



# IALA MODEL COURSE

C2007-1

## AIDS TO NAVIGATION - TECHNICIAN TRAINING RADAR BEACONS (RACON) MAINTENANCE

**Edition 3.0**

**December 2021**

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# DOCUMENT REVISION

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Revisions to this IALA Document are to be noted in the table prior to the issue of a revised document.

Date	Page / Section Revised	Requirement for Revision
June 2016	Pages 3 & 6	Minor text amendments and update of Teaching Modules
December 2021	Entire document	Review of content



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## FOREWORD

The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) recognises that training in all aspects of Aids to Navigation (AtoN) service delivery, from inception through installation and maintenance to replacement or removal at the end of a planned life-cycle, is critical to the consistent provision of that AtoN service.

Taking into account that under the SOLAS Convention, Chapter V, Regulation 13, paragraph 2; Contracting Governments, undertake to take into account the international recommendations and guidelines when establishing aids to navigation, including referring to the appropriate recommendations and guidelines of IALA. This includes recommendations on training and qualification of AtoN technicians, and consequently IALA has adopted Recommendation R0141 on Standards for Training and Certification of AtoN personnel.

IALA committees working closely with the IALA World Wide Academy have developed a series of model courses for AtoN personnel having E-R0141 Level 2 technician responsibilities. This model course on AtoN Service Craft and Buoy Tenders should be read in conjunction with the Training Overview Document IALA WWA C2000 which contains standard guidance for the conduct of all Level 2 model courses

This model course is intended to provide national members and other appropriate authorities charged with the provision of AtoN services with specific guidance on the training of AtoN technicians in an introduction to service craft and buoy tenders. Assistance in implementing this and other model courses may be obtained from the IALA World Wide Academy at the following address:

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Tel: (+) 33 1 34 51 70 01  
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## PART 1- COURSE OVERVIEW

### 1. SCOPE

This course is intended to provide technicians with the theoretical and practical training necessary to acquire a satisfactory competence in the installation and maintenance of Racons.

### 2. OBJECTIVE

Upon successful completion of this course, participants will have acquired sufficient knowledge and skill to install and maintain Racons within their organizations.

### 3. COURSE OUTLINE

This course is intended to cover the knowledge and practical competence required for a technician to properly install and maintain Racons used on fixed and floating aids to navigation. The complete course comprises five modules, each of which deals with a specific subject representing an aspect of installing and maintaining Racons. Each module begins by stating its scope and aims, and then provides a teaching syllabus. This is a practical, job-centred course designed to provide trainees with a realistic, hands-on educational experience

The required standard of competence is considered to be the level of proficiency that should be achieved for the proper performance of the duties carried out by the technician in their organization.

This Model Course is focussed at the satisfactory level of competence.

***Table 1 Levels of Competence***

Competence Level	Learning Outcome	Instructional Objectives	Required skills
2	The conduct of routine tasks unsupervised and some more complex tasks under guidance	A <b>satisfactory</b> understanding of theoretical concepts and principles so that they can be applied in practice	Correctly acquired responses have become habitual. Actions can be performed confidently and efficiently

### 4. TEACHING MODULES

***Table 2 Table of Teaching Modules***

Module Title	Time in hours	Overview
Introduction to Racon technology	1.0	Racon technology, terminology and the type of Racons used in aids to navigation
Safety	1.0	Safely storing, handling, and working with Racons at height.
Inspection, testing and maintenance	4.0	Understanding manufacturer's specification and testing, inspecting, and troubleshooting problems

Installation	2.0	Wiring, and installing Racons on buoys, ground, structures, lighthouses, and major floating aids
Inventory management and disposal	0.5	Managing the inventory, and properly disposing and recycling
Evaluation	1.0	
<b>Total Hours</b>	<b>9.5</b>	1.5 day course

## 5. SPECIFIC COURSE RELATED TEACHING AIDS

This course involves both classroom instruction and a visit to a buoy refurbishment facility. Classrooms should be equipped with appropriate teaching aids to enable presentation of the subject matter. Trainees should have access to the types of equipment that they will be expected to work with on the job. Relevant electrical equipment drawings should be available to each participant.

## 6. ACRONYMS

To assist in the use of this model course, the following acronyms have been used:

AtoN	Aid(s) to Navigation
CRO	Cathode-Ray Oscilloscope
GHz	Giga Hertz
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
Racon	Radar Beacon
RF	Radio Frequency
SOLAS	International Convention for the Safety of Life at Sea, 1974 (as amended)
WWA	World Wide Academy

## 7. DEFINITIONS

The definition of terms used in this Model Course can be found in the International Dictionary of Marine Aids to Navigation (IALA Dictionary) at <http://www.iala-aism.org/wiki/dictionary>

## 8. REFERENCES

In addition to any specific references required by the Competent Authority, the following material is relevant to this course:

- 1 IALA NAVGUIDE.
- 2 IALA Recommendation R0101 on Maritime Radar Beacons (Racons).
- 3 IALA Guideline G1010 on Racon Range Performance.
- 4 Technical documentation from Racon equipment manufacturers.

## PART 2 – TEACHING MODULES

### 1. MODULE 1 – INTRODUCTION TO RACON TECHNOLOGY

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#### 1.1. SCOPE

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This module provides an overview of Racon technology and the various AtoN applications.

#### 1.2. LEARNING OBJECTIVE

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Upon completion, the student will have a satisfactory understanding of how Racons work and be familiar with their various applications as an aid to navigation.

#### 1.3. SYLLABUS

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##### 1.3.1. LESSON 1 – RACON TECHNOLOGY

- 1 Physical construction.
- 2 Principles of operation.
- 3 Terminology.

##### 1.3.2. LESSON 2 – RACON TYPES

- 1 9Ghz Band.
- 2 3Ghz Band.
- 3 Frequency Agile.
- 4 Advantages and disadvantages.
- 5 Typical uses and applications.
- 6 Racon detection by new technology (solid state) radar systems.
- 7 Alternatives to Racon use.

### 2. MODULE 2 – SAFETY

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#### 2.1. SCOPE

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This module describes methods for safely storing and handling Racons.

#### 2.2. LEARNING OBJECTIVE

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Upon completion, the student will have a satisfactory understanding of how to work with Racons safely.

#### 2.3. SYLLABUS

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##### 2.3.1. LESSON 1 – POTENTIAL HAZARDS

- 1 Working with RF:
  - a Dangers of exposure to RF.
  - b First aid measures.
  - c Dangerous voltages.
- 2 Personal protection:
  - a Climatic protection.



- b Body protection.
  - c Hand and foot protection.
- 3 Safe handling and storage:
  - a Guidelines for transportation and storage.
  - b Proper lifting methods.

### **3. MODULE 3 – INSPECTION AND TESTING**

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#### **3.1. SCOPE**

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This module outlines the procedures for testing and transporting Racons. Applicable safety procedures from Module 2 will be reinforced during the lessons.

#### **3.2. LEARNING OBJECTIVE**

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Upon completion, the student will have a satisfactory understanding as to how to properly and safely inspect, test, and troubleshoot problems with Racons.

#### **3.3. SYLLABUS**

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##### **3.3.1. LESSON 1 – MEASUREMENT AND TEST EQUIPMENT**

- 1 Cathode-ray oscilloscope (CRO).
- 2 Power meter.
- 3 Power sensor.
- 4 Signal generator.
- 5 Circulators.
- 6 Racon test unit.
- 7 Remote working radar.

##### **3.3.2. LESSON 2 - PROGRAMMING THE RACON**

- 1 Testing Racon using remote ship's 3 and 9Ghz radar(s).
- 2 Morse Code programming.

##### **3.3.3. LESSON 3 – TRANSPORTING RACONS**

- 1 Demonstrated competence in Racon shipment, including:
  - a Racon shipment accessories required.
  - b Racon packaging.
  - c Racon shipment procedures.

### **4. MODULE 4 – INSTALLATION**

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#### **4.1. SCOPE**

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This module describes the methods for changing, wiring and installing Racons on buoys, structures, lighthouses and major floating aids. Applicable safety procedures from Module 2 will be reinforced during the lessons.

#### **4.2. LEARNING OBJECTIVE**

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Upon completion, the student will have a satisfactory understanding as to how to properly and safely install Racons on aid to navigation structures.

### **4.3. SYLLABUS**

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#### **4.3.1. LESSON 1 – INSPECTION PRIOR TO INSTALLATION**

- 1 Physical condition.
- 2 Documenting asset details.

#### **4.3.2. LESSON 2 - WIRING**

- 1 Cable types.
- 2 Connections.

#### **4.3.3. LESSON 3 – INSTALLATION**

- 1 Physical requirements:
  - a Racon orientation.
  - b Protection of the Racon against site environmental conditions.
  - c Working at heights.
- 2 Installing Racons:
  - a Racon stands.
  - b Dissimilar materials contact.
  - c Racon terminal boxes.

## **5. MODULE 5 – INVENTORY MANAGEMENT AND DISPOSAL**

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### **5.1. SCOPE**

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This module describes the procedures for managing the Racon inventory, and for proper disposal and recycling of Racons.

### **5.2. LEARNING OBJECTIVE**

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Upon completion, the student will have a satisfactory understanding of the policies and regulations in his or her organization which govern the proper management and disposal of Racons.

### **5.3. SYLLABUS**

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#### **5.3.1. LESSON 1 – INVENTORY MANAGEMENT**

- 1 Legal requirements and regulations governing management.
- 2 Procedures for life-cycle inventory tracking.
- 3 Racon labelling.
- 4 Installation and inspection records.

#### **5.3.2. LESSON 2 - DISPOSAL**

- 1 Legal requirements and regulations governing disposal.
- 2 Methods of disposal:
  - a Recycling options.
  - b Proper disposal methods.

### 3 Disposal records.