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1. INTRODUCTION

Although there are unique circumstances surrounding the work that Marine Aids to Navigation (AtoN) authorities undertake, in many ways the overall objectives of all businesses are the same:

To perform satisfactorily, meet customer requirements and continuously improve.

In the case of the provision of AtoN, the customer is the mariner, and the aim is to assist the mariner in making safe and efficient passage. Ensuring maritime safety and efficient passage has significant social, environmental and economic benefits. The customer also requires consistency of performance, with confidence that the organization delivers what it says it will deliver.

Many organizations have recognized the need to operate more efficiently, with due regard for cost effectiveness and value for money. AtoN organizations endeavour to identify best practices in service delivery that results in optimum use of management and staff. In addition, this will assist in effective planning; ensuring that funds are invested wisely in new technology; eliminating duplication and waste; and measuring performance to ensure that targets are met and to address areas of risk. Customers expect higher levels of accountability and greater transparency in regard to an organization's management and operations. The result is a growing need to provide and demonstrate quality service delivery, as evidenced through the development and maintenance of a quality management system (QMS).

In some respect quality management and environmental management are closely linked, requiring similar strategies and approaches in delivering the AtoN service.

At its 26th session the IMO Assembly adopted Resolution A.1018(26) *Further Development of the Voluntary IMO Member State Audit Scheme*. This resolution is complementary to resolution A.973(24) *Code for the Implementation of Mandatory IMO Instruments*, A.974(24) *Framework and Procedures for the Voluntary IMO Member State Audit Scheme* and A.975(24) *Future development of the Voluntary IMO Member State Audit Scheme*. As a result of A.1018(26) the audit scheme became mandatory on 1 January 2016.

An established QMS will assist members when preparing for such an audit.

2. SCOPE

This Guideline provides a basic platform for the implementation of a QMS. It is designed to encourage and assist competent authorities to consistently achieve the required outcomes in the delivery of AtoN services. Competent authorities can objectively evaluate compliance to established service levels.

This document provides a generic overview of QMS and should be read in conjunction with IALA Recommendation R0132 *Quality Management for Aids to Navigation Authorities* and related QMS standards documents as appropriate, e.g., ISO 9000 series on quality management systems. In developing a QMS, competent authorities should note that a QMS may be certified to different levels:

- Certification by an accredited third party
- Assessment by a third party
- Self-assessment

The process for implementing any of these mechanisms may vary between competent authorities. In many cases the delivery of AtoN services is only part of the Authority's responsibilities, in which case the QMS is likely to cover more than AtoN services. This guideline will then provide guidance on how to adapt the QMS to the AtoN service parts of the organisation.

3. DEVELOPING A QUALITY MANAGEMENT SYSTEM

The main objective of a QMS is to provide the AtoN service effectively and efficiently. QMS certification demonstrates that the service is being provided in accordance with the published aims of the organization and adds a level of trust between the competent authority and the user. Certification should not be the main objective of developing and implementing any QMS.

3.1. GOVERNANCE FRAMEWORK

The statutory basis for each competent authority should be set out in a way that specifies the legal basis for the provision of the service and/or the regulating activity. The legal powers from which the responsibility flows should also be clearly identified.

A QMS should include references to relevant sections of The *International Convention for the Safety of Life at Sea (SOLAS)*, Chapter V¹ and the IALA NAVGUIDE.

Regarding AtoN; SOLAS, Regulation 13, (Establishment and operation of Aids to Navigation) states:

1. *Each Contracting Government undertakes to provide, as it deems practical and necessary, either individually or in co-operation with other Contracting Governments, such aids to navigation as the volume of traffic justifies and the degree of risk requires.*
2. *In order to obtain the greatest possible uniformity in aids to navigation, Contracting Governments undertake to take into account the international recommendations and guidelines when establishing such aids.*
3. *Contracting Governments undertake to arrange for information relating to aids to navigation to be made available to all concerned. Changes in the transmissions of position-fixing systems which could adversely affect the performance of receivers fitted in ships shall be avoided as far as possible and only be affected after timely and adequate notice has been promulgated.*

For e-Navigation; the definition of e-Navigation adopted by the IMO is:

“e-Navigation is the harmonized collection, integration, exchange, presentation and analysis of maritime information on-board and ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment.

1. *e-Navigation involves the utilization and integration of all available navigational tools to ensure that a greater level of marine safety is achieved. The implementation of e-Navigation will deliver substantial operating efficiencies with resulting commercial and environmental benefits for Contracting Governments.*
2. *e-Navigation incorporates the use of new technologies that helps to enhance the various electronic navigational and communication systems/services.*
3. *e-Navigation provides Contracting Governments the opportunity to optimize the use of technical developments and ensure the focus of future developments is based on a holistic approach to safe berth-to-berth navigation.”*

¹ SOLAS Consolidated Edition, 2009

3.2. SERVICE DEFINITION

Traditionally called maritime signals, all visual, acoustic or radio devices that are meant to improve navigation safety, facilitating traffic and preserving the environment, are considered AtoN.

The service that provides and maintains these devices is called the AtoN service. To exist as such, it requires interaction between the service provider and the user (i.e., the mariner).

There should be uniformity not only in the AtoN themselves, but also in the level of service provided to ensure similar standards throughout the maritime community with particular emphasis in areas that serve as international boundaries.

For the purpose of identifying its scope of activity, the competent authority should prepare a basic document explaining its role and responsibilities and the statutory or other basis for its powers.

The competent authority may use flow processes, matrices and diagrams, to represent the different actions involved in the management of an AtoN system (Annex A refers).

User satisfaction exists when the user receives the service in the expected standards.² These terms should be defined as quality commitments that meet or exceed the minimum accepted standard. A service level commitment may be associated to every single AtoN or to a combination of AtoN.

3.3. ORGANIZATIONAL POLICY

Organizational policy should be developed to translate the organization's vision, mission and values into more specific guidance for provision of the AtoN service. The policy should contain a description of the services to be provided and guidance to align the service with higher-level priorities and objectives. The policy should be periodically reviewed.

3.4. PLANNING

The context of the organization is the combination of those internal and external factors that affect an organization's approach to the way in which it provides products and services that are delivered to its customer.

The organization shall determine external and internal issues that are relevant to its purpose and its strategic direction and that affect its ability to achieve the intended result(s) of its QMS.

When planning for the QMS, the organization shall determine the risks and opportunities that need to be addressed to and plan actions to address these risks and opportunities.

There are a number of internationally recognized QMS Standards. While the terminology used may differ, the basic principles are the same. The implementation of a QMS should generally be carried out by the organization's own staff. While advisors may be used to support and provide guidance on organizational aspects, ownership of the system by the organization is fundamental to its success. Figure 1 is an example of a QMS.

The first steps in developing a QMS include defining:

- Mission, Vision and/or Values
- Organizational Policy
- Strategic Plan
- Business Plan, annual or multi-annual objectives or projects

² Refer to IALA Recommendation O-130 on Categorization and Availability Objectives for Short Range Aids to Navigation Ed 2 (June 2011) and IALA Guideline 1035 on Availability and Reliability of Aids to Navigation Ed 2 (December 2004)

- Quality Manual (Refer to definitions in Section 6)

The use of a QMS will identify strong points and areas of improvement. The cycle of continuous improvement will result in changes to the business plan and QMS. One common method to facilitate continuous improvement is the PDCA (Plan – Do – Check – Act) cycle.

Figure 1 provides an overview of the elements that make up a QMS, and their relationship. There are many items that need to be included in a QMS, such as:

- Organizational level
- Strategic planning level
- Business planning
- Implementation
- Support
- Documentation
- Training

A checklist for items to be included in a QMS is provided at annex B. This checklist should be revised and amended to reflect the specific requirements of a competent authority.

Authorities may have existing documentation and processes that fulfil many requirements of a QMS.

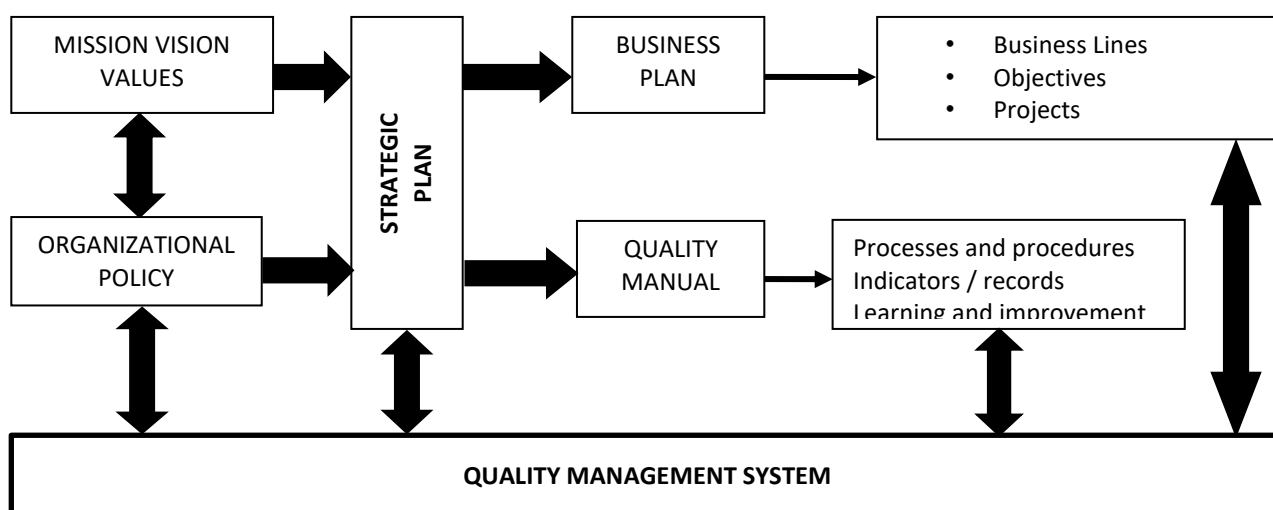


Figure 1 Quality Management System

3.5. RISK EVALUATION

Competent authorities should respond to criteria based on an evaluation of risk, taking into consideration the needs and expectations of users and the impact on other stakeholders.

In evaluating risks, IALA Guideline *G1018 Risk Management* should be referenced.

3.6. IDENTIFICATION OF PROCESSES

The AtoN service is the result of a series of elements and actions provided for the user. This is best represented through the management by process method, involving Management (Strategic) Processes, Operational (Key) Processes and Support Processes, or Sub-Processes.

3.7. MANAGEMENT BY PROCESS

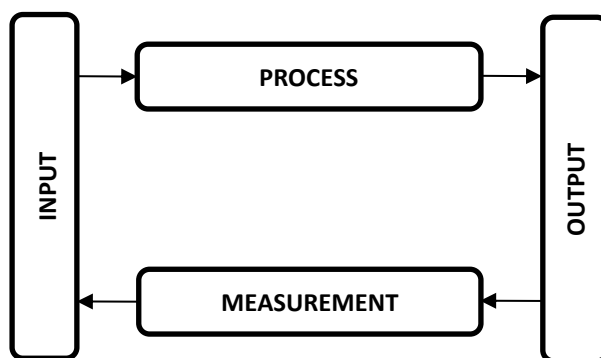


Figure 2 Management by Process

All processes (including Strategic, Key and Support processes or Sub-Processes), as explained in this section, should follow the scheme in Figure 2. Each process identifies input and output elements and should be assigned a ‘process owner’ responsible for the activity, its management, and improvement. The process should also determine a regulating framework, necessary resources, specific tasks and any sub-processes required. The process should clearly define measurement, recording points and the target values for each aspect, so that the entire process is auditable. This ensures that the process has traceability and may be reviewed by third parties.

The process should also ensure that stakeholders’ needs and expectations are clearly identified. To identify processes, the competent authority should state its mission and perform a strengths, weaknesses, opportunities and threats (SWOT) analysis, comparison to benchmarks and/or gap analysis. Results from these analyses are used to detect deficiencies and to assist with the definition of strategic and other processes in support of the mission.

To implement the business lines, key (operational/direct) and support (generic) processes should be developed. The following are examples of processes that, among others, should be considered in the AtoN Service.

3.7.1. MANAGEMENT PROCESSES

- Study and review stakeholder requirements
- Study and review AtoN technology
- Preparation of standards and recommendations
- Management control (costs/results /resources)
- Communication, image and presence in Society
- Organization structure

3.7.2. OPERATIONAL PROCESSES

- Design, build and revision of AtoN
- Deployment of AtoN
- Monitoring and inspection of AtoN (Service Operation)
- Maintenance and corrective action of AtoN

3.7.3. SUPPORT PROCESSES

- Outsourced service management
- Information systems and databases
- Finance and cost accounting
- Legal assessment
- Personnel management and training
- Surveys, records and auditing
- Logistics (transport, facilities)
- Health and safety

Processes should unfold through flow diagrams that define each one of the different activities. Each competent authority should prepare its own process maps. Examples of process maps are given in annex A.

3.8. DEVELOPING PERFORMANCE CRITERIA

There are four monitoring and measurement areas that need to be considered by the competent authority when developing performance criteria and implementing a QMS. The performance measurement of these areas provides a systematic method and approach to continual improvement:

3.8.1. SERVICE DELIVERY (MONITOR AND MEASUREMENT OF SERVICE)

The competent authority should monitor and measure the characteristics of the service to verify that service requirements have been met. This should be carried out at appropriate stages of the service realization process in accordance with the planned arrangements.

3.8.2. STAKEHOLDER SATISFACTION

As one of the measurements of the performance of the QMS, the Competent Authority should monitor Information - relating to stakeholder perception as to whether the organisation has met stakeholder requirements.

The methods of obtaining and using this information should be determined locally. IALA- Guideline 1079 on Establishing and Conducting user consultancy by Aids to Navigation Authorities refers.

3.8.3. MONITORING AND MEASUREMENT OF PROCESSES

The competent authority should apply suitable methods for monitoring and, where applicable, measurement of the QMS processes. These methods should demonstrate the ability of the processes to achieve planned results. When planned results are not achieved, corrective action should be taken, as appropriate, to ensure conformity.

3.8.4. INTERNAL AUDIT

The competent authority should conduct internal audits at planned intervals to determine whether the QMS:

- conforms to the planned arrangements and the QMS requirements established by the competent authority; and
- is effectively implemented and maintained.

3.9. DOCUMENTED INFORMATION

Documentation and records are basic elements in any QMS. Without documents and records, it is difficult to consider any kind of improvement action.

The organisation should keep documented information as being necessary for the effectiveness of the quality management system. The extent of documented information for a quality management system can differ from one organisation to another due to the size of organization and its type of activities, processes, products and services, the complexity of processes and their interactions and the competence of personnel.

The basic objectives of the service should respond to specific normative, mandatory, and reference documentation. These references should be composed of international and national standards, and, if applicable, regional or local standards.

All documents required by the QMS shall be controlled.

Documented information needed to be maintained by the authority for the purposes of establishing a QMS should at least include:

- documented information necessary to support the operation of processes
- the quality policy
- the quality objectives

Documented information for the purpose of communicating the information necessary for the authority to operate could be retained. Although they are not specifically required, examples of documents that can add value to a QMS may include:

- Organisation charts
- Process flow charts
- Procedures
- Specifications
- Documents containing internal communications
- Approved supplier lists
- Test and inspection plans
- Quality plans
- Quality manuals
- Strategic plans
- Forms

3.10. COMMUNICATION AND AWARENESS

The QMS must include the participation of all stakeholders affected by or involved in the delivery of the AtoN service. Stakeholders can be internal (such as administration staff) or external (such as mariners or the public).

A QMS should ensure that communication protocols are established with all stakeholders to maintain effectiveness and awareness of the QMS. These communication protocols will facilitate managing stakeholder expectations, risk management and service delivery.

3.10.1. STAKEHOLDER IDENTIFICATION

To facilitate communication and awareness, an important task is stakeholder identification. The participation of mariners and other users may be achieved in different ways but should be documented in the QMS.

The following are potential stakeholders for the AtoN service:

3.10.2. INTERNAL

The internal stakeholders of the AtoN service could include:

- staff of the competent authority; and
- government or regulating authority.

3.10.3. EXTERNAL

The external stakeholders of the competent authority could include:

- mariners: whatever their activity (including commercial traffic, fishing vessels and pleasure craft), mariners must be considered as the main users of the marine AtoN service, to the extent that such a service is used to facilitate their navigation and improve their safety; and
- others – including, but not limited to:
 - authorities, other than competent authorities;
 - shipmasters and their organizations;
 - marine pilots;
 - related agencies (including hydrographical institutes, marine search and rescue, marine structure agencies, organizations representing fishermen and leisure interests, etc.); and

- the community in general (including those affected by the environmental impact of the AtoN or heritage value, including also NGOs (Non-Governmental Organizations) in this field).

4. IMPLEMENTING A QUALITY MANAGEMENT SYSTEM

Once a QMS has been developed, specific elements will be required to ensure full implementation. Many of these elements will be on-going and will necessitate continuous development through the maintenance of the QMS (Section 6 refers).

4.1. TRAINING AND AWARENESS

The competent authority should have assigned process ownership to enable staff to comply with the QMS. The owner shall be responsible for the process, its management and its improvement.

The training for staff within the QMS should be aligned to the competency requirements determined for the process. Recommended competencies for all training activity are set out in IALA Recommendation *R0141 Training and Certification of Marine AtoN Personnel*.

Mechanisms to enable staff to reach and sustain the required level of competence should include:

- ensuring staff introduction training incorporates quality management training;
- ensuring that career development training incorporates QMS training;
- access for staff to QMS documents, e.g., web-based;
- recognising accredited courses, e.g., those published by the IALA World-Wide Academy; and
- feedback loop including comments, suggestions and statistical information.

4.2. STAKEHOLDER RELATIONSHIPS

To facilitate ongoing communication and awareness, stakeholders must be included in the implementation. The participation of users and other stakeholders may be achieved in different ways but should be documented in the QMS.

As one of the measurements of the performance of the AtoN service, the competent authority should monitor information relating to stakeholder perception as to whether the organization has met stakeholder requirements. The methods of obtaining and using this information should be determined locally but could include:

- establishing ongoing consultative forums;
- communicating implications of establishment of QMS; and
- ensuring stakeholders continue to receive the service to a consistent standard during implementation.

4.3. RESOURCE MANAGEMENT

Resources assigned to a process should be considered independently. These resources may be owned by the entities responsible for the process, may be subcontracted, or may be identified by some other type of indirect transaction.

Resources available to a competent authority for supporting the QMS can include:

- infrastructure (e.g., AtoN maintenance management system):
 - systems (hardware, software);

- buildings;
- logistics e.g., transport;
- working environment (Health and safety);
- financial; and
- people.

4.4. PROVISION OF SERVICES

The competent authority should monitor and measure the characteristics of the service provided to verify that service requirements have been met. This should be carried out at appropriate stages of the service realization process in accordance with the planned arrangements.

4.5. PERFORMANCE MEASUREMENT

The competent authority should apply suitable methods for monitoring and, where applicable, measurement of the QMS processes. These methods should demonstrate the ability of the processes to achieve planned results. When planned results are not achieved, corrective action should be taken, as appropriate, to ensure conformity.

The performance management process involves creating and maintaining a system for comparing performance against key performance indicators and would normally include:

- collection, analysis & reporting of performance data;
- feedback to process owner/service provider; and
- corrective action including refining processes where necessary.

4.6. AUDITING

The initial verification of a QMS implementation is typically conducted through an audit process. These audits are generally structured around international or national standards, such as those referenced in the Voluntary IMO Member State Audit Scheme. For guidance on preparing for a Voluntary IMO Audit, refer to IALA Guidelines G1054 and G1115.

The competent authority should conduct internal and/or external audits at planned intervals to determine whether the QMS:

- conforms to the planned arrangements and to the QMS requirements established by the competent authority; and
- is effectively implemented and maintained.

5. MAINTAINING A QUALITY MANAGEMENT SYSTEM

Once a QMS has been developed and implemented, organizations must strive for the satisfaction of their stakeholders and the continuous improvement of the QMS. Continuous improvement is a process of increasing the effectiveness of the organization to fulfil its quality policy requirements and defined quality objectives.

This section provides AtoN organizations with a basic platform for maintaining a QMS so that they can extend beyond compliance into business improvement. Organizations can learn to use the QMS as a business tool to improve performance and efficiency of their processes.

In maintaining an effective QMS the focus should be on continual business improvement. This should be fostered and led by senior management of an organization. A QMS is a dynamic system that should be continually reviewed and updated in order to operate effectively.

5.1. CHARACTERISTICS OF AN EFFECTIVE QMS

Characteristics of an effective QMS may include:

- flexibility and adaptability;
- development and ownership by personnel within the organization;
- the organization taking responsibility for a strategic approach to maintaining a quality management system;
- a basis for continuous improvement;
- effective allocation of resources (financial/training/personnel/etc.);
- system processes supportive of stakeholder's needs and expectations;
- an audit process acknowledged as adding value to the organization; and
- effective organizational communication.

An example of a process-based continuous improvement cycle for a quality management system is shown at Figure 3.

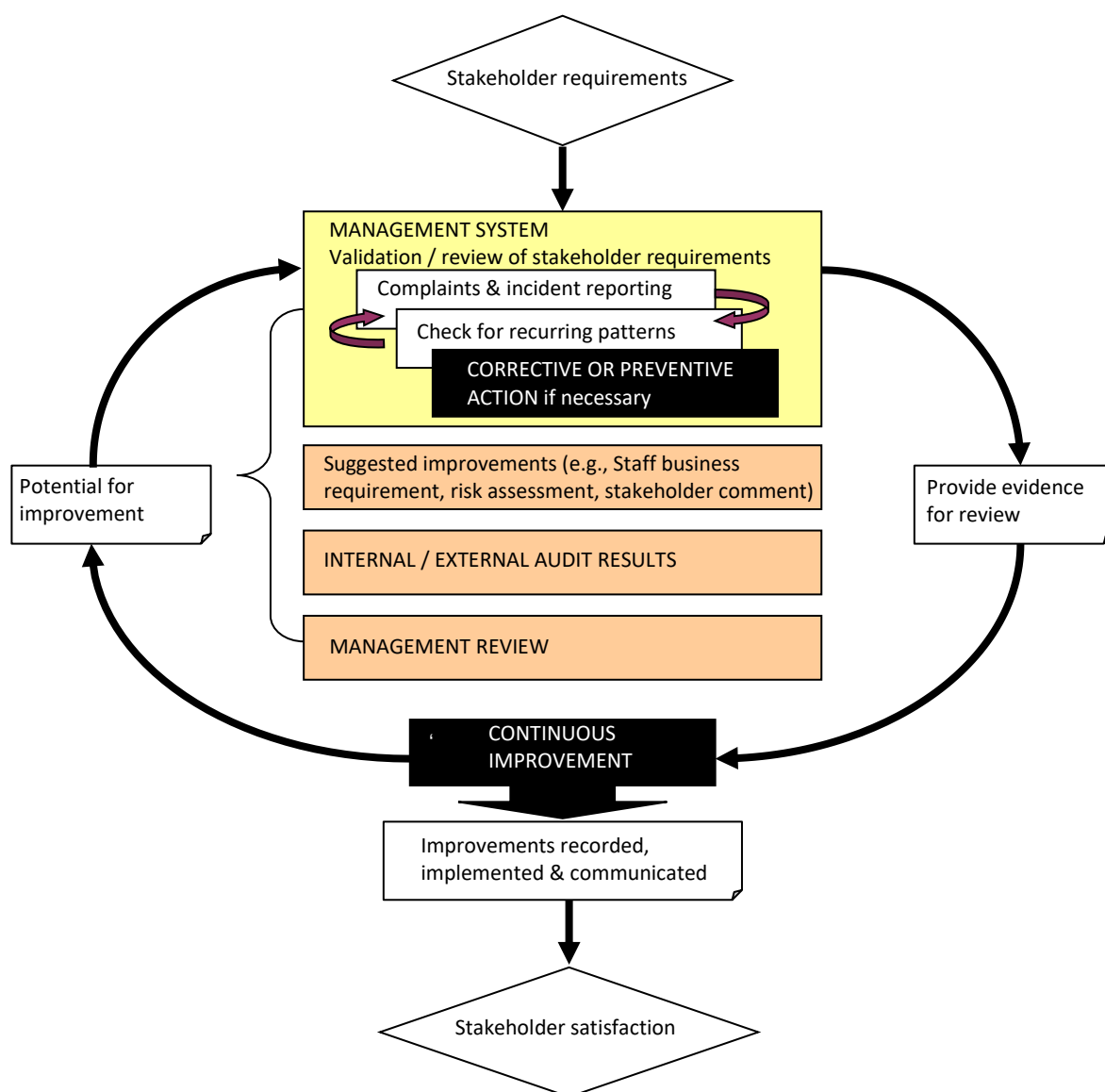


Figure 3 Model of a continuous improvement cycle of a QMS

5.2. COMPONENTS OF MAINTAINING AN EFFECTIVE QMS

To ensure the continued relevance and effectiveness of the QMS, the organization should undertake reviews and maintenance of the system. Components of maintaining the QMS include:

- management review;
- stakeholder satisfaction;
- internal / external communications;
- audit of the QMS; and
- continuous improvement.

In some cases, all of the areas can be captured and reported on through a single management review forum and/or report as the primary means for ensuring that the system is being maintained and improved.

5.3. MANAGEMENT REVIEW

Periodic management reviews should be conducted by personnel who have the appropriate authority to implement changes, taking into account relevant feedback from other interested parties. They should:

- ensure that the processes developed whilst establishing a QMS, are still applicable (section 3.7); and
- the management review should consist of, but not be limited to:
 - AtoN Management System/Policies/Objectives/Procedures;
 - legal/legislative framework for provision of AtoN service;
 - AtoN stakeholder consultation;
 - AtoN resources (physical/financial/training/etc.);
Are they adequate for appropriate level of service?
 - performance measurement results and future targets;
 - effectiveness of corrective or preventative actions; and
 - AtoN internal/external audits (i.e., IMO-Voluntary Audit Scheme, ISO compliance).

5.4. STAKEHOLDER SATISFACTION

Stakeholder satisfaction arrangements should be confirmed:

- Are processes developed for collecting stakeholder satisfaction implemented and accurately capturing that information?
- Are the appropriate metrics being captured?
- Do the results meet pre-stated stakeholder satisfaction targets?
- Ensure stakeholder satisfaction results are reviewed.

5.5. INTERNAL AND EXTERNAL COMMUNICATION

Internal and external communication arrangements should be confirmed:

- Is information communicated in line with the communication plan?
- Review communication plan to ensure continued effectiveness:
 - is adequate marine information being effectively communicated?
 - do metrics indicate communication deficiencies?

5.6. AUDIT OF THE QUALITY MANAGEMENT SYSTEM

Audit procedures should be confirmed:

- Ensure sufficient resources continue to be allocated to ensure all AtoN activities are audited within a suitable timeframe.
- Ensure all internal auditors continue to be fully competent (i.e., training and experience).
- Ensure audit results are reviewed and promulgated.

5.7. IMPROVEMENT

The organization shall determine and select opportunities for improvement and implement any necessary actions to meet customer requirements and enhance customer satisfaction. Examples of improvement can include correction, corrective action, continual improvement, breakthrough change, innovation and re-organisation.

- ensure opportunities for improvement continue to be identified and that they are:
- recorded and assessed;
- implemented and evaluated;
- communicated to appropriate stakeholders.
- ensure opportunities for improvement are reviewed to enable optimisation of performance measures.

An established method for continuous improvement is the Plan – Do – Check – Act (PDCA) cycle which is integral to many QMS.

PDCA is described as an improvement cycle based on the scientific method of proposing a change in a process, implementing the change, measuring the results, and taking appropriate action. It is also known as PDSA, where the “S” stands for “study”.

The PDCA cycle has four stages:

- 1 Plan — identify goals for a process and necessary changes to achieve them.
- 2 Do — implement the changes.
- 3 Check — study and evaluate the results in terms of performance
- 4 Act — establish the change as standard or begin the cycle again, depending on the results

PDCA is the foundation of continuous improvement. Management sets targets (plan) against a stable baseline of performance. Teams implement improvements (Do) to achieve the targets. Then they measure (Check) the change to evaluate performance against the target. If the team has achieved a measurable gain, it standardises (Act) the new method by updating the standardised work. This ensures the improvement is stable.

An illustration of the PDCA cycle is shown in figure 4.

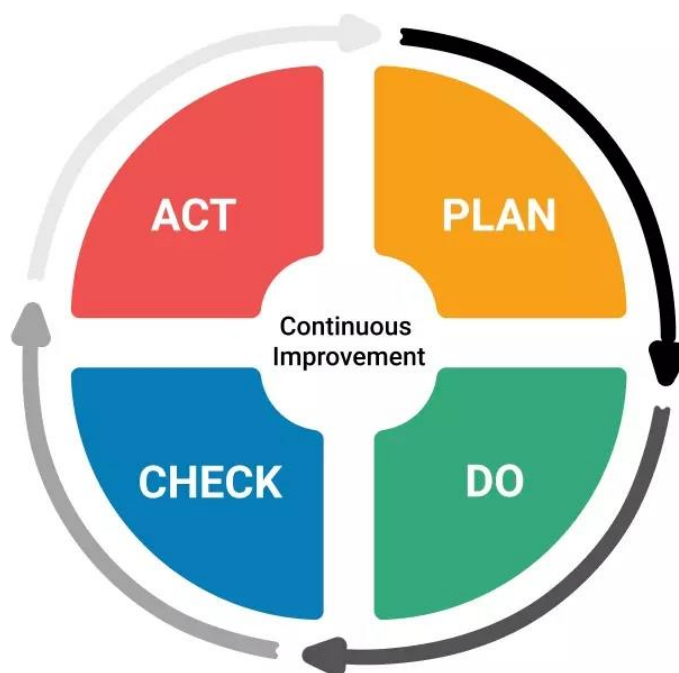


Figure 4 Illustration of PDCA cycle

6. DEFINITIONS

The definitions of terms used in this Guideline can be found in the *International Dictionary of Marine Aids to Navigation* (IALA Dictionary) and were checked as correct at the time of going to print. Where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.

In addition, to assist in the use of this document, a number of definitions are supplied. There are a number of internationally recognized QMS Standards and further definitions can be found in these standards.

| | |
|------------------------------------|--|
| Marine Aid(s) to Navigation (AtoN) | A device, system or service, external to vessels, designed and operated to enhance safe and efficient navigation of individual vessels and/or vessel traffic |
| Competent authority | An authority made responsible, in whole or in part, by the Government for the safety (including environmental safety) and efficiency of aids to navigation service provision and the protection of the environment. |
| Audit | A systematic and independent verification process to assess whether the required standards are being met. |
| Benchmarks | (also "best practice benchmarks" or "process benchmarking") is a process used in management and particularly strategic management, in which organizations evaluate various aspects of their processes in relation to best practice, usually within their own sector. |
| Certification | Demonstrates that the service or product is being provided in accordance with a standard. |



| | |
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| Customer / User/ Stakeholder | A person or group that benefits from a product or service. |
| Gap Analysis | A business assessment tool enabling a company to compare its actual performance with its potential performance. Gap analysis naturally flows from benchmarking or other assessments. |
| Governance Framework | A set of responsibilities and practices, policies and procedures, exercised by an authority to provide strategic directive, ensure objectives manage risk and use resources responsibly and with accountability. |
| Performance Measurement | The use of statistical evidence to determine progress toward specific defined organizational objectives. |
| Quality Manual | Documentation that identifies the processes and procedures, technical instructions, indicators, records, forms of measurement, monitoring analysis and improvement to ensure that stakeholder requirements, needs and expectations are met. |
| Risk Management | Process of measuring or assessing risk and developing strategies to manage the risk. |
| Strengths, Weaknesses, Opportunities and Threats | Analysis process to identify areas for improvement and assist with the definition of the strategic and other processes in support of the business activities. |
| Voluntary IMO Member State Audit Scheme | (IMO Resolution A.973(24) and A.974(24) refer) |

7. ABBREVIATIONS

| | |
|--------|--|
| AtoN | Marine Aid(s) to Navigation |
| IMO | International Maritime Organization |
| ISO | International Standardization Organization |
| NGO | Non-Governmental Organization(s) |
| PDCA | Plan – Do – Check – Act cycle |
| QMS | Quality Management System(s) |
| SOLAS | International Convention for the Safety of Life at Sea (IMO 1974 as amended) |
| SWOT | Strengths, Weaknesses, Opportunities and Threats |
| THLS | Trinity House Lighthouse Service |
| VIMSAS | Voluntary IMO Member State Audit Scheme |
| VTs | Vessel traffic services |
| WWA | World-Wide Academy (IALA) |

8. REFERENCES

- [1] IALA. Recommendation R0132 (O-132) on Quality Management for Aids to Navigation Authorities
- [2] IALA. Guideline G1018 Risk Management
- [3] IALA. Guideline G1054 Preparing for IMO Voluntary Audit AtoN Service Delivery
- [4] IALA. Guideline G1079 Establishing and Conducting user consultancy by Aids to Navigation Authorities
- [5] IALA. Guideline G1115 Preparing for an IMO Member State Audit Scheme



- [6] IMO. Resolution A.973(24) Code for the Implementation of Mandatory IMO Instruments
- [7] IMO. Resolution A.974(24) Framework and Procedures for the Voluntary IMO Member State Audit Scheme
- [8] IMO. Resolution A.975(24) Future development of the Voluntary IMO Member State Audit Scheme
- [9] IMO. Resolution IMO Resolution A.1018(26) Further Development of the Voluntary IMO Member State Audit Scheme
- [10] ISO 9000 series on quality management systems



ANNEX A PROCESS DIAGRAMS

The following sample diagrams have been provided, with permission, by IALA members. These are included to assist in the development of individual process diagrams. For further information on specific diagrams, please contact the AtoN organization directly.

A.1. TRINITY HOUSE

For example, the following diagram represents the core business (key processes), according to Trinity House.

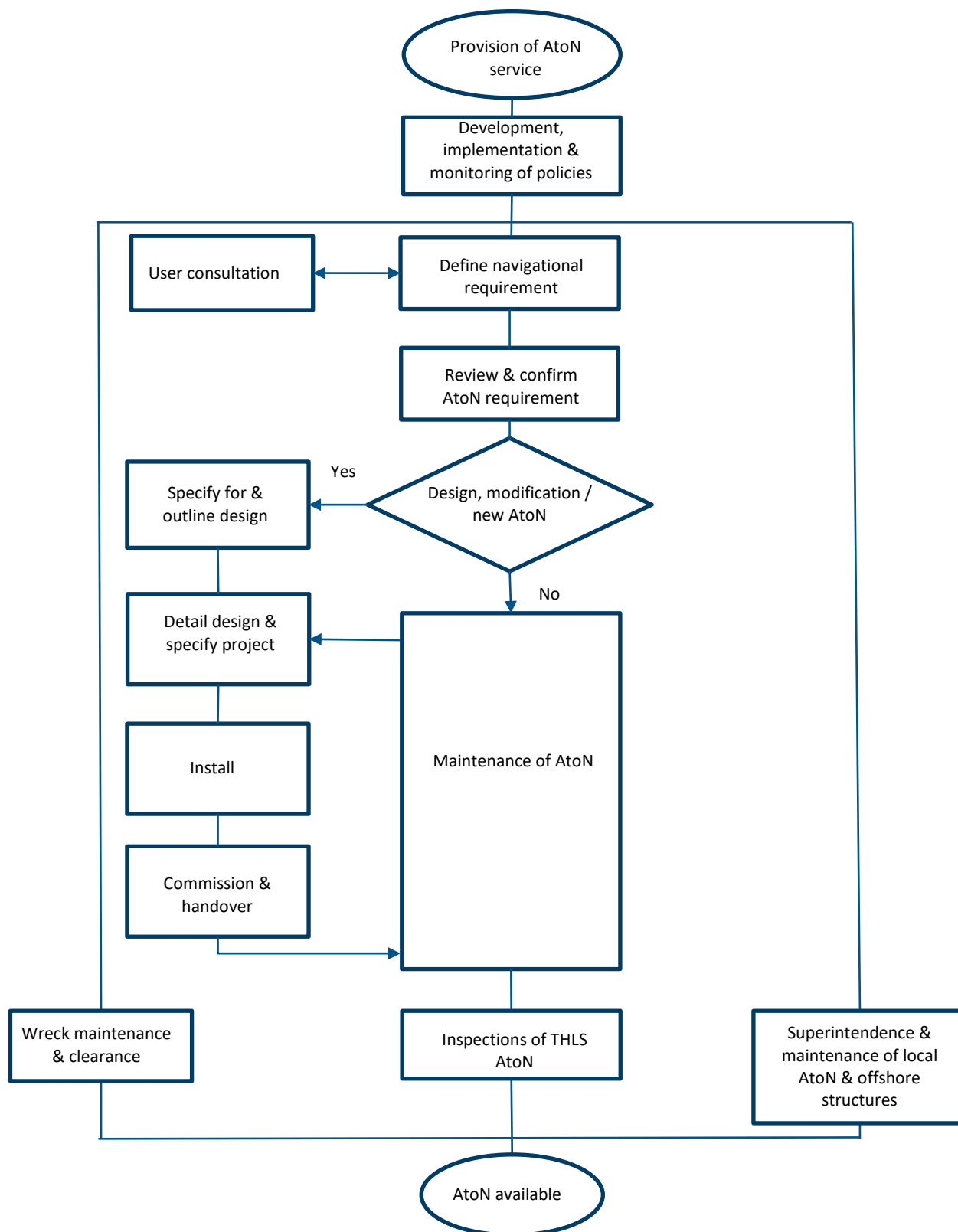


Figure 5 Core business (key processes), of Trinity House



A.2. STATE PORTS - SPAIN STATE PORTS - SPAIN

The following example is the process map for the marine Aids to Navigation service of State Ports (Spain). The Process Map is a matrix in which 'horizontal' relationships cross over a 'vertical' structure. The process relationships, reflected high, medium and low involvement, of the strategic and support processes through the key processes.

Table 1 Process map for marine Aids to Navigation

| General Regulation specific to AtoN | User Participation | Communication, image, presence in Society | Management Control | Preparation of standards and recommendations | Strategic planning for the service | ' State-of-the-art' study and review on the subject | KEY PROCESSES | Purchase and service subcontracting management | Infrastructure maintenance management and spare part policy | Information systems and Databases | Cost accounting | Legal assessment | Personnel management and Training | Surveys, records and auditing | General regulation infrastructures, safety and Environment |
|-------------------------------------|--------------------|---|--------------------|--|------------------------------------|---|-------------------------------|--|---|-----------------------------------|-----------------|------------------|-----------------------------------|-------------------------------|--|
| X | X | O | O | X | X | X | BEACONING DESIGN AND REVISION | - | O | O | O | O | X | X | X |
| O | | | | | | | BEACONING APPROVAL | | | | | | X | X | |
| X | - | - | - | X | - | O | IMPLEMENTATION OF AIDS | X | O | X | X | X | X | X | X |
| O | X | X | X | X | - | O | SERVICE OPERATION | X | X | X | X | X | X | X | X |
| O | - | - | - | X | - | - | INSPECTION AND MONITORING | O | O | X | - | X | X | X | X |
| STRATEGIC PROCESSES | | | | | | | | SUPPORT PROCESSES | | | | | | | |

X=High

O=Medium

-=Low

A.2.1. SPAIN – PUERTOS DEL ESTADO – EXAMPLE 1

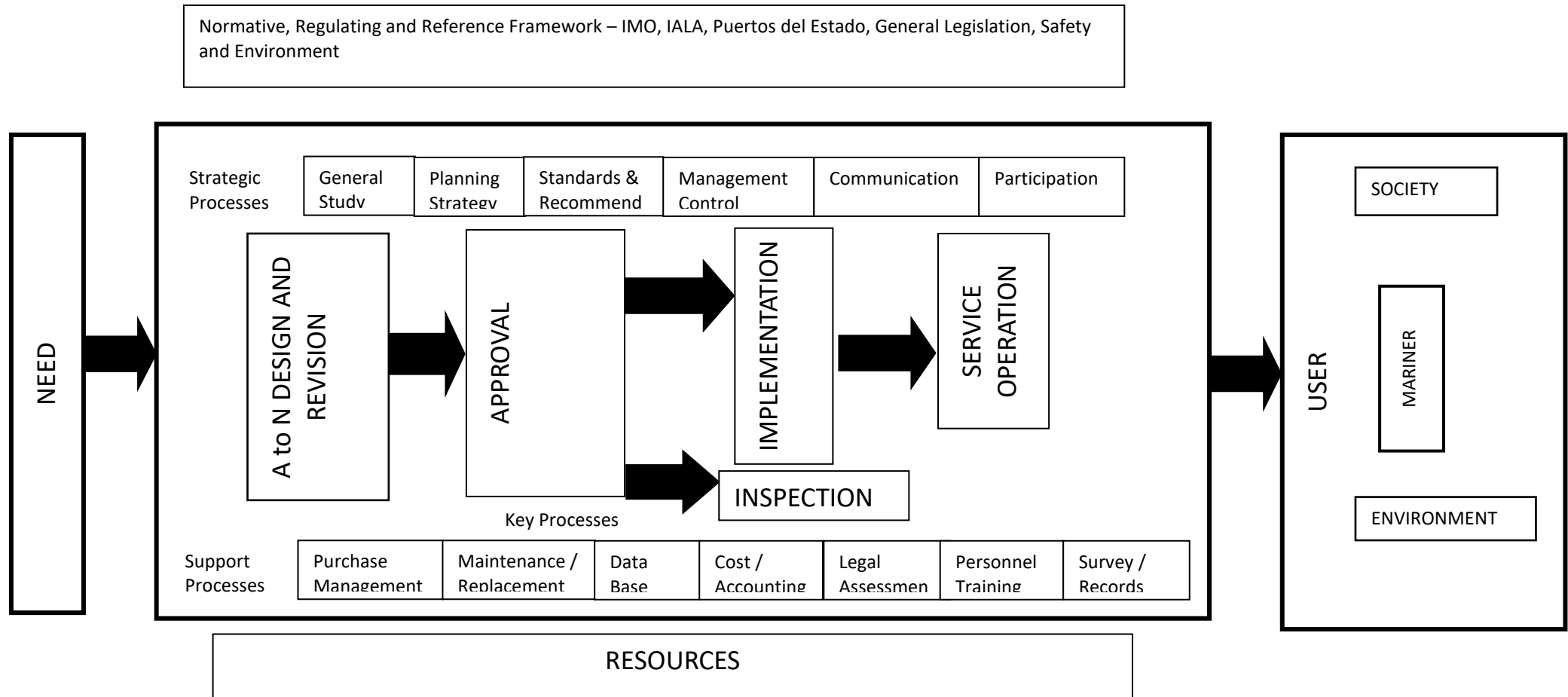


Figure 6 Normative, Regulating and Reference Framework

A.2.2. SPAIN – PUERTOS DEL ESTADO – EXAMPLE 2

A.2.2.1. Process: AtoN Design and Revision

OWNER:

State port area of influence: PORT AUTHORITY

State non-port area: STATE PORTS

INPUT: New need or revision of AtoN in the area under consideration.

OUTPUT: Proposal for Aids to Navigation, (upgrade)

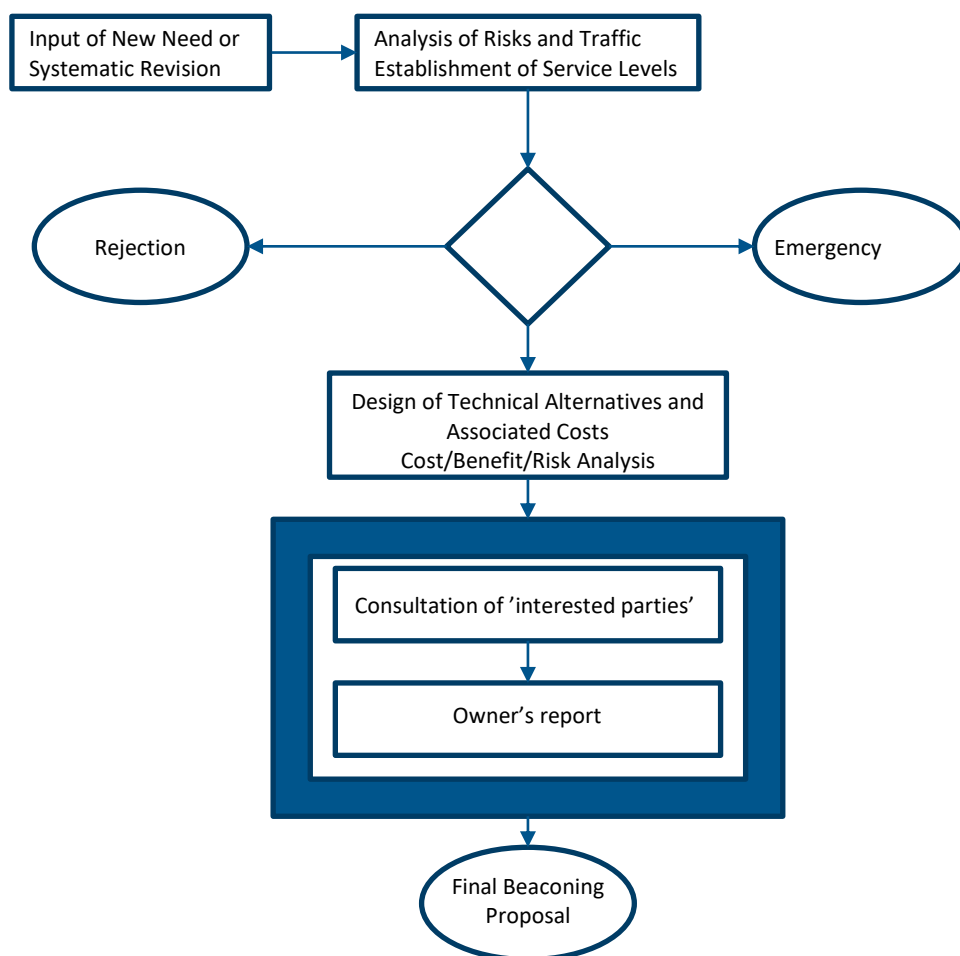


Figure 7 Process Diagram

A.3. CHINA MARITIME SAFETY ADMINISTRATION (CHINA MSA)

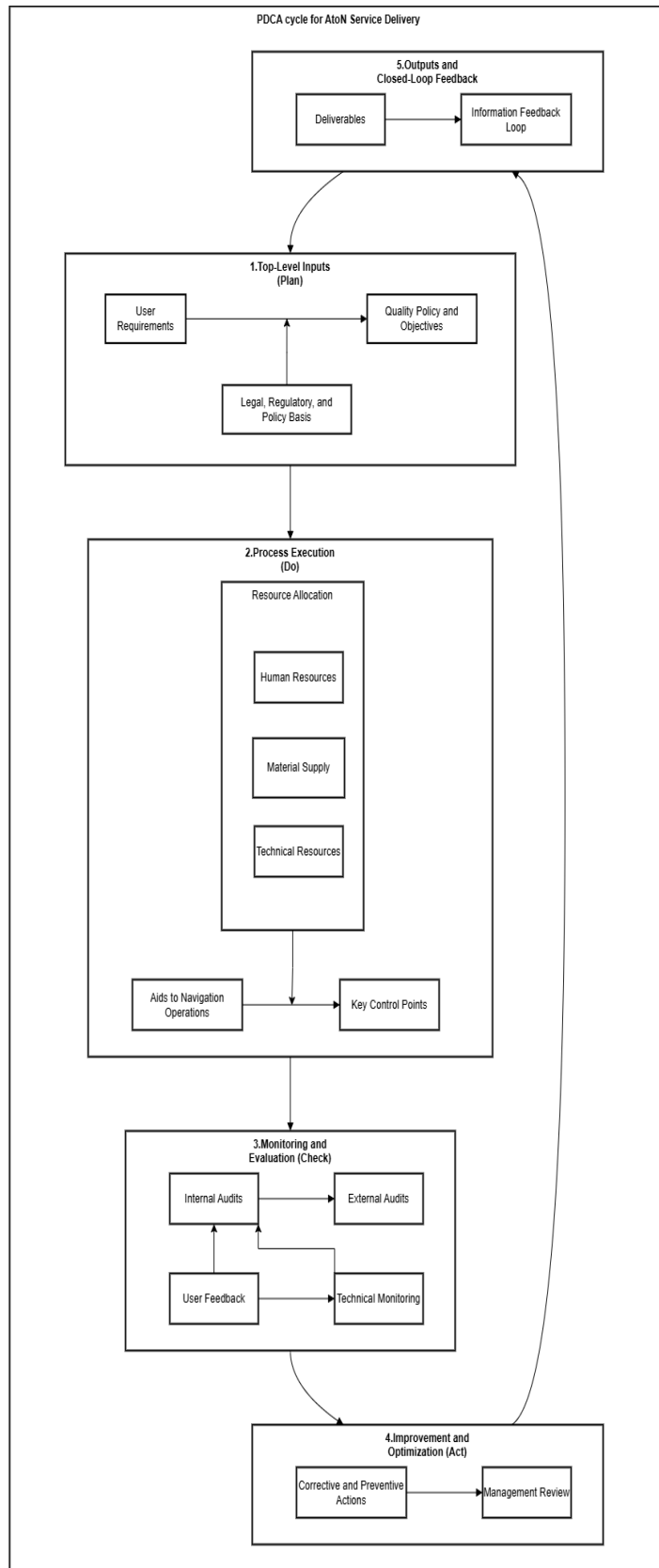


Figure 8 PDCA cycle for AtoN Service Delivery

1. Top-Level Inputs (Plan)

- User Requirements
 - Needs of port authorities, shipping companies, mariners, and regional maritime economic development, etc.
- Legal, Regulatory, and Policy Basis
 - SOLAS Convention, Maritime Traffic Safety Law of the People's Republic of China, Regulations on Aids to Navigation of the People's Republic of China, and administrative decrees from the Ministry of Transport, etc.
- Quality Policy and Objectives
 - Core service objectives (e.g., effective navigation assistance, availability $\geq 99\%$).
 - Defined quality commitments (safety, timeliness, reliability, accuracy, etc.).

2. Process Execution (Do)

- Resource Allocation
 - Human Resources: Role assignment, personnel training (e.g., vocational certification for AtoN technicians, etc.).
 - Technical Resources: Remote monitoring systems, BeiDou Positioning Technology, etc.
 - Material Supply: Procurement of equipment, inventory management, fleet allocation, etc.
- Aids to Navigation Operations
 - AtoNs layout design.
 - Deployment and implementation.
 - Routine inspection and maintenance.
 - Fault response.
- Key Control Points
 - Technical specifications of AtoNs (shape, color, light rhythm, range, etc.).

3. Monitoring and Evaluation (Check)

- Quality Control
 - Internal/External Audits: Periodic reviews of the QMS.
 - User Feedback: Satisfaction surveys.
 - Technical Monitoring: Real-time operational data tracking, fault statistics, and analysis, etc.
- Performance Metrics
 - Availability indicators (e.g., normal rate of AtoN, normal rate of AtoN maintenance).

4. Improvement and Optimization (Act)

- Corrective and Preventive Actions
 - Root cause analysis (e.g., supply chain tracing for batch failures etc.).
 - Process optimization (e.g., integrating drone inspections to supplement manual checks).
- Management Review
 - Annual review meetings to adjust quality objectives and resource allocation.
 - Decisions on new technology adoption (e.g., 5G+ integration, multifunctional AtoNs).

5. Outputs and Closed-Loop Feedback

- Deliverables
 - Continuous standardized navigation services (compliant with national mandatory standards).
 - AtoNs deployment optimized for maritime traffic flow.
- Information Feedback Loop
 - Integration of monitoring data and analysis results into management review inputs

ANNEX B CHECKLIST FOR DEVELOPING A QMS

When developing a QMS, the items below should be reviewed and referenced in some manner. Existing documentation may already provide the basis for many elements on the list. This list may be adapted to meet the specific requirements of the competent authority.

Table 2 Checklist for developing a QMS

| Element | How Met? |
|---|----------|
| Scope and objectives of the AtoN service | |
| Geographic limits, area of responsibility | |
| Regulating National Authority | |
| Authorities or agencies providing the service | |
| Organizational structure | |
| Possible alliances | |
| Stakeholders | |
| Mandatory and reference documentation | |
| Measurement | |
| Records | |
| Internal and external audits | |
| Mechanisms for dealing with non-compliances | |
| Training needs | |
| Supplier management | |
| Improvement actions | |