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***AISM***Association Internationale de Signalisation Maritime ***IALA***

International Association of Marine Aids to Navigation and Lighthouse Authorities

10, rue des Gaudines

78100 Saint Germain en Laye, France

Telephone: +33 1 34 51 70 01 Fax: +33 1 34 51 82 05

e-mail: [contact@iala-aism.org](mailto:contact@iala-aism.org) Internet: [www.iala-aism.org](http://www.iala-aism.org)

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**On**

**Cost Engineering of Short Range AtoN and Asset Management**

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Cost Engineering of Short Range AtoN and Asset Management

# Introduction

Strategic cost management has become an essential tool for all organisations. AtoN provision can be considered in the context of any service provision business. In order to ensure that mariners are provided with the most cost effective AtoN service, cost management is essential.

Strategic cost management is a way to address cost concerns while preserving the key parts of the business While formulating the strategy for the accomplishment of organizational overall objectives, different cost drivers should be clearly identified. Identification of key cost drivers help administrations to focus on key activities that will constitute almost 90% of the total costs. In view of this, the importance of strategic cost management should not be underestimated. This implies that organization should be installing an appropriate framework of strategic cost management to reduce its costs in key areas on which the success of organization is heavily dependent.

Cost management can be considered as the process of planning and controlling the budget of a business. It is a form of management accounting that allows a business to predict impending expenditures to help reduce the chance of going over budget. Many businesses employ cost management plans for specific projects, as well as for the over-all business model. Management of cost related activities is achieved by collecting, analysing, evaluating, and reporting cost information used for budgeting, estimating, forecasting, and monitoring costs.

# Purpose

The purpose of this guideline is to provide guidance on cost effective provision and management of Aids to Navigation (AtoN).

# Scope

This guideline will set out methods for assessing the cost of AtoN provision and performance indicators to assist AtoN service providers ensure that mariners are provided with the most cost effective AtoN service. The use of Key Performance Indicators (KPI) is considered and KPIs for different business areas are suggested.

This document should be considered as complimentary to other IALA quality recommendations and guidelines which are referenced in the relevant sections.

# Overall concept of asset management

Asset management is the practice of managing assets to achieve the most cost-effective solution that meets the customer requirements. Included in this is the process of monitoring and maintaining facilities and systems, with the objective of providing the best possible service to users. KPIs enable objective measurement of performance leading to good management.

# Financial

All aspects of a business can be related to cost, enabling a critical evaluation of cost to be carried out in each area.

## Cost benefit analysis

This is a systematic process for calculating and comparing financial benefits and costs of a project or decision.

Asset

1. Cost areas associated with AtoN provision

Cost Benefit analysis has two purposes:

1. To determine if it is a sound investment/decision (justification/feasibility),
2. To provide a basis for comparing projects. It involves comparing the total expected cost of each option against the total expected benefits, to see whether the benefits outweigh the costs, and by how much.

It should also take into account the time frame of an implementation and the impact this may have on both funding and resource profile.

These tools need to be used for new capital investment and should help set future maintenance and investment commitment. This will set a baseline for asset performance both in maintenance cost and resource.

## Whole life cost

Whole life cost refers to the total cost of ownership over the life of an asset. Also commonly referred to as "cradle to grave" costs. Costs considered include the financial cost which is relatively simple to calculate and also the environmental and social costs which are more difficult to quantify and assign numerical values. Typical areas of expenditure which are included in calculating the whole-life cost include, planning, design, construction and acquisition, operations, maintenance, renewal, depreciation and cost of finance and disposal.

## Depreciation

A common accounting tool used to compare costs of different expenditure streams is net present value. This enables costs in different time periods to be depreciated to a single time, enabling comparison of present day value of different expenditure streams. The table shown in Annex D enables calculation of NPV for any particular project.

## Fixed/ variable costs

In economics, fixed costs are business expenses that are not dependent on the level of services provided by the business. They tend to be time-related, such as salaries or rents being paid per month, and are often referred to as overhead costs. This is in contrast to variable costs, which are volume-related (and are paid per quantity produced). Depending on an Administration’s financial recording system, fixed and variable costs may be measurable against specific AtoN, providing an opportunity for distribution of costs against individual AtoN.

## Momentum after change

This refers to the fact that the implementation of change will not necessarily be realised immediately. It is important to periodically monitor the desired goals of change to identify, at the earliest stages, deviation for prediction, noting that the effect of change may take some time to become apparent.

# Equipment Provision and Performance

Having considered the financial aspects which apply to cost engineering and asset management it is necessary to identify the elements applicable to the provision and performance of AtoN equipment. This will allow a fuller understanding of the cost implications which will influence decisions. The four main elements are: Provision, Operation, Maintenance, and Decommissioning.

## Provision strategy

As customer needs are the first priority, there is a need to review the AtoN provided and determine if they are adequate and necessary. A review of AtoN will demonstrate that the use of funding is appropriate and oriented towards priority services for mariners.

The following methodology can be used to determine national priorities for each fixed aid site based on their operational importance and the physical condition of the assets. It establishs a rational and formal methodology capable of explaining why the investment budgets are directed primarily toward particular assets.

The general principles of the review are to:

* Ensure that the work identified in the investment projects are performed primarily on the assets that are of the utmost importance for the mariner.
* Consider the technical condition of the assets and the risk they represent as a second factor to determine the priority.

The criteria applied in assessing the operational status of each asset/ station is show in figure 2.

|  |
| --- |
| Importance of the Aid to Navigation |
| Purpose of the Aid to Navigation |
| Category of user |
| Cargo impact |
| Volume of traffic in the Aids to Navigation system |
| Economic Contribution |

1. Operational evaluation criteria for AtoN provision assessment

Criteria used in the technical assessment is shown in figure 3.

|  |  |
| --- | --- |
| **Criteria** | **Weighting Factors** |
| Asset Condition | Easy access to the site for service |
| Historical reliability of the site |
| Public Safety Issue | Injury severity due to technical issue |
| Risk of exposure to the danger |
| Probability |
| Occupational Health and Safety Issue | Severity of the impact on workers |
| Risk of exposure to the danger |
| Probability |
| Environemental Issue | Not applicable |
| Other Regulatory Issue | Not applicable |

1. Technical evaluation criteria for AtoN provision assessment

After evaluation, each site has 3 values:

* Operational Evaluation
  + the total score of 6 criteria
* Technical Evaluation – 2 values
  + each criterion is individually assessed
  + Only the maximum score is retained
* the total score of 5 criteria.

On completion of the evaluation, prepare a summary list of sites similar to figure 4.

|  |  |  |  |
| --- | --- | --- | --- |
| **Site** | **Operational** | **Technical –**  **max. score** | **Technical –**  **total score** |
| E | 81 | 18 | 44 |
| A | 81 | 14 | 48 |
| I | 81 | 10 | 28 |
| C | 72 | 8 | 16 |
| H | 59 | 18 | 48 |
| D | 43 | 20 | 72 |
| G | 42 | 20 | 88 |
| J | 42 | 20 | 85 |
| F | 42 | 20 | 64 |
| B | 37 | 16 | 28 |

1. Summary of evaluation results for a number of stations

This generate a first list of sites containing the following information

* the total of the operational criteria
* the maximum score of the technical evaluation criteria
* the total score of the 5 technical criteria

Sort the list in descending order

* First by the total of the operational priorities
* Second by the maximum score of the technical evaluation criteria
* Third by the total score of the technical criteria

Could Richard Moore please add red circles around the relevant criteria in figure 4 to help clarify the above sorting method. Can people understand this text – a better explanation may be needed.

This results in a prioritised list of assets, showing the stations most in need of capital investment.

## Provision procurement

There is a wide range of products available from manufacturers, each with their own benefits. The key question is how to provide services at minimum cost while ensuring quality product. To identify the most cost effective solution the elements to be considered will include:

* Sourcing / availability – while complying with national requirements relating to tendering processes it is important to understand the cost implications of product availability and lead times, e.g. “Just in Time” ordering /delivery, lead times to match seasonal operating windows, maintenance of levels, etc
* Continuity of supply – a sustainable and reliable supply will assist with budgeting and forward planning processes.
* Fit for purpose – AtoN products must conform fully with all relevant standards and legislation. Allowance should be made for previous documented experience pertinent to local conditions which may assist in avoiding costly repetition of previous errors. (refer to IALA guidelines)
* New developments will have cost implications for products and processes. It is necessary to maintain an awareness of new technology and understand how new processes can reduce costs.
* O&M Manual – a full manufacturer’s Operations and Maintenance Manual will assist in identifying through life costs.
* Certification – certificated compliance with all relevant standards and legal requirements will reduce liabilities and costs of insurance, if applicable.

Call off contracts with a time span of two to three years will often provide a cost effective means of system provision.

## Operation

The cost of operation is impacted by a number of factors which should be identified and understood. These will include:

* Energy consumption – the voltage range should be known as this will determine the range of energy sources which can be utilized. A lower the overall energy requirement will reduce the cost of energy generation.
* Power supply – the power supply may be predetermined by sources available on site or which can be installed on site. If determining a new power source, consideration should be given to the system costs and what it is feasible to install on, in or adjacent to the AtoN, eg utility mains, solar, wind, battery bank, diesel generators, etc
* Reliability – with reference to IALA Guideline 1037, data will have been collected to provide performance reliability data. This will assist in identifying the most reliable systems and permit the calculation of costs resulting from unplanned maintenance visits per AtoN which can be weighed as an element in Whole Life Cost.
* Durability – the expected lifespan and replacement period of the AtoN will impact on the Whole Life Cost.
* Compatibility with existing systems will have cost implications. The ability to integrate or utilise existing systems, eg AIS, monitoring, GPS synchronisation, will eliminate the cost of creating new interfaces or alternate systems.
* Ease of control – the ability to customise the functions of the AtoN on-site or in the workshop will increase versatility and thereby reduce cost caused by duplication of units needed as stock.

## Maintenance

After capital investment the second major cost is ongoing maintenance. IALA Guideline 1037 – on Data Collection for Aids to Navigation Performance Calculation – should be referenced for methodology in calculating the performance of the AtoN. Factors affecting cost of maintenance will include:

* Ease of maintenance, in terms of reduced frequency of maintenance visits and reduced on site time, will reduce cost of resources required to support the functioning of the AtoN.
* Frequency of maintenance will draw on other resources, especially manpower and logistics.
* Availability of spares/consumables from the manufacturer will determine the level of stock held, which impacts on storage costs.
* The level of service support available in house, or contracted in, may have a determining effect on maintenance capability, eg, depots, buoy yard, types of vessels, helicopter, etc. The operating costs of these facilities contribute to Whole Life Costs.
* Customer Support and Warranties provided by the manufacturer should be quantified and utilised to minimise on-going operating costs.
* Training should ideally be provided by the manufacturer for all new products. Staff retention and rotation and product upgrades will affect training costs.

## Decommissioning

At end of life, the AtoN will need to be withdrawn or removed. The cost factors will include:

* Removal – the costs of removal should be calculated as part of the Whole Life Cost before installation.
* Recycling of materials is desirable where possible. Some cost recovery may be achievable, eg scrap metal, but direct costs should be understood. Heritage artifacts can be sold or donated to museums.
* Cost of disposal of non-recyclable waste should factor in Whole Life Costs.

# Service capability

## Manpower

Most investment decisions impact on the manpower commitment into future years. The impact of such decisions needs careful assessment since there are often costs in this. The implementation of any change usually has a managed timeframe making this a variable cost over time. Political factors may change the whole life cost but enhance socio-political benefits.

## Ship

Ships are a key Service delivery resource and reflect a significant operational cost for any organisation. These need to be available for emergency use, yet any investment cost can have an impact on utilisation and could be seen to deliver a saving, but in fact the ship remains a fixed cost for the organisation. Only if the number or size of ship changes can this saving be associated with any whole life cost. However the cost of ship utilisation should be included in whole life costs for projects and operations to distribute the fixed cost and understand the value of the ship asset.

## Heli

Often this is an outsourced resource and as such any potential change in need can usually be reflected as a saving within the whole life costs. Helicopters are often used on an hour by hour basis and so they can be considered a variable cost. Costs can be distributed as for ships to gain an understanding of the value of the asset.

## Transport

In some countries the impact of transportation can be significant, but cost needs to be taken into account on an individual basis.

## Non AtoN service buildings

The use of any support building will need to be considered to understand the impact of change on it. Does it need to be as big, or bigger? Is it required at all? Does it have the right facilities? Is additional investment required to meet the answers to these questions? All of these are an effect and need to be considered in the whole life cost.

When considering any new investment, this will have an influence on supporting infrastructure such as Offices, buoy yards, workshops, etc. To implement a change could lead to either a saving through disposal or additional investment in new support equipment. Instead of upgrading the equipment an option could be to outsource.

When considering the impact on tangible assets such as offices, buoy yards and workshops, there is a need to not only need to consider the individual investment case but also consider the suite of investments the organisation is considering.

Although saving in use of such fixed assets can be made, realisation of this can be difficult as they are not scalable in nature, whether more or less space is needed.

## IT Service

In modern business practice, IT corporate computer service is deeply embedded in operating practices. Denial of IT service can have a serious impact on an Administrations ability to function. It is therefore essential to monitor the availability of IT corporate service and maintain IT service fully up to date. The cost of proposed IT capital expenditure can be compared to the value of improved services or cost of IT system failure, depending on the risk of failure.

Changes that involve IT services or systems need to be fully understood for their business risk and cost to the business for any lost time or lost data. Additionally, changes to operational system can reduce efficiency during the learning period before return enhancement after a settling time.

Investment projects that can lead to large amounts of data handling can impact of communications costs which are a variable, year on year.

# Performance

## Key performance indicators

KPIs are commonly used by an organisation to evaluate its success or the success of a particular activity in which it is engaged. Choosing the right KPIs is reliant upon having a good understanding of what is important to the organisation. What is important often depends on measuring the performance of the organisation and the KPIs will depend on the department. KPIs useful to finance will be quite different than the KPIs assigned to maintenance, for example. Because of the need to develop a good understanding of what is important, performance indicator selection is often closely associated with the use of various techniques to assess the present state of the business, and its key activities. These assessments often lead to the identification of potential improvements; and as a consequence, performance indicators are routinely associated with performance improvement initiatives.

KPIs used by AtoN administrations vary depending on the way the business is run and the culture of operation. Irrespective of whether an Administration carries out all its business using in-house resources or outsources some or all of its operations, KPIs provide an invaluable role in ensuring that the Administration achieves its goals.

Business performance management can be considered as in figure 5. Goals or key performance indicators are identified and required performance value set. Performance is measured against these goals. Performance is reviewed periodically and interventions are made in the light of this information with a view to improving future performance against these goals.

1. Business Performance Management

The key performance indicators listed in Annex A are grouped under the different headings typically found in an Administration. These are not definitive but are suggested as KPIs that would best suit AtoN providers and individual Administrations may use some, all or other KPIs to ensure cost effective management.

Care should be taken in setting KPIs. A small number of critical measures that effectively measure business performance is much better than a large number where employees’ focus is servicing the KPIs rather than the business.

## Measuring Key performance indicators

Having selected appropriate KPIs, measurement will depend on the data required. Collection of information can be implemented using a paper system, daily written logs, report sheets, computer reports, audit reports and so on. In most cases Computerised Maintenance Management Systems (CMMS) will be used for collecting the data as close to source as possible. It is also critical that any piece of data is collected only once but may be used by the CMMS for multiple purposes.

Whatever the KPI, a comprehensive written method for measurement is strongly advised. Measurement of AtoN Availability is outlined in IALA Recommendation O-130 and IALA Guideline 1037. In order to ensure that measurement is consistent across an Administration or between Administrations, the method statement in Annex B could be used.

Similar measurement methods statements could be provided for other KPIs in Annexes.

## Performance criteria for outsourcing

Annex C shows a list of criteria that could be considered when outsourcing. The provides a useful checklist of parameters that should be included in an outsourcing performance contract. KPI’s are used to measure contractor performance over the contract period and can be linked to an annual performance payment, which along with the monthly base fee, forms the annual contract price.

# Safety

The provision of AtoN supports Safety of Life At Sea (SOLAS) and the management of these assets should be carried out in a safe manner.

## Personal safety

Compliance with national safety standards and legislation is required and this cost will be an element of organisational overheads. With particular regard to site access and operations systems should be designed in and costed at manufacture. Cost of safety can be determined from cost of safety training and materials such as signs, guards and safety documentation.

There may be costs associated with retrofitting and maintenance of safety systems.

## Third party safety

The costs of ensuring Third Party safety can be determined from cost of safety signs and fencing.

## Safe design of systems and equipment

Safe design and costing of safe systems and equipment should take place at manufacture and installation stage to avoid costly operating procedures. Additional cost of provision of the safety systems can be determined at provision phase..

# Environmental

## Legal compliance

There are national and international legal obligations relating to human activity on the environment. IALA Guideline 1036 on Environmental Management in Aids to Navigation provides advice on operating AtoNs in an environmentally sensitive manner.

## Cost of compliance

There are costs associated with compliance, some of which require to be calculated as part of Whole Life Costs and some of which are corporate overheads.

## Environmentally compliant operations

Compliance with environmental requirements may have seasonal impacts on operational activity, eg bird and seal colonies. Operations should be planned around such requirements to minimise cost implications.

## Cost benefits of AtoN vs environmental marine accident

A cost benefit analysis comparing the cost of AtoN provision versus the cost of environmental marine accident will enable a decision in relation to the benefits of AtoN provision in environmentally sensitive areas.

# Legal

## Compliance with defined standards

Failure to meet corporate defined standards will have an adverse effect on the operational ability of the organisation or will lead to a detrimental view of the organisation to meet its obligations. There is usually little option for cost saving in relation to compliance with standards.

## Certification

IALA guideline1052 provides a basic platform for the implementation of a Quality Managemetn System (QMS) so that Authorities can objectively evaluate compliance to established service levels depending on user needs and expectations, traffic and the risks associated to each area.

The cost of achieving certification under QMS standards such as ISO 9001, ISO 14001, ISO 18001 is considerable and Administrations need to consider the cost benefit of achieving and maintaining such certifications.

The use of certified suppliers should lead to economical benefits that exceed the increased initial cost, either through product performance or improved support. This should allow the full predicted lifetime costs to be met.

# Surplus assets

## Heritage

When considering the management of surplus assets consideration should first be given to IALA Guideline No xxxx on The Management of Surplus Property and Guideline No 1075 on A Business Plan for the Complementary Use of a Historic Lighthouse. Listed heritage sites may have long term conservation obligations which give rise to additional maintenance costs when complying with national conservation legislation.

## Non AtoN

Non AtoN assets such as office buildings, buoy yards, etc are generally disposed of when no longer needed. This provides a one off cash income while reducing the maintenance cost burden. The longer term strategic value of such sites should be considered before releasing ownership.

## Artifacts

Many redundant Aids to Navigation have historic significance, if only for the local community. Consideration should be given to liaising with the appropriate conservation body, eg museums, local trusts, with regard to the long term future of AtoN artefacts with the view of minimising costs.

1. Aton key performance indicators

Note: this list should be verified and compared with the text for consistency. Other relevant KPIs could be added.

* 1. Customer Service
* Number of periodic reviews per year to verify and prioritise AtoNs required.
* Number of marine accidents per year.
* Availability of AtoN in accordance with IALA guidelines.
* Number of AtoN inspection per year to ensure quality.
  1. Financial
* Cost percentage reduction on previous year.
* AtoN unit cost (for comparable AtoN or using “standard” AtoN.
* Capital projects completed on time and budget.
* Return on capital investment
  1. Equipment performance
* Mean Time Between Failure
* Mean Time to Repair
* Planned maintenance programme on time and budget
* Innovation/ Improvement projects
  1. Manpower
* Number of personnel per AtoN.
* Number of back office staff as percentage of total workforce.
* Training budget as percentage of total budget.
* Employee turnover rate.
  1. Safety
* All accident frequency rate per year.
* Lost time injury rate per year.
* Sick Absence as percentage of total time per year.
  1. Logistics/ Services
* Ship working hours as percentage of total hours per year.
* Helicopter flying hours used per year
* Helicopter operational flying hours as percentage of total helicopter hours flying per year.
* Contractor transport cost compared with previous year.
* Office / Workshop infrastructure cost per unit floor area.
* IT Corporate Service availability.
  1. Environmental
* Number of prosecutions/ enforcement orders
  1. Legal
* Number of audits confirming compliance with defined standards.
* Cost of achieving/ retaining quality standards certification.
  1. Heritage
* Annual cost of non operational heritage assets.
* Gross and net income from alternative use of heritage assets.
* Number of heritage assets

1. KPI measurement - availability

The following sets out the method of calculating availability of AtoNs in accordance with IALA Recommendation O130 (AtoN excl DGPS, AIS) and IALA Recommendation R121 (DGPS). Reporting is over a 3 year period for short range aids and over a 2 year period for DGPS in accordance with the IALA recommendations.

* 1. Short Range Aids - Lights, Sound Signals, Racons and AIS

For clarity, IALA Recommendation O130 defines AtoN performance parameters as follows:

Total Time (Total Operational Hours) is the time that an individual AtoN or a system of AtoN should be performing their specified function.

Down Time (Hours Outage) is the sum of the periods during which the AtoN of the system of AtoN are unable to perform their specific function. It does not include those periods whe n the mariner has been notified of a discrepancy by prior publications through a Preliminary Notice to Mariners.

A failure is the malfunction of an aid to navigation or system of AtoN to display its proper characteristics or to be on its assigned position for its intended use by the mariner. As such, a failure of a technical function is not necessarily considered an aid to navigation discrepancy. For example, if the main power supply has failed but the light continues to function at normal intensity on standby power, this is not considered a failure, since the aid to navigation continues to provide its characteristics to the mariner. The failure may be caused by equipment malfunction, or scheduled or unscheduled maintenance work.

( Hours outage x 100 )

% Availability (3 year rolling average)= 100 - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

( Total operational hours )

where

* + Hours outage = total hours that the AtoN category is not available for use (includes daylight hours for lights and clear weather hours for sound signals) but excluding periods when the mariner has been notified of a discrepancy by prior publications through a Preliminary Notice to Mariners.
  + Total operational hours = number aids x 365 x 24 x 3

Mean Time Between Failures = ( Number of Aids x 365 )

(MTBF) (days) ( Number of Outages )

where

* + Number of Aids = total number of AtoN in the AtoN category
  + Number of Outages = total number of AtoN outages in the AtoN category excluding planned outages when the mariner has been notified of a discrepancy by prior publications through a Preliminary Notice to Mariners.

Mean Time to Repair = ( \_\_\_\_\_\_Hours Outage\_\_\_\_\_\_ )

(MTTR) (days) ( Number of Outages x 24 )

where

* + Hours outage = total hours that the AtoN category is not available for use (includes daylight hours for lights and clear weather hours for sound signals) but excluding periods when the mariner has been notified of a discrepancy by prior publications through a Preliminary Notice to Mariners
  + Number of Outages = total number of AtoN outages in the AtoN category excluding planned outages when the mariner has been notified of a discrepancy by prior publications through a Preliminary Notice to Mariners.

DGPS

IALA Recommendation R121 defines DGPS availability as the percentage of time that an aid, or system of aids, is performing a required function under stated conditions. The non-availability can be caused by scheduled and/or unscheduled interruptions. Performance is considered over a 2 year period.

* 1. DGPS Service availability

The IALA required availability for the GLA DGPS service is 99.8% (Service Availability) and is based on overlapping coverage between adjacent stations. In the event of failure of one transmitter, service to the mariner is maintained from the adjacent stations. A DGPS service failure is considered to occur only when adjacent stations have failed. Availability is calculated based on adjacent station outages for each of the GLA DGPS service areas. The lowest figure is used and the availability for the service as a whole is then quoted as being equal to or better than this figure. It has been agreed that for DGPS, availability includes planned outages.

( Seconds outage )

% Availability of each Service Area = 1 - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

( Total operational seconds )

where

* + Seconds outage = total number of seconds that overlapping coverage is not available for use in one DGPS service area and including planned maintenance outages and periods when the mariner has been notified of a discrepancy by prior publications through a Preliminary Notice to Mariners.
  + Total operational seconds = number of seconds in the review period (2 years).
  + Service availability is taken as the Service Area with the lowest availability.

Mean Time Between Failures for the DGPS service is calculated as for short range aids, except that planned outages for which NTM has been issued are included as outages.

Mean Time to Repair for the DGPS service is calculated as for short range aids, except that planned outages for which NTM has been issued are included as outages.

1. Outsourcing contract - key performance indicators

This section sets out criteria that could be considered when outsourcing.

* 1. Operational Performance Criteria

The following operational performance criteria are measured through the KPI process.

* Standard of works
* AtoN performance levels
* Quality, safety and environment
* General reporting requirements
* Monthly, quarterly and annual reporting requirements
* Project reporting requirements
* Incident reporting requirements
  1. Corporate Performance Criteria

The following management plans are in place to ensure that the agreed contract outcomes are achieved and are also monitored through the KPI process.

* Contract management plan
* Risk management plan
* Contract administration plan
* Audit program
* Quality, environment and safety management plan
* Transition and disengagement plans
* Human resource management plan
* Staff management plan
* Training management plan
* Occupational health and safety plan
* Engineering management plan
* Engineering design review
* Licensing and certification
  1. KPI Requirements
* KPI’s are used to measure contractor performance over the contract period and are linked to an annual performance payment, which along with the monthly base fee, forms the annual contract price.
* KPI’s are reviewed and agreed on an annual basis. The annual contract review process allows for KPI’s to be altered to address issues or opportunities identified during the previous year.
* Performance against the agreed KPI’s are reviewed, discussed and agreed on a quarterly basis.
  1. AtoN Performance Levels
* Maintenance and fault/failure restoration strategies are required to be in place to achieve the agreed availability and repair times.
* Performance levels are calculated in accordance with AMSA and IALA guidelines and reported quarterly.
* Equipment availability and failure restoration time is measured from the issue and cancellation of maritime safety information (Auscoast Warning or ReefVTS failure notification).
* The contractor is not penalised for failures due to unforeseen events such as severe weather events, vandalism or natural disasters
  1. Quality, Safety and Environmental Performance
* The contractor must maintain certification for quality, safety and environmental management systems.
* Lagging indicators such as number of lost time injuries or medical treated injuries are recorded but are not linked to performance payments. Incident and accident reporting information is a critical input to minimising future incidents. Any indicators that encourage non reporting should be avoided in performance payment based systems.
* Positive Performance Indicators (PPI’s) or leading indicators are used to measure actions that the contractor takes to achieve its safety targets.
* Good performance against PPI’s will lead to good safety outcomes. The following PPI’s could be considered for use in a KPI framework:
  + Number of OHS training & programs
  + Incident reports - the numbers of days overdue: > 3 months
  + Hazard reports - the number of days overdue: > 3 months
  + Number of safety inspections/audits conducted
  + Percentage of sub-standard conditions identified and corrected
  + Percentage of employees with adequate OHS training.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. Nett Present Value Table | | | | | | | | | |
| **Financial Appraisal – 15 Year (Operating) Programme** | | | | | | | | | |
| **Year** | **Remarks** | **Year No.** | **Capital Costs** | **Operating Savings (incl. 4% inflation)** | **Net Return** | **Pay Back** | **6.00% Discount Factor** | **NPV** | **Cumulative NPV** |
| 10/11 | Commence Project | 0 | -213.0 | 0.0 | -213.0 | -213.0 | 1.000 | -213.0 | -213.0 |
| 11/12 | Complete Project | 1 | -306.0 | 0.0 | -306.0 | -519.0 | 0.943 | -288.7 | -501.7 |
| 12/13 | Commence Running Cost Savings | 2 | 0.0 | 19.4 | 19.4 | -499.6 | 0.890 | 17.3 | -484.4 |
| 13/14 | Abandon accommodation, incur additional operating costs | 3 | 0.0 | 5.6 | 20.2 | -494.0 | 0.840 | 4.7 | -479.7 |
| 14/15 |  | 4 | 0.0 | 5.9 | 5.9 | -488.1 | 0.792 | 4.6 | -475.0 |
| 15/16 |  | 5 | 0.0 | 6.1 | 6.1 | -482.0 | 0.747 | 4.6 | -470.5 |
| 16/17 |  | 6 | 0.0 | 6.3 | 6.3 | -475.7 | 0.705 | 4.5 | -466.0 |
| 17/18 |  | 7 | 0.0 | 6.6 | 6.6 | -469.1 | 0.665 | 4.4 | -461.6 |
| 18/19 |  | 8 | 0.0 | 6.9 | 6.9 | -462.2 | 0.627 | 4.3 | -457.3 |
| 19/20 |  | 9 | 0.0 | 7.1 | 7.1 | -455.1 | 0.592 | 4.2 | -453.1 |
| 20/21 |  | 10 | 0.0 | 7.4 | 7.4 | -447.6 | 0.558 | 4.1 | -449.0 |
| 21/22 | Solar Batteries Replacement  10 Yr Intervention | 11 | -231.0 | 7.7 | -223.3 | -670.9 | 0.527 | -117.6 | -566.6 |
| 22/23 |  | 12 | 0.0 | 8.0 | 8.0 | -662.9 | 0.497 | 4.0 | -562.6 |
| 23/24 |  | 13 | 0.0 | 8.3 | 8.3 | -654.6 | 0.469 | 3.9 | -558.7 |
| 24/25 |  | 14 | 0.0 | 8.7 | 8.7 | -645.9 | 0.442 | 3.8 | -554.8 |
| 25/26 |  | 15 | 0.0 | 9.0 | 9.0 | -636.9 | 0.417 | 3.8 | -551.1 |
| 26/27 |  | 16 | 0.0 | 9.4 | 9.4 | -627.5 | 0.394 | 3.7 | -547.4 |
| **Net Present Value - €547,372** | | | | | | | | | |
| Note | | | | | | | | | |

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