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| IALA Guideline |

####

The use of the IALA Risk Assessment Made Simple (RAMS) Tool

Edition 1.0

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

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| Date | Page / Section Revised | Requirement for Revision |
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|  |  |  |
|  |  |  |
|  |  |  |

1. INTRODUCTION 4

2. BACKGROUND 4

3. PURPOSE 4

4. overview of RAMS 5

4.1. Probability and impact 7

4.2. the acceptabilty of risk 8

4.3. Risk control options 8

4.4. the practical use of RAMS 9

5. the RAMS process 10

6. summary 11

7. REFERENCES 11

7.1. Applicable IALA Guidelines, Recommendations 11

7.1. other references 11

ANNEX A guidance notes on how to complete the RAMS workbook 12

# INTRODUCTION

Regulation 13 of Chapter V of the 1974 SOLAS Convention (as amended) states that “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”.

The assessment and management of risk is therefore fundamental to the provision of effective aids to navigation (AtoN)[[1]](#footnote-1). To address this, IALA published a recommendation on IALA Risk Management Tool for Ports and Restricted Waterways for use by National Members. This Recommendation has two components. These are the **quantitative** IALA Waterway Risk Assessment Program (IWRAP) Mk2 tool, which requires a comprehensive dataset of AIS information, and the **qualitative** Ports and Waterways Safety Assessment (PAWSA) tool, which requires participation by up to 30 competent individuals comprising waterway users, stakeholders and agencies responsible for implementing risk mitigation measures. The International Maritime Organization (IMO) endorsed both these tools in 2010, which underscored the importance of formal risk management[[2]](#footnote-2).

However, in many developing and least-developed countries, good quality AIS data on which IWRAP Mk2 depends is not available nor are there usually sufficient numbers of individuals with the necessary level of experience in the six risk categories used by PAWSA[[3]](#footnote-3). There is therefore a need for a simpler risk management tool for use by national Competent Authorities who cannot practically use IWRAP Mk2 or PAWSA. The **S**imple **Qu**alitative **A**ssessment of **R**isk **T**ool (*RAMS*) was developed to enable those IMO Member Governments to assess the volume of traffic and degree of risk in their waters so that they can meet their obligations under SOLAS.

# BACKGROUND

The idea of developing a simplified risk management tool was first raised by the IALA Risk Management Steering Group (IRMSG) in late 2012. The IALA World-Wide Academy produced an initial version of the simplified tool in 2013, which was based on the risk management system endorsed by the Aids to Navigation (AtoN) Competent Authority of the Sultanate of Oman in 2006 and adopted by the AtoN service provider in Bahrain in 2010. The IALA World-Wide Academy used the acronym “*RAMS*” for its simplified tool, which was tested and refined before being presented to the successor of the IRMSG, Working Group 3 of the Aids to Navigation Requirements and Management Committee (ARM), in early 2016. This Guideline is based on the final version of *RAMS* submitted to ARM WG3 in late 2016.

# PURPOSE

The purpose of this document is to provide guidance on *RAMS*’s systematic process which starts with nominating stakeholders in a particular region before identifying hazards and determining the volume of traffic in that region. This leads to a **qualitative** estimate of the levels of risk and the production of potential risk control options to reduce such risk to acceptable levels.

# overview of RAMS

*RAMS* is based on the principles set out in IALA Guideline 1018 on risk management. Risk is defined as a combination of two factors – the **probability** (or likelihood) of an undesirable incident (a hazard[[4]](#footnote-4)) occurring and if it does occur, the severity of its potential long and short-term **impact** (or consequence). Risk is therefore a measure of the potential for a hazard to lead to an undesirable incident.

The management of risk involves a structured process that identifies hazards before taking action to reduce risks to the level of “As Low As Reasonably Practicable (ALARP)” which is acceptable to both the national Competent Authority and the stakeholders in a specified region[[5]](#footnote-5).

A “hazard” is something that may *cause* an undesirable incident. Hazards are grouped under six main categories identified as:

* Natural – a shoal, storms; strong tidal flow; tsunamis; solar flares etc
* Economic – loss of revenue to fund AtoN services; cost of losing a court case, etc
* Technical - equipment failure; obsolescence etc
* Human - piracy; poor training; lack of competence etc
* Operational – actions or errors which may cause collisions and groundings etc
* Waterway complexity – traffic density, low depth, limited available sea room, low under keel clearance, wreck, etc.

The basic thinking behind the RAMS method rests on the fundamental causal relationship between hazards and the consequences of undesirable incidents, which the hazards may cause. This is illustrated in Figure 1 below:

|  |  |  |
| --- | --- | --- |
|  | | |
| * Natural * Economic * Technical * Human * Operational * Waterway COmplexity | * Grounding * Collision * Allision[[6]](#footnote-6) * Foundering[[7]](#footnote-7) * (Other) | * Short-term * Long-term * Other |

1. Causal Relationship Between Hazards and Consequences

RAMS addresses each undesired incident such as the grounding of a vessel on a reef or the collision between two vessels as being **mutually exclusive** scenarios. This permits each scenario to be assessed in isolation so that the probability of the undesirable incident can be determined in a straightforward manner.

Clearly an undesirable incident can be caused by two or more hazards from the six different categories in combination, for example a limiting safe minimum depth with background glare, navigation aid failure and poor crew competency. RAMS therefore lists all potential hazards in each of the categories and invites the user to determine the combination in a specific area or zone that could lead to one of the four main undesirable incidents: grounding, collision, allision and foundering. It may be that another type of undesirable incident can be identified, hence the inclusion of “other” in the list shown in Figure 1 above.

Risk management requires Competent Authorities and other stakeholders to quantify both the probability of an undesirable incident occurring and its consequential impact based on:

* Maritime environmental studies and data including adequacy of nautical charts, sea state and wind force, tidal flow and overfalls, restricted visibility, ice, background lighting, natural hazards and dangers, nature of the seabed, changing bathymetry and other factors
* Historical data and future trends
* Stakeholder feedback
* Traffic routes, quality and size of vessels, under keel clearance, channel width, cargos carried, traffic mix and density
* Human elements – e.g. crew competency

## Probability and impact

## 

RAMS specifies three levels of probability and three levels of the impact that each type of hazard would create. Each is allocated a score from which a risk assessment value is calculated automatically from the product of probability and impact. Probability scores might be given using the descriptions in Table 2 below:

|  |  |  |
| --- | --- | --- |
| **Classification** | **Score** | **Probability** |
| Very rare | 1 | Very rare or unlikely, will occur only in exceptional circumstances and not more than once every 20 years. |
| Rare | 2 | Rare, may occur every 2-20 years. |
| Occasional | 3 | Occasional, may occur every 2 months to 2 years. |
| Frequent | 4 | Frequent, may occur once weekly to every 2 months. |
| Very frequent | 5 | Very frequent, may occur at least once every week. |

1. Descriptions of Probability

Impact scores *might* be allocated using the criteria in Table 3 below (please note that the financial thresholds may vary considerably by country)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Description | Score | Service Disruption Criteria | Human Impact Criteria | Financial Criteria[[8]](#footnote-8) | Environment |
| Insignificant | 1 | No service disruption apart from some delays or nuisance. | No injury to humans, perhaps significant nuisance | Loss, including third party losses, less than US$1.000 | No damage |
| Minor | 2 | Some non-permanent loss of services such as closure of a port or waterway for up to 4 hours | Minor injury to one or more individuals, may require hospitalization | Loss, including third party losses, US$1.000 – 50.000 | Limited short term damage to the environment. |
| Severe | 3 | Sustained disruption to services such as closure of a port or waterway for 4‑24 hours | Injuries to several individuals requiring hospitalization | Loss, including third party losses of $50.000-5.000.000 | Short term damage to the environment in a small area, |
| Major | 4 | Sustained disruption to services such as closure of a major port or waterway for 1-30 days or permanent or irreversible loss of services | Severe injuries to many individuals or loss of life. | Loss, including third party losses of $5.000.000-50.000.000 | Long term to irreversible damage to the environment in a limited area |
| Catastrophic | 5 | Sustained disruption to services such as closure of a major port or waterway for months or years | Severe injuries to numerous individuals and/or loss of several lives. | Loss, including third party losses of over $50.000.000 | Irreversible damage to the environment in a large area. |

1. Descriptions of Impact

Having determined probability and impact scores by consensus, the risk assessment value can be calculated in accordance with matrix in Table 4 below:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | PROBABILITY / (LIKELIHOOD) | | | | |
| Very Rare (1) | Rare (2) | Occasional (3) | Frequent (4) | Very frequent (5) |
| CONSEQUENCE (IMPACT) | Catastrophic (5) | 5 | 10 | 15 | 20 | 25 |
| Major (4) | 4 | 8 | 12 | 16 | 20 |
| Severe  (3) | 3 | 6 | 9 | 12 | 15 |
| Minor (2) | 2 | 4 | 6 | 8 | 10 |
| Insignificant (1) | 1 | 2 | 3 | 4 | 5 |

1. Risk Assessment Matrix

## the acceptabilty of risk

Having developed a semi-quantitative risk-rating matrix, the next step is to determine whether those risks are acceptable or not. RAMS specifies four colour-banded levels of risk. These are shown in Table 5 below:

|  |  |  |
| --- | --- | --- |
| Risk Assessment Value | Risk Category | Action Required |
| 1 – 4 | Green | Low risk not requiring additional risk control options unless they can be implemented at low cost in terms of time, money and effort. |
| 5 – 8 | Yellow | Moderate risk which must be reduced to the *“as low as reasonably practicable”* (ALARP) level by the implementation of additional control options which are likely to require additional funding. |
| 9-12 | Amber | High risk for which substantial and urgent efforts must be made to reduce it to “ALARP” levels within a defined time period. Significant funding is likely to be required and services may need to be suspended or restricted until risk control options have been actioned. |
| 15-25 | Red | Very high and unacceptable risk for which substantial and immediate improvements are necessary. Major funding will be required and ports and waterways are likely to be forced to close until the risk has been reduced to an acceptable level. |

1. Action Required for Risk Categories

## Risk control options

The objective is to identify risk control options (risk mitigation measures) for each undesirable incident that would, if implemented, reduce the risk to an acceptable level. The process conducted by the user forum operating *RAMS* is subjective, but the aim is to reach consensus on each risk control option so that the necessary arguments can be put forward to gain the funding necessary to implement the decisions.

Risk control options to reduce risk to an acceptable level may include[[9]](#footnote-9):

* Improved co-ordination and planning
* Additional training and education
* Enforcement of rules and procedures
* Improved navigation, hydrographical and meteorological information from new sources and surveys
* Enhanced aids to navigation service provision
* Improved radio communications
* Active traffic management such as Vessel Traffic Services
* Changes to the waterway

## the practical use of RAMS

RAMS forms part of the syllabus for IALA World-Wide Academy Level 1 AtoN managers[[10]](#footnote-10). Individuals with appropriate knowledge and experience in the maritime field can acquire competency in its use within a few hours. It generates a number of practical risk control options which, if implemented, could increase the level of navigational safety in the region.

# the RAMS process

The *RAMS* process is based on a Microsoft Excel™ Workbook. Each Competent Authority can adapt the Workbook so that it is applicable to its own State or region. Guidance on how to complete the Workbook is at Annex A to this Guideline.

The first step in the *RAMS* process is to define zones (or regions) in which the environmental conditions, volume of traffic and degree of risk are similar. The second step is to identify all possible stakeholders in each zone before gathering the statistical data to complete the process. The principle that should apply throughout the *RAMS* process is that the risk should be based on the ***worst possible scenario*** in each zone on any one day.

The Workbook comprises four worksheets:

* 1. Stakeholder worksheet
  2. Statistical data worksheet
  3. Risk matrix worksheet
  4. Risk control options worksheet

Worksheet A is a stand-alone document to be completed by the Competent Authority or user forum. Worksheet B is used to compile statistical data for a specified region. This provides the total number of AtoN in the zone; safe minimum depth(s); the combined effect of wind and tidal flow; the maximum predicted number of “large” and “small” vessels in the zone at any one time and subjective assessments of human and political factors.

Relevant data is transferred automatically to Worksheet C where the stakeholders conducting the *RAMS* analysis allocate subjective (qualitative) probability (Section 1) and impact (Section 2) scores to all potential undesirable incidents. These scores are then used to generate risk level values in Section 3 of Worksheet C.

The user group then decides on the overarching risk control options necessary to mitigate risk to the “ALARP” level. Worksheet D can be used to determine specific risk control options for each type of hazard in each undesirable incident scenario.

RAMS uses the same risk management process set out in IALA Guideline 1018. This is:

* Assess the theoretical risk in existing or planned restricted waterways, traffic choke points and ports
* Compare the risk with risk levels which are acceptable to the Competent Authority and stakeholders who form the user forum
* Consider:
  + Vessel handling and conditions - e.g. Under Keel Clearance
  + Traffic density and conditions
  + Existing navigational and waterway conditions
  + Immediate and subsequent consequences of a maritime accident

The process is then repeated to quantify the effect on risk assessment levels after potential risk control options have been implemented. This process is shown in Figure 2 below:

1. The Risk Assessment Process

# summary

*RAMS* is intended as a **basic tool** to generate risk control options covering the potentially undesirable incidents that a Competent Authority should address as part of its obligations under SOLAS Chapter V Regulations 12 and 13. These incident scenarios are groundings; collisions; allisions; founderings or another relevant scenario. It is intended to be used as part of objective stakeholder consultancy. As that Competent Authority builds its capacity, it is encouraged to use the more advanced risk management tools such as PAWSA and IWRAP Mk2. However, a satisfactory understanding of the maritime environment and maritime traffic patterns is an essential first step to understand the risk level within a waterway. *RAMS* is designed to assist that process.

The guidance notes at Annex A should enable potential users of *RAMS* to use this simple but effective tool successfully.

A free copy of the *RAMS* Workbook for use by any Authority can be requested by email from IALA. Note that IALA retains copyright ©of the *RAMS* MS Excel Workbook. The responsibility for all inputs and any decision to implement risk control options identified by *RAMS* shall rest entirely on the Competent Authority of the Government or other Authority that requests its use.

# REFERENCES

## Applicable IALA Guidelines, Recommendations

* Guideline 1018 on Risk Management
* Guideline 1079 on Establishing and Conducting User Consultancy
* Model Course E-141/1 for Level 1 AtoN Managers
* Model Course E-141/3 on Risk Management

## other references

* IMO SN.1/Circ.296 dated 7 December 2010

1. guidance notes on how to complete the RAMS workbook

**Introduction**

1. These guidance notes are designed to enable a user to complete the *RAMS* MS Excel™ Workbook. The Workbook comprises four worksheets:
   1. Stakeholder worksheet (A)
   2. Statistical data worksheet (B)
   3. Risk matrix and summary worksheet (C)
   4. Specific risk control options worksheet (D)
2. The stakeholder worksheet is a stand-alone document to be completed by the Competent Authority or AtoN service provider (or both) [[11]](#footnote-11). It should be completed for each maritime region or zone of a coastal State as defined by the Competent Authority. Guidance on the selection of zones is covered in paragraphs 11 – 14 below.
3. The principle that should apply throughout the *RAMS* process is that all possible scenarios of significance to the operation of the waterway should be considered including the ***worst possible scenario in each zone on any one day***.
4. All values should be determined by the stakeholder user group compiling the worksheets and not by a “facilitator. This will ensure that only local data and knowledge is used during the risk assessment process. However, the “facilitator” may offer advice and guidance if requested to do so by the Competent Authority.
5. There may be occasions where it is difficult to find personnel with the necessary maritime competence or experience to complete the worksheets. In such a case, the national Competent Authority may care to consider contacting IALA to request tailored training in the use of *RAMS*.
6. The statistical data worksheet (B) for each zone collates AtoN; hydrographic and meteorological data; volume of maritime traffic; and then human, operational and economic factors. This information should be obtained by the Competent Authority or AtoN service provider from all available sources. Selected numerical data entered is transferred automatically to the risk matrix worksheet.
7. In some regions where there is considerable seasonal change (ice formation; tropical cyclones etc.) a separate workbook may be required for each season.
8. The risk matrix worksheet (C) is designed to be used by stakeholder engagement at a local users forum to assess the probability and impact of each risk based on a score of 1 to 3 where 1 = low probability and/or minor impact and 3 = high probability and/or severe impact.
9. The Competent Authority or users’ forum must then identify what risk control options should be used to manage each identified undesirable incident before making decisions and taking the necessary actions to implement those decisions[[12]](#footnote-12).
10. Some national Competent Authorities with existing risk management procedures may find *RAMS* a useful checklist tool to be used during their own risk management processes.

**Selection of Zones**

1. Each State will have maritime regions in which the environmental conditions, volume of traffic and degree of risk are unique. For example an offshore zone; coastal zones; straights and choke points; restricted waters; major ports and riverine waterways. By dividing the waters of a State into defined geographical regions or zones, a risk assessment of each zone can be made and risk control options developed for that zone. Worksheets B, C and D should be adapted as necessary for each zone or waterway.
2. The Competent Authority of any State that decides to use *RAMS* should firstly divide its waters into geographically defined zones with similar volumes of traffic and degrees of risk. In broad terms, the offshore and coastal water zones can cover a large area, with smaller zones being defined for restricted waters and choke points.
3. Once the Competent Authority has defined its zones by identifying number (1 – 10 etc.) or letter (A - Z) and name (title), they should be listed in operational or strategic plans so that stakeholders can be made aware of the risk control options being implemented in them. This will enable targeted lists of stakeholders and user forum groups to be specified in the stakeholder worksheet for each zone.

**Statistical Data Worksheet (B) – Step-by-Step Guide**

1. **Technical Details**:
   1. Enter the identifying number or letter of the zone and give it a title.
   2. Enter the number of existing monitored and non-monitored floating AtoN in the zone. The total of floating AtoN will be produced automatically.
   3. Enter the number of Racons and fixed AtoN in the zone. Note that “beacons” includes lighthouses and daymarks. This should be the total number of AtoN whether they are owned, operated or maintained by the Competent Authority or by another AtoN service provider such as a port authority, military or private organisation. The total number of fixed and floating AtoN will be produced automatically.
   4. Answer the six questions relating to DGNSS; VTS; Routeing and reporting measures; pilotage and virtual AtoN potential. Note that additional factors such as traffic choke points, sharp bends in waterways and topography may need to be considered. If so, additional lines should be added to worksheets B and C.
   5. Not all the technical information on worksheet B is input directly to the risk matrix worksheet C, but will be used to inform stakeholders during discussions about possible risk control options.
2. **Hazards – Preparation:**
   1. Obtain copies of the largest scale paper charts covering the zone.
   2. From AIS images; information in IMO Ships’ Routeing publication, Sailing Directions and other sources, insert the main maritime offshore, coastal, ferry and local traffic routes onto the charts including routes into and out of ports and harbours.
   3. On the same chart(s), insert established anchorages, fishing grounds; aquaculture and offshore energy sites and the routes to and from them.
   4. Identify all isolated dangers including wrecks and obstructions with reference to the safe minimum depth (chart Datum) required for vessel operation within the waterway.. Liaison with the national hydrographic office is recommended to determine the quality of hydrographic data available.
   5. Identify all other objects or activity that might increase the degree of risk in the zone (e.g. spoil grounds, undersea cables, military exercise areas and Particularly Sensitive Sea Areas).
   6. Obtain historic meteorological data including statistics on restricted visibility for the zone from Sailing Directions, local meteorological offices and international airports (who are required to maintain such records).
   7. Obtain details of the volume and mix of traffic along all the predefined routes and areas within the zone. This information should be obtained from an analysis of AIS data (if available, both from IALA-Net by request and commercial suppliers), commercial port-call records and stakeholder liaison.
3. **Hazards – Data:**
   1. Risk from grounding will depend on the draft of the **largest vessel** operating in the zone. A combination of draft, UKC, half the maximum predicted swell (taken from sea-disturbance tables) and annual siltation will provide a safe minimum depth for this vessel. This value is transferred to the risk matrix worksheet C. The channel width information (if applicable) is not input directly to the risk matrix worksheet C, but will be used to inform stakeholders during discussions about possible risk control options concerning increasing the number of AtoN; wider channels or possible dredging options.
   2. Input the maximum rate of tidal flow in the most critical area of the zone. Insert direction of predominant flow and the season in which it occurs. Obtain data from the national hydrographic office if not known.
   3. Input the maximum predicted wind speed from meteorological records or Sailing Directions.
   4. Using the rule-of-thumb that 15 knots of wind on the beam is equivalent to 1 knot of tidal flow; the combined effect **worst-case** rate of drift is calculated and input to the risk matrix workbook C.
   5. Using the largest scale of chart input the distance to the nearest point of land from a coastal traffic route. The risk matrix workbook calculates the time in minutes before a vessel using that route might run aground after a total power failure. assessing the waterway in general insert the nearest point of danger on the approach route defined as the depth contour equivalent to the safe minimum depth entered in (a) above. This value is copied to the risk matrix workbook to inform what risk control options should be adopted to minimise the risk from grounding on a port approach (or passage through a narrow channel).
   6. Insert the minimum and average visibility in the zone in NM from meteorological data. Insert the number of predicted days that minimum visibility occurs and if appropriate the season in which it occurs. Note that if the visibility is less than 1NM for more than 10 days per year, audible AtoN (sound signals) should be considered[[13]](#footnote-13).
   7. If a passage through a narrow channel, restricted waters or port entry/exist can be affected by low sun or background lighting or glare, enter a “Y” (for yes) in these boxes.
   8. If there is historical evidence of natural and/or malicious interference to GNSS signals, enter “Y” in this box.
   9. If problems with marine communications have been identified in the past, enter “Y”. If no problems have been experienced insert “N”.
   10. Enter an assessment of yes “Y” or no “N” whether piracy or terrorism is a factor in the zone.
   11. Enter details if there are other natural or operations factors affecting the safety of navigation in the zone. If not, leave blank.

**Vessel Traffic Data.** Note that the aim is to assess the **maximum number** of both large and small vessels operating **within the zone at any one time**. This will assist the determination of whether competing uses for maritime space might lead to an increasingly crowded waterway with potential conflicts between large vessels and large and small vessels.

* 1. Enter the maximum number of commercial vessels by size operating in a zone on a typically busy day based on the best available data. Note that vessels greater than 10,000GT will be required to carry ECDIS by 2018 and modern commercial vessels greater than 3,000GT may carry new technology 3GHz radars that may not trigger Racon responses beyond about 4NM.
  2. Enter the number of energy carriers (e.g. Liquid Natural Gas carriers).
  3. Enter the number of passenger vessels and ferries.
  4. Enter the number of military vessels greater than 300 tonnes displacement. The total of “large” vessels (rows k to n) is transferred to the risk matrix worksheet.
  5. Enter the number of fishing vessels operating in the zone at any one time.
  6. Repeat for “service craft”.
  7. Repeat for “private” vessels. The total of “small” vessels (rows o to q) is transferred to the risk matrix worksheet C.
  8. Having obtained the total number of large and small vessels operating in the zone at any one time, decide whether this maritime traffic density and mix is likely to lead to an increasingly crowded waterway. If so, insert “Y” (for yes) in the box. If not, insert “N” (no).

**Human, other Operational and Economic Factors**. The Competent Authority should assess the quality of other organisations operating in the zone as well as the competence of the crews of both large and small vessels. The “score” should be based on 1 = competent, 2 = some shortcomings and 3 = poor. The scores are then copied to the risk matrix workbook C.

* 1. Enter scores for the quality and competence of other organisations and the crews of vessels operating in the zone. This includes an assessment of AtoN service delivery by providers other than the Competent Authority such as private ports, marinas or defence bases. If problems with the lack of VTS or existing traffic routeing and reporting systems have been experienced such as over-crowded waterways, illegal fishing, increases in crossing traffic etc. then insert a score of 2 or 3. If there are no existing Vessel Traffic Services or routeing or reporting systems (see paragraph 15d above) and none are considered necessary on the date of review, insert “NA” (not applicable) in these three boxes. Large vessels should carry STCW qualified personnel, but if problems have been identified through Port State Control inspections, the score should be modified appropriately. The competency of the crews of small vessels may be harder to judge. Stakeholder input and local maritime accident/incident reports should inform the score entered.
  2. Enter an assessment of whether political decisions may affect risk in the zone (Y) or not (N).
  3. Enter an assessment of whether there may be problems obtaining secure funding for AtoN services: “Y” for yes (potential problems; insufficient funding); “N” for no (i.e. secure funding in place).
  4. Repeat for an assessment of any potential legal problems, which could give rise to court cases against the AtoN service provider.

**Note**: If a particular entry on either worksheet 2 or 3 does not apply to the selected region or zone, it is suggested that those lines are either deleted from the sheets or have their cells “greyed out” using the “fill” tool.

**Risk Matrix and Summary – Worksheet (C)**

1. The risk matrix and summary worksheet is divided into 3 sections:
   1. Section 1 – Hazards
   2. Section 2 – Impact or consequences
   3. Section 3 – Risk summary and general control options

**Worksheet C Section 1**

1. Worksheet C Section 1 requires the local users’ forum to assess the probability of an undesirable incident occurring for each of the six categories of hazard (natural, economic, technical, human, operational and crowded waterway[[14]](#footnote-14)). Worksheet C displays the hazards in each category with the “value” of each based on the data entered in worksheet B. The local users’ forum should first enter an “X” in all boxes that apply to each undesired incident scenario. For example if the “minimum visibility value” affects both groundings and collisions, then insert an “X” in both columns. Similarly, if piracy is unlikely to result in groundings or collisions, but may result in a vessel foundering, insert an “X” in the “foundering” box.
2. If no “X”s are entered into a single undesired incident column (including “other”) it is suggested that the column be “greyed out” using the “fill” tool so that only those of concern are highlighted. Ensure that the same column is they “greyed out” in Section 2.
3. If there is no “other” undesired incident scenario, then delete or “grey-out” the “other” column.
4. The users’ forum should then use the “value” figure to assess the **probability** of an undesirable incident occurring to the **vessel with the deepest draft** in the zone based on the **worst-case scenario** where two or more hazards might contribute to an undesirable incident. This should be entered as a “probability score” (1, 2 or 3) at the bottom of each undesired incident column. Where possible, historical maritime casualty records should be used to inform the users group’s deliberations.
5. Where two or more hazards might contribute to an undesired incident, the probability score entered at the bottom of each category should be that for the hazard with the most likely probability. Use the right-hand “notes” column (e.g. “see note # below”) to cross-refer to specific risk control measures shown on Worksheet D. For example for if both the “proximity of danger” and “background glare” might contribute to a grounding, insert a comment to that effect in the notes section so that the user group can take it into consideration when developing more detailed risk control options on worksheet D.

**Worksheet C Section 2**

1. Worksheet C Section 2 shows the factors for which the users’ forum should assign **impact** scores for each category of undesirable incident in both the short and long-term. This list focuses matters that might adversely affect third parties (people, property and assets afloat or ashore) and the regional economy and environment including damage to. The local users’ forum should first enter an “X” in all boxes that apply to each undesired incident scenario as for Section 1. An “impact score” (1, 2 or 3) should entered at the bottom of each undesired incident column based on the estimated worst-case scenario.

**Worksheet C Section 3**

1. Start by entering the name of the user forum; date of meeting and planned date of the next meeting in the top right-hand box.
2. A quantative risk factor from low risk (1 or 2); moderate risk (3 or4); high (6) or very high risk (9) is calculated for each undesirable incident scenario using the probability and impact scores entered into Sections 1 and 2. For each risk assessment value of 2 or more, a general control option should be identified. The “risk” column should be colour coded in accordance with Table 5 above. If a low-cost risk control option can be identified for a risk assessment value of 1, then that too should be entered. These options should be stated in the simplest of terms (e.g. mandatory pilotage; enhanced AtoN; Port State Control or education programme). Examples are shown in Table 6 below. The six types of hazard (natural; economic; technical; human; operational and crowded waterways) would then have been addressed.
3. The objective is to identify risk control options for each undesirable incident that would, if implemented, reduce that risk to an acceptable level. Colour coding will highlight the urgency of action required. The process is subjective, but the aim is to reach consensus on each overarching risk control option.

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| --- | --- | --- | --- | --- |
| Worksheet D: Risk Summary and Control Options | | | | |
| Undesirable Incident | Probability | Impact | Risk | Control Option |
| Grounding | 2 | 2 | 4 | Install isolated danger mark |
| Collision | 3 | 3 | 9 | Enforce routeing measure (TSS) |
| Allision | 2 | 1 | 2 | Improved pilotage service |
| Foundering | 1 | 1 | 1 | Monitor – no immediate action required |

1. Example Section 3 - Risk Summary and Control Options

**Specific risk control options - Worksheet (D)**

1. Worksheet D is used to amplify all potential risk control options. Start by entering the zone number and zone title at the top of the worksheet. Then for each of the four main undesirable incident scenarios, “grey-out” the row for all hazards that were not considered to affect the undesirable incident scenarios in Worksheet C Section 1 (i.e. all those with no “X” in any of the scenarios).
2. If the users’ forum identified an “other” undesirable incident scenario, then insert another table at the bottom of the worksheet.

1. The users’ forum should then decide on specific risk control options. Possible examples are shown in Table 7 below.

|  |  |  |  |
| --- | --- | --- | --- |
| Undesirable Incident Scenario | | Grounding | |
| Hazard | | Risk Control Option | Note |
| Natural | Safe minimum depth | Dredge main approach channel | 1 |
| Background glare | Change colour of leading line signal lantern | 2 |
| Technical | Total navaid failure (large vessels) | Instigate waiting anchorage outside port approach | 3 |
| Human | Small vessel crew competency | Provide education programme by PSC officers | 4 |
| Mar Space | Crowded waterway issues | Introduce Vessel Traffic Service | 5 |

1. Example Worksheet D – Specific Risk Control Options
2. For each risk control option listed, a more detailed risk explanation should then be developed by the Competent Authority as part of the fourth stage of the risk control process set out in IALA Guideline 1018. These detailed options, together with the summary from worksheet C Section 3 can then be presented to higher authority as the justification for funding to enable them to be put into action.

1. The overarching guidance on risk management is contained in IALA Guideline 1018 [↑](#footnote-ref-1)
2. IMO SN.1/Circ.296 dated 7 December 2010. In addition to Recommendation O-134, the Annex to the Circular made particular mention of Recommendation O-138 on the Use of GIS and Simulation by Aids to Navigation Authorities; Guideline 1057 on the use of GIS by Aids to Navigation Authorities and Guideline 1058 on the use of Simulation as a Tool for Waterway design and Aids to Navigation Planning [↑](#footnote-ref-2)
3. Guideline #### gives specific guidance on the use of PAWSA [Note: This assumes that the draft GL on PAWSA will be output from ARM-5 and subsequently approved by Council] [↑](#footnote-ref-3)
4. A hazard is *“any biological, chemical, mechanical, environmental or physical agent that is reasonably likely to cause harm or damage to humans, other organisms, or the environment in the absence of its control”.*  [↑](#footnote-ref-4)
5. Stakeholders are individuals, groups or organisations able to affect or be affected by a decision or activity related to AtoN service provision. Refer to IALA Guideline 1079 on establishing and conducting user consultancy for more information [↑](#footnote-ref-5)
6. “Allison” is defined as a vessel striking a fixed man-made object such as a pier or berthing dolphin [↑](#footnote-ref-6)
7. “Foundering” is defined as the sinking of a vessel that is not the result of an earlier collision. For example a vessel might founder if its cargo shifted during bad weather [↑](#footnote-ref-7)
8. Actual value may differ in different parts of the world. This could also include short and long term environmental consequences. [↑](#footnote-ref-8)
9. These are similar to the risk mitigation categories used by PAWSA [↑](#footnote-ref-9)
10. See IALA Model course E-141/1 [↑](#footnote-ref-10)
11. Reference: IALA Guideline 1079 on on establishing and conducting user consultancy [↑](#footnote-ref-11)
12. Steps 4 and 5 of the risk management process set out in IALA Guideline 1018 [↑](#footnote-ref-12)
13. Reference: IALA Guideline 1090 [↑](#footnote-ref-13)
14. Category 5 (operational) and 6 (crowded waterways) are grouped together in worksheet C. [↑](#footnote-ref-14)