International Association of Marine Aids to Navigation and Lighthouse Authorities

IALA

Association Internationale de Signalisation Maritime

AISM

IALA Model Course E-141/1

On

Level 1 Aids to Navigation Manager Training

Edition 2

December 2015

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Document Revisions

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

Date	Page / Section Revised	Requirement for Revision
December 2015	Part A - D	Review of course overview and instructions with minor amendments
	Part E	Update of complete syllabus and references

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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 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, Contracting Governments, mindful of their obligations published by the International Maritime Organisation, 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 E-141 on Standards for 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 E-141 Level 1 management functions. This model course on Level 1 Aids to Navigation Manager Training should be read in conjunction with IALA Recommendation E- 141 on Standards for Training and Certification of AtoN Personnel. Mindful of the desire to harmonise the delivery of its published model courses, IALA has developed Guidelines for the accreditation and approval process for both AtoN personnel training (Guideline 1100) and Vessel Traffic Service training (Guideline 1014).

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 The Academy or a Training Organisation accredited by a national Competent Authority[1]. 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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[1] Definitions and clarifications of terms and common abbreviations used in the text of this document are listed at Articles 1.2 and 1.4 of IALA Recommendation E-141

PART A – 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 E-141.

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 instructors 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. It is not the intention of this model course programme to restrict instructors in the manner in which they deliver their lectures, particularly as the cultural backgrounds of the participants may vary considerably from country to country.

3   USE OF THE MODEL COURSE

The complete course comprises five modules; some 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. Each module is based on a subject framework which states its scope, aims and levels of competency to be acquired. 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 NAVGUIDE Manual[2].

To use the model course, a Training Organisation is advised to adopt a Training Management System which analyses the detailed syllabus and determines the entry standard for participants undertaking the training[3]. 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.

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.

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[2]   The version of the NAVGUIDE referred to in this document is the seventh edition (2014)

[3]   The pool of available talent is likely to vary from country to country. Article 5.2 of Recommendation E-141 assumes that participants selected for this Model Course will have an engineering background or hold a seagoing Master's Certificate or equivalent. Participants with these internationally recognised qualifications may not always be available. See Part C paragraph 2 of this document for greater detail.

PART B – DELIVERY OF THE MODEL COURSE

1   INTRODUCTION

The training and assessment of participants seeking accreditation as an AtoN Manager[4] 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 competency; and

- Conducted, monitored, assessed and supported by persons qualified in accordance with Part C; section 4 of this document – Training Staff requirements.

Training staff are recommended to review initially the course outline and detailed syllabus for each main subject heading. 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.

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. Such participants will however be expected to sit the complete final assessment 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 preferably should be considered as the minimum competency level for personnel with responsibilities for the management of AtoN service provision. Career development training and experience, both within the Organisation and internationally 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 tailor each course to match the results of the training needs analysis. Having determined what needs to be taught to whom, instructors would produce lesson plans which match the detailed syllabus for each module. Sub-elements for which competency has already been demonstrated through, for example, documented Accredited Prior Learning (APL), can be deleted. Lesson plans shown in Part E of the document assume that all participants will receive instruction in all sub-elements of the complete syllabus. IALA reference publications that the instructor may wish to use are listed under each modular subject element. Accredited Training Organisations can add local publications and training aids as appropriate.

The level of competence required from an 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). A further higher level 5 is reserved for senior management. Details are at Table 1 below.

3   SUBJECT OUTLINE

A subject outline for each module is shown in tabular form in Part E of this document. This lists the minimum recommended level of competence for each subject element or sub-element. Sub-elements

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[4]   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.

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.

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.

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 the basic training course'[5]. The Model Course for 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 or group of modules, supported where appropriate by a personality assessment of each participant. Further recommendations are at Part D paragraph 3.

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[5]   IALA Recommendation E-141 Article 4.1

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;[6]

- Support staff and facilities;

- Instruction and rest rooms;

- Training aids and equipment;[7]

- Reference books; publications or extracts and other reference material;[8]

- Navigational charts and nautical publications.

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[6]   *'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'* IALA Recommendation E-141 Article 5.2.2

[7]   Where possible Microsoft PowerPoint® presentations should be capable of being projected onto a suitable white background or screen

[8]   The standard reference publication is the IALA NAVGUIDE Manual. References to appropriate IALA Recommendations and Guidelines are given in Part E of this document

PART C – COURSE FRAMEWORK

1   INTRODUCTION

This model course is based on IALA Recommendation E-141. 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 IALA AtoN Level 1 Certificate. This will permit them to operate as a manager with an AtoN service provider approved by the 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 E-141 makes the assumption that participants selected for this model course would have a professional engineering background or hold a seagoing Master's Certificate. 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:

- Demonstrable competence in English or other approved main language of instruction;

- 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;

- 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 E-141 Article 5.2.2 expects that Competent Authorities will ensure that instructors for this model course are appropriately qualified. 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. The following list provides guidance on criteria for approved training staff:

4.1   Course Instructors

- 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;

- IALA-endorsed experts[9].

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.

References to specific paragraphs or sections in the IALA NAVGUIDE or other Manuals, Recommendations and Guidelines are shown in the detailed teaching syllabi.

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[9]   A list of IALA-endorsed experts is maintained by the IALA World-Wide Academy.

PART D – GUIDELINES FOR INSTRUCTORS

1   INTRODUCTION

AtoN managers and engineers are responsible to the Competent Authority for providing an appropriate quantity and quality of aids to navigation services which meet or exceed the obligations set out in the SOLAS Convention, Chapter V, Regulation 13 and other mandatory instruments issued by the International Maritime Organisation.

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.[10]

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 five broad module subject headings and sub-headings. These are shown in Part E 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 instructor should also make an allowance for external visits to National Organisations and Authorities; IALA Workshops and team-building instruction.[11] An example of course planning is shown in Table 2 below. This assumes the following: full time availability by participants for each Module; 49 forty-minute lectures, each followed by a 10 minute question session and a 10 minute break; a full day's instruction in First Aid; 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

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[10]   Extract from Article 1.1 of IALA Recommendation E-141.

[11]   Article 5.2 of IALA Recommendation E-141 specifies that 'training to work as a member of a team should normally be part of the syllabus' [see Part E Module 3 sub-element 3b.5.5]. E-141 Article 5.3 recommends that participants should attend model course IALA WWA.L1.3 on Risk Management Tools and IALA WWA.L1.4 on satellite and e-navigation.

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 paragraph 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

Day	Module	Lectures (see Part E)	Instruction hours	Other Activity	Remarks
0	1 to 5	0	0	Training Needs Analysis (see Annex A)	Conducted before course commences
1	1; 2A	2 to 4	5	Plotting exercises and external visit to Competent Authority	Module 2A for participants with a non- nautical background
2	1; 2A	5 to 7	5	Plotting and chart correction exercises	Plan visit to National Hydrographic Office
3	2B	08 to 10	5	External visit to port	One day can be allocated to this visit which would extend the course by a working day
4	2B	11 to 13	5	Meteorological exercise	Tutorials if required
5	1; 2A; 2B	0	0	Complementary Module Exam 1; 2A and 2B (see Part D.3)	Participants who fail should not proceed until Certificate awarded
6	3A	14 to 17	5	Stakeholder, Levels of service and desktop risk analysis exercises	Plan for IALA Risk Management Workshop: PAWSA; IWRAP Mk2 Convene stakeholder group discussion
7	3A; 3B	18 to 21	5	AtoN availability exercise	
8	3B	24,25,46	5	Historic lighthouse exercise and possible visit	Plan for Leadership/team training
9	3B	-	4	First Aid training day	Revision and tutorials
10	3B	22,23,26	4	HR group discussion	Revision and tutorials
11 (am)	3A; 3B	0	0	Complementary Module Exam 3A; 3B	Assessment for Module 1; 2 participants (see Part D.3)
11 (pm)	4A	27 to 29	3	Use of light range if available	
12	4A	30 to 33	5	Sector light and leading line planning exercise	
13	4B 4D	34 to 36 41; 43	5	Module 3 re-sit exam if required	Revision and tutorials
14	4B; 4D	37;38 43;44	4	e-Navigation video	
15	4C; 4D	45	3	e-Navigation forum	Revision and tutorials
16	4C	39; 40		External visit to VTS Centre	One day can be allocated to this visit which would extend the course by a working day
17	3B	-	-	Team Building day	Specialist Company
18	5	47 to 49	5	Load profile calculations	Revision and tutorials
19	4A-D: 5	0	0	Complementary Module Exam 4A-D; 5	Assessment for Module 3 participants (see Part D.3)
20	4A-D: 5	0	0	AtoN Level 1 Certificate awards	Assessment for Module 4 and 5 participants (see Part D.3)
4 working weeks			**68[12]**		

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[12] Total time allocated to participant instruction. This 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.

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 (ATO) 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 40 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 four 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 ATO 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 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 by the Course Supervisor (Assessor) the day following the written examination. 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.

PART E – COURSE MODULES

This model course comprises five main modules covering the key subject headings listed in Recommendation E-141. Three modules are sub-divided giving a total of 10 modules in all.

Table 2 in Part D above gives an example of how the whole syllabus might be covered in forty-nine 40 minute lectures; one four hour period of First Aid instruction; associated exercises and external visits spread over four working weeks.[13] 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.

In order to allow for different entry levels of knowledge held by individual participants, the proposed order of lectures does not always follow the order of modules. For example an appropriate level of competency in nautical knowledge (Module 2A) should be held before participants are given instruction in aspects of Law of the Sea (Module 1). 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
1	International Organisations and Law of the Sea	1; 6	Territorial Sea plotting exercise	3
2A	Nautical Knowledge (General)	2 – 5; 7,8	Position at sea plotting exercise (2) and chart correction exercise	9
2B	Position, Navigation, Timing and Meteorology	9 - 13	Weather forecast exercise Nautical revision exercise	8
3A	AtoN Provision; Design and Management	14 – 21	Stakeholder exercise Level of Service exercise Risk analysis exercise	9
3B 4D	Maintenance; Structures and Materials; Contracts; Environment; Historic Lighthouses and Human Resources	22 – 26 and 46	Historic Lighthouse exercise First Aid Training exercises (Five hour Team Building day not included)	11
4A	Technical Functions – Visual AtoN	27 – 33	Sector light and leading line exercises (2) Light revision quiz exercise	10
4B	Technical Functions – Radio AtoN and AIS	34 – 38		2
4C	Technical Functions – VTS and Routeing	39 – 40	Revision quiz exercise	6
4D	Technical Functions – Sound Signals; Communications; e-Navigation; Tide Gauges; Remote Monitoring	41 – 45		5
5	Power Supply	47– 49	Load profile exercise (2)	5
			Total Recommended Instruction Time	**68 hours**

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[13] Each lecture and exercise period has been allocated a time of 60 minutes to allow for breaks between sessions.

MODULE 1   **INTERNATIONAL ORGANISATIONS AND LAW OF THE SEA**

1   INTRODUCTION

Module 1 covers International Organisations concerned with AtoN and related safety of navigation matters and aspects of the United Nations Convention on the Law of the Sea (UNCLOS) 1982 which relate to AtoN service provision.

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.

2   SUBJECT FRAMEWORK

2.1   Scope

The syllabus for this module requires participants to gain the appropriate level of competence in understanding the role played by international organisations 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.

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.

2.2   Aims of Module 1

On successful completion of module, participants will demonstrate the ability to manage effectively their legal obligations concerned with AtoN service provision.

3 DETAILED TEACHING SYLLABUS FOR MODULE 1 – INTERNATIONAL ORGANISATIONS AND LAW OF THE SEA

Table 4 Detailed Teaching Syllabus Module 1

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
1			**INTERNATIONAL ORGANISATIONS AND LAW OF THE SEA**				
	1.1		**IALA; IMO and the IHO**				
		1.1.1	IALA – Categories of membership	3	Visit Competent Authority Head Office	NAVGUIDE Ch.1[14] www.iala-aism.org NAVGUIDE 8.12.2 IALA Rec E-141 NAVGUIDE 8.1 www.imo.org/conventions IALA Rec E-105 IALA GL 1054 www.iho-ohi.net	1
		1.1.2.	IALA Structure				
		1.1.3	IALA Publications: Recommendations and Guidelines				
		1.1.4	IALA World-Wide Academy	2			
		1.1.5	International Maritime Organisation				
		1.1.6	Mandatory Instruments of the IMO	2			
		1.1.7	IMO Audit Scheme				
		1.1.8	International Hydrographic Organisation	1			
	1.2		**PIANC; ILO; IEC and ITU**				
		1.2.1	IALA liaison with PIANC; ILO; IEC and ITU	1		www.pianc.org www.ilo.org www.iec.ch www.itu.int	
	1.3		**UNCLOS 82**				
		1.3.1	Background to United Nations Convention on the Law of the Sea	1	TW plotting exercise requires appropriate charts and drawing instruments	UNCLOS Articles 5; 6-14 UNCLOS Articles 17-26 UNCLOS Part III Art.43	6
		1.3.2	Territorial Waters, Exclusive Economic Zones and the High Seas				
		1.3.3	Maritime Baselines				
		1.3.4	Innocent Passage				
		1.3.5	Straits used for International Navigation				

[14] The version of the NAVGUIDE referred to in this document is the seventh edition (2014)

MODULE 2A   **NAUTICAL KNOWLEDGE (GENERAL)**

MODULE 2B   **POSITION; NAVIGATION; TIMING AND METEOROLOGY**

1   INTRODUCTION

Module 2 is split into two parts. Module 2A is designed primarily for participants with little or no previous nautical knowledge or experience. It provides a basic understanding of nautical terms and their application in AtoN management. Participants who hold a recognised recreational yachting qualification such as those issued by the RYA or other equivalent regional organisation might be sufficiently competent in Module 2A elements. This should be determined during the Training Needs Analysis process.

Module 2B introduces both traditional short-range and electronic Aids to Navigation (AtoN) including the IALA Maritime Buoyage System (MBS), Electronic Positioning Systems (EPS) and pilotage as a service to navigation. More technical issues are addressed in Module 4. This Module covers both natural and human generated factors affecting the performance of AtoN and methods to mitigate these effects for which a basic understanding of meteorology is required.

Instructors for these modules should hold international nautical qualifications recognised by the International Maritime Organisation. See Part C 4.1 for further guidance.

2   SUBJECT FRAMEWORK

2.1   Scope

The syllabus for Module 2A 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.

The syllabus for Module 2B requires participants to gain a detailed knowledge of the IALA MBS and other appropriate levels of competence in the types and limitations of electronic positioning systems; the function of pilotage as a service to navigation and the effect of meteorological conditions on AtoN performance.

2.2   Aims

On successful completion of Module 2A, 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.

On successful completion of Module 2B, participants will demonstrate a detailed understanding of the IALA Maritime Buoyage system and the ability to apply theoretical principles affecting the performance of aids to navigation to the management of AtoN service provision.

3   DETAILED TEACHING SYLLABUS FOR MODULE 2A NAUTICAL KNOWLEDGE (GENERAL)

Table 5   Detailed Teaching Syllabus Module 2A

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
2A			**NAUTICAL KNOWLEDGE (GENERAL)**				
	2a.1		**Introduction – Principles of Navigation**				
		2a.1.1	Introduction to methods of navigation; Lines of Position	1	Nautical quiz to test existing knowledge	NAVGUIDE Chapter 2.1; 2.2 IMO Resolution A.923(23) NAVGUIDE 2.3 NAVGUIDE 2.4.1 NAVGUIDE 2.4.2	2
		2a.1.2	Accuracy standards				
		2a.1.3	Phases of navigation: offshore; coastal; restricted waters				
		2a.1.4	Measurement errors	2			
		2a.1.5	Position fixing system accuracies				
	2a.2		**Hydrography, Nautical Charts and maps**				
		2a.2.1	Geographical positions, the nautical chart and projections	1	Small, medium and large scale charts published by National Hydrographic Office. Plotting exercises.	NAVGUIDE 2.5; 6.6.5 NAVGUIDE 2.5.3 National manuals of navigation such as the UK Manual of Navigation Volume 1	3
		2a.2.2	Chart scales and accuracy				
		2a.2.3	Source data diagram				
		2a.2.4	Basic geodesy and horizontal datums				
		2a.2.5	Plotting position at sea including by range and bearing				
		2a.2.6	Chart datum; tidal levels and vertical control datum	1	Appropriate charts. Symbol identification exercise Coordinate conversion program	NAVGUIDE 2.5.2 INT 1 – Chart symbols and Abbreviations	4
		2a.2.7	Chart symbols and abbreviations				
		2a.2.8	Navigation depths and dangers				
		2a.2.9	Magnetic and True North	2			
		2a.2.10	Grid positions and maps	1			
		2a.2.11	Coordinate conversions				
		2a.2.12	Basic tidal theory	1	Tidal height calculations	National Tide Tables NAVGUIDE 6.8	5
		2a.2.13	The nature of tides; regional tidal characteristics				
		2a.2.14	Tidal Flow: tidal steams; currents and tsunamis				
		2a.2.15	Under-keel clearance				

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
2A	**2a.3**		**Nautical Publications**				
		2a.3.1	Navigation Warnings - general		Visit National Hydrographic Office	NAVGUIDE 6.6.1 – 6.6.6 Lists of Lights and Radio Signals published by the National Hydrographic Office	7
		2a.3.2	World-wide Navigational Warning Service; NAVWARNS				
		2a.3.3	Standard terms and definitions				
		2a.3.4	Maritime Safety Information	2			
		2a.3.5	NAVTEX and Coast Radio Stations				
		2a.3.6	Lists of Radio Signals		Chart correction exercise		
		2a.3.7	Lists of Lights				
		2a.3.8	Chart and Nautical Publication corrections				
		2a.3.9	Electronic Navigation Charts and ECDIS	1	Visit ECDIS fitted vessel		8

4   DETAILED TEACHING SYLLABUS FOR MODULE 2B - POSITION; NAVIGATION; TIMING AND METEOROLOGY

Table 6   Detailed Teaching Syllabus for Module 2B

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
2B			**POSITION; NAVIGATION; TIMING; METEOROLOGY**				
	2b.1		**IALA Maritime Buoyage System (MBS)**				
		2b.1.1	Types of buoys in the IALA MBS	4		IALA MBS handbook (2010)	9
		2b.1.2	Charted and actual position of buoys	2	Visit suitable port and/or buoy maintenance base	NAVGUIDE 2.5.4 IALA Rec O-118 and O-130 IALA GL 1035 and 1046	10
		2b.1.3	Emergency Wreck Buoys	2			
		2b.1.4	Availability targets for floating AtoN	3			
	2b.2		**Electronic Positioning Systems**				
		2b.2.1	IALA World Wide Radio Navigation Plan	2	Visit national TRA	NAVGUIDE 4.1 – 4.8 GL 1072 IALA Rec eNav 140 IALA Rec R-101 and R-135 NAVGUIDE 4.10.1 – 2; 4.12.1 The Mariners' Handbook National Lists of Radio Signals	11
		2b.2.2	Global Navigation Satellite Systems (GNSS); error sources	2			
		2b.2.3	Differential GPS; Integration and enhancement	2			
		2b.2.4	Terrestrial Systems: Loran-C; e-Loran	1			
		2b.2.5	Radars and radar reflectors	2			
		2b.2.6	Radio Beacons - Racons	2			
		2b.2.7	Transmission Regulatory Authorities and MMSI numbers	1			
	2b.3		**Pilotage**				
		2b.3.1	Pilotage as a service to navigation	1	Visit pilotage simulator	NAVGUIDE 6.1 IALA Rec P-137	12
		2b.3.2	Use of traffic separation schemes; Inshore Traffic Zones	2			
		2b.3.3	Dredging schemes	1			
		2b.3.4	Anchorages	2			
		2b.3.5	Pilotage simulators	1		IALA Rec O-138	
	2b.4		**Meteorology**				
		2b.4.1	Pressure and wind	1	Beaufort and sea disturbance scales Basic forecasting exercise	The Mariners' Handbook National Sailing Directions	13
		2b.4.2	Weather systems	1			
		2b.4.3	Region seasons	2			
		2b.4.4	Wind and waves	2			
		2b.4.5	Tropical storms and hurricanes	1			
		2b.4.6	Super-refraction; inversions and ducts	1			

MODULE 3A   **AtoN PROVISION, DESIGN AND MANAGEMENT**

MODULE 3B   **MAINTENANCE; CONTRACTS; ENVIRONMENTAL MATTERS; HISTORIC
LIGHTHOUSES AND HUMAN RESOURCE ISSUES**

1   INTRODUCTION

Module 3 is divided into two sections. 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 five 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 navigation risk assessment and analysis; in the application of IALA risk management tools and hold an appropriate QMS certificate. Instructors for Module 3B should hold specialist qualifications recognised by the Accredited Training Organisation or other appropriate International body. External team-building training should be conducted by a recognised Leadership Organisation. See Part C 4.1 for further guidance.

2   SUBJECT FRAMEWORK

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 internationally acceptable standards and liaison with regional stakeholders.

The syllabus for Module 3B requires participants to gain the appropriate level of competence in contractual procedures; the maintenance and preservation of both new and historic aids to navigation stations and their responsibility to protect the coastal and marine environment. Participants will also be required to be competent members of a management team.

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.

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

Table 7   Detailed Teaching Syllabus for Module 3A

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	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	Review of Module 1	
		3a.1.2	SOLAS Chapter V Regulation 13	4		NAVGUIDE 8.1; 8.2	
	3a.2		National (Competent) Authorities				
		3a.2.1	The role of the National or Competent Authority	3			14
		3a.2.2	Regional stakeholders	2	Visit key stakeholder(s)	IALA GL 1079 and 1005	
		3a.2.3	The State and User-Pays principles	2		IALA Rec V-102	
	3a.3		Levels of Service				
		3a.3.1	Level of Service for extent	3		IALA GL 1004	
		3a.3.2	Level of Service for type	2		NAVGUIDE 8.2	15
		3a.3.3	Operational performance standards	2			
		3a.3.4	Maritime traffic analysis	2		**Note**: Availability targets for AtoN	
		3a.3.5	The Navigation Plan (NAVPLAN)	2	Traffic pattern exercise	are covered in more detail in	16
		3a.3.6	Level of service for quality	2		lecture 18	
	3a.4		Risk Management				
		3a.4.1	Probability and consequence	3	Risk analysis exercise	NAVGUIDE 8.3; Figure 36 ; 37	
		3a.4.2	Hazards and risks	3		IALA GL 1018	17
		3a.4.3	IALA Risk Management tools: PAWSA and IWRAP Mk.2	1	Book IALA workshop	IALA Rec O-134	
	3a.5		AtoN Availability Objectives				
		3a.5.1	Categories of AtoN	3		NAVGUIDE 8.4.3 - 4	
		3a.5.2	Mean Time Between Failure; Mean Time to Repair	3		IALA Rec O-130	
		3a.5.3	Continuity	2	Availability calculation exercise	IALA GL 1035	18
		3a.5.4	Availability of traditional AtoN	3		Quality Management System	
		3a.5.6	Availability of Radio AtoN including AIS	3		IALA Rec R-121	

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
	3a.6		**Reviews and Planning**				
		3a.6.1	The Strategic Plan	2	Visit organisation with operational GIS	IALA Rec O-138 IALA GLs 1033; 1057; 1058 NAVGUIDE 8.5.4	19
		3a.6.2	Standard Operating Procedures				
		3a.6.3	Use of Geographical Information Systems (GIS)				
	3a.7		**Performance Measurement and Quality Management**				
		3a.7.1	Monitoring AtoN	2	Visit by QMS Organisation representative (additional time required)	NAVGUIDE 8.4.4; 8.6; 8.7 IALA GL 1037 IALA Rec O-132 IALA GL 1052 ISO 9001 QMS or equivalent NAVGUIDE 8.7.1	20
		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	IALA GL 1079	21
		3a.9.2	Contracting out	1	Group discussion	IALA GL 1005	

4   DETAILED TEACHING SYLLABUS FOR MODULE 3B - MAINTENANCE; CONTRACTS; ENVIRONMENTAL MATTERS; HISTORIC LIGHTHOUSES AND HUMAN RESOURCE ISSUES

Table 8   Detailed Teaching Syllabus for Module 3B

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
3B			**MAINTENANCE; CONTRACTS; ENVIRONMENT; HISTORIC LIGHTHOUSES AND HUMAN RESOURCES**				
	3b.1		**Maintenance**				
		3b.1.1	Principles of maintenance				
		3b.1.2	Service intervals				
		3b.1.3	Preventative maintenance	2	Examples of Standard Operating Procedures and checklists	NAVGUIDE 8.8 IALA GL 1076 and 1077	22
		3b.1.4	Corrective maintenance				
		3b.1.5	Spares holdings				
		3b.1.6	Use of time-motion studies	1			
		3b.1.7	Efficiency principles: power; fixed versus floating; materials				
	3b.2		**Contracts**				
		3b.2.1	Introduction to technical specifications		Examples of contract formats	IALA GL 1034	
		3b.2.2	Principles of tender evaluation and preparation				
		3b.2.3	Cost elements and margins	1			23
		3b.2.4	Insurance issues				
		3b.2.5	Contract negotiation procedures				
		3b.2.6	Tender approval and award procedures				
	3b.3		**Protection of the Marine Environment**				
		3b.3.1	International regulations: MARPOL; London Convention		Visit by regional environment agency representative	NAVGUIDE 8.10 IMO Publications IALA GL 1036	24
		3b.3.2	National and regional legislation	2			
		3b.3.3	Hazardous materials				
	3b.4		**Historic Lighthouses**				
		3b.4.1	Heritage responsibilities		Visit historic lighthouse Historic lighthouse exercise [Note: consider including Lecture 46-structures and materials in this Module]	Lighthouse Conservation Manual IALA GL 1074 and 1075 NAVGUIDE 8.11	25
		3b.4.2	Alternative use and third party access	2			
		3b.4.3	Old lenses: size and terminology				
		3b.4.4	Case study (regional)				

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
	3b.5		**Human Resource Issues**				
		3b.5.1	Manpower as a resource			NAVGUIDE 8.12 IALA Rec E-141	
		3b.5.2	Training and certification of AtoN personnel		ISO 9001 or equivalent documentation		
		3b.5.3	Career development training	3			26
		3b.5.4	Health and Safety				
		3b.5.5	First Aid	4	External lecturer	**Note**: 4 hour practical instruction	
		3b.5.6	Leadership and team building	3	External organisation	**Note**: One day session	

MODULE 4A   **TECHNICAL FUNCTIONS – VISUAL AtoN**

MODULE 4B   **TECHNICAL FUNCTIONS – RADIO AtoN**

MODULE 4C   **VTS and ROUTEING MEASURES**

MODULE 4D   **SOUND SIGNALS; COMMUNICATIONS; e-NAVIGATION; TIDE GAUGES; STRUCTURES; REMOTE MONITORING AND CONTROL**

1   INTRODUCTION

Module 4 is divided into four sections. This division permits participants with proven competency in particular disciples to be exempt from instruction in that field.

Module 4A deals with technical aspects and functions of visual AtoN whilst Module 4B covers technical aspects and functions of satellite and land based radio aids to navigation including Automatic Identification Systems (AIS).

Module 4C is intended as a basic introduction to the principles of Vessel Traffic Services and traffic routeing measures. Participants intending to progress their competency in VTS should refer to the requirements set out in IALA Recommendation V-103.

Module 4D covers 6 subject areas in which potential AtoN managers must gain an appropriate level of competency depending on the regional requirement. A basic competency in e-Navigation is considered to be particularly important.

Instructors for Module 4A; B and D should competent in all aspects of AtoN management and hold appropriate qualifications recognised by the Accredited Training Organisation. Instructors for Module 4C should hold an appropriate IALA recognised VTS qualification. See Part C 4.1 for further guidance.

2   SUBJECT FRAMEWORK

2.1   Scope

The syllabus for Module 4A requires participants to gain the appropriate level of competence in theoretical and practical factors affecting the effective operation of traditional short-range visual AtoN. The syllabus for Module 4B requires participants to gain a similar level of competence in the effective operation or use of radio AtoN. The syllabus for Module 4C requires participants to acquire a basic understanding of the function of VTS in the provision of an AtoN service, particularly in areas where the routeing of vessels is subject to positive control. The syllabus for Module 4D requires participants to gain the appropriate level of competency in three unrelated but important subject areas: the use of sound signals; the value of real-time tide gauges and how structures are affected by external elements. Module 4D 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.

2.2   Aims

On successful completion of Module 4A and 4B, participants will demonstrate the ability to apply both theoretical and practical principles effecting the safe and efficient operation of both visual and radio aids to navigation to the effective management of AtoN service provision.

On successful completion of Module 4C, 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 4D, participants will demonstrate a satisfactory understanding of the e-Navigation concept and the operation of AIS and remote monitoring as key elements of e-Navigation. Participants will also demonstrate how the use of sound signals; real time tide and the protection and preservation of structures could assist in the effective delivery of AtoN service provision.

3   DETAILED TEACHING SYLLABUS FOR MODULES 4A; 4B – TECHNICAL FUNCTIONS – VISUAL and RADIO AIDS TO NAVIGATION

Table 9   Detailed Teaching Syllabus for Module 4A

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
4A			**TECHNICAL FUNCTIONS – VISUAL AtoN**				
	4a.1		**Visual AtoN – General Functions**				
		4a.1.1	Descriptions, definitions and distinguishing features	3		NAVGUIDE 3.1 IALA Rec O-130; E-106; E-108 IALA Rec E-200-3 IALA GL 1035	27
		4a.1.2	Signal colours	2			
		4a.1.3	Meteorological visibility; transmissivity, refraction				
		4a.1.4	Contrast and use of binoculars	3			
		4a.1.5	Ranges: geographical, meteorological, visual, nominal				
		4a.1.6	AtoN lights: lens development, light sources, IPS lanterns	2	Use of light workshop if available **Note:** some participants may require tutorials to ensure an equal entry level of understanding. If this applies to most participants, lecture 28 may have to be covered in two periods of instruction	NAVGUIDE 3.2; Figure 8 IALA GL 1043; 1048; 1064 IALA Rec E-200-2 and E-200-4 NAVGUIDE Figure 11 NAVGUIDE Tables 11 – 15 IALA GL 1038 and 1051	28
		4a.1.7	Light measurement: units; inverse square and Allard's law				
		4a.1.8	Luminous intensity and nominal range	3			
		4a.1.9	Colour measurement	2			
		4a.1.10	Timing of astronomical events	1			
		4a.1.11	Background lighting and glare	3			
		4a.1.12	Daytime operations: range and sector lights (see **4a.6.1**)				
		4a.1.13	Visual AtoN attribute information	2			
	4a.2		**Light and Characters**				
		4a.2.1	Rhythms and Characters	4		NAVGUIDE 3.2.4; Table 9 IALA MBS IALA Rec E-110; E-200; E-201 IALA Rec E-200-5 IALA GL 1065 and 1069	29
		4a.2.2	Lights used in the IALA MBS				
		4a.2.3	Maximum periods for light characters				
		4a.2.4	Synchronisation of lights	2			
		4a.2.5	Vertical divergence				
		4a.2.6	Performance of lights	3			

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
	4a.3		**Fixed Aids to Navigation**				
		4a.3.1	Types of fixed AtoN and their functions	3	Visit port operating with traffic signals if available	NAVGUIDE 3.2.5	30
		4a.3.2	Day marks				
		4a.3.3	Port Traffic Signals	1		IALA Rec E-111	
	4a.4		**Floating Aids to Navigation**				
		4a.4.1	Use of minor floating AtoN	3	Use of buoy models would be an advantage	IALA MBS; NAVGUIDE 3.2.6 IALA Rec O-104 and O-130 IALA Rec O-133 IALA GLs 1006; 1011; 1046 ; 1047	31
		4a.4.2	Major floating AtoN and light vessels	1			
		4a.4.3	Technical considerations and costs	2			
		4a.4.4	Steel versus plastic buoys				
		4a.4.5	Design considerations			IALA Rec E-107 IALA GL 1036; 1037;1066 Pharos Marine mooring handbook or similar	32
		4a.4.6	Mooring components, design and swing radius	2			
		4a.4.7	Installation and monitoring of buoy positions				
	4a.5		**Topmarks and markings**				
		4a.5.1	Use and design of topmarks	2		IALA Rec E-106	
		4a.5.2	Retro-reflecting materials	1			
	4a.6		**Sector Lights and Leading Lines**				
		4a.6.1	Range lights	2	Sector light and leading line planning exercise	NAVGUIDE 3.2.7 IALA GL 1023 and 1041	33
		4a.6.2	Bearings from seaward and angles of uncertainty	3			
		4a.6.3	Precision Direction Lights				
		4a.6.4	Design considerations for sector lights	2	Visit port with PDL and/or leading lights	IALA Rec E-112	
		4a.6.5	Transits and leading lines				

Table 10   Detailed Teaching Syllabus for Module 4B

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
4B			**TECHNICAL FUNCTIONS – RADIO AtoN**				
	4b.1		**Types of Radio AtoN; New Technology Radars**				
		4b.1.1	Background and definitions	2		NAVGUIDE 4.9.7 Lists of Radio Signals	34
		4b.1.2	New Technology (NT) radars	1			
		4b.1.3	Radar beacons and NT radars	2			
		4b.1.4	Radar target enhancers	1			
	4b.2		**Radar Beacons: Racons - Technical Aspects**				
		4b.2.1	Frequency agile radar beacons (revision of **2.2.6**)	2		NAVGUIDE 4.9.3 IALA Rec R-101 and O-113 IALA GL 1010	35
		4b.2.2	Signal characteristics				
		4b.2.3	Performance criteria				
		4b.2.4	Technical considerations				
	4b.3		**Loran**				
		4b.3.1	Loran-C – basic principles	1		Lists of Radio Signals NAVGUIDE 4.12	
		4b.3.2	Operational chains and their use to monitor GNSS				
		4b.3.3	e-Loran				
	4b.4		**Global Navigation Satellite Systems (GNSS)**				
		4b.4.1	IALA policy (revision of **2b.2.1**)	3		NAVGUIDE 4.9; 4.11 Lists of Radio Signals Mariners Handbook IALA Rec R-121 and R-115 (EU) IALA Recs R-129; R-135; A-124 IALA GLs 1016; 1053; 1060	36
		4b.4.2	GNSS vulnerability				
		4b.2.3	The future of GNSS and DGNSS				
		4b.2.4	Submission of DGNSS as a component of WWRNS				
		4b.2.5	Receiver Autonomous Integrity Monitoring	1			

		4b.5		Automatic Identification System (AIS)				
			4b.5.1	AIS overview: purpose; functions; strategic applications	3		NAVGUIDE 4.12 IALA GL 1028; 1029; 1050 IALA GL 1059 and 1062 IALA Rec A-123; A-124; A-126 ITU-RM.1371	37
			4b.5.2	AIS system characteristics and carriage requirements				
			4b.5.3	Shore-based AIS				
			4b.5.4	AIS as an AtoN				
			4b.5.5	Management and monitoring of AIS				
			4b.5.6	AIS standards and limitations	3	**Note**: LRIT can form part of lecture 39 if considered appropriate	IALA Rec A-126 IALA GL 1062 ITU-RM.585-4 NAVGUIDE 4.11	38
			4b.5.7	AIS generated virtual and synthetic AtoN				
			4b.5.8	Use of Message 8 for meteorological and hydro data				
			4b.5.9	IALA-Net				
			4b.5.10	Long Range Tracking and Identification (LRIT)	1			

4 DETAILED TEACHING SYLLABUS FOR MODULE 4C – VESSEL TRAFFIC SERVICES; MANAGEMENT AND TRAFFIC ROUTEING

Table 11   Detailed Teaching Syllabus for Module 4C

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
4C			**VTS and TRAFFIC ROUTEING**				
	4c.1		**Vessel Traffic Services**				
		4c.1.1	VTS definitions and services	2	External visit to VTS Centre if available	NAVGUIDE Chapter 5 IALA VTS Manual IALA Recs V-102; V-103; V-119 IALA Recs V-120; V-127; V-128 IALA GLs 1014;1017;1027; 1032 IALA GLs 1045; 1068; 1071	39
		4c.1.2	AIS as a VTS tool				
		4c.1.3	VTS beyond the limit of Territorial Seas				
	4c.2		**Traffic Routeing Measures**				
		4c.2.1	Traffic routeing: objectives and definitions	1	Group AtoN planning exercise for selected port approach	NAVGUIDE 6.2 SOLAS Ch V Reg 10 IALA Recs O-134; O-138; P-137 IALA GL 1058 IALA Rec O-139	40
		4c.2.2	Vessel manoeuvring	2			
		4c.2.3	Channel design and mix of AtoN				
		4c.2.4	Use of simulation (see **2b.3.5**)				
		4c.2.5	Offshore structures	1			

5 DETAILED TEACHING SYLLABUS FOR MODULE 4D – SOUND SIGNALS; COMMUNICATIONS; e-NAVIGATION; TIDE GAUGES; STRUCTURES; REMOTE MONITORING AND CONTROL

Table 12   Detailed Teaching Syllabus for Module 4D

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
4D			**SOUND SIGNALS; COMMUNICATIONS; e-NAV; TIDE GAUGES; STRUCTURES; REMOTE MONITORING**				
	4d.1		**Sound Signals**				
		4d.1.1	Use of sound signals			NAVGUIDE 6.5 IALA Rec E-109 and E109B	
		4d.1.2	Fog detectors	1			41
		4d.1.3	Range of sound signals				
	4d.2		**Communications**				
		4d.2.1	Global Maritime Distress and Safety System (GMDSS)	4		NAVGUIDE 6.6.6	
		4d.2.2	Maritime Safety Information (revision of **2a.3.4**)			NAVGUIDE 4.14	44
		4d.2.3	IALA WWRC Plan	2		Lists of Radio Signals	
	4d.3		**e-Navigation**				
		4d.3.1	Definition, strategy and implementation	3	e-Navigation forum on completion	NAVGUIDE 4.2 IALA Rec e-Nav-140	43
		4d.3.2	e-Navigation architecture and components	2		IALA GL 1072	
	4d.4		**Tide Gauges and Current Meters**				
		4d.4.1	Real versus predicted tidal heights	2		NAVGUIDE 2.5	
		4d.4.2	The International Ocean Commission (IOC)			NAVGUIDE 6.7	42
		4d.4.3	Tidal gauges	1			
		4d.4.4	Current meters and the use of buoy platforms				
	4d.5		**Structures and Materials**				
		4d.5.1	Types of material	3	External visit to AtoN maintenance facility	IALA GLs 1007; 1036; 106 IALA GL 1076	46
		4d.5.2	Corrosion and its prevention				
		4d.5.3	Weathering of stone and concrete	1	Visit by coatings expert		
		4d.5.4	Protection and preservation	2	**Note:** Consider combining this lecture in Module 3B		

	4d.6		**Remote Control and Monitoring**				
		4d.6.1	Methods to monitor AtoN	2		IALA GL 1008	45
		4d.6.2	Remote monitoring technologies				
		4d.6.3	Use of AIS Messages 6 and 21				

MODULE 5 **POWER SUPPLY**

1 INTRODUCTION

Module 5 is designed primarily for participants with only a limited knowledge of power supply systems.

Instructors for this module should hold an appropriate scientific degree supported by work experience in the field of electrical power supply. See Part C 4.1 for further guidance.

2 SUBJECT FRAMEWORK

2.1 Scope

The syllabus for Module 5 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 Aim

On successful completion of Module 5, participants will demonstrate the ability to calculate the electrical load at different AtoN stations; select the most appropriate source of electrical power for them and provide protection against the effects of lightning.

3   DETAILED TEACHING SYLLABUS FOR MODULE 5 – POWER SUPPLY

Table 13   Detailed Teaching Syllabus for Module 5

Module	Element	Sub-element	Subject	Level of Competence	Recommended training aids; exercises and external visits	References Rec = Recommendation GL = Guideline	Lecture No.
5			**POWER SUPPLY**				
	5.1		**Types of Power Supply**				
		5.1.1	Non-electrical energy sources	2		NAVGUIDE Chapter 7 IALA GLs 1067-0 to 1067-3	47
		5.1.2	Electric energy sources				
		5.1.3	Silicon solar cells	3			
		5.1.4	Wind and wave electrical generators	1			
		5.1.5	Diesel and petrol generators				
	5.2		**Rechargeable Batteries**				
		5.2.1	Lead-acid batteries	3		IALA GL 1044	48
		5.2.2	Lithium; nickel-hydride; lithium-iron batteries				
		5.2.3	Disposal of batteries	4			
	5.3		**Electrical Loads**				
		5.3.1	Methodology for calculating and defining load profiles	2	Practical use of IALA power calculation Excel Spreadsheet	IALA GL 1039	49
	5.4		**Lightning Protection**				
		5.4.1	Protection of AtoN structures and equipment	2		IALA GL 1012	47

ANNEX A   TRAINING NEEDS ANALYSIS – EXAMPLE FORMAT

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 E 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.

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.

3   ANALYSIS OF EXISTING COMPETENCIES

Before the start of the course of instruction, each participant, regardless of previous qualifications or experience, will be asked to take a short competency test followed by a private interview 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. After the test has been completed, each participant will be given an answer sheet so that participants can self-mark their papers. Participants will then be interviewed privately by the course Assessor. 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 14 below.

Table 14   Example of Participant Training Needs

Module	Element	Sub-element	Subject	Participant A	Remarks	Participant B	Remarks	Participant C	Remarks
1									
2A			**NAUTICAL KNOWLEDGE (GENERAL)**	🟩	Master Mariner	🟥	No maritime experience	🟥	Limited maritime experience
	2a.1		**Introduction – Principles of Navigation**	🟩		🟥		🟥	
		2a.1.1	Introduction to methods of navigation; Lines of Position	🟩		🟥		🟥	
		2a.1.2	Accuracy standards	🟩		🟥		🟥	
3-4		etc.							
5			**POWER SUPPLY**	🟥	Unfamiliar with power supply options for AtoN	🟩	Degree in electrical engineering	🟥	No formal qualification held
	5.1		**Types of Power Supply**	🟥		🟩		🟥	
		5.1.1	Non-electrical energy sources	🟥		🟩		🟥	
		5.1.2	Electric energy sources	🟥		🟩		🟥	

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.

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.

6   DOCUMENTATION

A record, based on Quality Management System principles should be maintained of training progress and results.

7   TRAINING FEEDBACK AND ANALYSIS

Feedback from participants and an analysis of test papers should be used to improve the quality of lectures.