MODEL COURSE

L1.1

MARINE AIDS TO NAVIGATION - MANAGER TRAINING

Edition 3.0

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International Association of Marine Aids to Navigation and Lighthouse Authorities
Association Internationale de Signalisation Maritime

DOCUMENT HISTORY

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

Date	Details	Attached
December 2011	1st issue	Council 52
December 2015	Entire document: Updated following publication of new NAVGUIDE in June 2015	Council 61
December 2017	Entire document: Rename from R0141/1 to L1.1. Amalgamate into 3 Modules and update syllabus based on current Recommendations and Guidelines. Add a major planning task to Module 3 – AtoN management	Council 65

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FOREWORD

The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) recognises that training in all aspects of the management of Marine Aids to Navigation (AtoN) service delivery is critical to the consistent provision of that AtoN service.

Taking into account that under the SOLAS Convention, Chapter V, Regulation 13, paragraph 2, published by the International Maritime Organization, Contracting Governments, mindful of their obligations, undertake to consider the international recommendations and guidelines when establishing aids to navigation, including recommendations on training and qualification of AtoN managers, IALA has adopted Recommendation R0141 - Training and Certification of AtoN personnel.

IALA Committees working closely with the IALA World Wide Academy (The Academy) have developed a series of model courses for AtoN personnel having "Level 1" management functions. This model course on Level 1 Marine Aids to Navigation Manager Training should be read in conjunction with IALA Recommendation R0141 - Training and Certification of AtoN Personnel. Mindful of the desire to harmonise the delivery of its published model courses, IALA has developed Guidelines (G) for the accreditation and approval process for both AtoN personnel training (G1100) and Vessel Traffic Service training (G1014).

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 managers. It is intended to be delivered by a training organisation accredited by a national Competent Authority. 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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PART 1 - COURSE OVERVIEW

1 OVERVIEW

IALA recommends that training organisations and other training providers utilise model courses concerned with the provision of AtoN services, including VTS, in accordance with IALA Recommendation R0141.

2 PURPOSE OF THE MODEL COURSE

The purpose of this model course is to assist maritime training organisations and their teaching staff with the preparation and introduction of new training courses for personnel concerned with AtoN service provision; or in enhancing, updating or supplementing existing training material where the quality and effectiveness of the training courses may thereby be improved.

The knowledge, skills and dedication of model course Trainers, Teachers and/or Instructors (TTIs) are the key elements enabling those being trained (the participants) to acquire the necessary level of competence; that is the ability to perform defined tasks or duties effectively. These competencies are the way that individuals deal with work and other people. They are the combination of personality, intelligence and innate skills together with acquired knowledge, skills and attitude mastered during an individual's lifetime.

It is not the intention of this model course programme to restrict Instructors in the way they deliver their lectures, particularly as the cultural backgrounds of the participants may vary considerably from country to country. However, TTIs (hereafter referred to as Instructors) should possess excellent interpersonal and communications skills and should have a comprehensive understanding of diversity and cultural differences.

3 USE OF THE MODEL COURSE

The complete course comprises three modules; all of them divided into two or more parts. Each module covers a specific subject or area of knowledge in which AtoN managers are required to have competence. These are written in the learning-objective format outlined in IALA Guideline 1103 – Train the Trainer. That Guideline is tailored specifically for personnel within an accredited training organisation assigned with the task of training VTS professionals however its principles and guidance are directly relevant to training AtoN professionals and should be studied in detail by facilitators who train Instructors within an AtoN organisation.

Each module of this model course is based on a subject framework which states its scope, aims and the levels of competency to be acquired. Each competence is defined in terms of its learning objectives, required knowledge, skills and attitude. Detail on recommended levels of competence are shown in Table 1 below. The main subject in each module is sub-divided into subject elements and sub-elements. The sub-elements form the detailed syllabus which takes account of IALA Recommendations and Guidelines and information contained in the latest edition of the NAVGUIDE Manual.

In order to set up an effective training system to deliver this model course, a Training Management System (TMS) should be in place as set out in IALA Recommendation R0141 Annex A Part 7. A TMS would *inter alia* analyse the detailed syllabus and determine the entry standard for participants undertaking the training.

Additional foundation training in some areas may be required to bring participants to a common entry level. Similarly, some participants with existing competencies may not require to attend each lecture. An example template for training needs analysis is at Annex A.

The pool of available talent from which potential participants can be selected is likely to vary from country to country. Article 4.1 of the Annex to Recommendation R0141 assumes that participants selected for this Model course will have an engineering background or hold a seagoing Master's Certificate or equivalent. However, participants with these internationally recognised qualifications may not always be available. See Part 3 paragraph 2 of this document for greater detail.

Because the majority of IALA publications are written in English, it is envisaged that this model course will be delivered primarily using the English language. However, some National Members have developed this course to be delivered in their own languages. In either case, explanations and clarifications can be presented in other regional languages if required with additional time allocated during lesson planning.

4 ACRONYMS

APL	Accredited Prior Learning
AtoN	Aid(s) to Navigation
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IMO	International Maritime Organisation
MoU	Memorandum of Understanding
SIRA	Simplified IALA Risk Assessment
SOLAS	(International Convention for the Safety of Life at Sea (SOLAS)
TMS	Training Management System
TTI's	Trainers, Teachers and/or Instructors

5 DEFINITIONS AND CLARIFICATIONS

The most pertinent definitions and clarifications related to this model course can be found at Annex A section 9 of IALA Recommendation R0141. Other definitions are listed below.

The term '**AtoN Manager**' is taken to mean a person who has been awarded an IALA Level 1 AtoN Certificate and holds the post of at least a junior manager.

Career development is the series of activities or the on-going/lifelong process of developing (or self-managing) an individual's career. It involves training on new skills to fit an individual to take on greater responsibilities. Having acquired additional competency, the individual should perform to achieve the goals and targets that he or she has set for themselves.

Short-range marine aids to navigation (AtoN) are all AtoN intended for use within visual, audible or radar range of a mariner.

PART 2 - DELIVERY OF THE MODEL COURSE

1 INTRODUCTION

The training and assessment of participants seeking formal qualification as an AtoN Manager through the award of an IALA AtoN Level 1 Certificate by an Accredited Training Organisation should be:

- Structured in accordance with written programmes, including such methods and means of delivery (such as Microsoft PowerPoint®), procedures and course material as are necessary to achieve the prescribed standard of competence; and:
- Conducted, monitored, assessed and supported by persons qualified in accordance with a Training Management System (TMS).

Training staff should review initially the course outline and detailed syllabus in each subject. A training needs analysis process should then be conducted for each participant based on academic qualifications; skills and competencies acquired prior to the model course and other relevant experience. This should lead to the identification of where additional foundation training (including language training) may be required or where specific training in some sub-elements can be deleted from the final course programme. Further detail of this gap-analysis process can be found at Annex A.

When considering whether some sub-elements can be deleted, participants with previous experience or knowledge in nautical or engineering fields which are not necessarily directly related to AtoN management should be tested formally using a simple (short answer) aural or written question paper based on specific modules in which early competencies may have been acquired. This will determine whether some or all of the participants with previous experience can be excused from some modules or lectures. Sub-elements for which competency has already been demonstrated through, for example, documented Accredited Prior Learning (APL), can be deleted from the syllabus to be taught to those participants. Such participants will however be expected to sit the complete final assessment test paper for the relevant modules to ensure that a common standard is maintained.

Successful completion of this model course leading to the award of an IALA AtoN Level 1 Certificate should be considered as the *minimum* competency level for personnel with responsibilities for the management of AtoN service provision whether they are staff members of a national Competent Authority or employed by an AtoN service provider such as a Port Authority or AtoN Contractor or Consultant. Career Development Training and experience, both within and outside the Organisation is encouraged so that it forms part of the process towards middle and senior management of AtoN services.

2 COURSE MODULES

A modular system enables the Training Organisation to modify the course content and provide any revisions to the objectives as required. Having determined what needs to be taught to whom, Instructors or Course Facilitators or Assessors should draw up lesson plans which match the detailed syllabus for each module and the references in that module to teaching material suggested for the course. An example of a lesson plan can be found at Annex A of IALA Guideline 1103. Lesson plans can often be in the form of structured Microsoft PowerPoint® presentations (see G1100 article 2.3 concerning PowerPoint presentations developed by the IALA World-Wide Academy).

Lesson plans shown in Part 5 of this model course assume that all participants will receive instruction in all sub-elements of the complete syllabus. Reference publications that are unlikely to change in the medium term (e.g. UNCLOS and SOLAS) that the Instructor may wish to use are listed under each modular subject element. References to IALA publications are contained in the PowerPoint lectures which form part of the IALA World-Wide Academy's TMS. These are updated at least every six months and will be available to Accredited Training Organisations that have signed a Memorandum of Understanding (MoU) with IALA (see article 2.3 in IALA

Guideline G1100). Accredited Training Organisations should add local publications and training aids as appropriate.

The level of competence required from a Level 1 AtoN manager is shown for each element or sub-element as required. These are graded from level 1 (basic understanding) to level 4 (detailed understanding). Details are at Table 1 below.

3 SUBJECT OUTLINE

A subject outline for each module is shown in tabular form in Part 5 of this document. This lists the minimum recommended level of competence for each subject element or sub-element. Sub-elements have been grouped so that training covering them might reasonably be delivered in a 40-minute lecture, assuming a standard entry level based on training needs analysis and a common standard of language comprehension for all participants.

A standard 40-minute lecture has been selected so that 10 minutes can be allocated to questions with an additional 10-minute interval between lectures. This should permit Instructors (having reviewed the training objectives of each element and the particular needs of participants) to adjust timing to match local circumstances. Specific lectures which require more or less than the standard 40-minute period are highlighted in Part 5.

Table 1 Levels of Competence

Level	Learning Outcome	Instructional Objectives	Required skills
1	The conduct of routine tasks with some supervision	A **basic** understanding of facts and principles	First stage in acquiring competency of a complex skill. Appropriate responses are identified through trial and error
2	The conduct of routine tasks unsupervised and some more complex tasks under guidance	A **satisfactory** 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
3	The skilful conduct of many complex and non-routine tasks	A **good** understanding of the subject matter and its interaction with others leading to an analytical distinction between facts and inferences	Complex actions are inherently co-ordinated and performed smoothly, accurately and skilfully
4	The professional conduct of unsupervised technical and managerial tasks	A **detailed** understanding of facts, theories and practical applications which enables problem solving and prioritisation	Acquired skills are developed to the extent that rapid reaction and adaptation to unforeseen situations is second nature

4 DETAILED TEACHING SYLLABUS

The detailed teaching syllabus for each module is laid out in a learning-objective format in which the objective for each sub-element describes what each participant must achieve to demonstrate that the necessary level of knowledge has been acquired. The learning-objective format assumes that the objective for each sub-element is preceded by the phrase:

> *The expected learning outcome is that the participant has acquired the recommended level of competence in……..*

5 PRESENTATION

The manner and frequency of the presentation of facts, concepts and methodologies will be determined by individual Instructors who will use what they see as the most appropriate teaching method to ensure that each participant has acquired the required level of competency in each sub-element of the syllabus. An explanation of teaching methods can be found in Annex B of IALA Guideline 1103.

6 EVALUATION OR ASSESSMENT OF THE COURSE PARTICIPANTS

The award of AtoN qualifications should be based on the principle that satisfactory results are obtained during a basic training course. This model course for Level 1 AtoN Managers is principally theoretical supported by some practical tasks. It is recommended therefore that the competency of each participant is evaluated or assessed by formal written tests taken by participants at the end of each module, supported where appropriate by a personality assessment of each participant. Further guidance is at Part 4 paragraph 3.

7 IMPLEMENTATION

It is self-evident that planning and preparation are essential to the successful implementation of this model course. In order to ensure that participants receive high quality instruction, Training Organisations will ensure that the following minimum assets are available before the course commences:

- Qualified Instructors;
- Support staff and facilities;
- Instruction and rest rooms;
- Training aids and equipment. Where possible Microsoft PowerPoint® presentations should be capable of being projected onto a suitable white background or screen. A separate white-board should form part of the minimum suite of training aids.
- Reference books; publications or extracts and other reference material. The standard reference publication is the latest version of IALA NAVGUIDE Manual. References to appropriate IALA Recommendations and Guidelines are given in the suite of PowerPoint presentations developed by the IALA World-Wide Academy (see Article 2 above).
- Navigational paper charts, Nautical Publications and drawing instruments.

PART 3 – COURSE FRAMEWORK

1 INTRODUCTION

This model course is based on IALA Recommendation R0141. Having demonstrated the required level of competence by passing all the modular examinations and other assessments required by the Accredited Training Organisation, participants will be awarded an AtoN manager "Level 1" Certificate. This will permit them to operate as a manager within a national Competent Authority or an AtoN service provider approved by that Competent Authority. This model course is considered to be 'basic' training. It is expected that AtoN service providers will provide professional development for newly certified Level 1 managers through their Quality and Training Management Systems.

2 ENTRY LEVEL REQUIREMENTS FOR A LEVEL 1 MANAGER

IALA Recommendation R0141 makes the assumption that participants selected for this model course would have a professional engineering background or hold a seagoing Master's Certificate or military equivalent. In some regions, the recruitment pool for potential AtoN managers may not hold personnel with these backgrounds. It will therefore be for the Accredited Training Organisation, in consultation with the Competent Authority, to determine minimum entry requirements for AtoN Level 1 Manager training. The following list provides guidance on criteria for selection of participants who must have a demonstrable competence in English; be expected to be employed as an AtoN manager for at least two years after successful completion of the Level 1 course **and** at least **one** of the following proven competencies or qualifications:

A degree in engineering or related sciences;

- A degree from an accredited maritime college;
- A seagoing Master's Certificate or equivalent military naval qualification;
- A diploma in an engineering or related science and at least 3 years' fieldwork experience;
- A recognised qualification in a marine-related discipline (e.g. FIG-IHO hydrographic certificate);
- Be in possession of IALA AtoN Level 2 Certificates and at least 3 years' fieldwork experience;
- At least 2 years' work experience with a recognised AtoN service provider in a junior management capacity.

3 COURSE INTAKE – LIMITATIONS

The Accredited Training Organisation will determine the maximum number of participants that can reasonably acquire the necessary competence during a specific course of instruction. Experience has shown that given the specialised nature of the syllabus, one Instructor should be able to transfer a satisfactory level of understanding to a maximum of 16 participants during a series of 40-minute lectures.

The course intake may have to be reduced if the level of language comprehension by participants is an issue. If the majority of participants do not use the main instruction language as their native tongue, class sizes may need to be reduced to between 6 and 10 participants depending on the quality of the Instructor and his or her ability to communicate successfully with the participants.

4 TRAINING STAFF REQUIREMENTS

IALA Recommendation R0141 Article 5.2.2 states that 'Competent Authorities should ensure that instructors and assessors are appropriately qualified and experienced for the particular training and assessment of competence for which they are given responsibility. Instructors should hold suitable professional qualifications'. The same should apply to the person responsible for training supervision and the assessment of participants' competence – the Assessor.

Accredited Training Organisations will be accountable to the Competent Authority for ensuring that the instructors and assessors tasked with the conduct of this model course, and any supporting staff, are appropriately qualified and subject to review by approved Quality Management System procedures. The key factor is that both instructors and assessors should have an appropriate balance of professional and teaching competencies.

4.1 COURSE INSTRUCTORS

Course Instructors should meet at least three of the following criteria. Course Assessors should have the required competency as an Instructor, and meet at least one of the criteria in article 4.2 below.

- Fluency in English or other approved main language of instruction;
- Be in possession of an IALA AtoN Level 1 Certificate and at least 3 years' management experience in AtoN service provision;
- At least 5 years' work experience with a recognised AtoN service provider or IALA Industrial Member in a middle management capacity;
- Hold a seagoing Master's Certificate or equivalent military naval qualification (for Module 2A instruction);
- Lecturing experience at a recognised nautical or engineering higher education establishment;
- Proven professional or technical expertise in a specialist field related to syllabus elements or sub-elements (for example pilotage; dredging; port design or battery technology).

4.2 COURSE ASSESSORS

- At least 3 years' experience as an approved IALA AtoN Level 1 trainer;
- Chair or vice-chair of an IALA Technical Committee;
- Experts endorsed by the Dean of the IALA World-Wide Academy.

5 TEACHING FACILITIES AND EQUIPMENT

It is assumed that standard lecturing equipment such as white boards and computer-assisted projectors will be provided. Additional teaching aids and equipment which might be appropriate to specific lectures are listed in the detailed teaching syllabus for each module. This includes suggestions for external visits where they might be available and appropriate.

PART 4 – GUIDELINES FOR INSTRUCTORS

1 INTRODUCTION

AtoN managers are responsible to the Competent Authority for providing an appropriate quantity and quality of Marine Aids to Navigation services which meet or exceed the obligations set out in the SOLAS Convention, Chapter V, Regulations 4; 12 (if appropriate) and 13 and other mandatory instruments issued by the International Maritime Organization. The opening article of the Annex to IALA Recommendation R0141 sates that:

The recruitment, selection and training of suitable personnel are a pre-requisite to the provision of professionally qualified personnel capable of contributing to safe and efficient AtoN operations…. to ensure that uniform standards of procedures, practices and professional standards are applied world-wide.

The role of the instructor in this process is vital, particularly as the safety of seafarers and preservation of the marine and coastal environments are at risk if uniform standards are neglected or procedures are not fully understood and applied. Many sub-elements of this model course are concerned with safety, navigation risk and preservation of the environment. Instructors should be thoroughly acquainted with both National and International regulations concerning these issues and emphasise these aspects during instruction whenever they arise.

Technological advances and threats to safe navigation, many of them being addressed by the e-Navigation initiative, are generating changes and strategies to existing equipment and practices. It is essential that both instructors and assessors keep abreast of new technologies and regulations and amend or update lesson plans as necessary to reflect changes and to add new sub-elements to the detailed teaching syllabus when appropriate.

2 CURRICULUM

The curriculum for this model course is based on three broad module subject headings and sub-headings. These are shown in Part 5 of this document. Each main module has been broken down into non-prioritised subject elements and sub-elements which show the level of knowledge that the instructor must impart to the course participants in order for them to achieve the specified level of competence.

The levels of competence shown in Table 1 above explain what a successful participant should be capable of doing in the workplace on the completion of the model course. The objective of each lecture is to ensure that each participant acquires the required level of understanding in each sub-element so that the required learning outcome can be achieved.

Sub-elements have been grouped into lectures capable of being delivered in 40 minutes under normal circumstances. Each Training Organisation will determine the optimum lecture length; the sub-elements it covers and over what period lectures will be delivered. This will depend on whether participants and instructors are available full time or whether work duties and other conflicting activities require lectures to be delivered in groups over an extended period.

The Course Assessor should also make an allowance for external visits to National Organisations and Authorities; IALA training events and First Aid and team-building instruction. An example of course planning is shown in Table 2 below. This assumes the following: full time availability by participants for each Module; 52 forty-minute lectures, each followed by a 10-minute question session and a 10-minute break; a half-day's instruction in First Aid and leadership training; external visits and examinations. Because some material may be unfamiliar to participants, sufficient time should be given for private study and clarification through tutorials. It is therefore recommended that no more than 5 lectures are held in any one working day. It is also recommended that examinations are held at least one day after the final lecture in any module to enable participants to revise adequately. Guidance on assessment; examinations and re-sits is at Article 3 below.

Table 2 is intended only as a guideline which Training Organisations may use to determine their own training programme based on participant numbers; availability and entry-level standards determined from the training needs analysis which is explained more fully at Annex A.

Table 2 Example Course Outline Planning Programme

Work Day	Module	Lectures (see Part 5)	Instruction hours	Other Activity	Remarks
0	1 to 3	0	0	Training Needs Analysis (see Annex A)	Conducted before course commences
1	1A; 1B	1 to 5	5	Administration and introduction; plotting exercises	Module 1B for participants with a non- nautical background
2	1B	6 to 10	5	Plotting and chart correction exercises; tutorials	Plan visit to National Hydrographic Office
3	1B; 1C	11 to 14	4	UNCLOS exercise; IALA MBS Self-study	
4	1B	0	0	External visit to port and/or AtoN base	(one day can be allocated to this visit which would extend the course by a working day)
5	1A; 3	-	3	Visit Competent Authority a.m. First Aid training p.m.	First Aid training by qualified professional
6	1C	15 to 17	4	Mariners' role-play exercise	Master Mariner and Pilot as guest lecturers
7	1	0	0	Module 1 exam (see Part D.3)	Participants who fail should not proceed until Certificate is awarded
7	2A	18 and 19	3	Use of light range if available	
8	2A	20 to 24; 26	5		
9	2B	25; 27 to 29	5	Sector light and leading line planning exercise	Revision and tutorials
10	2C	30-35	5	Module 1 re-sit exam if required e-Navigation forum	
11	2C	36	2	Visit to VTS centre a.m. Leadership exercise p.m.	
12	2D; E	37 to 40	5	historic lighthouse conservation exercise; Power budget exercise	Revision and tutorials
13	3A	41 to 43	3	Module 2 exam; Stakeholder exercise	
14	3A	44	3	Simple risk management exercise	
15	2	0	0	Module 2 resit exam if required	Tutorials if required
16	3A	45 to 48	5	IALA category availability exercise	
17	3B	49 to 53	5	AtoN funding exercise	

Work Day	Module	Lectures (see Part 5)	Instruction hours	Other Activity	Remarks
18	3	0	1	Module 3 exam; major planning task starts on completion	
19	1 to 3	0	0	Major planning task. Module 3 viva exam if required	Groups of 3 or 4 participants
20	-	0	0	Group presentations of planning task. Closing ceremony	Award of certificates
4 working weeks (3 weekends)			**63**		

The total time listed in Table 2 is that allocated to participant instruction. It does not include time for the team building exercise, examination preparation or tutorials.

The course Assessor should be involved actively in course planning and its conduct. Participants who encounter difficulties with any elements of the syllabus should be identified by regular discussions with instructors and analysis of examination results. Additional time should be allocated for tutorials so that every participant who is willing to gain the required competence has every opportunity to do so.

The inclusion of daily revision quizzes covering knowledge gained during each module have been found to be very beneficial to the participant learning process. Course Assessors may care to include such quizzes when developing the programme. A generic outline programme, including all aspects of the 4-week model course has been developed by the IALA World-Wide Academy and will be supplied to any Accredited Training Organisation on request.

In order to ensure quality management, improvement to the standard of lectures should be obtained through satisfaction feedback from participants based on ISO 9001 principles. Examination results should also be analysed by the course Assessor to determine whether the questions test competency to the required standard. If all participants achieve high scores, the questions may not be sufficiently testing. If all participants fall short of the required standard, the quality of the instruction and content is likely to be below standard too!

3 EVALUATION AND ASSESSMENT

The principle method of evaluating whether participants have acquired the required level of competence on this model course is by formal written examinations. Each Accredited Training Organisation will, in consultation with the Competent Authority, determine the most appropriate form of examination. It should be borne in mind that Level 1 managers will be dealing with the safety of mariners. Examinations should therefore be testing with answers generally provided from memory. The following points provide guidance on the style and content of examinations which ATOs may find helpful in determining the most appropriate in their circumstances:

- Examinations for each module or groups of modules should be conducted within a maximum time limit of between 50 and 60 minutes depending on the number of questions;
- A period to read the question paper before the examination time commences can be allocated, especially if the native language of participants is not the formal language of instruction;
- The questions should be short, clear and written in the formal language of instruction;
- Questions can either be multiple choice from 4 possible answers; require short written (few-word) answers, or a combination of both;
- The difficulty of each question should be based on the level of competence required from the participant in that subject. For example, a question on the IALA Maritime Buoyage System should be more searching than one on the Law of the Sea;
- Lectures should end with key learning points and only what has been taught should be examined;

- The questions asked of one course of participants should be changed for the next course.

Each Training Organisation will determine the pass mark for each examination paper. The guiding principle should be that a participant being considered for the award of an AtoN Level 1 Certificate is likely to be involved actively in the junior management of AtoN service provision and will consolidate his or her basic knowledge though additional on-the-job and career development training. A participant who just fails to meet the pass mark despite active participation in the course may well develop into a satisfactory manager within the Organisation and should be given the opportunity to demonstrate his or her potential at a formal aural 'viva' examination.

The following guidelines are proposed for consideration by ATOs:

- The standard pass mark in each examination is 50% equivalent to a satisfactory (Level 2) degree of understanding;
- Participants who fail a competency test by less than 10% will be subject to an aural ('viva') examination the day following the written examination by an Instructor and the Course Assessor acting as an adjudicator. Participants who fail the competency test by more than 10% or who do not demonstrate a satisfactory competence at a 'viva' interview will not be awarded a Level 1 Certificate. Further training may be required and failed participants will be required to re-sit another written competency test at a time to be decided by the Training Organisation.

As part of its TMS, the IALA World-Wide Academy has developed a data-bank of questions in English suitable for examinations in the content of this model course. The Academy will also prepare examination question and answer papers from its data-bank for use by Accredited Training Organisations with which it has signed a Memorandum of Understanding. All other Training Organisations will be expected to develop their own question and answer examinations.

The proposed total marks in the three tests of competence is 170 (60 each for Modules 1 and 2 and 50 for Module 3). Accredited Training Organisations may care to consider allocating an additional 30 possible marks (maximum 10 per participant as a group mark in the final planning task and a maximum of 20 marks for individual participants in the planning task). This would bring the total marks available to 200. The average mark of all participants who complete the full syllabus can be determined as a Key Performance Indicator for the Training Organisation and its Instructors).

PART 5 – COURSE MODULES

This model course comprises three main modules covering the key subject headings listed in Recommendation R0141. These modules are sub-divided giving a total of 11 modules in all.

Table 2 in Part 4 above gives an example of how the whole syllabus might be covered in fifty-three 40-minute lectures; one three-hour period of First Aid instruction; a leadership training session; associated exercises and external visits spread over four working weeks. Table 3 below shows the outline of the model course. This is followed by an introduction and subject framework for each module broken down into a detailed teaching syllabus for each sub-element.

The Training Organisation will determine the most appropriate order of lecture delivery for each course following the training needs analysis of participants (see ANNEX A).

Table 3 Model Course Outline

Module	Subject	Lectures	Exercises	Instruction Hours
1A	IALA and other International Organisations	1; 2		2
1B	Basic Nautical Knowledge	3 to 12	Self-test of nautical knowledge; position at sea; chart symbol; territorial sea plotting and weather forecast exercises	11
1C	Introduction to AtoN	13 to 15	IALA MBS self-study exercise	4
1D	The View from the Bridge	16 to 17	and bridge management role-play exercise	3
2A	Technical functions of visual and audible short-range AtoN	18 to 26	Sector light angle calculation exercise	9
2B	Technical functions of short-range radio AtoN and Differential GNSS	27 to 35	Includes a forum on e-Navigation	9
2C	Vessel Traffic Services	36	Includes visit to VTS Centre	2
2D	Structures, materials and historic lighthouses	37 to 38	Conservation plan exercise	3
2E	Power supplies	39 to 40	Load profile exercise	4
3A	AtoN Provision; Design and Management	41 to 49	Stakeholder exercise Level of Service exercise Risk analysis exercise	10
3B	Maintenance, contracts, funding, human resources and protection of the marine environment	50 to 54	AtoN funding exercise	5
1 to 3	Major planning task	-	Group exercise after final exam	1
			Total Recommended Formal Instruction Time	**63 hours**

1 MODULE 1 INTRODUCTION TO THE MARINE ENVIRONMENT AND MARINE AIDS TO NAVIGATION

1.1 INTRODUCTION

Module 1 covers the foundation maritime knowledge required by a Marine Aids to Navigation (AtoN) manager to conduct his or her duties. It is split into four modules; an introduction to IALA and International Organisations concerned with AtoN and related safety of navigation matters (Module 1A); basic nautical knowledge (Module 1B); an introduction to AtoN (Module 1C) and finally an insight into the mariners' view from the bridge of a ship (Module 1D).

Module 1A introduces IALA and its Academy and the main International Organisations concerned with legislation and standards related to the provision of aspects of safety of navigation.

Module 1B is designed primarily for participants with little or no previous nautical knowledge or experience. It provides a basic understanding of nautical terms, Maritime Safety Information (MSI) and their application in AtoN management. It also covers aspects of the United Nations Convention on the Law of the Sea (UNCLOS) 1982 which relate to AtoN service provision. Module 1B also covers a basic understanding of meteorology. Participants who hold a recognised recreational yachting qualification such as those issued by the Royal Yachting Association (UK) or other equivalent regional organisation might be sufficiently competent in Module 1B elements. This should be determined during the Training Needs Analysis process.

Module 1C introduces short-range AtoN and the IALA Maritime Buoyage System (MBS). The more technical issues of AtoN are addressed in Module 2.

Module 1D provides a mariner's view of AtoN service provision including pilotage as a service to navigation.

Instructors for this module should have proven competency, knowledge and experience in the workings of their regional Competent Authority; the International Maritime Organisation; the International Association of Marine Aids to Navigation and Lighthouse Authorities; related International Organisations and a qualification related to comprehension of UNCLOS 82. Instructors for these modules should hold international nautical qualifications recognised by the International Maritime Organization. See Part 4 paragraph 4.1 for further guidance.

1.2 SUBJECT FRAMEWORK

1.2.1 SCOPE

The syllabus for Module 1A requires participants to gain the appropriate level of competence in understanding the role played by international organisations, including IALA and its Academy in improving and monitoring safety at sea and the preservation of the marine environment so that successful participants can manage effectively their interaction with or within the regional Competent Authority.

The syllabus for Module 1B requires participants to gain the appropriate level of competence in the principles of maritime navigation, hydrographic factors affecting navigation such as dangers and tides and the use and correction of both paper and electronic nautical charts and publications, together with the effect of meteorological conditions on AtoN performance. Participants will also gain an appropriate level of competence in selected aspects of the Law of the Sea which will enable them to understand a Competent Authority's international maritime legal obligations and restrictions concerning AtoN service provision in their waters.

The syllabus for Module 1C requires participants to gain a detailed knowledge of the IALA MBS and other appropriate levels of competence in the types and limitations of short-range visual, audible and radio AtoN and Electronic Positioning Systems.

Module 1D requires participants to gain an appropriate level of competence in ships' routeing measures; AtoN on offshore structures, pilotage as a service to navigation and the function of the bridge team and AtoN from a mariners' point of view.

1.2.2 AIMS OF MODULE 1

On successful completion of module 1A, participants will demonstrate the ability to manage effectively their interaction with IALA and demonstrate a satisfactory understanding of the role of the main international organisations governing and controlling safety of navigation services provision.

On successful completion of Module 1B, participants will demonstrate the ability to plot geographic positions on nautical paper charts; identify charted navigational hazards; calculate tidal heights from charted depths and predicted tides; assess the rate and direction of tidal flow and keep nautical publications updated from information broadcast by the World-Wide Navigation Warning Service. They will also be able to demonstrate a basic understanding of the effects of weather on AtoN performance.

On successful completion of Module 1C, participants will demonstrate a detailed understanding of the IALA Maritime Buoyage system and the ability to apply theoretical principles affecting the performance of Marine Aids to Navigation to the management of AtoN service provision.

On successful completion of Module 1D, participants will demonstrate the ability to understand maritime routeing measures; AtoN on offshore structures and the role of a ship's Master and Navigator and their interaction with professional ships' Pilots.

1.3 DETAILED TEACHING SYLLABUS FOR MODULE 1A – IALA AND OTHER INTERNATIONAL ORGANISATIONS

Table 4 Detailed Teaching Syllabus Module 1A

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
1A			**IALA AND OTHER INTERNATIONAL ORGANISATIONS**				
	1a.1		**IALA AND THE IALA WORLD-WIDE ACADEMY**				
		1a.1.1	The background to IALA; its aims and goals	2		www.iala-aism.org	
		1a.1.2	The definitions of a Marine Aid to Navigation and a Navigational Aid	4			
		1a.1.3	IALA – Categories of membership	2			
		1a.1.4	IALA Structure	1			1
		1a.1.5	IALA Publications: Standards; Recommendations and Guidelines	3			
		1a.1.6	IALA World-Wide Academy	2			
		1a.1.7	IALA capacity building activity	3			
	1a.2		**INTERNATIONAL ORGANISATIONS**				
		1a.2.1	The International Maritime Organization	2	Visit Competent Authority Head Office	www.imo.org/conventions	2
		1a.2.2	Key Mandatory Instruments of the IMO	3			
		1a.2.3	IMO Audit Scheme	2			
		1a.2.4	Other IMO mandatory instruments and conventions	1			
		1a.2.5	The International Hydrographic Organisation	1		www.iho-ohi.net	
		1a.2.6	The UN “Delivery as One” strategy	2			
		1a.2.7	The International Telecommunications Union and International Electrotechnical Commission	2		www.iec.ch www.itu.int	

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
		1a.2.8	IALA liaison with other International Organisations	1		www.pianc.org www.ilo.org	
		1a.2.9	The World Meteorological Organization and International Ocean Commission (IOC)			www.gloss-sealevel.org	

1.4 DETAILED TEACHING SYLLABUS FOR MODULE 1B - BASIC NAUTICAL KNOWLEDGE

Table 5 Detailed Teaching Syllabus Module 1B

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
1B			**NAUTICAL KNOWLEDGE (GENERAL)**				
	1b.1		**Principles of Navigation**				
		1b.1.1	Introduction to methods of navigation; Lines of Position	1	Nautical quiz to test existing knowledge	IMO Resolution A.923(23)	3
		1b.1.2	Accuracy standards				
		1b.1.3	Phases of navigation: offshore; coastal; restricted waters; harbour				
		1b.1.4	Measurement errors	2			
		1b.1.5	Position fixing system accuracies				
	1b.2		**Hydrography; Nautical Charts and maps**				
		1b.2.1	Geographical positions, the nautical chart and projections	1	Small, medium and large-scale charts published by National Hydrographic Office. "tour of a chart" Plotting exercises: Distances on charts Geographical positions Position from range and bearing	National manuals of navigation such as the UK Manual of Navigation Volume 1	4
		1b.2.2	Chart scales and accuracy				
		1b.2.3	Source data diagram and Zones of Confidence				
		1b.2.4	Basic geodesy and horizontal datums				
		1b.2.5	Plotting position at sea including by range and bearing	2			
		1b.2.6	Chart datum; tidal levels and vertical control datum	1	Appropriate charts. Vertical datum diagram drawing exercise Symbol identification exercise	INT 1 – Chart symbols and Abbreviations	5
		1b.2.7	Chart symbols and abbreviations				
		1b.2.8	Navigation depths and dangers				
		1b.2.9	Magnetic and True North	2			
		1b.2.10	Grid positions and maps	1			

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
		1b.2.11	Coordinate conversions		Coordinate conversion program		
		1b.2.12	Basic tidal theory	1	Tidal height calculations	National Tide Tables	6
		1b.2.13	The nature of tides; regional tidal characteristics				
		1b.2.14	Tidal Flow: tidal steams; currents and tsunamis				
		1b.2.15	Real versus predicted tidal heights		UKC exercise		7
		1b.2.16	Tidal gauges and current meters				
		1b.2.17	Under-Keel Clearance	2			
	1b.3		**Nautical Publications, Maritime Safety Information and ENCs**				
		1b.3.1	Classes of ships under SOLAS and Gross Tonnage		Visit National Hydrographic Office Chart correction exercise	SOLAS Chapter V Regulation 1 SOLAS Chapter V Regulation 9 Lists of Lights; Radio Signals; Sailing Directions and Mariners' Handbook published by a National Hydrographic Office	8
		1b.3.2	Lists of Lights; Radio Signals; Sailing Directions and the Mariner's Handbook	2			
		1b.3.3	Chart and Nautical Publication corrections				
		1b.3.4	Global Maritime Distress and Safety System	3		SOLAS Chapter IV Regulation 5 SOLAS Chapter V Regulation 4 SOLAS Chapter V Regulation 13.3 Joint IMO/IHO/IALA Manual on MSI – IMO MSC.1/Circ.1310 IMO MSC.1/Circ.1310 and IHO publication S.53	9
		1b.3.5	World-wide Navigational Warning Service - NAVWARNS	3			
		1b.3.6	GMDSS Sea Areas NAVTEX and Coast Radio Stations	3			
		1b.3.7	Maritime Safety Information	4			
		1b.3.8	Obligation of a Competent Authority related to MSI	4			
		1b.3.9	Standard terms and definitions	2	List of Standard Terms		
		1b.3.10	Electronic Navigational Charts and ECDIS	1	Visit ECDIS fitted vessel "feature object" exercise	NP 231 (UKHO) NP232 (UKHO)	10
	1b.4		**United Nations Convention on the Law of the Sea (UNCLOS)**				
		1b.4.1	Background to United Nations Convention on the Law of the Sea	1		UNCLOS Articles 5; 6-14	11

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
		1b.4.2	Territorial Waters, Exclusive Economic Zones and the High Seas		TW plotting exercise requires appropriate charts and drawing instruments	UNCLOS Articles 17-26 UNCLOS Part III Art.43	
		1b.4.3	Maritime Baselines				
		1b.4.4	Innocent Passage and limitations on charging Light Dues				
		1b.4.5	Straits used for International Navigation				
	1b.5		**Basic Meteorology**				
		1b.5.1	Pressure and wind	1	Beaufort and sea disturbance scales Basic forecasting exercise	The Mariners' Handbook National Sailing Directions www.bbc.co.uk/weather	12
		1b.5.2	Weather systems				
		1b.5.3	Region seasons	2			
		1b.5.4	Wind and waves				
		1b.5.5	Tropical storms and hurricanes	1			
		1b.5.6	Super-refraction; inversions and ducts				

1.5 DETAILED TEACHING SYLLABUS FOR MODULE 1C – INTRODUCTION TO SHORT-RANGE ATON AND DIFFERENTIAL GNSS

Table 6 Detailed Teaching Syllabus for Module 1C

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
1C			**THE IALA MBS, AND RADIO NAVIGATION SYSTEMS**				
	1c.1		**IALA Maritime Buoyage System (MBS) and Floating AtoN**				
		1c.1.1	Types of buoys and other AtoN in the IALA MBS	4	IALA MBS self-test exercise Models of buoys Visit suitable port and/or buoy maintenance base	IALA MBS handbook (2010)	13
		1c.1.2	Introduction to rhythmic light characters	1			
		1c.1.3	Charted and actual position of buoys	2			14
		1c.1.4	Emergency Wreck Buoys				
		1c.1.5	Availability targets for floating AtoN	3			
	1c.2		**Electronic Positioning Systems and Radio Beacons**				
		1c.2.1	Introduction to the IALA World Wide Radio Navigation Plan	2	Visit national TRA	The Mariners' Handbook National Lists of Radio Signals	15
		1c.2.2	Global Navigation Satellite Systems (GNSS); error sources				
		1c.2.3	Receiver Autonomous Integrity Monitoring	1			
		1c.2.4	Differential GNSS	2			
		1c.2.5	Terrestrial Systems: Loran-C; e-Loran	1			
		1c.2.6	Radars and radar reflectors	2			
		1c.2.7	Radio Beacons - Racons				
		1c.2.8	Transmission Regulatory Authorities (TRA) and MMSI numbers	1			

1.6 DETAILED TEACHING SYLLABUS FOR MODULE 1D – THE VIEW FROM THE BRIDGE

Table 7 Detailed Teaching Syllabus for Module 1D

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
1D			**SHIPS' ROUTEING AND BRIDGE MANAGEMENT**				
	1d.1		**Routeing, Anchorages, and Offshore Structures**				
		1d.1.1	Introduction to ship routeing measures	1		IMO Publication "Ships' Routeing" 10th Edition SOLAS Chapter V Regulation 10 IMO resolution A.982(24) on PSSAs COLREG Rule 10	16
		1d.1.2	Particularly Sensitive Sea Areas				
		1d.1.3	Routeing definitions	2	List of example definitions		
		1d.1.4	Use of traffic separation schemes; Inshore Traffic Zones	1			
		1d.1.5	Anchorages				
		1d.1.6	Offshore structures	2			
	1d.2		**Pilotage and Bridge Management**				
		1d.2.1	The role of ship's Master and Navigating Officer	1	Role-play exercise by Master Mariner and qualified Pilot		17
		1d.2.2	Vessel manoeuvring				
		1d.2.3	Pilotage as a service to navigation				
		1d.2.4	The role of the Pilot				
		1d.2.5	The Master-Pilot Exchange				
		1d.2.6	Pilotage simulators				

2 MODULE 2 - TECHNICAL FUNCTIONS OF VISUAL; RADIO AND AUDIBLE ATON; VESSEL TRAFFIC SERVICES

2.1 INTRODUCTION

Module 2 – technical aspects of AtoN - is divided into five sections all of which must be completed by potential AtoN managers.

Module 2A deals with technical aspects and functions of short-range visual and audible AtoN whilst Module 2B covers technical aspects and functions of satellite and terrestrial radio AtoN including Automatic Identification Systems (AIS); remote monitoring techniques and the e-Navigation concept.

Module 2C is intended as a basic introduction to the principles of Vessel Traffic Services. Participants intending to progress their competency in VTS should refer to the requirements set out in IALA Recommendation R0103.

Module 2D covers AtoN structures and materials used in their construction and the conservation of historic lighthouses.

Module 2E is designed primarily for participants with only a limited knowledge of power supply systems.

Instructors for Modules 2A; B and D should be competent in all technical aspects of AtoN management and hold appropriate qualifications recognised by the Accredited Training Organisation. Instructors for Module 2C should hold an appropriate IALA recognised VTS qualification. Instructors for Module 2E should hold an appropriate scientific degree supported by work experience in the field of electrical power supply. See Part 4 paragraph 4.1 for further guidance.

2.2 SUBJECT FRAMEWORK

2.2.1 SCOPE

The syllabus for Module 2A requires participants to gain the appropriate level of competence in theoretical and practical factors affecting the effective operation of short-range visual and audible AtoN. The syllabus for Module 2B requires participants to gain a similar level of competence in the effective operation or use of radio AtoN then focuses on the concepts behind e-Navigation and how AIS and real-time monitoring of AtoN form vital elements of this over-arching concept.

The syllabus for Module 2C requires participants to acquire a basic understanding of the function of VTS in the provision of an AtoN service. The syllabus for Module 2D requires participants to gain the appropriate level of competency in how structures are affected by external elements and preservation methods for both new and historic Marine Aids to Navigation stations.

The syllabus for Module 4E requires participants to gain the appropriate level of competence in various methods to supply electrical power to AtoN stations; the safe and effective use of batteries; calculation of load profiles and protection against lightning strikes.

2.2.2 AIMS

On successful completion of Modules 2A and 2B, participants will demonstrate the ability to apply both theoretical and practical principles effecting the safe and efficient operation of visual, audible and radio AtoN including the operation of AIS and remote monitoring to the effective management of AtoN service provision and a clear understanding of the e-Navigation concept.

On successful completion of Module 2C, participants will be able to demonstrate a basic understanding of the function of VTS as a vital service to safe navigation, commercial efficiency and the protection of the marine and coastal environment.

On successful completion of Module 2D, participants will be able to demonstrate how AtoN structures and historic lighthouses can be protected and preserved as part of the effective delivery of AtoN service provision.

On successful completion of Module 2E, participants will demonstrate the ability to select the most appropriate source of electrical power at AtoN stations; maximise battery life and to provide protection against the effects of lightning.

2.3 DETAILED TEACHING SYLLABUS FOR MODULES 2A, 2B – TECHNICAL FUNCTIONS OF VISUAL, AUDIBLE AND RADIO MARINE AIDS TO NAVIGATION

Table 8 Detailed Teaching Syllabus for Module 2A

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
2A			**TECHNICAL FUNCTIONS – VISUAL AtoN**				
	2a.1		**Technical Functions of Visual AtoN**				
		2a.1.1	Descriptions; definitions; distinguishing features of visual AtoN	3			
		2a.1.2	Visual AtoN attribute information	1			
		2a.1.3	AtoN lights and their development, light sources, IPS lanterns	2			
		2a.1.4	Factors affecting the visibility of visual AtoN	3			18
		2a.1.5	Detection of visual AtoN against its background (contrast) and the use of binoculars				
		2a.1.6	The range of a visual AtoN; transmissivity				
		2a.1.7	Luminous intensity and nominal range				
		2a.1.8	Signal colours for visual AtoN	2	Use of light workshop if available.	**Note:** some participants may require tutorials to ensure an equal entry level of understanding.	19
		2a.1.9	Colour measurement				
		2a.1.10	Light measurement: units; inverse square and Allard's law				
		2a.1.11	Timing of astronomical events				
		2a.1.12	Background lighting and glare				
		2a.1.13	The use of lights during daylight hours				

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
	2a.2		**Light and Characters**				
		2a.2.1	Rhythms and Characters	4	Light character plotting exercises	IALA MBS booklet List of Lights	20
		2a.2.2	Lights used in the IALA MBS				
		2a.2.3	Maximum periods for light characters	2			
		2a.2.4	Synchronisation of lights				
		2a.2.5	Vertical divergence				
	2a.3		**Fixed Marine Aids to Navigation**				
		2a.3.1	Types of fixed AtoN and their functions	3	Visit port operating with traffic signals if available		21
		2a.3.2	Rotating marine lanterns	1			
		2a.3.3	Day marks				
		2a.3.4	Port Traffic Signals	1			
	2a.4		**Floating Marine Aids to Navigation**				
		2a.4.1	Use of minor floating AtoN	3	Use of buoy models would be an advantage	IALA MBS booklet Pharos Marine mooring handbook or similar	22
		2a.4.2	Major floating AtoN and light vessels	1			
		2a.4.3	Technical considerations and costs	2			
		2a.4.4	Steel versus plastic buoys				
		2a.4.5	Design considerations – buoyancy and stability				

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
	2a.5		**Moorings; Topmarks and markings**				
		2a.5.1	Mooring components, design and swing radius	2		IMO-CALMAR mooring line calculation software	23
		2a.5.2	Installation and monitoring of buoy positions				
		2a.5.3	Use and design of topmarks				
		2a.5.4	Retro-reflecting materials	1			
	2a.6		**Channel design; Sector Lights and Leading Lines**				
		2a.6.1	Bearings from seaward and angles of uncertainty	3	Visit AtoN simulator if available Group AtoN planning exercise for selected port approach	PIANC handbook	24
		2a.6.2	Vessel characteristics factors affecting channel design	2			
		2a.6.3	Dredging of channels				
		2a.6.4	Channel design and mix of AtoN				
		2a.6.5	Use of simulation in channel design				
		2a.6.6	Range lights	2	Visit port with PDL and/or leading lights Sector light and leading line planning exercise (1 hour)		25
		2a.6.7	Precision Direction Lights (PDL)				
			Design considerations for sector lights				
			Transits and leading lines				
	2a.7		**Audible (Sound) Signals**				
		4d.1.1	Use of sound signals	1	**Note**: short 20-minute lecture	Manufacturers' specifications	26
		4d.1.2	Fog detectors				
		4d.1.3	Range of sound signals				

Table 9 Detailed Teaching Syllabus for Module 2B

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
2B			**TECHNICAL FUNCTIONS – RADIO AtoN**				
	2b.1		**Types of Radio AtoN; New Technology Radars and Racons**				
		2b.1.1	Background and definitions	2		Lists of Radio Signals	27
		2b.1.2	New Technology (NT) radars	1			
		2b.1.3	Radar beacons (Racons) and responses to NT radars	2			
		2b.1.4	Technical aspects of frequency agile radar beacons				
		2b.1.5	Passive and active Radar Target Enhancers				
	2b.2		**Loran; Chayka and eLoran**				
		2b.2.1	Loran-C – basic principles	2		Lists of Radio Signals	28
		2b.2.2	Loran-C/Chayka chains and their role in uninterrupted Precision, Navigation and Timing (PNT)				
		2b.2.3	e-Loran				
	2b.3		**World-Wide Radio Navigation Plan and its Components**				
		2b.3.1	IMO WW Radio Navigation System	3		Copy of IALA WWRNP IMO Resolution A.1046(27) Lists of Radio Signals Mariners Handbook	29
		2b.3.2	Space and Ground-based augmentation systems				
		2b.3.3	AtoN and other systems dependent on GNSS				
		2b.3.4	GNSS vulnerability				
		2b.3.5	IALA 's WWRNP to provide uninterrupted PNT				
		2b.3.6	Other non-radio back-up systems (e.g. inertial navigation)	1			

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
2B	**2b.4**		**Automatic Identification System (AIS) and LRIT**				
		2b.4.1	AIS overview: purpose; functions; strategic applications	3		ITU-RM.1371	30
		2b.4.2	AIS system characteristics and carriage requirements				
		2b.4.3	Shore-based AIS				
		2b.4.4	AIS as an AtoN				
		2b.4.5	Management and monitoring of AIS				
		2b.4.6	AIS standards and limitations	3		ITU-RM.585-4	31
		2b.4.7	AIS generated virtual and synthetic AtoN				
		2b.4.8	Use of Message 8 for meteorological and hydro data	2			
		2b.4.9	IALA-Net	1			
		2b.4.10	Long Range Tracking and Identification (LRIT)				
	2b.5		**GMDSS; IALA Maritime Radio Communications Plan (MRCP)**				
			Ship carriage requirements under GMDSS	2		SOLAS Chapter IV Lists of Radio Signals Copy of IALA's MCRP	32
			GMDSS components and Digital Selective Calling (DSC)	3			
			Modernisation of GMDSS	1			
			IALA WWRC Plan as a component of eNavigation				
			Bandwidth availability				
			VHF Date Exchange Systems (VDES)				

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
2B	**2b.6**		**e-Navigation**				
		2b.6.1	Definition of e-Navigation, its aim and strategy	2	e-Navigation videos e.g. "Mona Lisa"	IMO e-Navigation Strategic Implementation Plan (SIP)	33
		2b.6.2	Components of e-Navigation				
		2b.6.3	e-Navigation architecture	1			
		2b.6.4	Maritime Service Portfolios				
		2b.6.5	IMO Strategic Implementation Plan				
		2b.6.6	S-100 and Product Specifications				
		2b.6.7	Common Maritime Data Structure	1	e-Navigation forum on completion		34
		2b.6.8	Building blocks of e-Navigation				
		2b.6.9	Marine Information Overlays				
		2b.6.10	e-Navigation test beds				
	2b.7		**Remote Control and Monitoring**				
		2b.7.1	What AtoN should be monitored and why?	2			35
		2b.7.2	Methods to monitor AtoN				
		2b.7.3	Remote monitoring technologies				
		2b.7.4	Remote control communication options				
		2b.7.5	Remote control using AIS				

2.4 DETAILED TEACHING SYLLABUS FOR MODULE 2C – VESSEL TRAFFIC SERVICES

Table 10 Detailed Teaching Syllabus for Module 2B

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
2C			**VESSEL TRAFFIC SERVICES**				
	2c.1		**Vessel Traffic Services**				
		2c.1.1	Definition of VTS	2	External visit to VTS Centre if available	SOLAS Chapter V Reg.12 IALA VTS Manual IMO Resolution A.857(20)	36
		2c.1.2	Risk-based requirement for VTS				
		2c.1.3	VTS services				
		2c.1.4	VTS Infrastructure				
		2c.1.5	AIS as a VTS tool				
		2c.1.6	VTS beyond the limit of Territorial Seas				

2.5 DETAILED TEACHING SYLLABUS FOR MODULE 2D STRUCTURES; MATERIALS AND HISTORIC LIGHTHOUSES

Table 11 Detailed Teaching Syllabus for Module 2D

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
2D			**STRUCTURES; MATERIALS AND HISTORIC LIGHTHOUSES**				
	2d.1		**Structures and Materials**				
		2d.1.1	Types of material	3	External visit to AtoN maintenance facility	IALA "Level 2" technician model courses	37
		2d.1.2	Traditional and modern construction methods	1			
		2d.1.3	Threats to construction materials	2			
		2d.1.4	Humidity, condensation and weathering	1	Visit by coatings expert		
		2d.1.4	Corrosion and its prevention				
		2d.1.5	Removal of vegetation obstructing AtoN				
		2d.1.6	Theft; vandalism and its prevention				
	2d.2		**Historic Lighthouses**				
		2d.2.1	Heritage responsibilities	2	Visit historic lighthouse Historic lighthouse exercise	Complementary Lighthouse Use Manual	38
		2d.2.2	Alternative use and third-party access				
		2d.2.3	Old lenses: size and terminology				
		2d.2.4	Case study (regional)				

2.6 DETAILED REACHING SYLLABUS FOR MODULE 2E – POWER SUPPLY

Table 12 Detailed Teaching Syllabus for Module 2E

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
2E			**POWER SUPPLY**				
	2e.1		**Types of Power Supply**				
		2e.1.1	Power supply alternatives	3			39
		2e.1.2	Non-electrical energy sources	2			
		2e.1.3	Electrical energy sources	3			
		2e.1.4	Wind and wave electrical generators	1			
		2e.1.5	Petrol, diesel generators and mains utility	3			
			Photovoltaic cells				
	2e.2		**Batteries and Lightning Protection**				
		2e.2.1	Lead-acid batteries	3			40
		2e.2.2	Nickel Cadmium; nickel-metal hydride and lithium-ion batteries	2			
		2e.2.3	Disposal of batteries	4			
			Protection of AtoN structures; equipment from lightning strikes	2			
	2e.3		**Electrical Load calculations**				
		2e.3.1	Methodology for calculating and defining load profiles	2	Optional Instructor led exercise (2 hours)	IALA power calculation Excel Spreadsheet or equivalent	

3 MODULE 3A ATON PROVISION, DESIGN AND MANAGEMENT

4 MODULE 3B MAINTENANCE; CONTRACTS; ENVIRONMENTAL MATTERS AND HUMAN RESOURCE ISSUES

4.1 INTRODUCTION

Module 3 is divided into two sections and a major group planning task. Module 3A focuses on obligations imposed on National Competent Authorities under SOLAS Chapter V; the responsibilities of AtoN service providers and the levels of service that they should deliver.

Module 3B covers four main subject areas, each of which forms an essential element in the management of AtoN service provision.

Instructors for Module 3A should be fully competent in the generation of a Levels of Service statement and the drafting of Operational Plans; navigation risk assessment and analysis and the application of IALA risk management tools. Competence as a Quality Management internal or external auditor would be an advantage. Instructors for Module 3B should hold specialist qualifications recognised by the Accredited Training Organisation or other appropriate International body. External first aid and team-building training should be conducted by a qualified First Aid instructor and a recognised Leadership Organisation. See 4 paragraph 4.1 for further guidance.

4.2 SUBJECT FRAMEWORK

4.2.1 SCOPE

The syllabus for Module 3A requires participants to gain the appropriate level of competence in understanding the role of Competent Authorities and the obligations placed on them by international maritime conventions including the provision of AtoN services to full international standards. This requires competence in planning; publication of a level of service statement; liaison with regional stakeholders and basic risk management procedures.

The syllabus for Module 3B requires participants to gain the appropriate level of competence in contractual procedures and funding an AtoN service and their responsibility to protect the coastal and marine environment. Participants will also be required to be competent members of a management team.

The final major group planning task requires participants to act as the national Competent Authority of a small coast State charged with the delivery of an internationally compliant AtoN service.

4.2.2 AIMS

On successful completion of Module 3A, participants will demonstrate the ability to apply internationally acceptable principles of navigation risk analysis to the effective management of AtoN service provision.

On successful completion of Module 3B, participants will demonstrate the ability to work effectively as part of an AtoN management team tasked with the preparation and conduct of AtoN supply and/or maintenance contracts and projects whilst ensuring that the marine environment is properly preserved.

On successful completion of the group planning task, participants will demonstrate that they can generate all the major planning and management documents required by a fully competent national Competent Authority. This task aims to consolidate all the theoretical competencies gained during Modules 1, 2 and 3.

4.3 DETAILED TEACHING SYLLABUS FOR MODULE 3A - ATON PROVISION, DESIGN AND MANAGEMENT

Table 13 Detailed Teaching Syllabus for Module 3A

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
3A			**AtoN PROVISION; DESIGN AND MANAGEMENT**				
	3a.1		**AtoN Provision**				
		3a.1.1	International Criteria for AtoN service provision	3	List of national and regional stakeholders' compilation exercise	SOLAS Chapter V	41
		3a.1.2	SOLAS Chapter V Regulation 13	4			
	3a.2		**National (Competent) Authorities**				
		3a.2.1	The role of the national Competent Authority	3			
		3a.2.2	National Maritime Committee	2			
		3a.2.3	National Maritime Law related to safety of navigation	1	Shipping Act or equivalent		
		3a.2.4	AtoN inspections and audits				
		3a.2.5	Safety of Navigation Departmental Organisation				
		3a.2.6	Regional stakeholders	2	Organisation Diagram Visit key stakeholder(s)		
	3a.3		**Levels of Service**				
		3a.3.1	Level of Service for type; extent and quality	3			42
		3a.3.2	Level of Service Statement	2			
		3a.3.3	Operational Performance Statement for AtoN				
		3a.3.4	Level of Service for Quality - AtoN performance standards				
		3a.3.5	Analysis of maritime traffic and the marine environment		Traffic pattern exercise Level of Service drafting exercise	**Note**: Availability targets for AtoN are covered in more detail in lecture 46	43
		3a.3.6	The Operational Plan				
	3a.4		**Risk Management**				
		3a.4.1	Probability and consequence	3	Simple risk analysis exercise using SIRA framework Reserve places on IALA risk management course	**Note**: 90 minutes should be allocated to the SIRA exercise for which a PowerPoint presentation should be prepared	44
		3a.4.2	Hazards and risks				
		3a.4.3	IALA Risk Management tools: PAWSA; IWRAP MkII and SIRA	1			

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
	3a.5		**AtoN Availability Objectives**				
		3a.5.1	Categories of AtoN	4	Availability calculation exercise using charted AtoN		45
		3a.5.2	Availability; down-time and outages	3			
		3a.5.3	Failures and faults				
		3a.5.4	Continuity	1			
		3a.5.6	Availability of short-range visual AtoN	4			
			Availability of short-range radio AtoN including AIS				
	3a.6		**Reviews and Planning**				
		3a.6.1	The Strategic Plan	2	Visit organisation with operational GIS		46
		3a.6.2	Standard Operating Procedures				
		3a.6.3	Marine Spatial Planning	1			
		3a.6.4	Use of Geographical Information Systems (GIS) and simulation				
	3a.7		**Performance Measurement and Quality Management**				
		3a.7.1	Monitoring AtoN	2	Visit by QMS Organisation representative (additional time required) Single AtoN availability exercise over a 3-year period	ISO 9001 Quality Management System documentation	47
		3a.7.2	Analysis of availability				
		3a.7.3	Cost Issues and efficiency measures				
	3a.8		**Quality Management**				
		3a.8.1	QMS principles including continuous improvement				
		3a.8.2	Non-conformance reports				
		3a.8.3	Corrective and Preventative Measures				
	3a.9		**AtoN Service Delivery**				
		3a.9.1	User consultancy and liaison with stakeholders	3	Develop sub-element 3a.2.2 Group discussion		48
		3a.9.2	Contracting out	1			

4.4 DETAILED TEACHING SYLLABUS FOR MODULE 3B - MAINTENANCE; CONTRACTS; FUNDING; ENVIRONMENTAL MATTERS AND HUMAN RESOURCE ISSUES

Table 14 Detailed Teaching Syllabus for Module 3B

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
3B			**MAINTENANCE; CONTRACTS; FUNDING; ENVIRONMENT AND HUMAN RESOURCES**				
	3b.1		**Maintenance**				
		3b.1.1	Principles of maintenance	2	Examples of Standard Operating Procedures and checklists	The “bathtub curve”	49
		3b.1.2	Total cost of ownership				
		3b.1.3	Service intervals				
		3b.1.4	Preventative and condition-based maintenance				
		3b.1.5	Corrective maintenance				
		3b.1.6	Spares holdings				
		3b.1.7	Use of time-motion studies	1			
		3b.1.8	Efficiency principles: power; fixed versus floating; materials				
	3b.2		**Contracts**				
		3b.2.1	Introduction to technical specifications	1	Examples of contract formats		50
		3b.2.2	Principles of tender evaluation and preparation				
		3b.2.3	Cost elements and margins				
		3b.2.4	Insurance issues				
		3b.2.5	Contract negotiation procedures				
		3b.2.6	Tender approval and award procedures				

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References	Lecture No.
3B	3b.3		**Funding AtoN Services**				
		3b.3.1	The State and User-Pays principles	1	MS Excel-based budget compilation exercise for a new AtoN	Manufacturer's specification sheet and prices	51
		3b.3.2	Elements in the total cost of ownership				
		3b.3.3	Procurement, installation and through-life cost estimates				
		3b.3.4	Manpower and training cost estimates				
	3b.4		**Protection of the Marine Environment**				
		3b.4.1	International regulations: MARPOL; London Convention	2	Visit by regional environment agency representative	IMO and regional Publications related to the protection of the marine environment	52
		3b.4.2	National and regional legislation				
		3b.4.3	Hazardous materials				
	3b.5		**Human Resource Issues**				
		3b.5.1	Manpower as a resource	2	ISO 9001 or equivalent documentation		53
		3b.5.2	Training and certification of AtoN personnel				
		3b.5.3	Career development training	1			
		3b.5.4	Health and Safety	3			
		3b.5.5	First Aid	4	External lecturer	**Note**: 3-hour practical instruction	
		3b.5.6	Leadership and team building	3	External organisation	**Note**: 4-hour session	

5 MAJOR GROUP PLANNING TASK

The major planning task is designed for groups of 3 or 4 participants who have completed Modules 1 to 3 of the course and demonstrated their theoretical competency by passing the three examinations covering these Modules. The task is to put this knowledge into practice by acting as the Competent Authority responsible for AtoN in the area covered by a selected small to medium scale chart (1: 100 000 or 1: 50 000) published by a National or International Hydrographic Office.

The Course Assessor should select a section of coastline in a coastal State that the participants would not reasonable be expected to have previous knowledge of. For example, an area of a coastal State in the Caribbean Sea for participants principally from East Asia, or a South-West Pacific State for participants from Africa.

Each group will be required to provide "such AtoN as the volume of traffic justifies and the degree of risk requires" within the geographical area covered by the selected chart.

The groups will need to decide what information they require to determine the "volume of traffic" and "degree of risk" and then obtain this data from the internet or the resources provided by the Course Assessor in the form of published charts and Sailing Directions for the region. They will also be provided with the IALA Guideline covering the Use of the Simplified IALA Risk Assessment Method (SIRA) and its associated Excel Workbook. Participants will need to use their experience and imagination to create data where none is available to them from other sources including the internet.

The First Step

1. Select a team leader
2. Create a list of tasks to be completed
3. Delegate specific tasks to team members
4. Create a time-table so that all actions are complete 1 hour before the final presentation.

Tasks

1. Divide the area covered by the smallest scale chart into Zones.
2. Select one zone where the density of maritime traffic is expected to be greatest and create a stakeholder list for that zone.
3. Analyse the maritime environment in that zone.
4. Analyse the maritime traffic (routes; density and mix) in that zone. Routes should be drawn on the charts.
5. Conduct a simple risk analysis using SIRA for that zone.
6. Decide if the existing AtoN (including VTS) are adequate (range; secondary AtoN etc.) or whether more (or less) are required.
7. Create a register of all AtoN in that to include proposed IALA categories.
8. Write a Level of Service Statement for that zone.
9. Draft an abbreviated Operational Plan and Operational Performance Standard for 1 fixed and 1 floating IALA Category 1 AtoN in that zone.
10. Prepare a PowerPoint brief to deliver to the "Minister of Transport" on the adequacy or otherwise of AtoN service provision in the region. This will be the basis for seeking funding for new or improved services for which a budget will need to be prepared.

The Final Step

Each group will deliver a 15-minute (maximum) brief to the "Minister". The Course Assessor will debrief all groups after the presentations have been delivered.

ANNEX A TRAINING NEEDS ANALYSIS – EXAMPLE FORMAT

A 1. INTRODUCTION

The process of specific training is conducted in six steps:

1 Determine what needs to be taught – in this case the syllabus set out in Part 5 of this document

2 Analysis of existing competencies held by potential participants.

3 Determine which participants are exempt from specified subjects and which require full or additional training.

4 Plan lectures based on who needs to be taught what.

5 Lecture delivery and documentation.

6 Analyse training feedback and update lecture plans.

A 2. THE SYLLABUS

The syllabus is broken down into Modules, elements and sub-elements. The IALA Model course for AtoN Level 1 Managers has been formatted in this manner.

A 3. ANALYSIS OF EXISTING COMPETENCIES

There are two methods of analysing existing competencies. The first is for participants who are known to the Training Organisation and are judged to be able to take the course successfully. The second is for participants who are not known to the Training Organisation.

The second method can be split into a formal and less formal method to determine the ability of a potential participant to take the course. In both cases, CVs of candidates should be sent to the Course Assessor before the interview process takes place. The informal method is for the Course Assessor to arrange a Skype or telephone conversation with the candidate to determine the level of his or her technical knowledge and understanding of the language of instruction. The more formal procedure is explained below.

Before the start of the course of instruction, each candidate, regardless of previous qualifications or experience, will be asked to take a short competency test followed by a private interview, preferably by Skype, to determine his or her training needs. It should be explained that the sole aim is for the participant to determine for themselves the amount of instruction that will be required so that they can demonstrate competency in each Module by passing each Module test. It should be explained that all participants will be required to sit the Module tests, even though they hold a professional qualification in a particular subject area.

Each participant will be given a 100-question test paper based on the complete syllabus for the IALA Model Course. Each question requires a one-word or short phrase answer and will be timed for completion in 60 minutes. Participants will be expected to answer the questions from memory without referring to text books or other documentation. The course Assessor will then mark the papers. Each Module should be analysed by sub-elements. Existing proven competencies for which the participant required no further training will be given a green flag. Red flags will be allocated to sub-elements where further training is either requested or required. A matrix of which participant requires what training in various subjects can then be produced which shows which participant should attend which lecture or whether exemption in a complete Module or subject element can be granted. See Table 15 below. A participant scoring less than 15% in this initial assessment may not have the necessary minimum entry level of specialist knowledge or comprehension of language of instruction (normally English) to complete successfully the course.

Table 15 Example of Participant Training Needs

Module	Element	Sub-element	Subject	Participant A	Remarks	Participant B	Remarks	Participant C	Remarks
1B			**NAUTICAL KNOWLEDGE (GENERAL)**		Master Mariner		No maritime experience		Limited maritime experience
	1b.1		**Introduction – Principles of Navigation**						
		1b.1.1	Introduction to methods of navigation; Lines of Position						
		1b.1.2	Accuracy standards						
2A		etc.							
2E			**POWER SUPPLY**		Unfamiliar with power supply options for AtoN		Degree in electrical engineering		No formal qualification held
	2e.		**Types of Power Supply**						
		2e.1.1	Non-electrical energy sources						
		2e.1.2	Electric energy sources						

A 4. LECTURE PLANNING

Having determined who needs to be taught what, the course Assessor allocates specific lectures to individual instructors, engaging external lecturers where required. Instructors then use the required level of competence, recommended training aids and references shown in the Model Course to prepare a series of 40-minute lectures in Microsoft PowerPoint® format supported by hand-outs containing all appropriate references. Each lecture ends with a list of key learning points. An allocation of 10 minutes should be made for questions.

A 5. PREPARATION OF TEST PAPERS

Instructors responsible for each Module should prepare written test papers on what was taught with questions set at the appropriate level of difficulty based on the required level of competence. The IALA World-Wide Academy has developed a data-bank of questions from which formally-analysed test papers are compiled. Competent Authorities that have signed a training MoU with IALA will have the option of using test papers complied by the IALA World-Wide Academy for Level 1 courses delivered by an Accredited Training Organisation (see IALA Guideline G1100).

A 6. DOCUMENTATION

A record, based on Quality Management System principles should be maintained of training progress and results. A complete set of training documentation, together will training in its use, will be supplied to an Accredited Training Organisation whose Competent Authority has signed a training MoU with IALA.

A 7. TRAINING FEEDBACK AND ANALYSIS

Feedback from participants and an analysis of test papers should be used to improve the quality of lectures. Lectures will also need to be updated to reflect new or revised IALA publications posted on the IALA website after every IALA Council meeting.