

Team Size and Fatigue

IAMSP-2012-01-MAN-001 v1.4

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This standard contains guidance and advice with respect to the size of security teams, given reasonably predictable impacts associated with fatigue. This document is not intended to be prescriptive in nature. As the guidance in this document pertains directly to security controls, the specific measures are to be based on an assessment of risk conducted by appropriately competent personnel.

Change Control

Serial	Date	Change	By	Comments
1	13 Jan 2012	Initial Draft	McDougall	In response to concerns regarding pressures to reduce team sizes
2	14 Jan 2012	Addition of Appendix B based on IMO Human Element Guidance	McDougall	Incorporation of additional IMO guidance
3	02 Feb 2012	Integration of comments returned	McDougall	Based on version 1.2 with comments integrated
4	09 Feb 2012	Validation of comments and release. Integration into DQMS	McDougall	Based on comments and returns

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Foreword

7. This foreword is considered an introduction to the IAMSP and is not considered to be part of the development process.

About IAMSP

8. The International Association of Maritime Security Professionals (IAMSP) was founded in 2010 as the result of a perceived need by a number of private entities to raise the level of professional conduct within the maritime security industry.
9. The Association is a not-for-profit, volunteer organization.
10. The IAMSP seeks to address a broad range of issues associated with the maritime security industry, ranging from the protection of vessels and platforms operating at sea and seaports.
11. The IAMSP is an inclusive organization, seeking to build strong relationships between likeminded organizations. It is the belief of the IAMSP that such alliances build stronger voices and further the ability to build capacity within the industry.

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Revision History

13. This document is the first version of this standard.

Standard Designation

14. This standard is designated as IAMSP-2012-01-MAN-001 where
 - a. 2012 refers to the originating date,
 - b. 01 refers to its applicability to ships,
 - c. MAN referring to the manning considerations, and
 - d. 001 refers to its being a general topic.

Keywords

15. Minimum manning, scheduling, team size

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Scope, Summary, and Purpose

Scope

16. The *Team Size and Fatigue* is not intended to cover all aspects of minimum manning but is rather intended to address what are seen as key points. It is intended to take a broad and international focus.
 - a. In this context, the term minimum manning is to be interpreted in terms of the size, security detail, and
 - b. In this context, the term minimum manning is not intended to limit, change or otherwise disrupt calculations associated with the minimum manning associated with the safe manning and operation of the vessel
17. It is recommended that persons using this standard consult with legal counsel with appropriate competence and experience in the domain if seeking to develop internal policies regarding the application of force.

Summary

18. The *Team Size and Fatigue* covers the following issues:
 - a. General considerations with reference to authoritative material
 - b. A sample process to be used with reference to guidance material
 - c. A sample schedule based on a four man team, eight day week.

Purpose

19. The purpose of this document is to provide a foundation for those developing internal *processes for determining the size and schedules of security teams*.

Terms and Definitions

20. **Alertness** – the ability to think in a clear and intelligent manner, being able to maintain a level of focus or attention to what is happening and being ready to respond appropriately and quickly
21. **Communication** – the process involving one party expressing a message to another party in a way that reasonably ought to lead to the intent and content of the message being understood by the receiving party.
22. **Contributing factor** – Conditions that increase the likelihood or opportunity for an individual to become impaired. Within the context of Human Factors technical literature, a contributing factor may also be referred to as a performance shaping factor.
23. **Deprivation** – the lack of inadequate supply of something to support alertness, performance or health.
 - a. **Sleep Deprivation** – a lack of sufficient restorative sleep over a cumulative period so as to cause physical or psychiatric symptoms and affect routine performance or tasks.
 - b. **Acute Sleep Deprivation** – refers to no sleep or a reduction in the time allowed to sleep over a period of 24 hours to 48 hours.

- c. **Chronic Sleep Deprivation** – Also referred to as sleep restriction involves conditions where the individual routinely sleeps less than what is required to maintain functionality
- 24. **Impairment** – any abnormality, loss of (partial or complete) or loss of function of any body part, organ or system. In this context, this includes the deterioration of an individual’s judgment.
- 25. **Normal person** – an individual that has no medical or psychological condition that can exacerbate.
- 26. **Reasonable** – in this context, the legal test applies. This involves whether or not an individual of sound mind would arrive at a similar conclusion given the same conditions and information.
- 27. **Routine Tasks** – common place tasks or duties as must be done at specified intervals, generally daily or during a set administrative period of time. Examples of routines tasks in this context may include (but are not limited to), the maintenance of equipment, standing watch, etc)

General Policies and Principles

- 28. General policies and principles are divided into three major sections. These are the following:
 - a. Oversight
 - b. Specific infrastructure and considerations
 - c. Sample schedule

Oversight

- 29. Oversight refers to management’s establishment, communication, monitoring and enforcement of its decisions. While it is important for an organization to have a *Scheduling or Minimum Manning Policy*, the value of that policy is also heavily dependent upon management’s commitment to ensuring that its organization adheres to that policy.
- 30. The following sections describe certain requirements that need to be met in their policy.

Internal Policies

- 31. The organization’s policies regarding minimum manning or security team size must be endorsed by the senior management of the organization. Where this is developed by a functional group (such as a legal department) or an outside contractor, they must still be clearly endorsed by the company’s senior management.
- 32. The internal policies must take into account the security of personnel (including those under the care of team), the safety of personnel, and the reasonable expectation that tasks can be performed. Given the nature of this policy, consideration should be given to ensuring that the company seeks appropriate legal advice regarding liability and medical advice regarding the reasonable expectation that persons will be able to perform routine tasks without impairment.
 - a. Companies should ensure that their decision making processes take into account medically and similarly accepted standards with respect to the protection of others against unreasonable risk or harm. This includes ensuring that the routine work being assigned to individuals or distributed across the team does not inappropriately increase

the presence of potential contributing factors to accidents or unsafe conditions to inappropriate levels.

33. The internal policies associated with the scheduling and minimum team size must be clearly documented and communicated to all employees that may be reasonably expected to supervise personnel as part of their duties.
34. The internal policies associated with the scheduling and minimum team sizes must also be periodically reviewed from time to time to ensure that they remain accurate and relevant to both the legal environment and operations of the organization.
35. The internal policies associated with scheduling and minimum team sizes, if updated, must clearly indicate the nature of the revision, the individual making the revision, the authority upon which the revision was based, and the dates associated with the revision (decision and coming into force). Past versions of the policies are to be removed from circulation and marked to prevent their inadvertent use (if not destroyed).
36. It must be clearly understood that this topic also requires a level of personal responsibility. Individuals are expected to comply with instructions to be on forced rest or not to engage in activities that can diminish or impair their ability to perform routine tasks.
37. It must be clearly understood that the company must also demonstrate that it has taken all reasonable steps to ensure that it has met the requirements of due diligence. A company, or its directors, cannot shed their accountability with respect to scheduling or maintaining team sizes at or above the minimum by failing to address the issue or by transferring the issue to another body.
 - a. When assigning tasks or creating positions involving routine work, the company is to identify conditions that could become contributing factors. One example of how to break down these factors is the following:
 - i. Mechanical factors – knowledge, skills, abilities, characteristics, etc
 - ii. Immediate environment – facilities, weather, design, time, teamwork, communications, work environment, etc
 - iii. Supervision – planning, organizing, prioritizing, delegating, instructing, feedback, performance management, team building, etc
 - iv. Organizational factors – policies, procedures, processes, selection, training, continuous improvement
38. The scheduling or minimum manning policy is to clearly define how the company intends to monitor decisions and the steps that will be taken should it be determined that a violation of the policy be identified.
39. It should be noted that decisions regarding the safety and security of personnel on board the vessel ultimately resides with the Master. The policy is to clearly state that the company understands and accepts the authority of the Master to require an individual to be relieved should the Master believe that the individual be impaired to the point of posing a risk to the safety or security of the vessel, those on board, or its cargo.

Infrastructure

40. Companies rely upon personnel, assets and information to carry out their decisions. There are certain elements of this activity that are specific to each of these elements.

Personnel

41. Personnel who are put in a position of authority must remain aware of the potential impacts associated with the following:
- The size of the teams and the effect that the team's size will have on watch keeping and scheduling,
 - The impact of routines on an individual's ability to remain alert and focused.
42. Personnel who occupy or hold supervisory positions are to remain aware of and incorporate the following into their decisions:
- The requirement for an individual, as determined by medical practitioners, to get seven to nine hours sleep per night in order to remain alert and operating at capacity,
 - The effects of a lack of sleep (including a lack of quality of sleep) and how that influences the individuals on the team, and
 - The impacts associated with a team member's loss of alertness, judgment, or awareness when performing routine tasks—including the impacts on decisions involving the use of force and with respect to the safety of the individual.
43. The individual is to remain aware and govern himself or herself accordingly with respect to the following
- Ensuring that when rest periods are provided, appropriate activities are undertaken so as to ensure that that period is used to best effect,
 - Ensuring that if he or she should determine or reasonably suspect that his or her performance has been affected or judgement is being impaired that the Team Leader be informed, and
 - Ensure that he or she complies with the legitimate and appropriate direction of the Team Leader or Master with respect to security and safety concerns.
44. It should be clear to all persons involved that extenuating circumstances may prevent individuals from being able to maintain routines that meet rest period or scheduling standards. This is not an excuse to put personnel in a position where they are at an inappropriate risk of becoming impaired for the purposes of reducing the team size or costs.
45. When assigning the size of the team, the company must take into account the following considerations:
- That at least two persons should be on shift. This is to ensure that as one person performs tasks associated with the maintenance of the overall security posture on the vessel (on shift), an appropriate level of individual safety and watchkeeping can be maintained at all times,
 - It should be noted that this requirement may be affected by the size of the vessel where personnel at rest are in close proximity and can respond quickly. For example, a small tug with quarters immediate aft of the bridge may not require

two persons on shift where all-round watchkeeping is possible by one person from one position,

- b. That the environment around the vessel must be able to be monitored in such a way that the vessel is afforded consistent 360 degree monitoring and protection at all times,
- c. That schedules be maintained so that security team maintains an appropriate level of experience and training,
- d. The effects of stress, strain and fatigue on the individual and the potential impact in terms of the creation or increase of the number or severity of contributing factors that could lead to accidents or unsafe acts, and
- e. The results of the threat and risk assessment with respect to operations (size of vessel, ability to provide all-round defence), threat environment (knowledge, skills, abilities, resources, intent, commitment and past tactics) and duration of the transit.

Assets

- 46. A document or record of the basis of the decision to offer or engage a certain team size is to be maintained by the company.
- 47. A shift schedule will be maintained by the Team Leader, including any notes regarding instances where individuals may not have been operating at optimal capacity or had become impaired due to the nature of routine tasks.

Information

- 48. The size of the team will take into account the following information:
 - a. The results of the risk assessment with respect to the ability to maintain an appropriate level of 24/7 and 360-degree monitoring of the environment around the vessel, and
 - b. The safe manning level of the vessel, noting that a decision would have to be made with respect to whether or not the team size could be reduced while maintaining an appropriate level of due diligence or if a waiver from the flag state should be sought.
- 49. As part of the ability to determine the effects of routine tasks on personnel, Team Leaders and company planners should remain aware of the following (at a minimum and on the understanding that other factors may be recommended on a case-by-case basis):
 - a. The physical fitness and mental fitness of the individual,
 - b. The past experience of the individual in operational environments,
 - c. The effect of the routine tasks in terms of physical and mental fatigue (including strain), and
 - d. The effect of periods of increased activity, including those that may involve higher levels of intensity (adrenaline rush), on the individual's ability to perform routine tasks.
- 50. In situations where the client attempts to reduce the team size for matters of cost, they should be advised of the need to maintain full coverage (spaces surrounding and time) around the vessel and to reduce the risks that factors leading to impairment could be inserted into routines.

Threat and Operating Environment

- 51. There are two elements associated with environmental considerations:

- a. Threat environment
- b. Operating environment or physical environment.

Threat Environment

52. The size of the team must be appropriate to the highest threat environment encountered by the vessel. When determining the highest level of threat environment, the ability to appropriately and legitimately embark and disembark persons, weapons and other equipment must be taken into account.
- a. When taking into account the threat environment, the knowledge, skills, abilities, resources, intent, commitment and past tactics of the threat are to be considered in addition to any reasonably credible information regarding possible changes in any of the same.
53. The size of the team must take into account the ability of the team to detect, identify, categorize, notify and respond to threats appropriately and as safely as can be reasonably made possible.
- a. Given the need to provide an all-round and continuous (24/7) watch in higher risk areas, it is not recommended that team sizes drop below four persons. This is dependent on the size and design of the vessel.

Physical or Operating Environment

54. The size of the security team must take into account the nature and operations of the vessel. This includes the following:
- a. The size of the vessel and the ability to protect the vessel fully,
 - b. The duration of time that the vessel is to be protected (daytime, night-time, 24/7, etc),
 - c. The design of the vessel, particularly with respect to blind spots, the use of technology, and the ability to respond appropriately to potential threats,
 - d. Routines on board the vessel that may pose a barrier to the ability to respond effectively (such as not being able to pass through certain compartments during normal operations, etc), and
 - e. General arrangements and deck arrangements of the vessel.
55. The Security Team on board the vessel provides a number of functions with respect to the security of the vessel. These functions include the following:
- a. Watchkeeping in terms of watching for suspicious vessels or aiding in the determination that vessel is suspicious based upon specialized training and experience, and
 - b. Monitoring the condition of security infrastructure and specific security controls on board the vessel, taking steps as required to conduct or to assist in the conduct of any appropriate repairs or work, and due to the specific understanding of the overall interaction of security measures with each other and how they operate to protect the vessel.
56. In accordance with Resolution A 890.2(21) Principle of Safe Manning and taking into account the subsequent amendments, this would preclude the ability of the vessel to operate with only one security person on watch as the duties associated with the repairs and maintenance of security

controls and other functions would conflict directly with the ability to maintain that appropriate watch.

- a. Consideration should also be given to the fact that maritime watchkeeping practices require that individuals who are monitoring through glasses (binoculars) and maintaining external watch be able to be spelled off due to the inherent mental strain associated with the environment and the need for concentration.
57. The basic elements of the Duty of Care that must be addressed are the following:
- a. Determination that a standard of care is owed (in this case, the size of the team and the scheduling of routine activities must take into account the safety and security of personnel),
 - b. Identification of those that may be affected directly or indirectly by the individual's actions or decisions,
 - c. Determination that all reasonable steps (given the operating environment and reasonable expectation of risks routinely accepted in work) have been taken to prevent the individual from being placed in conditions which would reasonably be expected to create or exacerbate factors contributing to the potential for an accident.
58. When determining the minimum size of team and scheduling, due consideration must be given to the potential for an individual to become impaired, particularly when dealing with equipment or other material that could pose a risk to the safety or security of themselves or others.

Recommended Authorities

59. The following are the general sources of information pertinent to this effort:
- a. MSC/Circ 1014 (Resolution A.772(18))– Guidance on Fatigue Mitigation and Management as found at <http://www.imo.org/OurWork/HumanElement/VisionPrinciplesGoals/Documents/1014.pdf>
 - b. Resolution A.890(21) – *Principles of Safe Manning* - adopted on 25 November 1999 as found at <http://www.imo.org/OurWork/HumanElement/VisionPrinciplesGoals/Documents/890.pdf> and subsequent amendments to that document as found as part of Resolution A.955(23) – *Amendments to the Principles of Safe Manning* as found at <http://www.imo.org/OurWork/HumanElement/VisionPrinciplesGoals/Documents/955.pdf>
 - c. Section A-VIII-1 of the STCW Convention regarding the amount and distribution of periods of rest.
 - d. The US Coast Guard documentation regarding *Crew Endurance Management Practices: Guide for Maritime Operations* was also consulted during the development of this document. This document can be found at <http://www.uscg.mil/hq/cg5/cg5211/docs/GuideForMaritimeOperations.pdf>

Procedures

60. Identify the specific nature of the services to be provided.
61. Identify if any of the following conditions apply:
 - a. The requirement not to work in isolation,
 - b. The requirement to provide for adequate rest, and / or
 - c. Operational factors that would reasonably require more than one person to perform tasks.
62. Conduct the Threat and Risk Assessment or review the existing Threat and Risk Assessment (or Ship Security Assessment) that clearly includes the operating, threat, and environmental conditions. Identify the following:
 - a. The ability to maintain an appropriate level of monitoring around the vessel given the design of the vessel (blind spots, etc), the use of technology (CCVE, etc), and lighting (particularly glare),
 - b. The ability to maintain an appropriate continuity of watch given the requirements defined in the IMO references above, and
 - c. The ability to mount an effective defence of the vessel, taking into account the size of the team and disposition of the team at the time of activation or attack.
63. Calculate the minimum team size given the need to meet any requirements identified above and communicate it to the client.
64. Receive the return from the client. Prepare a response regarding the following:
 - a. Should the client require that the team size be reduced, inquire about the basis for that requirement and identify that the team size is based upon the need to maintain appropriate protective measures for the vessel and remain in accordance with the guidance of the IMO.
 - b. Should the client continue to require a team that cannot adhere to those principles, the company should remain aware that going below the minimum team level as calculated may have legal and other ramifications. Legal advice would be required to determine if the company would assume any additional or increased liability in this regard.
 - c. Should the company be required to reduce the team size, other measures should be integrated into the contract to ensure, as best able, that the ship will assist in maintaining the appropriate defensive posture, taking into account the same references above and the training of personnel involved.
65. Select the team and team members as per internal corporate routines, taking into account the balance of training and experience.

Guidelines

66. Several guides and other material are published through insurance and safety organizations regarding the effects of fatigue on personnel.

- a. Skuld Guide *How to Prevent and Mitigate Fatigue* as found at <http://www.skuld.com/upload/Loss%20Prevention/Fatigue/Skuld%20Guide%20-%20Fatigue.pdf>
- b. Several bulletins, including the PSC Inspection on Hours of Work / Rest (25 August 2010) from the Marine Department (Shipping Division) as found at http://www.mardep.gov.hk/en/pub_services/pdf/psc_insp.pdf
- c. The IMO Website for the Human Element, including guidance regarding Safe Manning, Fatigue, and Seafarers Hours of Work or Rest can be found at <http://www.imo.org/OurWork/HumanElement/VisionPrinciplesGoals/Pages/Fatigue.aspx>

67. Consideration should also be given to the specific nature of the operating and threat environment. While such guidelines are written for general operations, several military medical organizations have published works on the effects of fatigue on personnel.

Revision of Standard

This document shall be reviewed at least annually and upon any of the changes indicated in this document.

Sample 4-Member Shift Schedule (option only)

Shift	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7		Day 8	
0001-0100	A	B	A	B	B	C	B	C	C	D	C	D	D	A	D	A
0101-0200	A	B	A	B	B	C	B	C	C	D	C	D	D	A	D	A
0201-0300	A	B	A	B	B	C	B	C	C	D	C	D	D	A	D	A
0301-0400	A	C	A	C	B	D	B	D	C	A	C	A	D	B	D	B
0401-0500	A	C	A	C	B	D	B	D	C	A	C	A	D	B	D	B
0501-0600	A	C	A	C	B	D	B	D	C	A	C	A	D	B	D	B
0601-0700	B	C	B	C	C	D	C	D	D	A	D	A	A	B	A	B
0701-0800	B	C	B	C	C	D	C	D	D	A	D	A	A	B	A	B
0801-0900	B	C	B	C	C	D	C	D	D	A	D	A	A	B	A	B
0901-1000	B	D	B	D	C	A	C	A	D	B	D	B	A	C	A	C
1001-1100	B	D	B	D	C	A	C	A	D	B	D	B	A	C	A	C
1101-1200	B	D	B	D	C	A	C	A	D	B	D	B	A	C	A	C
1201-1300	C	D	C	D	D	A	D	A	A	B	A	B	B	C	B	C
1301-1400	C	D	C	D	D	A	D	A	A	B	A	B	B	C	B	C
1401-1500	C	D	C	D	D	A	D	A	A	B	A	B	B	C	B	C
1501-1600	C	A	C	A	D	B	D	B	A	C	A	C	B	D	B	D
1601-1700	C	A	C	A	D	B	D	B	A	C	A	C	B	D	B	D
1701-1800	C	A	C	A	D	B	D	B	A	C	A	C	B	D	B	D
1801-1900	D	A	D	A	A	B	A	B	B	C	B	C	C	D	C	D
1901-2000	D	A	D	A	A	B	A	B	B	C	B	C	C	D	C	D
2001-2100	D	A	D	A	A	B	A	B	B	C	B	C	C	D	C	D
2101-2200	D	B	D	B	A	C	A	C	B	D	B	D	C	A	C	A
2201-2300	D	B	D	B	A	C	A	C	B	D	B	D	C	A	C	A
2301-2400	D	B	D	B	A	C	A	C	B	D	B	D	C	A	C	A

Appendix B – Notes for the Formal Safety Assessment Regarding (Anti-Piracy) Security Watchkeeping

These notes are provided for basic guidance only and are not to be considered complete or exhaustive. Each operating, threat and climatic environment should be assessed on its own merits and, where necessary, elements may be added and, only after due consideration and diligence, may also be removed.

This assumes that the security detail on board is providing services that involve the provision of armed or unarmed services including watchkeeping (visual, radio and RADAR) and the maintenance of security controls (such as the perimeter controls).

Guidance with respect to the Formal Safety Assessment process can be found on the IMO Human Element website at

<http://www.imo.org/OurWork/HumanElement/VisionPrinciplesGoals/Pages/Formal-Safety-Assessment.aspx>

Identification of Hazards

The following are some of the core hazards to be considered with their potential consequences or risks:

- Impaired judgment
 - Misidentification of a non-threatening vessel as threatening
 - Misidentification of threatening vessel as non-threatening
 - Misapplication of the Use of Force
- Over-fatigue (sleep)
 - Failure to detect hostile acts such as firing or attempts at boarding
 - Failure to receive or hear emergency communications
 - Failure to defend the vessel until boarding underway
- Impaired Motor Skills
 - Accidents involving perimeter control material (barbed wire, etc)
 - Accidents involving equipment (fine motor skills)
 - Reduced ability to maintain equipment
 - Increased chance of negligent or accident discharging of weapons

Identification of Risks

The following are some of the core risks to be considered:

- Loss of life or serious injury
 - Discharging of weapon (against vessel or negligent / accidental)
- Bodily injury
 - Through accidents involving equipment or activities (impaired judgment, motor skills)

- Loss of vessel to attacker
 - Through lack of detection or ineffective response
- Increased strain or stress to the Officers and Crew of the vessel
 - Through lack of coherent and effective defence
 - Through loss of confidence

Risk Control Options

Risk control options include the following:

- *Avoiding high risk areas entirely*
 - *Taking into account operating costs and scheduling challenges*
- *Use of crew members to provide security services*
 - *Taking into account the IMO guidance above and the need for training*
- *Use of security personnel to provide security services*
 - *Taking into account IMO guidance with respect to the use of on-board security details (armed or unarmed)*

These controls are only basic suggestions. Proper assessment should be conducted to identify any additional controls or adjustments to controls.

Cost-Benefit Analysis

Given that security teams provide the major line of defence for a vessel when under attack, the cost of the four-man team and appropriate work cycles should take into account the potential for vessels, particularly on longer transits, to be operating at reduced security posture in higher risk areas. The consequences to be considered include the following:

- Real Costs
 - Ransoms
 - Damage to the ship other equipment
 - Cost of replacement of vessel
 - Fines, penalties or other consideration paid for failure to make delivery
 - Injuries to personnel (physical and psychological)
 - Repatriation costs
- Potential Costs
 - Lost revenues
 - Legal liability
 - Increased insurance and similar premiums

Recommendations for Decision Making

The following are recommended controls:

- Use of an appropriate 4-person team and schedule (taking into account exceptions due to reduced size or complexity of vessels),

- Ensure that security team members receive rest periods in line with the IMO guidance, and
- Ensure that security team members do not operate in isolation but have a system of mutual monitoring or integration into ship routines.

IAMSP Standards and Guidance - Final Draft v1.4

Appendix C – Sample Approach

It must be clear in the mind of all readers of this document that the size of the vessel's security detail is not a product of a standard but of an appropriate assessment of risk performed by competent individuals.

1. Determine the hours of coverage that are needed.
2. Determine the length of the transit in terms of days.
3. Given that a team of 4 persons can establish a 24 / 7 watch with adequate rest to be sustainable for extended periods of time, consider the following:
 - a. The need for additional security personnel to cover blind spots or obstructed areas so as to be able to maintain an appropriate level of watch keeping
 - i. Consider that the average field of view for an individual is approximately 130 degrees total in each eye can give a field of view of approximately 160 degrees total
 - ii. Consider that visual assists, such as weapon sights and binoculars, will extend the range at which the eye can see but limits the field of view. In many cases, the field of view is expressed either in degrees or in the width observed at 1000m.
 - iii. Understand that watch keeping through visual assists only can lead to a condition similar to "scope lock" where an adversary can approach by being outside of the field of view of the individual focussing solely using the visual assists.
 - b. The extent of defensive coverage that can keep the attacker at bay given the reach of the defensive tools and the need to take up new positions,
 - i. Consider the length of the vessel in meters,
 - ii. Consider the range at which the attacker is to be kept away from the vessel,
 - iii. Consider the effective range of the defensive tools that can be applied, taking into account the training of the individual
 1. Let the length of the vessel be L
 2. Let the range that the attacker is to be held back be represented by " b " (use 1.0m if alongside)
 3. Let the range that the defensive tool can reach effectively be represented by " a "
 4. Let the length of the hull that can be covered effectively from that position be represented by " c " noting that c is an absolute value.
 - c. The number of potential attackers that the defender can engage effectively within that area and taking into account the tactics used by the attackers. Also take into account the probability of that size or scale of attack.
 - i. For example, the majority of reports may involve a mothership supported by between two to four skiffs but there may be additional reports that involve a much larger number of skiffs. In these cases, the risk assessment should take into

account the probabilities associated with the lower, average and upper level of attack

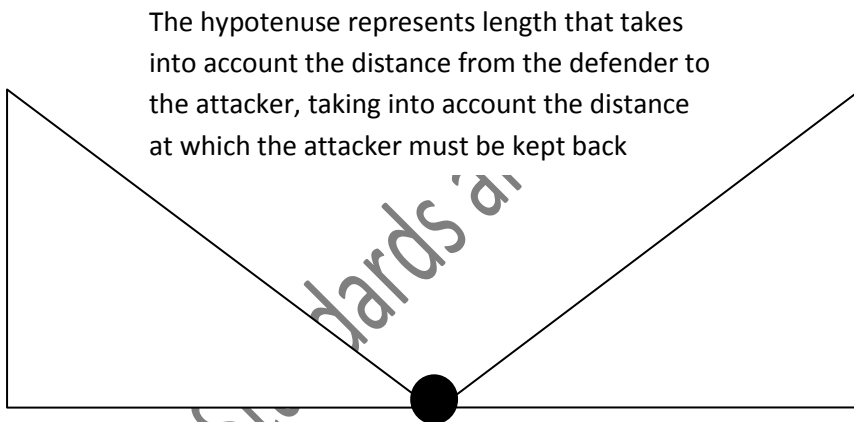
- d. Consider the general time of attacks and compare them to the peak periods of awareness (see the US Coast guidance on Red Zones for a description of this factor). Note that where attacks happen on off hours (normal sleeping or rest hours), personnel may not be as alert or able to respond to full effectiveness.
- e. Taking into account the baseline number of people, the effectiveness of defensive tools at being able to reach the attacker and keep them at range, the tactics of the attacker and the number of persons involved and factoring in the potential for a reduction in alertness during non-peak performance periods (Red Zones), assess the number of persons needed.

C1 - Approach by Diagram

$$a = \sqrt{b^2 + c^2}$$

or

$$a^2 = b^2 + c^2$$



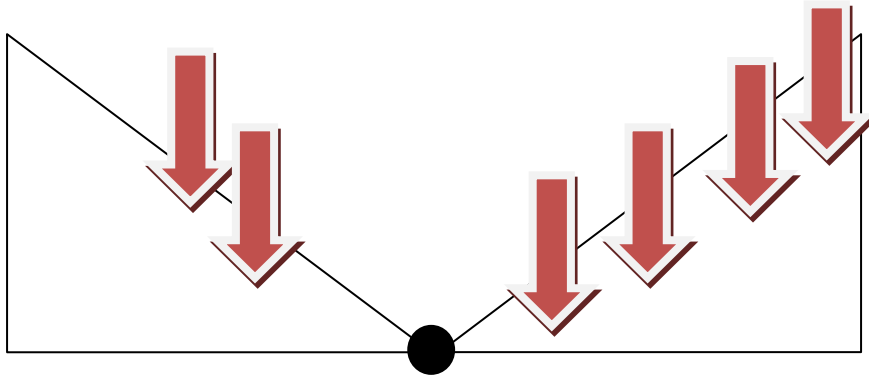
The hypotenuse represents length that takes into account the distance from the defender to the attacker, taking into account the distance at which the attacker must be kept back

This represents the distance at which the attacker must be kept. This is represented by "b"

In this case, the base of one triangle (or half the distance of the line) represents the length of coverage. This may be longer, the same as, or shorter than the length of the hull. Where shorter, it may be that additional personnel are needed (in addition to obstructions, blind areas, etc). This is represented by "c"

For example, if there is a need to keep the attacker 300m from the vessel and an individual an engage effectively at 500m, then the length of coverage is 400m in one direction. Given the length of the vessel being 200m, then the primary factor would be saturation of defences.

Now consider that the defender can engage a single target in 30 seconds (including identification of the threat, taking aim, delivering controlled and effective fire in the case of the use of firearms)



Consider that the attacker can cover the 300m in approximately 90 seconds. In this case, the defender would require approximately 180 seconds to cover the full range of six potential targets. This means that there are twice as many attackers as can be handled by the defender. A second defender would be required at this point.

At this point, a decision must be made. Is the need to maintain the 360 degree coverage more important than the need to address the attack. If the full range of coverage must be maintained, then an additional position may be required. Where that additional position is required, this would require adjustment of the schedule to ensure full coverage, adequate rest, etc.