairings. Indicator - Flap Position Spoilers, Drag Devices & Variable Aerodynamic Fairings Lift Spoiler System. Jack – Lift Spoiler. Lift Spoiler Valve – Lift Spoiler Selector. Switch – Lift Spoiler Pressure. Valve – Lift Spoiler Flow Control. Airbrake Control System – Actuator – Airbrake. Valve – Airbrake Servo. Airbrakes. Potentiometers – Airbrake Position (Command & Feedback). Sensor – Airbrake Proximity. Detent – Airbrake Lever.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	

Components	Level	Training Method / Material	Learning Objectives	Time Required
Gust Lock & Damper System – Damper – Aileron & Elevator Gust. Damper Servicing. Controls – Rigging Procedures	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	

CHAPTER 28 - FUEL SYSTEM - SUMMARY

Fuel is contained in three integral tanks, one in each wing and one in the fuselage centre section. Pannier tanks can be installed on the fuselage, either side of the dorsal fin, aft of the wing trailing edge and are considered an extension of the wing tanks.

Access to the main tanks is via manhole cover panels in the wing lower skin & the centre section front spar.

The primary engine fuel feed supply is by AC powered pumps (x4) located within defined feed tanks, linked to specific engines. A back up system is provided using hydraulically powered pumps. Valves within the feed system can be used to connect the engines to alternative pump supplies. Jet pumps are used to transfer fuel between tanks.

A single pressure refuel point is located on the underside of the right wing. Each of the three main tanks also have a gravity refuel capability via the upper wing skins.

Fuel contents indication is provided by a capacitance type system for each tank.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Fuel – General Pipes & Couplings. Pannier Tanks Pipes & Couplings. Fuel Storage - Fuel Tanks. Overwing Filler Cap. Covers – Manhole. Valve – Flap. Valve – Water/Fuel Drain. Valve – Pannier Tank Drain. Valve – Water/Fuel Drain (Remote). Pannier Tank. Vent System. NACA Duct. Transfer System. Valve – Non-Return. Canister – Standby Fuel Pump. Pump – Standby Fuel. Unit - Thermal Relief. Jet Pumps – Feed & Transfer. Valve – Float (Transfer). Distribution Refuel/Defuel System – Valve – Non-Return (Defuel). Coupling Assembly – Refuel.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate	**4.25**

Components	Level	Training Method / Material	Learning Objectives	Time Required
Valve – Drain (Gallery to Tank). Valve – Surge & Air Inlet. Switch – Fuel Level. Valve Assembly – Refuel. Valve Assembly – Offload. Microswitch – Refuel/Defuel Access Panel. Diffusers – Refuel End Pipe. Fuel Feed System – Valve Assembly – Common Feed. Canister – Electric Fuel Pump. Pump – Electric Fuel. Valve – Air Release Non-Return. Low Pressure Valves. Cables – Engine Low Pressure Valves. Valve – Feed Pipe Non-Return. Valve Assembly – Crossfeed. APU Fuel System – Valve Assembly – APU Low Pressure. Valve – APU Fuel Low Pressure Switch. Indication – Tank Units. Processors. Indicators. Load Preselector. Magnetic Fuel Level Indicator. Valve Position Switches. Fuel Temperature. Low Pressure Switch. Low Level Float Switch. High Level Float Switch.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate	

CHAPTER 29 - HYDRAULIC POWER - SUMMARY

Hydraulic power is provided by two independent hydraulic systems (Yellow & Green), operating at 3100 psi, using Type IV Phosphate Ester fluid.

Each system is powered by a self - regulating variable delivery engine driven pump (EDP). Pumps are mounted on the inboard engines.

Fluid is stored in bleed air pressurised reservoirs located in the fuselage hydraulic bay. Accumulators are provided for each system, with a third accumulator provided for the yellow wheel & brake system.

Within the yellow system, an AC powered pump provides the main system back up. A DC powered pump provides pressure to top up the brake accumulator and to assist in the extension of the main landing gear in an emergency. The green system utilises a Power transfer Unit (PTU), which is hydraulically driven by pressure from the yellow system to generate pressure in the green.

Each system supplies services, either independently or in tandem. Some services are supplied by both systems, thereby offering redundancy protection.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Main Hydraulic Power - Hydraulic Piping. Hydraulic Fluid Containment System. Main System – Tank – Hydraulic. Valve – Isolation. Pump – Engine Driven. Valve – Full Flow Relief. Filters – Pressure & Return. Valve – Purge. Attenuator. Valve – Non-Return. Valve – Low Pressure Relief. Valve – Tank Air Charge. Valve – Tank Non-Return. Green Hydraulic System Spoiler Return Line – Non-Return Valve. Green Hydraulic System Spoiler Return Line – LP Relief Valve. Auxiliary System – Pump – AC. Switch – AC Pump Cooling Fan Temp Heat Exchanger – AC Pump. Power Transfer Unit - Accumulator. Valve – PTU Flow Control. Valve – PTU On/Off.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate	**4.0**

Components	Level	Training Method / Material	Learning Objectives	Time Required
Fan – AC Pump Heat Exchanger. RCCB. Indicating – Indicator – Hydraulic Pressure. Transmitter – Hydraulic Pressure. Indicator – Tank Contents. Transmitter – Tank Contents. Switch – Fluid Temperature. Switch – Low Pressure. Indicator – Tank Air Pressure. Switch – Tank Air Pressure. EDP Isolation Valve Position. AC Pump LP Warning. Switch – Hydraulic Pressure. Hydraulic Servicing.		Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate	

CHAPTER 30 - ICE AND RAIN PROTECTION - SUMMARY

Ice protection is provided for the wings, horizontal stabiliser and engine air intakes (ATA 75) by hot air obtained from the engines HP compressor.

The air intake bullet on each engine is anti-iced by using recirculated engine oil.

Four of the six flightdeck windows; the pitot, static, Q-feel heads, potable water pipes and drain masts are all electrically heated.

An ice detector provides an automatic in-flight warning whenever the aircraft enters icing regions.

Two windscreens are equipped with independently operated wipers a screen wash facility.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Ducts, Pipes and Fittings. Wing Anti-ice & De-ice – **Anti-icing Valve.** **Tail Anti-ice –** Anti-icing Valve – L/R. Switch – Tail Overheat Temp. De-icing - Pitot, Static & Airflow Sensor Vanes – Pitot, Q-Pot, & Airflow Sensor Vane Heaters - Monitor – Undercurrent. Static Plate Heaters. Windshield De-ice and Demist – **Thermal Controller.** Windshield Wipers – Arm & Blade Motor/Converter. Windshield Wash System – Bottle, Pump & Shutoff Valve. Water Lines – Water Pipe Heaters. Thermostat. Drain Mast. Detection – Detector – Ice.	All at Level **3**	Classroom training using PDF document based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**2.0**

CHAPTER 31 - INDICATING AND RECORDING SYSTEMS - SUMMARY

Visual & audible warnings of major system malfunctions are generated by a central warning system, which consists of a central warning panel, coaming mounted attention getters and condition/warning annunciators.

A flight data recorder system records the last 25 to 27 hours of specific aircraft parameters.

A cockpit voice recorder, records on four channels, the duration being 25 minutes to 120 minutes.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Central Warning System – Attention Getters. Master Warning Panel. Control Boards. Panel Filaments. Resistors. Ground 'OP' Button. Flight Annunciators. PCB's. Audio Warnings.	**3**	Classroom training using PDF document based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**1.75**
Davtron Clock Recorders – Flight Data Recorder. DARU. Data Entry Panel. Accelerometer Transducers.	**2**		LEVEL 2 The student should be familiar with the basic elements of the subject and be able to give a simple description of the systems. The student should be able to use typical terms.	**14.0**

Components	Level	Training Method / Material	Learning Objectives	Time Required
Control Surface Position Transmitters. Underwater Locator Beacon. **RJ -** Flight Data Acquisition Unit. Control Surface Position Transmitters. Solid State Flight Data Recorder. FDR Panel. Quick Access Recorder. Wheelspin Test Circuit. FDR Transducer Maintenance Warning Relay. Cockpit Voice Recorder – Control Unit – Type 1 to 4. Underwater Locator Beacon. Sundstrand Magnetic Tape CVR. Fairchild Magnetic Tape CVR. Allied Signal – Solid State CVR. Control Units. L3 solid state CVR. Remote Area Microphone. Portable Interface Unit. BASE Solid State CVR.	**2**	Classroom training using PDF document based presentation.	The student should be able to read and understand sketches, drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using detailed procedures.	

CHAPTER 32 - LANDING GEAR - SUMMARY

The aircraft is equipped with a tricycle landing gear mounted on the fuselage.

Landing gear extension and retraction is electrically selected and hydraulically operated. Provision for emergency extension of the gear is provided.

There are four wheels fitted to the main gear and two to the nose gear.

There are four hydraulically operated brake units fitted to the main gear. These use a mechanical/hydraulic command system and are equipped with an electrical anti-skid system.

Nosewheel steering is mechanically selected and hydraulically operated.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Landing Gear Description & Operation – General. Main Gear & Doors – Main Fitting. Wheel Lever. Shock Absorber. Side Stay. Nose Gear & Doors – Main Fitting Uplock & Downlock. Sliding Member & Valve Tube. Torque Links. Main Gear Extension & Retraction – Gear Selector Switch. Gear Selector Valve. Oleo Overcentre Lock Jack. Unlock Jack. Retraction Jack. Uplock Jack. Main Gear & Door Uplocks. Nosegear Extension & Retraction – Retraction Jack. Landing Gear Emergency Lowering – Free Fall Assister Jack. Free Fall Assister Selector Valve. Accessory Kit.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**8.5**

Components	Level	Training Method / Material	Learning Objectives	Time Required
Nosegear Assister Spring Dump Valve. Cable Circuit. Indicating & Warning – Proximity Sensors & Harness. Downlock & Uplock Relays. Normal & Standby Position Indicators. Steering – Rack & Pinion. Differential Box. Steering Valve. Shutoff Valve. Compensator. Follow-up Springbox. Cables. Wheels & Brakes – Mainwheel. Fusible Plug. Nosewheel. Tyres. Brake Units – Heat Pack. Wear Indicator Pin. Spacer. Brake controls & Indication– DC Pump. DC Pump Filter. Solenoid Valves. Brake Control Valve. Accumulator. Hydraulic Fuse.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	

Components	Level	Training Method / Material	Learning Objectives	Time Required
Wheel Speed Transducer. Anti-skid Control Box. Dual Adaptive Anti-skid Valve. Brake Pedal Circuit. Park Brake. Brake Cooling System – Fan & Motor. Brake Temperature Indication. Squat Switching.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	

CHAPTER 33 - LIGHTING SYSTEMS - SUMMARY

Internal illumination, both general floodlighting and lighting of specific areas, is provided by fluorescent tubes and filaments.

Light emitting diode (LED) light units are used for navigation lights.

Sealed beam units are used for landing, taxi, runway exit & leading edge ice inspection light. Xenon flashtubes anti-collision beacons are fitted.

Two emergency lighting systems are fitted, one for the flightdeck, run from the aircraft busbars and the cabin, using power units with internal batteries.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Lights – General. External Lights. Flight Compartment Lights– Flight Kit. Lap. Pedestal Flood. Roof & Sill. Instrument Panel Integral. Flightdeck Emergency Lighting. Standby Compass. Passenger Cabin & Freight Compartment Lighting- Fluorescent Tubes. Ballast Unit. Vestibule Lights. Lavatory Lights. Safety Signs. Passenger & Toilet Call. Crew Call. Aisle Lights. Cargo & Service Lights.	All at level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**1.0**

CHAPTER 34 - NAVIGATION SYSTEMS - SUMMARY

The navigation systems include the equipment used for the transmission, reception and presentation of navigational information required during all phases of flight.

The radio navigation system has the capability to use ADF, VOR, ILS and Marker beacon signals. A

single or dual Navigation Managements System (NMS) may be fitted.

Radar navigation is provided by the weather radar system; DME and a transponder system is also fitted. Radio

altimeter equipment using separate transmitter/receiver antennas is installed.

An enhanced ground proximity warning system (EGPWS) is installed.

Standby navigation systems include an attitude indicator, compass, altimeter and outside air temperature system.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Air Data – 146. Pitot Static System. Water Drain Valves. Pitot Static Shelf. Plates & Vents Pitot Probes. 'Q' Pot. Total Air Temperature Probe. True Airspeed Computer. Air Data – RJ. Air Data Computer. Air Data Accessory Unit. Vertical Reference Unit. Compass System – Flux Valves. Magnetic Compensators. Coupler. Directional Gyros. Standby Compass. Inertial Reference – IRS Unit. Mode Select Unit. Accelerometers. Laser Gyros. Flight Instruments. – Attitude Direction Indicator.	All at level **2**	Classroom training using PDF document-based presentation.	**LEVEL 2** The student should be familiar with the basic elements of the subject and be able to give a simple description of the systems. The student should be able to use typical terms. The student should be able to understand the theoretical fundamentals of the subject and should be able to give a general description of the subject using, as appropriate, typical examples. The student should be able to read and understand sketches, drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using detailed procedures	**13.0**

Components	Level	Training Method / Material	Learning Objectives	Time Required
Horizontal Situation Indicator. HIS/RNAV Changeover Switches Instrument Comparator Monitor. Basic Instruments – Servo Altimeters (146/RJ). Non-Servo Altimeter. Air Data Display Unit. Analogue Interface Unit. Standby Altimeter/Airspeed Indicator. Combined Speed Indicator. Vertical Speed Information. Outside Air Temperature. Analogue Standby Attitude Indicator. (146 Analogue). Standby Attitude Indicator. (EFIS). Distance Bearing Indicator. VHF Navigation – Control Panel. Receiver. Antennas. VOR/LOC Splitter/Distributor. Nav. Selector Panel. DFGS Control Panel. Marker Receiver. Instrument Landing System. Flight Annunciator Panel. Distance Measuring Equipment –	All at level **2**	Classroom training using PDF document-based presentation.	**LEVEL 2** The student should be familiar with the basic elements of the subject and be able to give a simple description of the systems. The student should be able to use typical terms. The student should be able to understand the theoretical fundamentals of the subject and should be able to give a general description of the subject using, as appropriate, typical examples. The student should be able to read and understand sketches, drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using detailed procedures	

Components	Level	Training Method / Material	Learning Objectives	Time Required
Automatic Direction Finder- Receiver. Control Panel. Sense Aerial Coupler. Sense Equalizer. Loop Aerial. Radio Altimeter – Transmitter/Receiver. Antennas. Control Panel. Decision Height Knob. Mode 'S' Transponder. Front Panel. Control Panel. Enhanced Mode 'S' Transponder. Traffic Collision Avoidance System – Computer. Directional Antennas. LCD Display. Combined Vertical Speed/TCAS Indicator (146). Weather Radar – (Primus 90. Bendix 708A. Bendix RDR – 4A) Antenna. Receiver/Transmitter. Indicator. Power Supplies & Fans.	All at level **2**	Classroom training using PDF document-based presentation.	The student should be familiar with the basic elements of the subject and be able to give a simple description of the systems. The student should be able to use typical terms. The student should be able to understand the theoretical fundamentals of the subject and should be able to give a general description of the subject using, as appropriate, typical examples. The student should be able to read and understand sketches, drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using detailed procedures	

Components	Level	Training Method / Material	Learning Objectives	Time Required
Enhanced Ground Proximity Warning System – Computer. GPS Antenna. Annunciators Flight Management System – (GNS-XLS,) Control Display Unit. Configuration Module Unit. GPS Antenna. DME 42 Interrogator. TAS Computers. Switching Units. Annunciators. (GNLU) Multi Purpose Control & Display. Unit (MCDU). GPS Sensor Antenna. Windshear – Computer. Annunciators. Flight Director Relay. Pitot-Static Isolation Valve.	All at level 2	Classroom training using PDF document-based presentation.	The student should be familiar with the basic elements of the subject and be able to give a simple description of the systems. The student should be able to use typical terms. The student should be able to understand the theoretical fundamentals of the subject and should be able to give a general description of the subject using, as appropriate, typical examples. The student should be able to read and understand sketches, drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using detailed procedures	

CHAPTER 35 - OXYGEN SYSTEM - SUMMARY

Flight deck oxygen is provided to the three masks by a gaseous circuit supplied by either a dual or single storage bottle.

Depending on aircraft variant, cabin oxygen is provided by either a gaseous system, or chemical generator units located above the passenger positions.

All aircraft carry therapeutic oxygen bottles and smoke hoods.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Flight Deck Oxygen Cylinder (s). Valve – Charging. Indicator – Pressure (Charging & System). Indicator – Discharge. Valve – System Isolation. Regulator – Pressure. Flight Crew Oxygen Masks & Stowage. Passenger Oxygen System (s). Stowage – Passenger Mask (Chemical) Switch – Aneroid. Portable Oxygen Sets.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**1.5**

CHAPTER 36 – PNEUMATIC - SUMMARY

The pneumatic system and its components provide primary pressure, temperature control and distribution of the bleed air obtained from the main engines and the auxiliary power unit (APU).

The bleed air is utilised to provide cabin pressurisation and air conditioning, airframe ice protection, hydraulic and potable water tank pressurisation and the stall recovery protection system.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Main Engines & APU air supply. Pipes and Ducts. Valve - Isolation/Pressure Reducing. Pre-cooler. Valve -Temperature Control. Switch - Over Pressure Switch -Over Temperature Valve - Non-return. Valve - Pressure Regulating – Hydraulic tank. Valve - Shuttle. Valve - Duct Relief. Switch – Flow Indicator. Switch – Low Temperature. Switch – APU duct Pressure.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**1.5**

CHAPTER 38 - WATER AND WASTE - SUMMARY

The aircraft is equipped with a single potable water tank, which is pressurised with bleed air, supplying water to galley(s) and toilet unit wash basins.

Normally two self-contained chemical toilets, with pneumatic flush operation, are fitted.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Potable Water. Valve – Fill/Drain. Valve – Overflow. Gauge – Temperature. Tank – Potable Water. Heater – Water. Washbasin – Faucet. Valve – Isolation (Washbasin). Valve – Rear Water Drain. Transmitter – Contents. Indicator – Contents. Waste Disposal. Valve – Washbasin Drain. Filter Box. Muffler. Toilet Disposal. Toilet Tank. Valve – Toilet Service Point. Water System Air Supply. Valve – Pressure Regulating. Valve – Relief. Valve – Non-Return. Valve – Air Charging. Valve – Toilet Flush. Toilet Servicing Potable Water Servicing	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate	**0.5**

CHAPTER 49 – AUXILIARY POWER UNIT - SUMMARY

The auxiliary power unit (APU), located in the tail fuselage, can supply bleed air to the air-conditioning packs for cabin environmental control and is fitted with an electrical generator, which supplies the AC network.

Depending on aircraft variant, either a Garrett or Sundstrand APU is fitted, contained within a fireproof box, with a dedicated fire detection and extinguishing system.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Garrett - Air Surge Valve. Load Control Valve. Accessory Gearbox. Starter Motor - Clutch. Cooling Fan Fuel Control Unit. Generator – Adapter. Filter. Relief Valve. Cap. Check Valve. Oil Pressure Switch. Oil Temperature Switch. Dipstick. Cooler. Speed Probe. Drains. Door & Fire Door. Ignition. Flexible Mounts. Air Inlet Ducting. Exhaust Air Ducting. Generator Gearbox Oil Cooling Duct. Controller. Fuel Shutoff Valve. Temperature Sensing Probe. Warnings & Indictors. Rotating Assembly & Bearings.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**7.0**

Components	Level	Training Method / Material	Learning Objectives	Time Required
Hour meter. Thermocouples. Overtemperature Switch & Sensing Module. Speed Sensor & Module. Test Switch. **APS 1000 -** Electronic Sequence Unit. Turbine Module. Combustor Module. Gearbox Module Fuel Control Assembly. Fuel Filter. Fuel Manifolds. Fuel Solenoid Valves. Oil Filler Cap. Oil Filters & Differential Pressure Indicators. Low Pressure Switch. Oil Cooler. Pressure Pumps. Magnetic Drain Plug. De-prime Solenoid Valve. Starter Motor - Clutch. Ignition Exciter.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	

CHAPTER 52 & 56 - DOORS, EXITS & WINDOWS - SUMMARY

The aircraft cabin is provided with two passenger doors and two service doors. Below the cabin floor line there are two baggage compartment doors, a door for access to the electrical/avionic bay and a door to access the hydraulic bay. At the rear of the fuselage there are doors for access to the air conditioning bay and the APU bay.

The passenger and service doors are normally fitted with inflatable evacuation slides. An

optional hydraulically operated freight door can be installed the rear fuselage.

All doors use a combination of mechanical and electrical indications for door security status.

There are six flightdeck windows, four of which are electrically heated and two which can be opened. Cabin windows are installed on each side of the fuselage.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Doors General. Passenger & Service Doors. Handles & Operating Mechanism. Door Catch release. Baulk Mechanism. Evacuation Slide Mechanism. Counter Balance. Gust Damper. Door Trim. Cargo Doors. Handle & Mechanism. Equipment Bay Doors - Electrical Bay Door Operating Mechanism. Hydraulic Bay Door Operating Mechanism. Air Conditioning Bay Door Mechanism. APU Bay Door Mechanism. Flightdeck Door. Door Control Panel. Toilet Doors. Upper Door Warning Microswitches & PCB Lower Door Warning Ground AC Supply Door. Water Servicing Panel Door.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**3.0**

Components	Level	Training Method / Material	Learning Objectives	Time Required
Freight Door – Control & Warning Panel. Hydraulic Actuators. Latch & Lock Mechanism. Hydraulic System – Handpump & Filter. Control Valve. Isolation Valve. Non-Return Valve. Pressure Relief Valve. Shutoff Valve. Restrictor Valve. Plunger Valve. Non-Return Double Pilot Valve. Over-centre Latch Actuator. Safety Lock/Vent Door Actuator. Electrical System. Support Strut. Door Sill Protectors. Door Trim. Entrance Stairs Accumulator. Selector Valve. Reservoir. Windows – General. Panel 'A'. Panel 'B'. Temperature Controller. Panel 'C'. Cabin Windows.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate	

CHAPTER 51, 53, 54, 55, 57 – STRUCTURES - SUMMARY

The aircraft is predominantly of alloy construction with some composites for panels and fairings.

The fuselage is constructed using failsafe principles and consists of light alloy frames and stringers supporting rolled and stretch-formed skin panels.

The pylons support the engines, under and forward of the wings. A variety of systems services are contained within the pylon structure, in segregated areas.

The stabilisers consist of the vertical stabiliser, attached to the tail section of the fuselage and the horizontal stabiliser mounted on top of the vertical stabiliser.

The wings are constructed in three major parts, joined as a permanent structure, forming an integral part of the fuselage in the centre. The wings are sealed to form integral fuel tanks.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Fuselage – General. Nose & Radome. Centre. Rear. Tail. Corrosion Prevention. Blow-out Panels. Drain Valves. Door Surround Seals. Acoustic Seals. Wings – General. Centre. Attachments & Fittings – Flaps. Ailerons Spoilers. Pylons – Drains. Forward Attachment Rear Attachment. Stabilisers – Horizontal. Upper Fin Fairing. Elevator. Vertical. Rudder.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**2.0**

CHAPTER 71-72 - POWERPLANT & ENGINE - SUMMARY

The engine is a high bypass, twin spool, turbo fan, with a front mounted fan driven via a gear by the core of the engine.

The 146 is fitted with the ALF-502 engine & the RJ is fitted with the ALF-507 engine. The engines are numbered 1 to 4 when viewed from the rear of the aircraft. Electrical generators are fitted to engines 1 and 4, hydraulic pumps to 2 and 3.

The engines are of modular construction and are interchangeable, except for some specific components and front engine mount requirements.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Powerplant – Mounts. Air Intakes. Engine Drains. Ecology Tank & Pump. Fan Module. Gas producer Module. Combustor Turbine Module. Accessory Drive. Cowlings. Nose Cowl. Gas Generator Fixed Cowl. Top Shoulder Cowling Front Cowling Doors. Rear Cowling Doors. Jet Pipe Firing. Fireproof bulkhead. Firewalls & Seals. IDG Oil Cooler Pipes seal. Front Mount Yoke Seal. Rear Mount Link Seal. Access Panels. Starter Motor Cable & Mount Seal. Fireproof Bulkhead Hydraulic Pump Pipes Seal. Hot Air Bleed Pipe Seal Rear Cowling Door Seal Engine Stand. Engine Mounted Ejector Pump. Float Valve.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**3.0**

CHAPTER 73 - ENGINE FUEL & CONTROL - SUMMARY

The engine fuel system is divide into two sections; distribution and controlling.

Fuel is delivered to the engine mounted boost pump, is filtered & heated prior to entering metering mechanism.

Fuel flow control is via a hydro-mechanical system, with inputs from a thrust management system, FADEC unit or the flight crew.

Engine Fuel Control has been combined into respective Chapter 76 for each aircraft variant.

Indicating has been combined into Chapter 77.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Boost Pump. Dual Heat Exchanger. Main Filter. Differential Pressure Switch. Inline filter. Solenoid Valve. Flow Divider. Fuel Manifolds. Combustion Chamber Drain. ***See Chapter 76.*** *Hydromechanical Assembly.* *Electronic Control Unit.* *ECU/HMU Harness.* ***See Chapter 77*** *Fuel Flowmeter.* *Fuel Low Pressure Switch.*	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**2.0** (*Time Shared With ATA 76 & 77)*

CHAPTER 74 & 80 - IGNITION & STARTING

This system provides electrical ignition capabilities to enable ground and in-flight starting of the engine. The system is also designed for continuous use during take-off, landing and adverse weather conditions.

Each engine is fitted with a DC starter motor, mounted on the accessory gearbox, to crank it during a start or motoring cycle on the ground.

Switches in the engine N2 speed indicators control cranking duration automatically.

Indication is provided in the event of motor clutch seizure to enable action and to prevent motor & gearbox damage.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Igniter Plugs. Ignition Exciters.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**3.25**

CHAPTER 75 - ENGINE BLEED AIR - SUMMARY

The air bleed system supports the engine functions of compression control, used during start and acceleration, temperature sensing to the HMA, engine anti-ice and airframe services.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Engine And Air Intake Anti-Icing – Engine Valve. Intake Anti-Icing Valve. Pressure Switch. Compressor Bleed Band. Actuator. T1 Sensor/Ejector.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**2.0**

CHAPTER 76 - ENGINE CONTROLS - SUMMARY

Four independent levers in the flightdeck, control the thrust of the engines via a system of cables & pulleys. The levers also operate the HP fuel valve for engine start and shutdown.

The 146 aircraft is equipped with a thrust management system (TMS), which trims the engine speed to parameters set by the pilot.

The RJ aircraft is equipped with a full authority digital electronic control (FADEC), which trims the engine speed to parameters set by the pilot in response to signals received from engine and aircraft sensors.

The RJ is further equipped with an auto-throttle, which responds to signals from the digital flight guidance computer (DFGC).

Engine replacement can be achieved without loss of rigging adjustment in the airframe cable system.

Components	Level	Training Method / Material	Learning Objectives	Time Required
146 - Thrust Control System – Thrust Lever. Cables & Pulleys. Cable Compensator. Microswitches. Flexible Control Flight Idle Baulk. Rigging Pins. Thrust Modulation System – Computer. Control/Display Unit. Static Pressure Sensor. Throttle Trim Actuator. **RJ –** FADEC. DFGS. Thrust Lever. Fixed Idle Baulk. TOGA Switches. Autothrottle Disconnect Switches. Thrust Rating Panel. Primary Engine Display. Thrust Lever. FADEC Status Panel.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**6.0**

Components	Level	Training Method / Material	Learning Objectives	Time Required
Hydro-mechanical Unit – Fuel Pump Unit. Metering Head Regulator. Windmill Bypass Valve. Pressurising & Shut-off Valve. PLA Shaft Mechanism. Manual Wf/P3 Servo Mechanism. P3 Transducer. Mechanical Multiplier. Changeover Solenoid. Metering Valve. Stepper Motor Drive. 3 Phase Alternator. Core Speed Sensor. Bleed Valve. Electronic Control Unit. Auto-throttle. Compensation Resistor. Thrust Rating Panel. Cables & Pulleys. Cable Compensator. Flexible Control.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	

CHAPTER 77 - ENGINE INDICATION - SUMMARY

The engine indicating system monitors engine performance, with sensing elements mounted on each engine continuously transmitting data for display on either analogue gauges or light emitting diode type displays on the flightdeck.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Engine Oil – Pressure transducer. Temperature Bulb. Engine Vibration Monitoring – Accelerometer Test Button. Fan (N1) Speed – Probes. Gauge. Compensation Resistor. Overspeed Sensors. Turbine Gas Temperature (146) – Thermocouple. Exhaust Gas Temperature (RJ) – Thermocouple. N2 Shaft – Magnetic Pickup. Fuel Indicating – Flowmeter Pressure Switch. Filter Clogged. Overtemperature Labels. Primary Engine Display.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**2.75**

CHAPTER 78 - EXHAUST

See Chapter 71/72

Components	Level	Training Method / Material	Learning Objectives	Time Required

CHAPTER 79 – OIL - SUMMARY

The oil system serves the engine with the dual function of lubricating and cooling. The oil system is completely self-contained within the engine envelope.

Components	Level	Training Method / Material	Learning Objectives	Time Required
Oil Tank Pump & Filter element. Filter Assembly. Chip Detectors. Dual Heat Exchanger. **Indication – Included In Chapter 77**	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner-using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**2.0**

CHAPTER 80 – STARTING - SUMMARY

Components	Level	Training Method / Material	Learning Objectives	Time Required
Starter Motor. Voltage Monitor Amplifier. Soft Start Resistor. Contactors – Soft Start. Start Select. Start. Ground DC Supply.	All at Level **3**	Classroom training using PDF document-based presentation.	The student should know the theory of the subject and interrelationships with other subjects. The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. The student should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject. The student should be able to apply his knowledge in a practical manner- using manufacturer's instructions. The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate.	**2.25**

COURSE LENGTH JUSTIFICATION

The BAE 146 / RJ is an all-metal high wing monoplane with four under-wing, pylon mounted engines, a T-shaped tail, and a tricycle landing gear.

The 146 is powered by four Textron Lycoming 500 series turbofan engines, with manual control and a simple thrust trimming system. There is no reverse thrust capability.

The RJ is four Textron Lycoming LF507-1F turbofan engines, flat rated at 7,000 lbs thrust up to 23.3°C at sea level. The LF507-1F engine has Full Authority Digital Engine Control (FADEC). There is no reverse thrust capability.

The rudder is the only primary control, which is hydraulically operated, the remaining are cable operated. There

are two hydraulic systems, which have similar components and are similar in operation.

The electrical system is supplied by three onboard generators, which are of similar construction and operation, with conversion from AC to DC achieved with duplicate components.

There is no on-board central maintenance system and there are no in-flight entertainment systems.

For the reasons above we have established that it is appropriate to schedule approximately 135 hours for this course.