



# IALA GUIDELINE

1020

TRAINING RELATED TO AtoN

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# DOCUMENT REVISION

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# CONTENTS

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<b>1</b>	<b>GENERAL CONSIDERATIONS.....</b>	<b>6</b>
1.1	Scope.....	6
1.2	Introduction.....	6
1.3	Training Task Selection.....	6
1.4	Training Development Processes Overview.....	7
1.5	Selection of Training Methods.....	8
1.6	Training Strategy Suitability.....	10
1.7	Development and Implementation Cost Considerations.....	10
1.8	Life-cycle Delivery Cost Considerations.....	10
<b>2</b>	<b>METHODOLOGY AND PROCESS REGARDING THE TRAINING REQUIREMENT DEFINITION AND DELIVERY</b>	<b>11</b>
2.1	Training Task Analysis.....	11
2.1.1	General.....	11
2.1.2	Updating the Task Analysis.....	12
2.1.3	Detailed Task Analysis.....	12
2.1.4	Selecting Tasks for Training.....	13
2.1.5	Tasks Not Requiring Training.....	13
2.1.6	Identifying Task Elements.....	13
2.1.7	Selecting Skills and Knowledge Elements.....	14
2.2	PERFORMANCE OBJECTIVES.....	15
2.2.1	General.....	15
2.2.2	Performance Objective Preparation Guidelines.....	16
2.2.3	Performance Objective Checklist.....	17
2.3	TRAINING STANDARD.....	18
2.3.1	General.....	18
2.3.2	Preparation Instructions.....	18
2.3.3	Overview of Document Structure.....	18
2.4	TRAINEE EVALUATION PLAN.....	19
2.4.1	Preparation of a Trainee Evaluation Plan.....	19
2.5	TRAINING PLAN.....	19
2.5.1	Preparation Instructions.....	19
2.5.2	Overview of Document Structure.....	19
2.6	STUDENT HANDOUTS.....	20
2.7	COURSE CRITIQUES.....	21
<b>3</b>	<b>EXAMPLE OF THE METHODOLOGY USED FOR CONTRACTOR SUPPLIED TRAINING.....</b>	<b>21</b>
3.1	General.....	21
3.1.1	Quotations.....	21
3.1.2	Preliminary Training Plan Content.....	22



# CONTENTS

<b>3.2</b>	<b>CONTRACTOR'S RESPONSIBILITIES .....</b>	<b>22</b>
3.2.1	Personnel.....	22
3.2.2	Course Duration.....	22
3.2.3	Course Commencement.....	22
3.2.4	Language of Course .....	22
3.2.5	Course Objectives.....	22
3.2.6	Syllabus.....	23
3.2.7	Approval .....	23
3.2.8	Training Equipment .....	23
3.2.9	Classroom and Laboratory Facilities.....	23
3.2.10	Training Materials.....	23
3.2.11	Reports on Training .....	23
3.2.12	Test Equipment.....	23
3.2.13	Course Critiques .....	24
3.2.14	Unsatisfactory Training.....	24
3.2.15	Training Equipment Maintenance .....	24
<b>3.3</b>	<b>NUMBER OF STUDENTS .....</b>	<b>24</b>
<b>3.4</b>	<b>STUDENT QUALIFICATIONS.....</b>	<b>24</b>
<b>3.5</b>	<b>TRAINING CURRICULUM REQUIREMENTS.....</b>	<b>24</b>
<b>4</b>	<b>ACRONYMS.....</b>	<b>24</b>
<b>5</b>	<b>REFERENCES .....</b>	<b>25</b>
<b>ANNEX A</b>	<b>TASK ANALYSIS WORKSHEET .....</b>	<b>26</b>
<b>ANNEX B</b>	<b>PERFORMANCE OBJECTIVES WORKSHEET .....</b>	<b>27</b>
<b>ANNEX C</b>	<b>TRAINING STANDARD TEMPLATES.....</b>	<b>28</b>
APPENDIX 1	MAIN REFERENCES .....	32
APPENDIX 2	TASK LIST .....	33
APPENDIX 3	SPECIAL TOOLS AND TEST EQUIPMENT .....	34
APPENDIX 4	PERFORMANCE CHECK FOR PERFORMANCE OBJECTIVE No .....	35
APPENDIX 5	TRAINING PLAN EXAMPLE OF PART 4 .....	39
APPENDIX 6	STUDENT HANDOUT COVER SHEET SAMPLES.....	44
APPENDIX 7	SAMPLE COURSE CRITIQUE .....	46
<b>ANNEX D</b>	<b>TRAINING CURRICULUM REQUIREMENTS .....</b>	<b>52</b>

## List of Tables

<i>Table 1</i>	<i>Common instructional strategies .....</i>	<i>9</i>
<i>Table 2</i>	<i>Example of a breakdown for a maintenance task analysis .....</i>	<i>11</i>
<i>Table 3</i>	<i>Example of a breakdown for an operator task analysis .....</i>	<i>12</i>
<i>Table 4</i>	<i>Identifying task elements .....</i>	<i>14</i>



# CONTENTS

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Table 5	Techniques that can be used to derive and verify task lists .....	14
Table 6	Examples of Action and Vague verbs.....	16
Table 7	Examples of standards.....	17
Table 8	Example Task Analysis Worksheet.....	26
Table 9	Example Performance Objective Worksheet .....	27
Table 10	Main references.....	32
Table 11	Task list.....	33
Table 12	Special tools and test equipment.....	34
Table 13	Practical examination checklist .....	37
Table 14	Example Marking sheet.....	38
Table 15	Teaching points/time/references - Enabling (lesson) objective # 01.01.....	40
Table 16	Teaching points/time/references - Enabling (lesson) objective 401.02 .....	42



# 1 GENERAL CONSIDERATIONS

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## 1.1 SCOPE

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This guideline on training related to Aids to Navigation should assist Lighthouse Authorities in the delivery of their Life Cycle Management requirement, which include Training. Training is essential in addressing liability and due diligence issues related to safety and environmentally sensitive systems. The Lighthouse Authority may or may not elect to undertake its own training.

The guideline is structured in three parts and annexes. Part 1 addresses training general considerations including the merits of different training methods. Part 2 addresses the methodology and process regarding the training requirement definition and delivery. Part 3 provides an example of the methodology used for Contractor supplied training. Whereas not all sections apply if the training is provided within the Lighthouse Authority's own resources, some are nonetheless relevant. The appendices give further examples.

## 1.2 INTRODUCTION

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Effective training ensures that an organization's human resources use the tools and test equipment, documentation, and spare parts efficiently to provide the required system operational reliability, through the proper installation, operation and maintenance of the prime mission equipment.

This document concentrates on training related to maintenance as an example.

## 1.3 TRAINING TASK SELECTION

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The importance of performing valid and effective maintenance is most evident in the marine field where equipment failure could result in gross losses of revenue, human injuries, loss of life, and/or environmental damage.

In order that proper preventive and corrective maintenance be performed, the maintenance organization must be provided with the proper tools and resources to ensure the required system availability. These tools and resources include:

- Lighthouse Authority maintenance philosophy and reporting procedures;
- relevant documentation;
- tools and test equipment;
- spares and consumable supplies;
- adequate human resources;
- effective training.

The bases for maintenance training course content are the tasks defined by the following source documents:

- maintenance plans;
- maintainability analysis reports;
- supplier equipment documentation.

Very often what suppliers provide must be further scrutinized in order to its applicability in the context of the operational system, its operating environment, and its intended use.

ANNEX D provides a list of Training Curriculum Requirements that may be a source of inspiration.

The resulting list of tasks may also contain special tool or test equipment requirements, which will in turn result in the definition of operation and maintenance tasks associated with the support equipment. In addition to the defined maintenance tasks, technicians must normally perform basic operation skills required to exercise the



equipment during routine and unscheduled maintenance. Apart from the operation and maintenance of the primary system, the technician must, in many cases, also be acquainted with the operation and servicing of secondary equipment that is required to operate the system such as existing generators, UPS systems and other installation or facility equipment. All such general, system-level tasks must also be identified and defined before a training task analysis can take place.

From the maintenance task list, an inventory of the skills and knowledge required to perform each task must be compiled. This inventory of skill and knowledge is compared to the current repertoire of skills and knowledge possessed by maintenance personnel in order to define the training requirements. The existing, pre-training skills and knowledge may be determined through one or more methods, including:

- review of general and specialty trade specifications;
- interviews with maintenance organization supervisors and technicians;
- review and annotation of the maintenance task list by subject matter experts (SME) belonging to the target maintenance organization.

In some cases, supplementary training may be required to cover gaps in skills and knowledge outside of the system-specific maintenance requirements. These areas may include:

- safety certification;
- use of complex commercial test equipment such as network analysers and device testers;
- generic computer skills, knowledge of operating systems (OS);
- workshop-related qualifications.

#### **1.4 TRAINING DEVELOPMENT PROCESSES OVERVIEW**

Generically the maintenance training development process consists of the following steps:

- task analysis (analyse the job) and training task selection;
- documenting the results of the task analysis with the performance objectives (descriptions of what the trainees will be able to do, with tools, support equipment, references, and required skills and knowledge);
- authoring of the training standard as a record of the performance objectives (used as the base specification for training development);
- authoring of the trainee evaluation plan (how performance of the trainees will be measured and verified);
- authoring of the enabling (lesson) objectives (how the required skills and knowledge will be imparted to the trainees);
- selection of relevant training strategies;
- creation of the instructor guides, student training handouts, computer-based training packages, training videos, and other training aids.

The task analysis allows the training developer to collect information related to the specific job that must be performed by the trainees, following graduation. Some of the skills and knowledge may already be held by the trainees prior to training commencement. The analysis allows the developer to compile an inventory of non-trivial tasks that the trainees must learn to perform that are not already part of their repertoire of skills.

Documenting the tasks as performance objectives in the training standard provides the training developer with a record of the activities that the trainees must be able to perform at the conclusion of training. Each recorded activity, or performance objective is thoroughly described as a set of parameters that include, a statement of the action itself, resources and references required to perform the action, and the standard to which the action must be performed.



Once the performance objectives are defined, the methods and means are devised to test the performance of each task against their respective standards. These methods and means are recorded in the trainee evaluation plan. The marking and pass/fail criteria in the trainee evaluation plan are based on the performance objective standards.

The enabling objectives describe how the required skills and knowledge is imparted to the trainees in order that they may achieve the performance objectives to the required standard. They are used as a guide by the trainers in preparing their personal lesson plans and training materials.

## **1.5 SELECTION OF TRAINING METHODS**

The selection of appropriate training strategies is a central element of the training development process. Instructional methods are selected that provide the most effective, and in the context of the system life cycle, the most cost-effective means of providing the training.

Table 1 summarizes common instructional strategies, embodying a range of methods, media and delivery options. In order to ensure that the optimum solution is chosen, a trade-off analysis must be performed for applicable options, comparing the effectiveness and costs of each. The four left-most criteria deal with the effectiveness of a strategy while the two right-most columns deal with the relative cost of each. Rough-order-of-magnitude estimates of the preparation costs and delivery costs, over the life cycle of the system, may be traded-off against each other to determine the most cost effective training strategy for each option while ensuring that the course training objectives are met.

**Table 1 Common instructional strategies**

Item No.	Training Method	Effectiveness				Cost	
		Scheduling Advantage	Level of Interactivity	Ease of Feedback	Evaluation of Training Success	Preparation Cost	Delivery Cost / Trainee
1	Instructor-led classes	Instructor convenience	High	High	High	High	High
2	Paper-based training documents	Trainee convenience	None	Low	None / low	Medium	Low
3	Videotapes	Trainee convenience	None	Low	None / low	Medium	Low
4	Computer-based Training (CBT)	Trainee convenience	Medium	Low	Medium / high (requires trainee to submit score results)	High	Low
5	Videoconferencing	Instructor convenience	High	High	High	Medium	High
6	Teleconferencing	Instructor convenience	Medium	High	Medium / high	Medium	Low
7	Web-based Training (WBT)	Trainee convenience	Medium	Medium	Medium / high (requires trainee to submit score results)	High	Low



## 1.6 TRAINING STRATEGY SUITABILITY

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Each instructional strategy must be examined to determine its potential effectiveness in enabling learners to achieve the training objectives. Some of the strategies lend themselves to knowledge-based learning requirements and are not necessarily well suited to skill-based requirements, which generally involve physical practice of techniques and procedures. Each training objective must be analysed individually in order to ensure the suitability of an option to the type of training goal. The primary emphasis is always placed on achieving the required on-the-job performance; following training, graduates must possess the required skills and knowledge related to the specific job that must be performed by the trainees.

When more than one effective training option is under consideration, the option, which meets the need at the lowest total cost, is normally selected. The total cost is a composite of development, implementation, and life-cycle training delivery costs. For some low-tech solutions the development and implementation costs are relatively low while the life-cycle delivery costs are very high. Conversely, certain high-tech options may have high development costs and low life-cycle delivery costs.

## 1.7 DEVELOPMENT AND IMPLEMENTATION COST CONSIDERATIONS

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Development and implementation costs represent the one-time, non-recurring costs associated with developing training and delivering the initial training capability to a customer's training organization. These costs are fairly easy to estimate and are normally part of the estimation process accompanying a proposal effort. When estimating the development and implementation costs, the following should be considered:

- cost of authoring and development tools;
- cost of delivery system hardware and software (including simulators);
- software licensing cost for off-the-shelf software components;
- development labour costs;
- development learning curve for new or unfamiliar authoring tools;
- including reviews and quality control processes;
- other direct training implementation costs such as materials and travel and living costs.

## 1.8 LIFE-CYCLE DELIVERY COST CONSIDERATIONS

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Life-cycle training delivery costs represent the future training costs incurred during the life of an equipment or system. Life-cycle costs are more difficult to estimate than development and implementation costs, and require knowledge of future, forecasted training requirements. These costs depend greatly on factors such as:

- projected number of trainees and course hours;
- human resources required to support the training, if any;
- student and instructor travel and living requirements, if any;
- printing and reproduction material costs, if any;
- training material update cost;
- training equipment maintenance costs;
- length of the lifetime of the primary system.

## 2 METHODOLOGY AND PROCESS REGARDING THE TRAINING REQUIREMENT DEFINITION AND DELIVERY

### 2.1 TRAINING TASK ANALYSIS

#### 2.1.1 GENERAL

The task analysis uses a systematic process to identify specific tasks to be trained on and tasks that do not require training. A task analysis is used to describe and sequence observable, measurable behaviours involved in the performance of a job/duty/task. This procedure is done before beginning to design and develop training.

The information obtained from a task analysis can be used to develop performance objectives, sequence instructional content, identify appropriate instructional media and select appropriate instructional strategies.

A job can be defined as an individual's occupation within the organization. It is composed of all the tasks that the individual performs as part of their job.

The occupational/job analysis is performed to determine the elements of a job/duty. From this analysis, the job/duty is broken down into tasks. A task is normally an observable and measurable unit of work activity or operation that forms a significant part of a job. The tasks are further broken into task elements. It is then possible to identify which task elements require training and which do not.

Some of the sources that can be used to collect data for the task analysis are:

- Lighthouse Authority technical publications;
- training documentation;
- Subject Matter Experts (SME);
- engineering data and reports;
- any job aids or checklists;
- Lighthouse Authority regulations and manuals;
- supplier data and manuals.

To break down the tasks, determine all the steps that must be performed and the order in which they are actually performed. These become the task elements.

An example of a breakdown for a maintenance task analysis is shown in Table 2 and an example for an operator task analysis is shown in Table 3.

*Table 2 Example of a breakdown for a maintenance task analysis*

<b>Job</b>	Electronics Technician
<b>Duty</b>	Perform corrective maintenance on the system
<b>Task</b>	Fault isolate system equipment at first line
<b>Task Element</b>	Troubleshoot the electronics cabinet

**Table 3** *Example of a breakdown for an operator task analysis*

<b>Job</b>	System console operator
<b>Duty</b>	Operate the system
<b>Task</b>	Power up and initialise the system
<b>Task Element</b>	Perform the built-in tests

The task analysis is used to determine how the job/duty can be broken down into tasks and elements that will determine what will be taught to the trainees. Task analysis is performed at two times, for equipment updates that require a formal training and for completely new equipment systems, which will need a more time consuming and detailed analysis.

### 2.1.2 UPDATING THE TASK ANALYSIS

This type of analysis is done when an update or improvement has been made to current equipment, software and/ or procedure to do this type of analysis:

- review the updated training material and publications to determine the impact of the change on the user;
- from this review, list any new tasks or elements that may have been created by the updates to the equipment;
- determine if the new tasks or elements require training, or if an alternate method, such as a rewritten procedure, is all that is required.

### 2.1.3 DETAILED TASK ANALYSIS

This is used when developing training for completely new equipment or systems for which no analysis has ever been done and that are not part of the current product line. Understanding the criteria for identifying tasks will help during this phase of instructional development. Use the criteria below to help identify and select tasks.

A task has the following attributes:

- is a group of related physical or mental activities directed towards a goal;
- has definite beginning and end;
- involves people interacting with equipment, media and other items;
- may be directly or indirectly observable;
- is measurable;
- when completed, results in a meaningful product or process;
- includes physical activities, decision making problem solving, attitudes and perceptions;
- is an independent part of a duty;
- may be of any size or degree of complexity.

Consider one task at a time and ask what the trainee must know in order to learn this task. Make a list of the prerequisites. From each of these prerequisites, make another list of what other tasks a trainee must know to learn this task.

This process is repeated until you have reached the likely pre-level of instruction of the trainee.

During this process, as each task is examined to determine the performance requirements, the conditions under which they are performed and the standard that must be achieved are also developed and written down in the task analysis report.



Conditions include:

- equipment required to perform task;
- tools required to perform task;
- safety considerations when performing task;
- references/documentation used in task performance, such as job aids or technical publications;
- others human interface involved in performing the task;
- location/environment where task is performed;
- standards must be measurable and may include:
  - time;
  - quantity/rate;
  - percentage;
  - quality, accuracy, completeness, sequence, tolerance, number of errors permitted.

#### 2.1.4 SELECTING TASKS FOR TRAINING

In order to determine which tasks will be taught during the course, the following issues should be considered:

- can most of the trainees perform the task without training?
- how often is the task performed on the job?
- will job degradation occur if the task is not taught?
- is the task critical to the job?
- is it economical to teach the task?
- is there enough time to teach the task?
- will conditions make it unreasonable to train everyone to perform the task?
- how many people will perform the task?
- is the task difficult to learn?
- if the students are trained to perform the task, will they remember how to perform the task when they get the job?

From there, the task elements that require training are further analysed to determine which are skill (practical) learning and which are knowledge (theory) learning. These are then divided into POs for training purposes.

#### 2.1.5 TASKS NOT REQUIRING TRAINING

In general, tasks may require no training when the required knowledge is already known because of previous training or learning (through a course or work experience). A task may also require no training if only a negligible degree of skill or knowledge is required to perform the task or if a job aid, such as a checklist, is available.

#### 2.1.6 IDENTIFYING TASK ELEMENTS

Once the tasks representing the duties of the job have been identified, the task elements must, in turn, be identified. Task elements are activities that, when combined, make up a task. However, not all tasks are composed of task elements. Task elements should be identified for the following reasons:

- complex tasks can be analysed more easily if they are broken into task elements;
- breaking a task into task elements will often help the instructor sequence the training.

Table 4 is a guideline for identifying the task elements.

**Table 4 Identifying task elements**

<b>Step 1</b>	Examine each task statement to see if it contains more than one group of activities that must be performed sequentially or independently
<b>Step 2</b>	Review the complete list of task elements for each task; make sure that no task element overlaps; make sure that together they account for all performances required in the task

Once all the data has been collected and analysed, and once the duties of the job, the task and task elements have been compiled, the information must be verified.

Table 5 provides techniques that can be used to derive and verify task lists.

**Table 5 Techniques that can be used to derive and verify task lists**

<b>FUNCTION</b>	<b>TECHNIQUE</b>
Verifying Assembled Task Lists for an Existing Job	SME interview questionnaires Observations of performance of an expert
Deriving a New Task List for a New Job	Interviews with SMEs and LA personnel Questionnaires Simulation Assumptions

### 2.1.7 SELECTING SKILLS AND KNOWLEDGE ELEMENTS

An important decision point in the development of the training standard (TS) and the training plan (TP) is the classification of learning into type of skill or knowledge. This classification will be used to determine the time requirements, training methods, training aids and instructional material to be used.

Knowledge is the information the trainee has gained through experience and stored. Knowledge can be classified into three main categories with their own subcategories.

- facts - knowing objects, events, names, etc.:
  - concrete associations;  
Things observed and remembered, knowledge of a factual nature gained by direct experience, characterized by the ability to recognize objects or people.
  - verbal information. Language, mathematics, logic, knowledge of a factual nature gained by means of a symbolic language.
  - fact systems.  
Includes the complex interrelated factual knowledge that one acquires and is composed of facts (concrete or symbolic) that are interrelated in a specific way.
- procedures – knowing how to proceed in specific situations:
  - linear procedures (chains), simple step-by-step procedures, steps and their sequences;
  - multiple discriminations distinguishing similar information;
  - algorithm procedures, which may be complex but guarantee correct performance if followed correctly.  
These usually involve decision-making between different courses of action that are clearly specified.



- concepts – Information that requires understanding and can be used in many ways:
  - concrete concept classes of real objects or situations, such as the colour red;
  - defined concept classes of other objects learned with the use of a suitable language, such as colour or size;
  - concept systems (schemata), sets of related concepts, which the learner stores in memory in such a way that the relations between the concepts as well as the concepts themselves are remembered and can be recalled;
  - principle rules that guide action or explain change;
  - principles of nature (rules governing action), including all principles or rules in operation in the world that we can observe or infer from their effects;
  - principles of action or rules that govern the behaviour of the principle holder, including the appropriate actions or reactions to specific theories;
  - rule systems (theories or strategies), discrete but related rules forming a set of highly specific problem solving strategies, suitable for a given class of problem.
- skills are divided into four categories:
  - cognitive skills involved with decision-making, logical thinking, problem solving;
  - psychomotor skills of physical action, perceptual acuity, repetitive actions, physical designs;
  - reactive skills in dealing with one's own attitudes and emotions;
  - interactive skills in dealing with other people.

Each of these skill categories should not be thought of as discrete items at a particular level of skill, but as a continuum that spans from a reproductive ability for the skill to a productive ability. The trainee goes from being able to replicate what was learned to being able to use what was learned in a new context. Many skills may not fit into any of the categories; when this occurs, select the one that is most appropriate.

- Once the tasks to be taught have been identified, verified and documented, the results are published in a Training Standard. A sample task analysis record form is shown in ANNEX A.

## 2.2 PERFORMANCE OBJECTIVES

### 2.2.1 GENERAL

Once an inventory of the required skills and knowledge has been compiled, the corresponding performance objectives (PO) are defined. The objectives set out what must be performed by the technicians for each task requiring training. The emphasis is placed on what each trainee must be able to do upon completion of the training. The following is defined for each target objective:

- the normal conditions under which the work is performed;
- the manuals and other job-related reference material that must be used;
- tools and test equipment required to perform the task;
- the standards to which the task must be done in terms of safety, workmanship, and time.

Eventually each training objective is further broken down into enabling (lesson) objectives, which address how skills and knowledge associated with each training objective is to be imparted to the trainees. For traditional instructor-led training this takes the form of classroom lectures for the knowledge-based lessons and demonstration and hands-on practice for the skill-based lessons where the knowledge is applied.

## 2.2.2 PERFORMANCE OBJECTIVE PREPARATION GUIDELINES

One product of the task analysis is the list of tasks that require training. This task list is used to develop objectives for the course.

A PO is a statement of what the trainees are expected to be able to do at the end of training. PO are called differently depending on what references or guides are used, for example:

- behavioural objectives;
- instructional objectives;
- training objectives;
- criterion objectives;
- knowledge objectives.

The purpose of writing POs is to ensure the trainees get a clear picture of what is expected during instruction. They are also used for testing purposes and real life applications of the skills. For the instructor, the POs are a valuable part of the planning process because the training methods and training aids can be selected or developed once the POs are defined.

The PO is selected for each main task and developed around three areas. The first area is the performance or the learned capability the student is expected to demonstrate. The second is the condition(s) under which the performance must be completed. The third is the standard that must be met to successfully complete the task, usually expressed in time, as a quantity or as a quality.

The performance part of the objective states what trainees will do to demonstrate that they have learned a specific skill, knowledge or attitude. The capability must be written in measurable or observable terms so that the trainees can be evaluated fairly. The performance has to be clearly stated so instructors and trainees know exactly what must be learned.

Action verbs are used to describe the objective in order to reduce ambiguity because action verbs are observable.

***Table 6 Examples of Action and Vague verbs***

Action Verbs	Vague Verbs
Troubleshoot	Understand
Repair	Know

Examples of performance statements:

- repair faults on the radio system equipment;
- power up the Primary Power Supply (PPS).

For more information on the use of action verbs, see Norman Grolund's Stating Objectives for Classroom Instruction[1].

The condition(s) specified in an objective, whenever possible, should be the same as the actual conditions under which the job is performed. A properly prepared objective will state the conditions of the trainee's performance. This may include:

- the references or technical publications that the trainee can use;
- the tools or equipment available for the trainee;
- the environment and work area where the trainee must perform.

Some examples of condition statements are:

- using a multimeter and schematic diagram measures;
- set up the optical sight during day or night and in all weather conditions;
- power up the system using the operator's manual.

Condition statements can be derived from the task analysis.

The final part of an objective is a clearly stated standard of performance.

The trainees' performance will result in an output, the quantity or quality of which is the standard of performance. This standard defines the criteria for acceptable performance. It is stated in terms such as completeness, accuracy requirements, time constraints, performance rates and qualitative requirements. It identifies the proficiency the students must achieve when they perform the behaviour under specified conditions. Without a standard it is impossible to determine if the students have achieved the objective.

Most of the standards can be taken from the task analysis worksheet. If there were no standards set during the task analysis due to unavailability of information such as equipment or SME, the standards will have to be based on other sources such as experience or similar tasks. The standards can then be refined during the review process or when compared with actual on the job performance.

***Table 7 Examples of standards***

Standard	Example
Minimum acceptable level of performance	'measure the resistance of circuit with no more than 5% error'
Time requirement	'... within 15 minutes.'
Quantity	'identify five simulated faults.'

An example performance objective worksheet is included in ANNEX B.

### **2.2.3 PERFORMANCE OBJECTIVE CHECKLIST**

The following guidelines and criteria must be kept in mind while documenting the performance objectives:

- general guidelines:
  - use task descriptions developed during the analysis phase;
  - analyse each task on the task list to determine the number of objectives that are required for each item;
  - document each objective on a worksheet.
- checklist:
  - do I have a clear idea of what the trainees must do at the end of the training course?
  - has an action verb been used to describe this behaviour?
  - have the conditions (resources) that the trainee will require to perform the task been listed?
  - has the standard of satisfactory performance been listed?
  - can the behaviour be tested to the standard under the specific conditions?
  - do the objectives have any behaviours or skills that should not be developed in the trainees?
  - do the objectives exclude any behaviours or skills that are crucial to adequate performance?



## 2.3 TRAINING STANDARD

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### 2.3.1 GENERAL

The performance objectives are formalized in a document named the training standard. The training standard contains a complete description of the performance objectives and acts as the blueprint for the development of training documentation.

### 2.3.2 PREPARATION INSTRUCTIONS

The Training Standard (TS) is the main control document used by a training department to conduct Customer training. It lists the course requirements as well as the resources needed to set up and run a course.

The TS integrates the information collected and developed during the task analysis phase of the training development process, plus the material from the preparation of the trainee evaluation plan.

### 2.3.3 OVERVIEW OF DOCUMENT STRUCTURE

The TS consists of the following components:

- Cover page;
- Foreword;
- Preface;
- Record of revisions;
- Table of contents;
- Part 1: Outline of Training;
- Part 2: Course Management Details;
- Part 3: Assessment Details;
- Part 4: Performance Objectives;
- Annexes.

Part 1 provides an outline of the training that will take place during the course and includes how to use the TS, where the course will be given and by what organization.

Part 2 lists the course management details. This information is derived from the operation and maintenance concept documents, existing training material, and the personnel and organizational structure of the customer. Some of the details included in this document are the course duration, number of students, course prerequisites and other critical requirements.

Part 3 is based on the trainee evaluation plan. It presents details of how the trainees will be assessed and graded, what type of course report will be written (if any), and how the trainee's failures will be dealt with.

Part 4 is derived from the task analysis and the performance objective statements developed from this process. The performance objectives are recorded in the TS along with any references required (including a recognizable identification number); references can be technical manuals, videocassettes, films, Compact Disc - Read Only Memory (CD-ROM), etc.

Example training standard templates are included in ANNEX C.



## 2.4 TRAINEE EVALUATION PLAN

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### 2.4.1 PREPARATION OF A TRAINEE EVALUATION PLAN

Following the definition of performance objectives in the training standard, a trainee evaluation plan is developed to capture the trainee performance requirements. The main purpose for preparing the trainee evaluation plan at this early stage is to ensure there is a direct relationship between instructional objectives and assessment measures. The trainee evaluation plan is updated as required during the training development process. A sample trainee evaluation plan template is provided in ANNEX C APPENDIX 4.

The trainee evaluation plan must be updated as maintenance requirement change, and therefore the performance objectives described in the training standard, are changed.

## 2.5 TRAINING PLAN

---

### 2.5.1 PREPARATION INSTRUCTIONS

The training plan (TP) is used to provide a detailed plan for conducting the training of the PO listed in the Training Standard. The TP is used as a source from which the instructors will develop the lesson plans for the courses.

In the TP, the performance objectives are broken down by the instructor (SME), into Enabling (lesson) Objectives and teaching points. Enabling (lesson) Objectives describe the means of imparting particular supporting knowledge or skills that are considered essential to achieving the PO. A teaching point is an element of the Enabling (lesson) Objective that must be learned prior to achieving the Enabling (lesson) Objective.

To develop the TP, the following steps must be completed:

- sequence the PO. Sequencing is merely the organization of the course content to help the trainees achieve the course objectives. There are two main methods for sequencing PO:
  - take the objectives and analyse them one at a time, asking what must the trainees know to begin to learn the PO;  
This is the same as teaching the easier PO first and then moving on to the more complex objectives.
  - organise the POs into the order the steps will be performed.  
This method is most often used in psychomotor or skill training.
- select knowledge and skill elements;
- organize the knowledge and skill elements;
- write Enabling (lesson) Objectives;
- write teaching points;
- select the training method;
- identify the training aids and instructional material to be used;
- detail the time requirements.

### 2.5.2 OVERVIEW OF DOCUMENT STRUCTURE

The suggested format used for this document is as follows:

- Foreword;
- Preface;
- List of Annexes;
- Part 1 - General:



- outline of instruction;
- objectives;
- use of the TP.
- Part 2 Course management details:
  - critical requirements;
  - course administration;
  - course prerequisite;
  - qualification;
  - related documentations;
  - terminology;
  - language of instruction.
- Part 3 Assessment of Trainees:
  - general;
  - progress monitoring;
  - course member critiques;
  - removal from training;
  - course reports;
  - procedure;
  - unsatisfactory student progress;
  - cease training procedures;
  - cheating policy.
- Part 4 Performance objectives:
  - PO 01;
  - PO 02;
  - .....
- Annexes:
  - Annex A: Activity summary (course schedule);
  - Annex B: Technical reference material and instructional aids;  
List of manuals and training aids.
  - Annex C: Facilities and equipment requirements;
  - Annex D: Trainee evaluation plan.

## 2.6 STUDENT HANDOUTS

The student handout is structured in accordance with the Training Plan (TP). It is designed to provide the student with the information required to support the learning process. In addition to inform the student on official information such as the structure of the course (PO/Enabling (lesson) Objectives), the student is provided with



information on the official technical publications. Additionally, the student will find in the student handout a collection of information developed for training purposes only.

The structure of the student handout follows the TP structure. Enabling (lesson) Objective section is comprised of the following sections:

- theory information sheets:
  - Information regarding the current PO and Enabling (lesson) Objective.
    - additional information developed for training purpose only, such as:
      - ✓ diagrams merging information from various technical publications;
      - ✓ additional information developed by the training staff not available in the official documentation;
      - ✓ excerpts of official diagrams modified for training purpose.
- practical lab sheets:
  - information regarding the current PO and Enabling (lesson) Objective;
  - detailed information on the practical exercise;
  - assignment.

Example student handout coversheets are included in ANNEX C APPENDIX 6.

## 2.7 COURSE CRITIQUES

Course critiques provide valuable feedback that can be used to improve future courses.

## 3 EXAMPLE OF THE METHODOLOGY USED FOR CONTRACTOR SUPPLIED TRAINING

### 3.1 GENERAL

In the event a Lighthouse Authority wishes to contract-out some of its training needs, this example methodology may be of use. Whereas not all sections apply if the training is provided within the Lighthouse Authority's own resources, some are nonetheless relevant.

#### 3.1.1 QUOTATIONS

Separate quotations shall be submitted by the Contractor for each type of course required and for the following options:

- training at the Contractor's Plant;
- training at a Lighthouse Authority Site.

The quotation shall include the cost of preparing and the cost of presenting the course once, twice or three times in an agreed time period and at the sites specified in the equipment specification.

Included in the quotation shall be an estimate of the duration of each course in days. A per diem cost shall also be included for the purpose of determining the cost variations relative to increasing or decreasing course length.

A separate submission shall indicate costs associated with conducting course one (1) at the contractor's plant followed by courses two (2) and three (3) at Lighthouse Authority facilities. As part of the quotation the Contractor shall provide an estimate of the duration of each course in days.

Separate development and presentation costs shall be provided for all instructional strategies used to deliver the training. A brief justification detailing the cost/effectively advantages of the suggested training delivery method shall accompany each set of costs.



Alternative proposals by the Contractor beyond that are covered in the specification will be given full consideration during the review of quotations.

### **3.1.2 PRELIMINARY TRAINING PLAN CONTENT**

The Contractor shall include a proposed schedule of training courses and the period over which such training courses would be presented.

Any anticipated supporting material, resources, and facilities required to conduct the training shall be contained in the plan, including but not limited to the following items:

- operation and maintenance manual copies and other reference materials;
- special tools, test equipment, and consumables that would not normally found in the end-user organisation's tool compliment;
- equipment used in classroom presentations and hands-on training;
- special facilities such as sound booths, battery maintenance rooms, clean rooms, etc.;
- on-site customer-supplied assistance required to support training activities.

Individual equipment specifications will indicate the requirement for technical maintenance and/or operational courses.

## **3.2 CONTRACTOR'S RESPONSIBILITIES**

The Contractor shall be responsible for the following:

### **3.2.1 PERSONNEL**

The Contractor shall provide a suitable number of competent and qualified instructors fully capable of providing a standard of training acceptable to the Lighthouse Authority.

Lighthouse Authority reserves the right to examine the background, training and experience of the Contractor's instructors with a view to assessing their competence and deciding on their suitability to provide the required standard of training.

### **3.2.2 COURSE DURATION**

Based upon the syllabus of each type of training course to be submitted by the Contractor, Lighthouse Authority shall decide on the duration of each course. In drawing up each syllabus, the Contractor shall normally schedule no more than six (6) hours of formal classroom instructions in one (1) day. The total classroom and associated instruction, exclusive of a meal period, shall not exceed seven (7) hours, in one (1) day. Additionally, courses shall be scheduled to allow at least one (1) weekday immediately before and after each course for trainee travel.

### **3.2.3 COURSE COMMENCEMENT**

The starting date of each course will be subject to negotiations. Normally the first training course presented at the Contractor's plant should be completed at least one (1) month prior to the shipment of the first system.

Courses presented at a Lighthouse Authority site should be scheduled to begin at a mutually agreed time following completion of site system acceptance tests. Normally this will be as soon as possible after completion of acceptance tests.

### **3.2.4 LANGUAGE OF COURSE**

The Contractor shall indicate the capacity to present the training in the language the Lighthouse Authority requires the training to be conducted.

### **3.2.5 COURSE OBJECTIVES**

A detailed list of course objectives based on the equipment maintenance philosophy and stated in the terms of what the student will be able to do on completion of the training, shall be submitted to Lighthouse Authority for



approval at least three (3) months prior to the commencement of each type of training course. The submission of the course objectives shall also contain a statement of how student achievement of the course objectives is to be measured (refer to ANNEX B and ANNEX C).

### **3.2.6 SYLLABUS**

The proposed training course syllabus based on the approved course objectives shall be submitted to Lighthouse Authority for approval two (2) months prior to commencement of each type of training course. The preliminary syllabus shall be included in the training plan (refer to ANNEX C APPENDIX 5).

### **3.2.7 APPROVAL**

Lighthouse Authority reserves the right to review both the course objectives and the syllabus and through consultation amend same, to ensure consistency with the level of training required.

### **3.2.8 TRAINING EQUIPMENT**

Complete and fully operational equipment, which may be dedicated to practical hands-on instruction, and all necessary test equipment required, shall be provided by the Contractor where training at the contractor's plant has been selected. Where training is to be conducted at a Lighthouse Authority facility the Contractor shall supply all equipment necessary to meet the course objectives. These requirements shall not exceed those which would have been supplied had the course been held at the Contractor's plant.

Any training that is required to operate or maintain specialized test equipment, for the purposes of primary system operation and maintenance, shall be provided by the Contractor. Requirements for maintenance and calibration of specialized test equipment that are not directly related to the primary training courses will be addressed separately.

### **3.2.9 CLASSROOM AND LABORATORY FACILITIES**

Recognizing the required environment for good teaching practices, suitable classroom and laboratory facilities shall be provided by the Contractor where training at the Contractor's plant has been selected. Lighthouse Authority reserves the right to inspect these facilities to ensure their suitability.

### **3.2.10 TRAINING MATERIALS**

The complete set of training materials shall consist of the course objectives, course syllabus, lesson plans, training methods, examinations, schematics illustrations and other notes and training aids used during the presentation of each type of training course. Lighthouse Authority reserves the right to use this material for its own training purposes.

On the completion of each type of training course the Contractor shall provide the Lighthouse Authority with all the training material in an agreed to format.

The Contractor shall provide the name, version, and supplier of all multi-media authoring tools and all source materials used in the development of electronically delivered training products to the Lighthouse Authority. The Authority reserves the right to use or alter this material for its own training purposes.

### **3.2.11 REPORTS ON TRAINING**

Lighthouse Authority may require the Contractor to conduct tests and/or examinations, at intervals to be determined by the Department, in the interests of monitoring the progress of each trainee and to confirm the effectiveness of the training. Following the course, the Contractor shall report on the performance of each trainee. During each type of course, should a trainee experience such difficulty as to warrant withdrawal from the course the Contractor shall immediately advise the Lighthouse Authority, which will then decide on the action to be taken.

### **3.2.12 TEST EQUIPMENT**

The Contractor shall provide all test equipment for course of training presented at the Contractor's plant. Such tests equipment shall be as near equivalent to currently available Lighthouse Authority types as possible. Where



test equipment of a special form, not forming part of the contract, is specified by Lighthouse Authority as a requirement for use during training, arrangements shall be made for the provision of such test equipment by the Department.

### **3.2.13 COURSE CRITIQUES**

The Contractor will be supplied with critique forms at the discretion of the Lighthouse Authority. The forms shall be completed by the trainees at the end of the course and returned to Lighthouse Authority for evaluation. Criticisms considered valid by Lighthouse Authority will be discussed with the Contractor and areas where improvement can be made will be noted for implementation in future courses.

### **3.2.14 UNSATISFACTORY TRAINING**

Where the course critiques and/or test and examination results indicate that the training failed to meet the course objectives to the satisfaction of the Lighthouse Authority, the Contractor shall provide the additional training necessary to meet those objectives at no extra cost to the Lighthouse Authority.

### **3.2.15 TRAINING EQUIPMENT MAINTENANCE**

The Contractor shall be responsible for equipment maintenance during the duration of each course whether plant or site training is selected and shall ensure that sufficient spares are available to keep equipment fully operational.

## **3.3 NUMBER OF STUDENTS**

Normally Lighthouse Authority will supply from six (6) to fourteen (14) students on each type of course. Course loading will be subject to negotiation considering factors such as system complexity and type of training required.

## **3.4 STUDENT QUALIFICATIONS**

Candidates for the technical training courses will normally be (Lighthouse Authority to define level of expertise). Additionally, as outlined in the individual equipment specification, each candidate will have received pre-requisite training to the extent determined by the Lighthouse Authority.

## **3.5 TRAINING CURRICULUM REQUIREMENTS**

The training curriculum content requirements for equipment maintenance courses are listed in ANNEX D.

# **4 ACRONYMS**

AGC	Automatic Gain Control
CBT	Computer Based Training
CD-ROM	Compact Disc-Read Only Memory
FTC	Fast Time Constant
LA	Lighthouse Authority
OPH	Overhead Projector
OS	Operating System(s)
PC	Performance Check
PC	Practical Check
PO	Performance Objective(s)
PPS	Primary Power Supply
RF	Radio Frequency
SME	Subject Matter Expert(s)
STC	Sensitivity Time Control



TP	Training Plan
TS	Training Standard
UPS	Uninterruptable Power Supply
WBS	Web Based Training

## 5 REFERENCES

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- [1] Norman Grolund; Stating Objectives for Classroom Instruction; Macmillan Publishing Co.; ISBN-13: 978-0023480003





**ANNEX B**    **PERFORMANCE OBJECTIVES WORKSHEET**

***Table 9 Example Performance Objective Worksheet***

1. Performance:
_____
_____
_____
...
2. Condition(s):
Given: _____
_____
_____
_____
_____
3. Denied: _____
_____
_____
_____
_____
4. Standard:
_____
_____
_____
_____
_____
_____
...



## **ANNEX C    TRAINING STANDARD TEMPLATES**

### **C 1    TRAINING STANDARD PART 1 TEMPLATE**

#### **C 1.1.    OUTLINE OF TRAINING**

The outline gives an overall picture of the course and provides the objectives of the course. This paragraph should include a brief description of the intent of the course, the need for training, the scope of the training and the methods to achieve the objectives of the course.

##### **C 1.1.1.    USE OF THIS TS**

This TS shall be used by the following school(s) as the primary reference for organization and conduct of \_\_\_\_\_ (fill in course name).

- a.    \_\_\_\_\_ (name and location of school);
- b.    \_\_\_\_\_ (as necessary);
- c.    \_\_\_\_\_ (as necessary).



## C 2 TRAINING STANDARD PART 2 TEMPLATE

---

### C 2.1. COURSE MANAGEMENT DETAILS

---

- Aim of the course;
- Critical requirements;
- Course duration;  
The duration of the course is \_\_\_\_\_ training days;
- Productive hours per serial;
- Instructor type desired;
- Other critical requirements;
- Course capacity;  
The course capacity is:
  - Maximum;
  - Minimum;
  - Groupings or multiples if applicable (practical exercise team sizes);
  - Minimum.
- Course administrative organization and key offices;
- Course prerequisites and student selection criteria.



## **C 3 TRAINING STANDARD PART 3 TEMPLATE**

---

### **C 3.1. STUDENT ASSESSMENT**

---

#### **C 3.1.1. GENERAL**

Successful completion of the POs as identified in Part 4 of this Standard will be the basis for pass/fail assessment. Failure to meet the standards required by each performance objective, based on the assessment guidelines will constitute a course failure.

#### **C 3.1.2. SUPPLEMENTAL ASSESSMENT**

- 1 State the re-testing policy.
- 2 State consequences of failing the re-test.
- 3 State the authority responsible for determining the disposition of the trainee.

#### **C 3.1.3. PROGRESS MONITORING**

- 1 State student progress monitoring methods.
- 2 Describe records that will be kept of student progress and how they will be maintained.
- 3 Describe how student critiques of training will be obtained and recorded.

#### **C 3.1.4. REPORTS**

Describe the responsibilities for producing end of course reports on each student's progress.



## C 4 TRAINING STANDARD PART 4 TEMPLATE

---

### C 4.1. PERFORMANCE OBJECTIVES

---

#### C 4.1.1. PERFORMANCE OBJECTIVE 01

- 1 Performance. Maintain the \_\_\_\_\_ system.
- 2 Conditions.
  - a Given:
    - i List training equipment.
    - ii References.
    - iii Common tools and equipment.
    - iv Assistance.
  - b Environment (state environment in which work must be performed).
- 3 Standard.

In accordance with references and all safety procedures, the technician shall:

  - a complete start-up/shut-down procedures of the \_\_\_\_\_ system.
  - b operate the \_\_\_\_\_ equipment.
  - c isolate \_\_\_\_\_ equipment faults.
  - d repair \_\_\_\_\_ equipment faults.
- 4 Specific Reference Numbers (list publication reference numbers).
- 5 Specification Task Numbers (list task spec. reference numbers).
- 6 Supporting Skills and Knowledge Specification Task Numbers
  - a skills statement numbers (list applicable skill spec. numbers).
  - b knowledge statement numbers (list applicable knowledge spec. numbers).
- 7 Training Limitations (state training limitations imposed by safety or training equipment constraints, if any).

(FOLLOW WITH SUBSEQUENT PERFORMANCE OBJECTIVE DESCRIPTIONS)



## APPENDIX 1    MAIN REFERENCES

*Table 10 Main references*

REFERENCE	PUBLICATION NUMBER	TITLE	MAXIMUM QUANTITY REQUIRED
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			



## APPENDIX 2    TASK LIST

Table 11 Task list

TASK NO.	TASK DESCRIPTION	TRG REQUIREMENT		PO NO. (IF TRG)
		TRG	NO TRG	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				



## APPENDIX 3    SPECIAL TOOLS AND TEST EQUIPMENT

*Table 12 Special tools and test equipment*

NO.	PART NO.	MANUFACTURER	NOMENCLATURE	QTY
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				



## **APPENDIX 4 PERFORMANCE CHECK FOR PERFORMANCE OBJECTIVE No**

---

### **1. SAMPLE TRAINEE EVALUATION PLAN TEMPLATE**

---

#### **1.1. PART I INSTRUCTIONS TO CHECK ADMINISTRATOR**

---

This section will include special instructions about what check conditions are, the time allotted and any other factors required to ensure the standardization and conduct of the PC.

#### **1.2. PART II INSTRUCTIONS TO THE TRAINEE**

---

This section will provide the trainees with information that will ensure an understanding of what is required of them during the check. This includes details on equipment, safety precautions, time, method of scoring and other pertinent data.

#### **1.3. PART III CHECKLIST**

---

This section will contain an ordered set of tasks, which form the complete checklist from the PO that will be used to evaluate the trainees.



## 2. TEMPLATE FOR WRITTEN EXAM

---

### 2.1. PART I INSTRUCTIONS TO CHECK ADMINISTRATOR

---

- 1 Inform the trainees that this is a multiple-choice examination on the material they have covered during PO \_\_\_\_.
- 2 Provide one examination package per student.
- 3 Reference material may not be used.
- 4 Randomly select \_\_ questions from the question bank.
- 5 Inform the trainees they have \_\_ minutes to complete the examination.
- 6 Inform the trainees not to start until told to do so.
- 7 A minimum grade of \_\_ is required to pass.
- 8 Assign a spare room in which the trainees who have completed the examination will wait.

### 2.2. PART II INSTRUCTIONS TO BE GIVEN TO THE TRAINEE

---

- 1 This is a multiple-choice examination on the material you have learned during PO \_\_\_\_.
- 2 There are \_\_ multiple-choice questions, and you have one hour to complete the exam.
- 3 For each question, select the answer that best completes the statement or answers the question, and completely fill in the appropriate square.
- 4 Use only the proper marking pencil.
- 5 Complete the top portion of the cover page first.
- 6 Do not start the exam until told to do so.
- 7 If you want to change your answer, do not attempt to erase, simply put an X through the square of your wrong answer and proceed with your second choice.
- 8 Since your score will be the number of items answered correctly, be sure to answer every question.
- 9 The passing grade is 70%. You must pass this exam before proceeding to the practical PC \_\_\_\_\_.
- 10 When you have completed and turned in your exam, go into spare classroom number \_\_\_\_\_. When everyone has finished, return to this classroom for debriefing and further instructions.

### 2.3. PART III EXAMINATION QUESTIONS

---

See the course question bank for the selection of questions that may be used for an examination pertaining to the subject matter of this PO.



### 3. TEMPLATE FOR PRACTICAL EXAM

#### 3.1. PART I INSTRUCTIONS TO CHECK ADMINISTRATOR

- 1 The following tasks must be completed prior to administering the PC:
  - a Brief trainees one day before the PC and advise them to review the appropriate material. Ensure they understand the PC requirements.
- 2 To successfully complete the PC, the trainees must meet the requirements on the checklist.
- 3 The number of instructors required to conduct this PC is \_\_\_\_\_.
- 4 Ensure that the trainees are aware of the PC result as soon as possible.

#### 3.2. PART II INSTRUCTIONS TO BE GIVEN TO THE TRAINEE

- 1 The following instructions are to be given to the trainees one day before the PC:
  - a Review the training material subject to the PC.
  - b To successfully complete this PC, you will be required to perform \_\_\_\_\_.
  - c You will be assessed on: \_\_\_\_\_.
  - d You will have \_\_\_\_ minutes to complete the PC. A second attempt may be permitted in the event of an unsuccessful first attempt.
  - e You will report to the waiting area when the PC is completed.

#### 3.3. PART III CHECKLIST

*Table 13 Practical examination checklist*

<b>PO Checklist:</b>	<b>Date:</b>
<b>Section I</b>	
Student Name _____	ID# _____
Course Name _____	Instructor _____
<b>Section II</b>	
Pass ___ Fail ___ First attempt ___ No. correct: ___	
Pass ___ Fail ___ Second attempt ___ No. correct: ___	
<b>Section III</b>	
Performance:	
Conditions:	



Table 14 Example Marking sheet

STEP #	ACTIONS	PASS	FAIL



## APPENDIX 5 TRAINING PLAN EXAMPLE OF PART 4

Note: Only One Performance Objective is shown.

### 1. PO # 01

#### 1 Performance.

Maintain \_\_\_\_\_ Equipment.

#### 2 Conditions:

a Given:

- i Training Equipment (specify).
- ii References.
- iii Common tools and equipment.
- iv Assistance.

b Environmental: all conditions day or night.

#### 3 Standard.

In accordance with references and all safety procedures, the technician shall:

a Complete start-up/shutdown procedures of the \_\_\_\_\_ system including:

i (list of equipment)

b Isolate \_\_\_ equipment faults.

c Repair \_\_\_ equipment faults.

#### 4 Enabling objectives.

a 01.01 Describe the characteristics and principles of operation of the \_\_\_\_\_ system equipment.

b 01.02 Fault isolate and repair the \_\_\_\_\_ system equipment.

#### 5 Time:

	01.01	01.02	TOTAL MINS	APPROX DAYS
Training				
Practice				
PC Written				
PC Practical				
PC Review				
<b>Total</b>				

#### 6 References.

a (technical manual #). (manual title)

b (technical manual #). (manual title)

c (technical manual #). (manual title)



**7 Practical Check (PC).**

- a The PC for PO #01 consists of two parts:
  - i A written test (PC01A) in accordance with the trainee evaluation plan developed in Appendix II to Appendix V.
  - ii A practical test (PC01B) in accordance with the assessment checklist developed in Appendix II to Appendix IV.
- b All parts must be passed in order to pass this PO.

**8 Remarks.**

**2. ENABLING (LESSON) OBJECTIVE # 01.01**

**1 Performance.**

Describe the characteristics and principles of operation of the \_\_\_\_\_ equipment.

**2 Conditions.**

- a Given:
  - i References.
  - ii (specify required manuals)
  - iii Student Guide.
- b Environment: Classroom.

**3 Standard.**

In accordance with references, the technician shall describe:

- a The \_\_\_\_ equipment.
- b The system intended purpose or use.
- c The physical equipment.
- d The location of each unit.
- e The \_\_\_\_\_ operational modes.

**4 Teaching points/time/references.**

*Table 15 Teaching points/time/references - Enabling (lesson) objective # 01.01*

TEACHING POINT	TIME (mins)	REFERENCE
1. INTRODUCTION Describe the contents of the student guide Describe the contents of the course State the objective of the ENABLING (LESSON) OBJECTIVE Describe the contents of the ENABLING (LESSON) OBJECTIVE Describe the method of evaluation	60	Student Guide, Section _.    Student Guide, Section _



TEACHING POINT	TIME (mins)	REFERENCE
2. PRESENTATION		
Describe the _____ system equipment:	60	A3 (manual reference number from PO description paragraph 6)
Describe component locations	60	
Describe the system configurations:	60	
Describe the system communication paths:	60	
Describe the system message formats:	30	

5 **Test details.**

The material contained in this ENABLING (LESSON) OBJECTIVE will be tested in PC01B (system fault isolation).

6 **Method.**

Teaching points will be covered by lectures.

7 **Training aids:**

- a Overhead Projection (OHPs).
- b Training equipment (specify).

8 **Learning aids.**

Student guide.

9 **Remarks.**

### 3. ENABLING (LESSON) OBJECTIVE 401.02

1 **Performance.**

Maintain the \_\_\_\_\_ system equipment.

2 **Conditions:**

- a Given:
  - i References.
  - ii (specify training equipment)
- b Environment: (specify training environment).

3 **Standard.**

The technician shall, in accordance with references:

- a Fault isolate the \_\_\_ system equipment, down to replaceable card or module level.
- b Repair the faulty equipment.
- c Perform the required \_\_\_ system functional checks to prove the repair.

4 **Teaching points/time/references:**

**Table 16 Teaching points/time/references - Enabling (lesson) objective 401.02**

TEACHING POINT	TIME (mins)	REFERENCE
<p>1. Introduction</p> <p>State the objective of the ENABLING (LESSON) OBJECTIVE</p> <p>Describe the contents of the ENABLING (LESSON) OBJECTIVE</p> <p>Describe the method of evaluation</p>		
<p>2. Presentation</p> <p>Assign _____ scenario worksheets and supervise worksheet completion</p> <p>State the objectives of the exercise:</p> <p>Set up ____ system with scenario data with one or two technicians at each network position</p> <p>Locate fault(s) within the _____ system</p> <p>Repair located faults</p> <p>Class is divided into crews once system faults are located</p> <p>Verify correct system operation</p> <p>Describe the physical system set-up for the exercise</p> <p>Describe the crew rotation for the system workstations</p> <p>Describe the ____ system overall checkout procedures:</p> <p>System power up</p> <p>System checks</p> <p>System initialisation</p> <p>Supervise the initialisation and checkout of a serviceable _____ system:</p> <p>Assign initial crew positions</p> <p>Once system is initialised, rotate crews through the workstation positions for performance of the system checks</p> <p>Insert system faults as per fault list</p> <p>Assign crew positions for system initialisation and checkout and repair</p> <p>Each instructor will supervise work at one of two possible fault sites</p> <p>A maximum of two areas of the system will be faulted to allow for sufficient supervision by two instructors.</p> <p>Any students not assigned to a faulted system site will be reassigned for the fault isolation and repair of faulted areas</p> <p>Crew rotation will allow each technician equal initial exposure to system faults</p> <p>Debrief technicians at the conclusion of each fault set</p>	<p>180</p> <p>420</p> <p>840</p> <p>20</p>	<p>Student Guide, Section 1, Practical Exercise 2</p>

**5 Test details.**

The material contained in this Enabling (Lesson) Objective will be tested in PC01B.



6 **Method.**

Teaching points will be covered by lectures and practical exercises.

7 **Training aids:**

a (specify required training aids, i.e., training equipment).

8 **Learning aids.**

Student guide.

9 **Remarks.**



## APPENDIX 6    STUDENT HANDOUT COVER SHEET SAMPLES

### 1.    EXAMPLE 1 - THEORY HANDOUT COVER SHEET

2.0    \_\_\_\_\_ System Maintenance

2.1    Theory Information Sheets

Course:	_____ Maintenance Course	Serial: (course #)
PO: 02	Maintain the _____ system.	
ENABLING (LESSON) OBJECTIVE: 02.01		
Describe the _____ system hardware		

#### **Condition**

Reference material:

- 1    Student handout.
- 2    (specify technical manuals).

#### **Standard**

The trainee must describe the \_\_\_\_\_ system hardware, using references.

### 2.    EXAMPLE 2, PRACTICAL HANDOUT COVER SHEET

5.0    Practical Lab Sheets

Course:	C <sup>3</sup> Radio Maintenance Course	Serial: (course #)
PO: 05	Maintain the _____ system.	Students/Crew: 2
		Hours/Crew: 1
ENABLING (LESSON) OBJECTIVE: 05.02		Identify and locate _____ system components.

#### **1    Objective.**

Identification and location of \_\_\_\_\_ system components.

#### **2    Materials.**

Students must have the following in their possession:

- a    Student guide.
- b    (specify technical manuals).

#### **3    Assignment.**

Students must complete the assignment at the end of this demo-performance.



4 **Performance.**

The students will locate and identify the following \_\_\_\_\_ system components with the assistance of the instructor:

- a (main component):
  - i (sub component).
  - ii (sub component).
  - iii (sub component).
- b (main component):  
Interconnecting cables.
- c The IEU:
  - i (sub component).
  - ii (sub component).

5 **Debrief.**

Time will be allotted for general discussion of the demo-performance exercise.

6 **Assignment.**

While in class, complete the following assignment. Using the \_\_\_\_\_ system cable interconnection diagrams in the (reference):

- a (Question)?
- b (Question)?
- c (Question)?
- d (Question)?
- e (Question)?



## APPENDIX 7   SAMPLE COURSE CRITIQUE

The following pages contain the standard course critique to be completed by the trainees and the instructors.

Serial No. \_\_\_\_\_

Date \_\_\_\_\_

Course Critique

for

---





## 2. PART 1 - RATINGS/COMMENTS ON THE COURSE

A series of statements that may be made about this course is presented below. Check the appropriate box to indicate whether you:

	1	2	3	4	5
	1 Strongly Disagree				
		2 Disagree			
			3 Neither Agree Nor Disagree		
				4 Agree	
					5 Strongly Agree
1. This course was generally well presented.					
2. This course was generally well sequenced.					
3. This course was generally well paced.					
4. Comments and criticism made by instructors were helpful and constructive.					
5. The administration of this course was well handled.					
6. The material presented was relevant to this course and to my future role with this system.					
7. The presentation of the course material was well structured.					
8. Sufficient time was allocated to each segment of the course.					
9. The practical exercises were well prepared and meaningful.					
10. The training aids were effective and facilitated learning.					





- 2 What topics/areas would you like to see expanded or presented in more detail?
  
- 3 What topics would you like to see reduced?
  
- 4 What areas gave you most difficulty in understanding? What are some suggestions to ease understanding of those areas?
  
- 5 What segments of this course did you find particularly valuable?
  
- 6 What suggestions do you have for improving the course?
  
- 7 Please add any comments, suggestions or statements you feel would help improve the course.

### **Instructor's Comments and Observations**

Please indicate your comments and suggestions on the following topics. Your comments will be used along with the student's critique to enable the training establishment to fine-tune the course content.

- 1 Was there a problem using only English?





## **ANNEX D    TRAINING CURRICULUM REQUIREMENTS**

### **D 1    GENERAL**

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The training curriculum content requirements for equipment maintenance courses are listed below:

#### **D 1.1.    PURPOSE OF SYSTEM**

---

To be able to describe the system or equipment in terms of:

- the Maintenance philosophy and reporting procedures;
- the intended purpose or use;
- the relationship to other systems or equipment involved;
- the physical units;
- the location of each unit;
- the similarity to other systems using the same principles.

#### **D 1.2.    BASIC PRINCIPLES**

---

To be able to state the basic principles employed by the system or equipment in order to achieve its purpose. Such principles would cover:

- the type of information provided;
- audio signals, coded signals, etc.;
- how the information is provided;
- transmitted or received;
- modulation methods;
- special features.

#### **D 1.3.    MODES OF OPERATION**

---

To be able to state various modes of operation as well as different configurations which may be used in terms of:

- reasons for each mode or configuration;
- use of each mode or configuration;
- difference for each mode or configuration.

#### **D 1.4.    SYSTEM FUNCTIONAL DIAGRAM**

---

To be able to explain the operation of the system (or equipment) in terms of the critical signal paths and major functional areas. The system functional diagram will show, in functional detail, how the basic principles of operations are achieved, and include controls and indicators for system functions or parameters.

##### **D 1.4.1.    SYSTEM DIAGRAMS**

System diagrams will be in three levels of detail:

- 1    System Block Diagram



Consists of all units, subunits, cards, interconnections, primary signal flows and block functions that describe system operation.

## 2 Detailed Functional Block

Consists of all units, subunits, cards and interconnections.

Contains significant Test Points (if any), Test waveforms or levels, Stage Gains, connector nomenclature, card functional details, and signal flow and control lines that describes system operation.

## 3 Schematic Diagram

Consists of Schematic or Logic diagram of each unit or board including interconnections.

All Test Points labelled.

Direction of major signal flows should be indicated and emphasised.

### **D 1.5. SYSTEM ADJUSTMENTS**

---

To be able to explain the function or purpose of all controls and indicators including:

- when controls should be adjusted;
- the use of controls and indicators in system troubleshooting or alignment.

### **D 1.6. EFFECTS OF ADJUSTMENTS**

---

To be able to state the effect of adjustments on overall system performance and, in particular the effect of critical adjustments which affect the nature of signals being transmitted or received and waveforms shall also be provided where applicable.

### **D 1.7. OPERATING PROCEDURES**

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To be able to perform all operation procedures; in a safe and competent manner, such as:

- normal turn-on and shut-down procedures;
- emergency shutdown procedures;
- special start-up procedures;
- partial turn-on or shut-down;
- system re-configuration or patching;
- proper operation of manual controls.

### **D 1.8. SAFETY OF PERSONNEL**

---

To be able to state safety precautions to be observed in regard to:

- possible electric shock;
- RF or radioactive radiation hazards;
- disposal of dangerous devices or substances;
- explosion or implosion hazards;
- any noxious fumes or substances;
- possible injuries due to falls or striking objects;
- environmental hazards (e.g. noise);



- fire.

#### **D 1.9. SAFETY OF EQUIPMENT**

---

To be able to state precautions that must be observed when working on equipment in order to avoid damage to equipment. For example:

- o use of proper tools and test equipment;
- o correct control settings;
- o excessive power or signal levels;
- o use of attenuators or probes;
- o care in removal, replacement, and adjustment;
- o use in cleaning substances or methods;
- o effect of excessive heat;
- o observation of correct maintenance procedures;
- o removal or replacement of connecting cables or wires.

#### **D 1.10. TECHNICAL MANUALS**

---

To be able to use Manufacturer's Manuals and Lighthouse Authority Standards and Procedures in the performance of maintenance activities, with emphasis on the following:

- knowledge of applicable technical manuals;
- organisation of the manuals;
- understanding of nomenclature and symbols used;
- organisation of schematics, wiring and logic diagrams;
- understanding of manual revisions;
- procedures used to report deficiencies or errors in manuals;
- procedure to be used in order parts.

#### **D 1.11. THEORY OF OPERATION**

---

To be able to describe the theory of operation for a circuit or device to the level of understanding required which would allow maintenance fault monitoring or fault-isolation to be carried out as specified in the relevant maintenance procedures.

#### **D 1.12. SCHEMATIC OR LOGICAL DIAGRAMS**

---

To be able to use schematic or logic diagrams for the purpose of:

- tracing primary or secondary signals from source to destination;
- identifying circuit elements used in producing or processing various signals;
- identifying input signals required for various output signals;
- identifying likely faulty circuit elements for a given set of input and output conditions.



### **D 1.13. WIRING OR CABLING DIAGRAMS**

---

To be able to use wiring, backplane, motherboard or cabling diagrams for the purpose of:

- tracing signal, control, or power lines between assemblies, units, equipment, and power sources;
- identifying wires and cables in situation by colour code or labels.

### **D 1.14. CONTROL CIRCUITS**

---

To be able to identify and describe the function of control circuit elements involved in such operation as:

- equipment turn-on and turn-off;
- equipment warm-up or standby;
- changes in operating mode or configuration;
- monitoring of equipment operating parameters;
- selecting operational options (e.g. AGC, FTC, STC);
- changing operational parameters.

### **D 1.15. PERFORMANCE MONITORING**

---

To be able to describe the Performance Monitoring system in terms of:

- the parameters or functions being monitored;
- the physical and circuit location of sensing devices;
- the normal indications and allowable tolerances;
- the use of readout indications in analysing system malfunctions.

### **D 1.16. MAINTENANCE PROCEDURES**

---

To be able to carry out all scheduled maintenance procedures as specified in the relevant Standards and Procedures manual or in the manufacturer's service manuals.

### **D 1.17. TEST EQUIPMENT**

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To be able to operate and set-up test equipment specified for use in carrying out scheduled maintenance activities with emphasis on:

- care and handling of test equipment;
- correct control settings and input levels;
- precautions to be observed;
- reading and interpreting indications;
- correct use of attenuators or probes.

### **D 1.18. SET-UP PROCEDURES**

---

To be able to carry out all test and alignment procedures as specified in the relevant manufacturer manuals.



## D 1.19. SYSTEM TESTS

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To be able to carry out all system functional or performance tests or checks as specified in the relevant Standards and Procedures manuals or in the manufacturer's service manuals.

## D 1.20. REPAIR PROCEDURES

---

To be able to carry out all repair procedures as specified in the relevant manufacturers' manuals and in accordance with maintenance requirements as shown in the Standards and Procedures manuals, with emphasis on:

- importance of observing step-by-step disassembly and assembly instructions;
- special tools or equipment requirements;
- proper use of correct tools;
- precautions when effecting repairs.

## D 1.21. REPLACEMENT PROCEDURES

---

To be able to carry out replacement procedures in accordance with maintenance requirements with emphasis on:

- proper care in making replacement;
- knowledge of equipment warranty requirements;
- knowledge of manufacturers or contractor replacement procedures;
- care in handling, packing, unpacking, or shipping replacement parts.

## D 1.22. TROUBLE SHOOTING AIDS

---

To be able to list and demonstrate proper use of available aids for trouble shooting and state which aids should be used for a given problem situation. Such aids would include:

- test equipment;
- equipment and monitor indicators;
- other readout devices;
- fault-charts or fault-trees;
- diagnostic software;
- system functional diagram;
- block diagrams, wiring diagrams, schematic or logic diagrams.

## D 1.23. FAULT-FINDING PROCEDURES

---

To be able to demonstrate correct fault-finding procedures by:

- using available indicators to assess the problem;
- making such test and measurements as to gain additional relevant information, which would allow further isolation of the problem;
- evaluating all data obtained from observation and measurement in a logical manner in order to identify most probable cause of trouble;



- selecting most appropriate trouble shooting aids.

#### **D 1.24. FLOW CHARTS**

---

To be able to use flow-charts for the purpose of:

- identifying the different software modules and functions;
- explaining the software modules at a detailed flow chart level;
- tracing signal flow through flow chart.

#### **D 1.25. MEMORY MAPS**

---

To be able to use memory maps for the purpose of:

- identifying the different portions of memory;
- explaining the purpose of these portions of memory.