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Piracy Risk and Mitigation Framework

By

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ABSTRACT

Piracy has been a problem for waterway transport, since the beginning of the 17th century. Pirate attacks have increased significantly over the last 15 years and recent insurgence can be observed in Western Africa. As pirates become technologically more advanced, they are able to constrict vessels in the main shipping bottlenecks at Suez and Singapore/Malacca Straits. Pirate in these regions are not violent, however pirates in West Africa tend to use more force.

The effects of piracy have an economical consequence, affecting not just transportation, but the overall supply chain. This has placed pressure on ship-owners, insurance agencies and piracy reporting centres to provide security at sea, or develop methods to mitigate risk. This thesis identifies the critical factors vessels should consider that makes them vulnerable to piracy attacks. These factors are then utilised to create a piracy risk and mitigation framework.

The critical security factors are identified by a meta-analysis of previous studies in the field of vessel operation risk analysis and working operational manuals of shipping companies, IMO guidelines and IMB reports. These factors are quantified and are analysed using binary-logistic regression. The results of the regression show ten factors that are significant to assess risk, Geographical Region, Freeboard, Sea State, Citadel, Boarding Access, Status of the Vessel, Anti-piracy Equipment, Speed, Reporting Points and Lookouts. These factors are then prioritised using Analytic Hierarchy Process Questionnaire. The priority rankings show that Speed has the highest weightage and Boarding Access the lowest.

Prioritising the factors enables us to develop a framework that incorporates operational hazards whilst assessing the risk through a score-based evaluation. The framework then identifies the severity of the hazard and propagates a mitigation response. This technique can be reused as a reviewing technique after revising the mitigation advice.

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LIST OF ABBREVIATIONS

AHP – Analytic Hierarchy Process
ALARP – As Low As Reasonably Practicable
BMP – Best Management Practices
CSF – Critical Security Factors
CSI – Continuous Security Improvement
ETA – Event Tree Analysis
FSA – Formal Safety Assessment
FTA – Fault Tree Analysis
GoA – Gulf of Aden
GLM – General Linear Model
HCSS – The Hague Centre of Strategic Studies
ICS – International Chamber of Shipping
IMB – International Maritime Bureau
IMO – International Maritime Organisation
ISM – International Safety Management Code
ISPS – International Ship and Port Facility Security Code
MARSEC – Maritime Security Level
MO – Modus Operandi
MSCHOA – Maritime Security Centre Horn of Africa
NVIC – Navigation and Vessel Inspection Circular
PDCA – Plan-Do-Check-Act
SSP – Shipboard Security Plan
UKTMO - United Kingdom Marine Trade Operations
UNCLOS – United Nations Convention on Law of the Sea
USCG – United States Coast Guard

Chapter 1 Introduction

1.1 The Piracy Problem

Piracy has been a problem for waterway transport since the beginning of the 17th century. The problem hit its peak in the late 90's and early 21st century (Bumstead, 2009). Pirate attacks increased three fold in the years 2005-2008 and exponentially between 2008 and 2009 (from 293 to 406) (IMB, 2010). The advent of armed guards from 2009 onwards, helped deter attacks in the Gulf of Aden (GoA) and South East Asia, through the increase in maritime and port security.

According to the IMB, 177 attacks occurred in the first six months of 2012, compared to 266 for the same time frame in 2011, a 33% reduction of pirate attacks in the GoA. However, figures for West Africa show a dramatic rise (Jauregui, 2012). Vessels transiting the area or entering port are vulnerable to attacks, hi-jacking, armed robbery, theft and arson. Where in the GoA the effect of piracy is reducing, in other regions of the world pirates are still highly active (Figure 1).

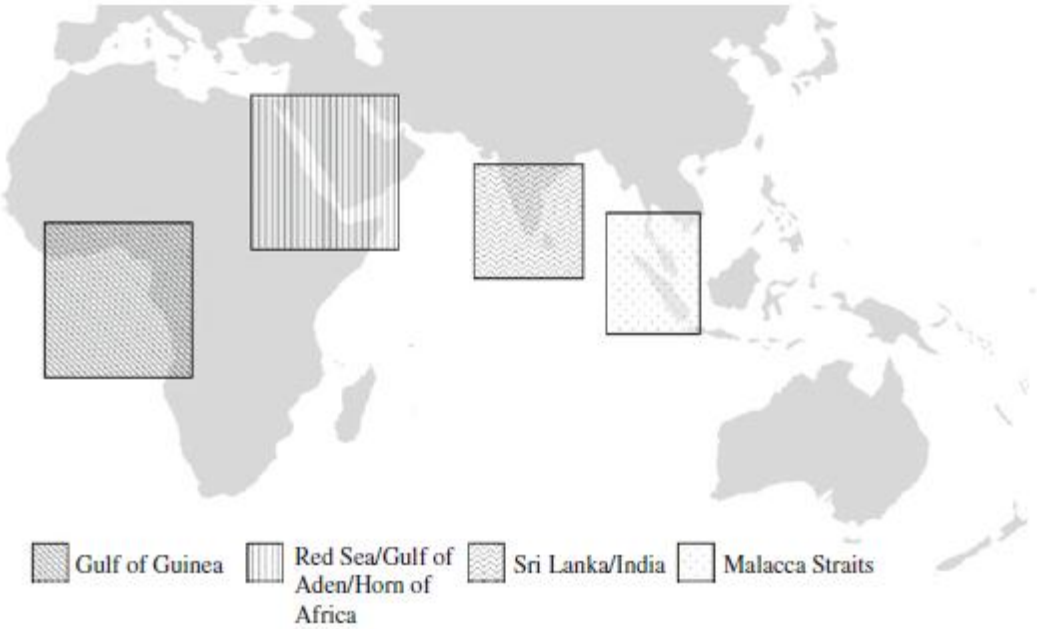

Figure 1: Piracy hotspots and high risk areas (Source: Sullivan, 2010)

As pirates become more technologically advanced, often using automatic weapons and explosives to stop vessels in transit and board stationary vessels at anchorage, they are able to constrict vessels in the main shipping bottlenecks at Suez and Singapore/Malacca Straits, to a confined region easily. However, most pirates in this

region are not violently aggressive as they benefit more from obtaining ransom than causing destruction. Piracy in West Africa on the other hand seems to be drawn to illegally confiscating cargo and bunker fuel, with little to no regard for what happens to the vessel or the crew. These pirates tend to use more force and violent measures to get what they want, which has lead to causalities (Jauregui, 2012). Under-reporting of such incidents become highly problematic.

1.2 The Effects of Piracy

As piracy becomes a global phenomenon, it starts affecting not only sea transportation, but overall supply chains. The costs of piracy are larger than the cost of spending to employ guards or provide individual convoys for extremely expensive cargo through these regions (Sullivan, 2010). However the cost of hiring security firms and guards is a trade-off that ship-owners need to make with regard to the transit time difference between The Suez Canal and The Cape of Good Hope (Sullivan, 2010). Insurance companies in this aspect offer reduced Kidnap & Ransom (K&R) premiums for carrying armed guards (Jauregi, 2012). Sullivan, 2010 shows the potential monetary effect of piracy on the total supply chain by estimating a loss of USD 109 million for Suez Canal (Figure 2). Hiring private security firms, with a presence in these regions has become a norm for most shipping companies as pirates become increasingly violent (Onuoha, 2009).

Total Number of Vessels Traveling Suez Canal	17,228
Total Tonnage Cargo Traveling Suez Canal	559,245,000
Total Revenues from Suez Canal Tolls	$4,289,500,000.00
Average Tonnage per ship	32,461
Average Revenue per ship	$248,984.21
Average Revenue per ton	$7.67
Cargo that must pass through Horn of Africa	78%
Revenues Directly Exposed to Piracy in Horn of Africa	$3,345,810,000.00
Number of Ships Exposed to Piracy in Horn of Africa	13437.84
Pirate Attacks in Horn of Africa	215
Percentage of Suez Canal Traffic Attacked	2%
Estimated Value of International Trade Goods by Sea	65%
Percentage of Global Ship Traffic through Suez Canal	7%
Value of World Exports:	$12,140,000,000,000.00
Estimated Total Value by Sea	$7,891,000,000,000.00
Total Tonnage of Shipping by Sea - 2008	8,170,000,000.00
Total Tonnage of Shipping by Sea - 2009	7,434,700,000.00
Suez Canal Tonnage	559,245,000.00
Percentage of Global Total moving though Canal	7.52%
Average Dollars per Ton	$1,061.37
Value of Tonnage through Suez Canal	$593,568,307,396.40
Value of Tonnage through Horn of Africa	$462,983,279,769.19
Possible Value Exposed to Piracy (Total Suez Traffic)	$9,496,852,625.89
Possible Value Exposed to Piracy (Moving through danger zone)	$7,407,545,048.19
*All data from 2009 unless otherwise noted	
Suez Revenue 2008	$5,381,000,000.00
Suez Revenue 2009	$4,291,000,000.00
Suez Decreases	$1,090,000,000.00
Percentage attributed to piracy	10%
Suez Losses to piracy	$109,000,000.00

Figure 2: Potential monetary effect of piracy on a supply chain (Sullivan, 2010)

In subsequent years, studies have been carried to trace and find the root cause of piracy. Most economics experts are in agreement that the political turmoil and instability in the region has made the advent of piracy possible. Hence, the ease with which one can earn money by hi-jacking vessels combined with an unstable regional demographic of low economic activity, poor infrastructure and lack of security patrol, make it a dangerous combination for a piracy hotspot (Swart, 2012).

How ship-owners approach the increasing costs of piracy strongly depends on the risk they face sending their vessel into high risk areas. The benefits that ship owners receive are more so attributed to the savings whilst taking up K&R insurance, through reduced premiums, but statistics show that most owners still indulge in covering payment of ransom through defences set in the Hull and Machinery (H&M) or War Risk (WR) Clause (Jauregi, 2012). This is because owners incur an extra expense when an

incident occurs, with a hike in the insurance premium or losses from a number of expenses that are excluded from the policies.

1.3 Defining Piracy

The definition of piracy has also been under debate for a long time. The International Maritime Bureau – Piracy Reporting Centre (IMB-PRC) definition follows the definition as laid down in Article 101 of the 1982 United Nations Convention on the Law of the Sea (UNCLOS) and armed Robbery as laid down in Resolution A. 1025 (26) adopted on 2nd December 2009 at the 26th Assembly of the International Maritime Organisation (IMO).

(a) Any illegal acts of violence or detention, or any act of depredation, committed for private ends by the crew or the passengers of a private ship or a private aircraft, and directed:

> (i) On the high seas, against another ship or aircraft, or against persons or property on board such ship or aircraft;
> (ii) Against a ship, aircraft, persons or property in a place outside the jurisdiction of any State;

(b) Any act of voluntary participation in the operation of a ship or of an aircraft with knowledge of facts making it a pirate ship or aircraft;
(c) Any act inciting or of intentionally facilitating an act described in sub-paragraph (a) or (b) (IMO, 2013).

The interpretation assesses piracy as an international crime and provide for a holistic inclusion of all crimes committed at sea. Pirates are considered enemies of all states and therefore, can be brought to justice in any state court on ground of International Law of the Sea (MTRC, 2013). The study, henceforth will take into account incidents of piracy with regard to the definition stated by IMB-PRC and IMO.

1.4 Aims and Objectives

Piracy has affected not just the maritime industry, but also the periphery industries that rely on shipping to transport goods. In essence, piracy has lead to the whole supply chain i.e. many manufacturing and multinational companies, to put pressure on ship owners to increase security onboard their vessels, or find methods to mitigate the risk by taking alternate shipping routes, for the safety of the crew and the vessel. For this reason, the vessels need to, firstly, identify the key operational factors that make them vulnerable to piracy attacks and secondly, establish an accurate risk assessment

scheme incorporating such factors that will enable them to clearly prepare for and mitigate risk before proceeding through high risk areas.

In order to create a piracy risk and mitigation framework, we aim to answer the main research question and sub-questions (Section 1.5). The study will be structured by looking to identify the various critical factors through a meta-analysis of previous studies in the field of risk management in a literature review (Chapter 2). These factors will be quantified to analyse the correlation towards the likelihood of a pirate attack, in the Hypothesis section (Chapter 3). The Research Methodology (Chapter 4) will deliver the results of the analysis that will be used to prioritise the factors using Analytic Hierarchy Process. The results and construction of the framework (Chapter 5) will follow with corresponding mitigation techniques. The conclusion (Chapter 6) will present the validity of the Hypothesis and summarise the result of the study. In Chapter 7 the limitations and recommendations of the study will be highlighted.

1.5 Research Questions

The research questions that conform to the outcomes required from the study are given below:

Main Research Question:

Which key risk indicators are relevant for a risk assessment framework to measure maritime piracy risk?

Sub Research Questions:

1. Does the current HCSS piracy risk and mitigation framework contain the relevant factors to assess risk?
2. What additional or new risk indicators are necessary to provide an accurate risk assessment?
3. Can the framework identify and take into consideration the operational characteristics of the vessel when considering the key vulnerability indicators?
4. How will these indicators be operationalised?
5. Can the framework accurately assess risk on the basis of historical data?
6. What type of mitigation advice can vessels extract from the framework?

These questions will be answered in various sections and chapters of the study. Some require background information and other will look to provide direction to develop a framework for piracy risk and mitigation. The Literature Review, the next chapter, explains previous methods used for assigning factors and the different types of risk analysis. It then builds on the current techniques and collates various variables required for the progression of the study.

Chapter 2 Literature Review

In this section, the study looks to identify new and current critical factors for assessing risk through meta-analysis of previous studies in the field of risk management, risk analysis and maritime security. It will build on some theories provided by the authors, identifying the pros and cons of each approach whilst consolidating the results produced with regards to identifying critical factors.

2.1 Conventional Approach to Risk

"The conventional approach to risk is defined as the chance, in quantifiable terms, of an accident or adverse occurrence. It therefore combines a probabilistic measure of the occurrence of an event with a measure of the consequence, or impact, of that event. The process of risk assessment and management is generally based on three sets of sequenced and inter-related activities: Assessment of Risk, Risk Management and The impact of risk assessment" (Bichou, 2008).

The conventional approach of risk management and the associated assessment techniques follow the fundamental design of hazard analysis using the sequential dependent and sequential independent representation of risk (Table 1). Sequence dependent analysis, analyses events that follow a certain logical sequence i.e. events that cause or are a consequence of the next event, whereas Sequence independent analysis, analyses the factors that cause certain events to occur i.e. an accident occurring due to break failure, could be the effect of low brake fluid or bad carbon pads, driver skill etc. This enables the selection of causal or consequential criteria to become apparent, which helps to interpret and identify risk. The most common method of Hazard Analysis is Event Tree Analysis (ETA) and Fault Tree Analysis (FTA).

	Consequence analysis	Cause analysis
Sequence dependent	Event Tree Analysis	Markov Process
Sequence independent	Failure Mode and Effects	Fault Tree Analysis

Table 1: Major Hazard Analysis Tools (Source: Bichou, 2008)

2.2 Fault Tree Analysis (FTA)

FTA is a logical process that works by identifying all factorial incidents leading up to an accident. Influential factors are chosen in conjunction with experience from previous working procedures and standard operating procedures that enable the assessor to estimate the effects on the accident rate. The mathematical model is then able to

generate the likelihood of a similar incident occurring. The accuracy of this method depends solely on the type of data available to identify the governing factors and a logical step-wise scenario construction to deduce risk (Bichou, 2008).

The limitations regarding this technique are related to the choice of factors and the scenario construction. Firstly, the events in each scenario may not be basic enough and hence may require an individual factorization process and thus a separate FTA to collate the probability of occurrence. Secondly, the interdependency of the critical factors and their evaluation criteria may result in an incomplete framework. Thirdly, the assessor may miss out on factors that need to be incorporated in the assessment scheme to be able to create an accurate assessment. Lastly, the importance of the degree of hazard is not identified as it is sequence dependent. It doesn't identify the critical factors with priority rankings.

2.3 Event Tree Analysis (ETA)

ETA on the other hand is a logical process that focuses on the mitigation technique. This is the opposite process of FTA. It takes into account past incidents and estimates the probability and the likelihood in which they occur. This statistical analysis is then used to predict the risk and consequence of future accidents (Bichou, 2008).

The methodology assumes that events following the incident develop in a certain sequence, where these sequences do not develop the methodology of 'Failure Modes and Effects' (FME) is exercised. It also assumes that all relevant factors are equal across all cases. FME has a holistic effect, once the factors are identified for the entire system. The key to using this method is to determine an extensive list of factors. However, it is difficult to determine these factors as the focus of the technique is to measure the likelihood of the incident taking place, instead of measuring the probability of the factors causing the incident.

2.4 Formal Safety Assessment (FSA)

Maritime institutions have been known to prefer the Formal Safety Assessment (FSA) criteria to design a framework for risk analysis. It was introduced by the UK Maritime and Coast Guard Agency (MCGA) and then incorporated into the IMO interim guidelines for safety assessment (IMO, 2007). The process of FSA is a five step process (Figure 3) that includes hazard identification, risk assessment, risk management, cost-benefit analysis and decision making (mitigation techniques) (MCA, 2013). The process shows that without considering risk control options, the framework for risk assessment or hazard identification is futile. However, to consider the risk

control options, a cost-benefit analysis needs to be done and vice versa. When the framework is defined, the assessor is able to use the results of the risk assessment, risk control options and the cost-benefit analysis to make recommendations using the decision making process i.e. mitigation techniques in the case of piracy framework.

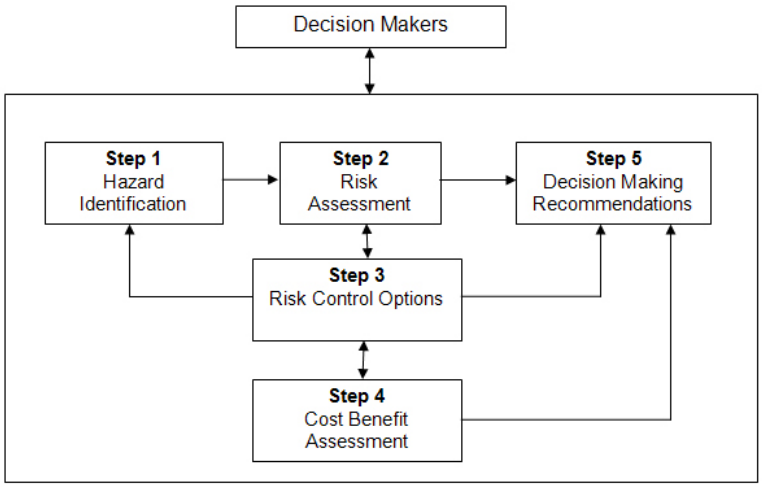

Figure 3: FSA Methodology (Source: MCA, 2013)

The methods of risk analysis mentioned above all have a fundamental principle that exposes them to an element of subjective judgment of the assessor. Hazards impose a range of low frequency events resulting in high consequences e.g. natural calamities or riots, or incidents with high frequency and low consequence e.g. machinery failure. This causes a variation in the level of severity that is problematic as past case histories may not provide for new hazards nor is it possible to measure the frequency with which it occurs. In case of piracy attacks, the frequency at which they occur is unpredictable, due to a number of reasons that are discussed further on.

The structure of the framework is also an important aspect to analyse risk. A well structured system that also enables the assessor to analyse the shortcomings of the process through risk analysis through a feedback mechanism is essential. However, in the context of shipping and terminal operations, several elements need to be assessed individually, but due to the constant inherent change in operating procedures, these factors become difficult to assess. Thus an advent of a priority system dampens the effect of an assessor's subjective view, which can be tested using the framework on past incidents.

2.5 The Navigation Vessel Inspection Circular (NVIC)

The Navigation Vessel Inspection Circular (NVIC) Assessment model is another assessment tool that is widely accepted as a risk analysis model for maritime security. NVIC is a safety-based risk approach that is used to assess security risk onboard vessels.

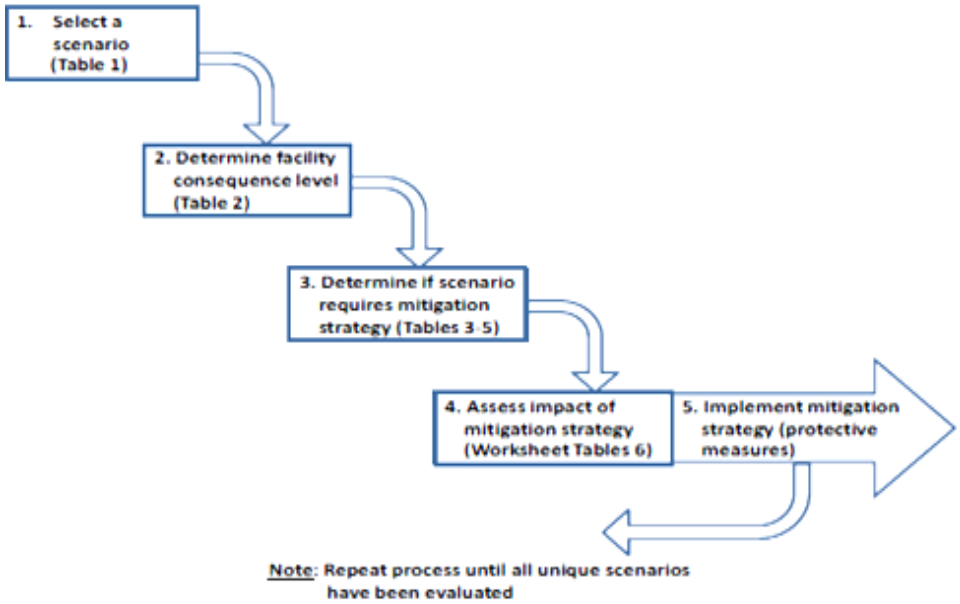

Figure 4: NVIC risk assessment model procedure (USCG, 2011)

The model, (Figure 4) shows a step-wise process that involves identifying the attack scenario threat to a particular vehicle (These scenarios are generally in accordance with ones developed for FSA and the ISPS Ship security plan SSP), determining the consequence level, assessing the vulnerability on a scale measuring availability, accessibility, organic security robustness e.g. port facilities assess risk and provide for MARSEC levels on a scale of 1-3, that gives an indication of vulnerability at the facility (Table 2). The final step deals with risk mitigation and contingency planning in accordance to the score projected in the previous steps.

Score	Accessibility	Organic security
3	No deterrence (e.g. unrestricted access to facility and unrestricted internal movement)	No deterrence capability (e.g. no plan, no guard force, no emergency communication, outside law enforcement not available for timely prevention, no detection capability.)
2	Fair deterrence (e.g. single substantial barrier, unrestricted access to within 100 yards of bulk storage tanks)	Fair deterrence capability (e.g. minimal security plan, some communications, security force of limited size relative to the facility, outside law enforcement with limited availability for timely prevention, limited detection systems)
1	Good deterrence (expected to deter attack, access restricted to within 500 yards of bulk storage tanks, multiple physical/geographical barriers)	Good deterrence capability expected to deter attack (e.g. detailed security plan, effective emergency communications, well trained and equipped security personnel, multiple detection systems (camera, x-ray, etc.), timely outside law enforcement for prevention.)

Table 2: Vulnerability Scenarios and Scores (Source: USCG, 2011)

All risk assessments currently being used, evaluate vessel vulnerability and likelihood of an attack, on a points based scale using factors identified by IMO BMP (BMP, ICS, 2011). The issues related to such a risk assessment framework, deal with identifying the correct critical factors, defining a weightage system and generic points based scale using the experience of current operational expertise.

The shortcomings of NVIC model and other conventional methods of risk assessment follow a safety-risk approach without incorporation of the 'human element' factor to quantify risk. It evaluates risk by equating it to cost or any other quantifiable factor, which then highlights the consequence level and mitigation strategy. Removing the operational equation by cost quantification does not provide accurate risk analysis, as the risk associated with human elements form a substantial part of the operational requirements of a vessel.

On the other hand security based systems evaluate the operational aspects by considering the factors of an incident, which pose a threat. These factors can be identified specifically to vessel operations, fleet operations, supply chain and maritime network etc. Most studies, however do not incorporate the risk to the supply chain whilst evaluating risk for vessel operations, since it is more a cost evaluated quantity rather than a security analysis.

The issue dealing with maritime security is related to the validity of intelligence-based data. It is a well known fact, that piracy incidents are under-reported; hence the analysis of risk is based solely on reports that are received by piracy reporting centres in various regions. However, the focus of our study is based on the operational facets that govern vessel security and the likelihood of attacks occurring.

2.6 Continuous Security Improvement (CSI) Cycle – Deming Cycle

CSI is another non-conventional risk based approach based on the Total Quality Management (TQM) principle, which gains emphasis from supply chain management. Since quality is a continuous process, organization strive for a 'zero' defect quality goal throughout their supply chain. The concept of Deming cycle also obeys this principle in the four step process known as the PDCA cycle (Plan-Do-Check-Act). Thai (2009) observes that maritime security is no different from industrial processes as it too provides a service that needs to proceed in accordance with the Deming Cycle. The continuous improvement of security on vessels is a required to be able to asses risk better and provide equally effective contingency plans.

The CSI cycle is based on Deming cycle to correctly assess and reassess the likelihood and vulnerability of a vessel to an attack. "A detailed study of vulnerability, criticality (consequence) and threat is necessary to formulate a security risk profile" (Thai, 2009). Such a security risk assessment is the key to making IMO's ISPS Code effective. However, we observe that whilst implementing a 'standards' based risk assessment criteria, setting the threshold of vulnerabilities very stringently may lead to a significant amount of events not being reported. On the other hand if the threshold is too low, a lot of inconsequential data may present false impacts (Bichou, 2008).

A risk-based security management process should consist of four core elements: threat identification, risk assessment, acceptance criteria, and implementation process of risk control (Bateman, 2010). First, it is necessary to identify all possible threat scenarios and critical security factors. Second, the vulnerability and likelihood of each scenario must be analysed and possible consequences should be determined. Finally, the information gained from the risk assessment must be used to develop security policy, contingency plans, controls and mitigation techniques prevalent with normal operational risk. (John, 2008 Thai, 2009, BMP 2011). A reasoned method explained by Thai, 2009 shows how the Deming Cycle and CSI can provide improvement in risk analysis (Figure 5).

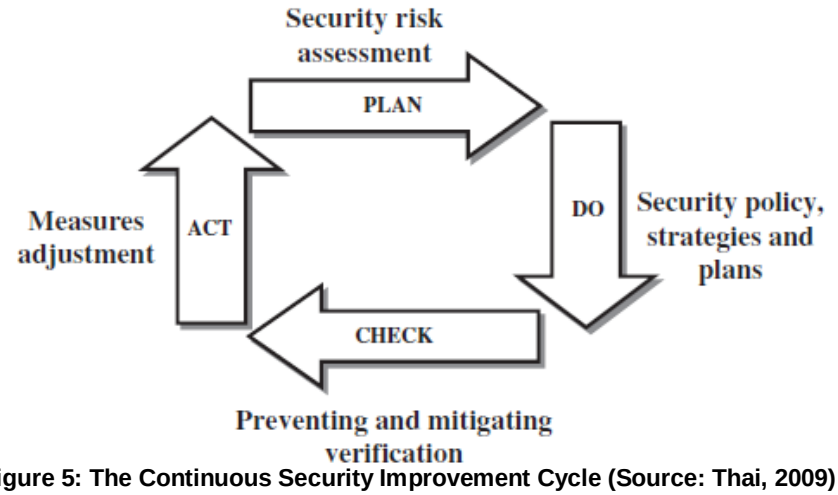

Figure 5: The Continuous Security Improvement Cycle (Source: Thai, 2009)

There have been some studies insisting risk-based solutions for security problems, but very few studies approach the research about effective maritime security from the holistic perspective. Though the CSI provides a good structure to provide continuous security improvement, it revolves around the aspects of management and administrative factors. Hence it takes into account elements of quality management which can help define operative factors related to vessel operating manuals and contingencies, but it does not provide an accountability of live scenarios.

2.7 Triangulation: Using CSI and Research Data – Identifying Factors

Multiple studies identify the critical risk factors that are required to form a robust risk assessment framework. These studies and research methods have identified different holistic risk factors that draw up a heterogeneous framework of various risk-based assessments. Thai, 2009 draws a list of 24 associated critical success factors (CSF) in 13 dimensions, which include administrative, security costs, strategies and contingency planning, communication, CSI, Management based decision making criteria. These factors were analysed on a confidence level of 95%, the table below shows the ranking of each factor (Table 3).

Critical Success Factor	Mean	STD	Rank	Z statistics (95% confidence)	Z observation
CSF23	4.66	0.56	1	1.96	32.31
CSF2	4.58	0.57	2	1.96	29.98
CSF24	4.56	0.62	3	1.96	27.53
CSF5	4.44	0.58	4	1.96	27.17
CSF14	4.42	0.54	5	1.96	28.45
CSF1	4.42	0.60	6	1.96	25.67
CSF13	4.39	0.55	7	1.96	27.30
CSF7	4.34	0.57	8	1.96	25.50
CSF4	4.28	0.52	9	1.96	26.82
CSF3	4.25	0.52	10	1.96	26.05
CSF12	4.21	0.69	11	1.96	19.21
CSF20	4.16	0.74	12	1.96	17.18
CSF6	4.15	0.48	13	1.96	26.12
CSF19	4.15	0.73	14	1.96	17.15
CSF8	4.13	0.50	15	1.96	24.73
CSF15	4.02	0.68	16	1.96	16.40
CSF22	4.02	0.64	17	1.96	17.40
CSF16	3.99	0.56	18	1.96	19.32
CSF10	3.87	0.62	19	1.96	15.42
CSF9	3.85	0.63	20	1.96	14.63
CSF21	3.73	0.65	21	1.96	12.33
CSF18	3.64	0.62	22	1.96	11.22
CSF11	3.52	0.57	23	1.96	10.06
CSF17	3.34	0.78	24	1.96	4.85

Note: relative ranking based on factors' mean scores; 1 = not at all important, 5 = very important

Table 3: Perception of 24 different CSF (Source: Thai, 2009)

The study shows that of the 24 CSF's, 17 factors score a mean of 4+, according to Thai, 2009 these factors should be considered whilst carrying out risk based assessments (Appendix I).

The weightage system of critical security factors is done through the method of Triangulation. Triangulation is a process that uses both quantitative and qualitative methods to obtain a comprehensive understanding. The triangulation method carried out in this study is done by econometric analysis and interviews. Factors involving security risk assessment and risk-based security mitigation strategies and plans are perceived as being among the most important critical success factors of effective maritime security. Security risk levels clearly defined (CSF5), resource allocation plan to mitigate security risks based on defined security risk levels (CSF7), minimum security requirements for resources identified and risk acceptance level established (CSF4), security threats, critical resources to be secured and impacts of security threats identified, analysed and evaluated (CSF3), security risk mitigation strategies and plans should be in place and clearly understood by operators(CSF6), are operational factors listed as the fourth, eighth, ninth, tenth, and thirteenth most important factor respectively (Thai, 2009).

Factors that are graded below 4 on the mean grade scale range show a higher standard deviation and a lower z-statistic (Appendix II). The correlation of these factors

with pirate attacks shows no significance administratively and operationally. Hence they have been removed from the list of critical security factors (Thai, 2009).

To approach the weaknesses associated with common day risk and mitigation frameworks, assembling the correct critical factors is not only essential, but they also need to be prioritised. The only process that has shown a method of assessing factor weightage for such a framework is through Triangulation. Triangulation is a process that uses more than two methods to assess prioritisation. In the study by Thai (2009) econometric analysis was combined with interviews to provide administrative factors for risk analysis.

The literature and results show comprehensive results, but the limitation of the CSI model is built on a service based assessment regime (Deming Cycle). From the results, it is observed that none of the factors incorporate the operational capabilities of the vessel. Thus the results of the study can provide a general framework that can be tailor-made for different companies. Secondly, the study has been done taking into account a single region where maritime security needs to be managed successfully to provide safer waters and port facilities i.e. South East Asia. It would be beneficial if this methodology would be applied to all regions where there is a high density of shipping traffic passing through areas of high pirate activity. This would also require looking into other factors such as choice of route, conditions of attack and modus operandi of the pirates.

2.8 Pirate Capabilities & Modus Operandi – Identifying Factors

The characteristics and behaviour provide a good source of information to assess the operational capabilities of pirates. Majority of the studies and approaches to risk, mentioned above do not mention pirate behaviour as a factor in their risk assessment. However, they provide for mitigation methods that counter these behavioural and operational patterns. Using pirate behaviour as part of the risk assessment may enable the assessor to understand more about the vulnerability of vessel to a pirate attack.

Assessing the operational capabilities of vessel to deter pirate attacks, requires a better assessment of operational factors to provide substantial results that identify the critical security factors from an operational perspective. The data provided by the IMO and IMB databases enable us to find descriptive results that help analyse the frequency of attacks and the modus operandi of pirates.

Assessing this data provides an indication of pirate capabilities and type of pirate tactics used. This information can be used to strategise mitigation techniques against assault and prevention. Herbert-Burns, 2007 classify the piracy modus into 5 categories:

- Piracy modus 1: Simple robbery of ship stores and valuables from vessels at anchor/moored at a buoy/berthed alongside;
- Piracy modus 2: Armed/violent robbery against vessels at anchor/moored at a buoy/berthed alongside;
- Piracy modus 3: Armed/violent robbery against vessels underway or making way;
- Piracy modus 4: Armed attacks against ships underway or making way for purposes of hostage-taking and ransom demand;
- Piracy modus 5: Deliberate vessel hijacking and devolution—"Phantom ship" operations.

The frequency of each modus has been illustrated in the graph below (Figure 6). We observe that at large piracy hotspots, where vessels are stagnant, more violent attacks leaded to deaths and in regions that are considered bottlenecks, the frequency of hi-jacking is greater.

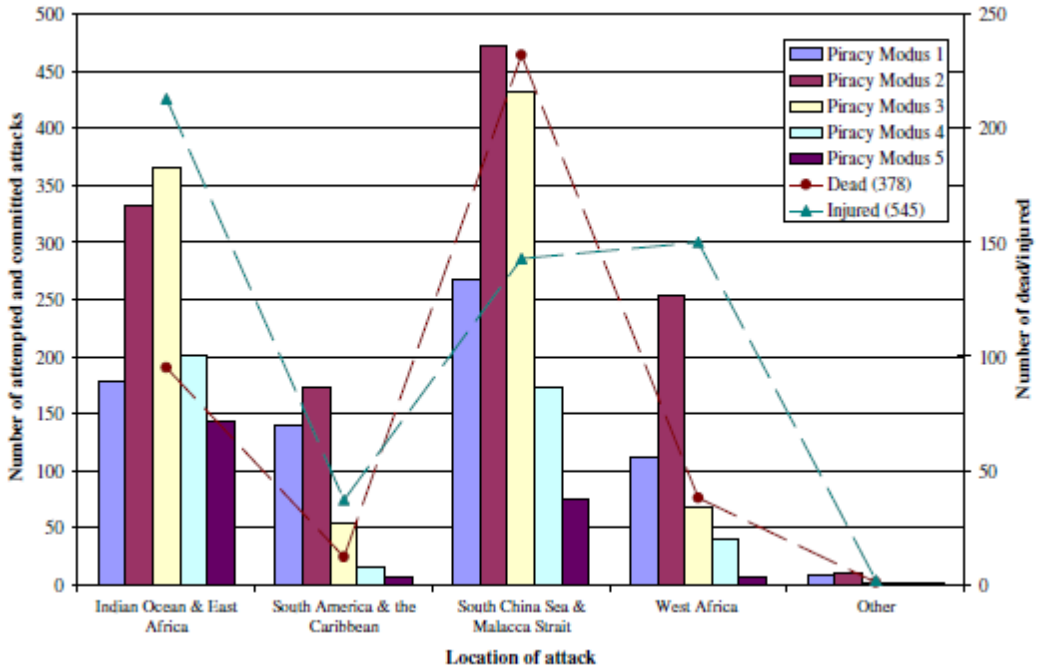

Figure 6: Classification of Piracy attacks per geographical area (Source: Psarros et al, 2011)

These attacks have been assessed according to the capabilities of the pirate attackers; this includes armed assault, 'phantom' ship operations, and the number of individuals in organised assault. Christiansen and Mærli, 2011, show that these incidents can be categorized into certain levels to characterize the capabilities of the pirates:

- Capability Level 1: Individuals operating alone or in pairs (1∼5 persons) searching for opportunities of occasional removal of items who are usually armed with simple boarding equipment (i.e. knives, metal bars, hooks, axes)
- Capability Level 2: Individuals organised in small groups (∼10 persons) looking for action and removal of valuable items and/or equipment who are usually armed with light weapons (i.e. pistols, rifles, machine guns), as well as boarding equipment.
- Capability Level 3: Individuals organised in gangs (more than 10 persons) with the aim to obtain control of the ship and are equipped with heavy weaponry (i.e. Rocket Propelled Grenades—RPGs) as well as light weapons and boarding equipment.

Combining the piracy modus and the characterized capability we can identify the frequency and extract the factors regarding regional attacks and modus operandi of the pirates. The classifications of the piracy incidents according to the modus and capabilities define two important factors to establish whilst carrying out risk assessment and subsequently creating contingency plans. The two factors defined are the frequency and level of attacks organised per region and the type tactics these armed pirates use to hijack vessels. The graph illustrates the classification of piracy incidents (Psarros et al., 2011). It establishes the relation between the number of perpetrators and the 'heaviness' of weaponry (Figure 7). It explains that a greater number of pirates attack vessels underway than that at anchorage. Hence, there is a greater probability that these vessels are attacked by pirates with heavy machinery. The presence of security forces around high risk areas also explains the reason why pirates attacking vessels in transit have heavy weapons.

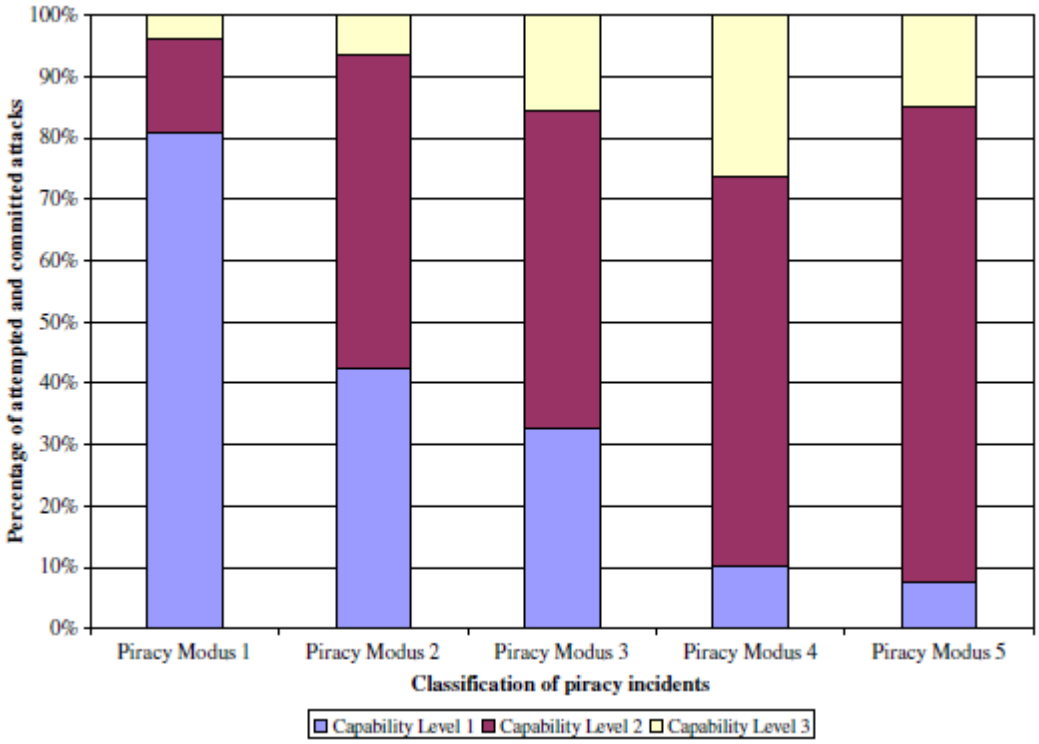

Figure 7: Modi and Capability levels of piracy incidents

However, there are some underlying assumptions made by the study. Firstly, it assumes that the piracy modus and capabilities depend on the number of pirates attacking the vessel, rather than the number of pirate vessels coordinating the attack. Secondly, it suggests that the intention of the pirates is clear before the attack is carried out e.g. kidnapping, theft, or hi-jacking. The effect of the numbers game in piracy is extremely important. Depending on the strategy of attack, the number of vessels in the initial period of the attack and the number of pirates once, they have boarded makes a difference in the swiftness with which hi-jacking occurs.

2.9 Econometric Modelling – Identifying Critical Factors

Another conventional model that has been used in the maritime industry to identify factors to carry out risk assessment has been the General Linear Model (GLM). The GLM uses probit regression (cumulative normal distribution), logistic regression (logistics distribution), and Binomial regression and Poisson regression to identify several factors (Psarros et al. 2011).

(Mejia Jr et al., 2008, 2009) used probit regression to show the probability of a vessel under an Asian flag being attacked while sailing frequently on the intra-Asia route.

Bateman (2010) identified a correlation between the type of vessel, with emphasis on the specific vessel characteristics, i.e. fully laden chemical tankers and product carriers, which have a low freeboard and therefore are much easier to board. The probit model has been utilised by Talley and Rule (2008) indicating that monthly attacks have been decreasing from 2000 - 2007 and that a seasonal variation exists with the highest number of attacks occurring in the month of May. The time and seasonality trends were studied in detail by Percy and Shortland (2009, 2010), who used Poisson and negative binomial regression on daily data demonstrating that the occurrence of attacks increases during full moon periods, whilst the number of attacks during the monsoon season is reduced.

Psarros (2011) used the modus operandi, Piracy modus and the capabilities to find a significant correlation between the frequencies of attacks on certain types of vessels in particular regions with regards to the type and frequency of attacks on these vessels. Observations show that the probability of a successful attack is decreased as the size of the vessel increases. Furthermore, the success of an attack is higher for oil tankers followed by general cargo ships, bulk carriers, containerships and chemical tankers. Similar observations are found for the success rates (odds ratios). The limiting factor of the data used for the study is the under-reporting of incidents at sea, due to the cost of increase in insurance premiums for vessels transiting high risk areas.

A wide area of research has also identified factors related to port facilities and vessel hijackings. Vessel transit in bottlenecks with high congestion of maritime traffic limits and unavailable water make it difficult to carry out contingency manoeuvring. This has also been identified as a potential factor that enables easier hijacking. The lack of coastguard and water patrols around the Anambus Islands in the South East Asia Region and the Lakshadweep Islands in the Arabian Sea, make these areas hotspots for pirate hideouts and enable attacks further from the coastlines of the mainland. It has also been known for vessels carrying a certain type vessel to be more vulnerable to attacks. Bulk carriers are generally more prone to attacks (Raymond, 2006). Simultaneously, if these vessels carry bulk shipments of hazardous cargo, such as ammonium nitrate that have uncontrolled use as a fertilizer, they could easily be used for illegal purposes (Raymond, 2006).

Vessels flying certain flags of convenience have been prone to more attacks than others (Raymond, 2006). However, there is very little correlation between these two factors, as ship owners tend to register with a certain flag, to ease their financial costs, by hiring cheap foreign labour and paying less tonnage tax on less stringent safety regimes. Thus a large percentage of the world fleet is registered under a certain flag more than others.

Vessels registered under some flags are older than the average age of the world fleet. Due to a relaxed safety regime, they are able to sail for longer. These vessels promote sub-standard shipping and maybe used to carry out illegal activities. The older the vessel the longer transit time it has, the more likely it is to be hijacked (Bateman et al.,

2007). Due to the financial crisis, a lot of vessels have been scrapped in the last 5 years, hence a renewed fleet due to cheaper building prices has decreased the average age of vessels sailing. Majority of vessels currently are fitted with economical engine systems that enable speed variation and shorten transit time. Even with the advent of slow steaming, vessels still have the option to increase speeds when transiting high risk areas.

Speed has become of paramount importance in today's shipping scenario. Due to the rise of the cost of bunker fuel in the last 5-6 years, we witness the reduction of average vessel speeds. The trade-off between slow steaming speeds and those used whilst transiting through high risk areas are needed in order to prevent piracy attacks. When vessels transit the Gulf of Aden (GoA) the average speed of the convoy is limited by the slowest vessel. However, due to convoy protection by navy vessels employed, attacks on these vessels can be deterred easily. On the other hand vessels on solo transit are generally larger with higher speeds. Typical speeds for these vessels are about 18-20 knots, whereas those in convoy approximate about 12-15 knots. It is observed that vessels with speeds over 18 knots are attacked less often. (Bateman et al., 2007).

Vessels that proceed in solo transit are generally larger vessels that have higher freeboards and faster speeds than smaller vessels that travel in convoy with lower freeboards and reduced speeds. The direction of transit also is a factor in determining vessel freeboard. Vessel deployed in the East-West trade, are normally fully laden and those on the West-East passage are in ballast condition, which enables them to have a higher freeboard. However, some of the smaller vessels are known to be hijacked in ballast condition, as the freeboard was not a deterring factor, in such instances the speed and manoeuvring capability of the vessel play a role to prevent boarding. Smaller vessels are relatively easier to attack, which has enabled pirates to spread their antics far from the coastline (Appendix III), by using these vessels as 'phantom' ships (Bateman et al., 2007).

2.10 Best Management Practices 4 – Identifying Critical Factors

In addition to all the factors mentioned above the UKMTO, ReCAAP and MSCHOA establish certain fundamental factors that are paramount for risk assessment in high risk areas (BMP4, 2011). Crew safety is a fundamental obligation, hence ship-owners in addition to have inherent construction of citadels on new-building vessels, have also started using armed guards, especially while entering or transiting East and West African ports. The armed guards have had a significant effect of reducing boarding and attempts of piracy

The use of armed guard's onboard vessels has its own sceptics. Even though armed guards have been very effective in reducing boarding attempts, there is no limit to how violently pirates may act to counter security onboard vessels; consequences of pirates boarding vessels with armed guards may be disastrous. Armed guards may lead to an aggravation of the situation as pirates become more equipped with long distance weapons. It is reasoned that a faster deployment of navies around the region should be strengthened and used as a method of an effective alternate approach (Murphy, 2011). Hence assessing onboard security as an important factor for crew safety in risk analysis has prominence, yet very little date is available due to ISPS, similar difficulties are experienced assessing vessels moving in convoy.

BMP 4, 2011 also states the state of sea as a defining factor. According to IMB data, sea state above Beaufort 3 has been observed to deter piracy and render deployment of the mother ships ineffective. In addition to the sea state, state of visibility and weather conditions also provide for factors governing piracy attacks. Fog and cloud cover in the South China Sea and Anambus Island, can hinder the vessels prospects of piracy prevention, even with operational radar. Low state of visibility influences the speed of the vessel. In GoA, haze and sand storm influence the operation of the radar. Keeping a good lookout on the bridge and monitoring reporting points and weather notifications through radiotelephony in these circumstances is of paramount importance. Vessels transiting these areas are given strict instruction to adhere to reporting points and report the vessel position or any incident or suspicious craft in the vicinity.

2.11 Risk Mitigation Techniques

Risk mitigation techniques are approached in two ways. Firstly, maritime security companies can counter piracy as whole and apply measures to combat piracy politically by providing stability in the region, through consistent patrols over the coastline. Secondly, the more cost effective solution is to provide counter-measures for the factors that increase the likelihood and vulnerability of a vessel to an attack. Risk mitigation techniques have been identified in BMP4 as vessel manoeuvring techniques; this has been studied in depth using game theory (Gkonis et al., 2010). The study outlines the probabilities and tactics to escape pirate boarding by course alteration, and making an experienced guess on the movement of the pirate skiffs. Though the study provides impressive measure regimes, it doesn't account for the consequences of such manoeuvres on speed and the turning characteristics of the vessel. Hence,decision-making entities should be based on operational aspects and contingency planning.

Using the data provided in the IMO reports, the preventive measures that the master, crew and the navies have used are categorized into a codified system of risk mitigation (Psarros et al., 2011).

Preventive (actions taken by master and crew):

- Code 1: No action;
- Code 2: Alarm raised, Ship Security Alert System (SSAS) engaged, crew mustered and being vigilant;
- Code 3: Passive anti-piracy measures (hoses, lights, flares)—In addition to previous
- Code 4: Active anti-piracy measures (evasive manoeuvres and increasing speed) - In addition to previous.

The effect of these techniques to mitigate pirate attacks is shown in Figure 8.

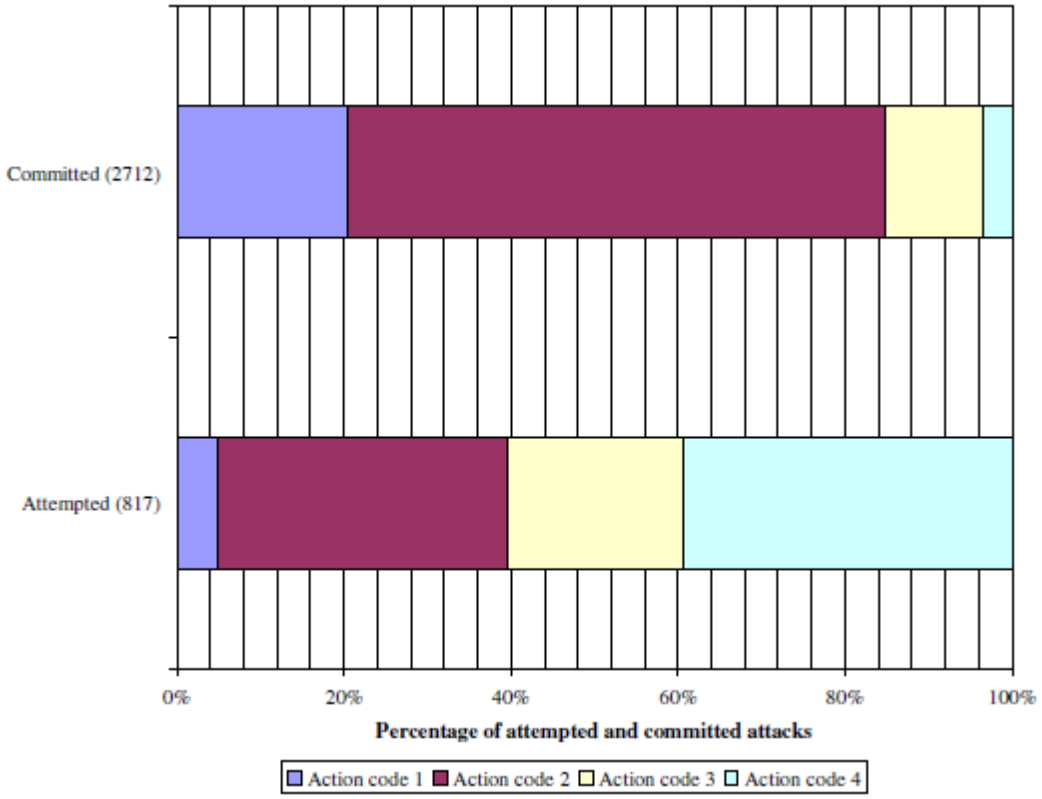

Figure 8: Preventive counter-piracy measures taken (Source: Psarros et al., 2011)

Using this system of risk mitigation it can be seen that vigilance of the crew in conjunction with quick evasive measures has deterred pirates from boarding. Detection of pirates in close range reduces the impact of these preventive measures and leaves little space to avoid boarding. Active anti-piracy measures (action code 4) are more beneficial on the high seas i.e. Indian Ocean and East Africa rather than the restricted waters of the other geographical regions (Figure 9) where emphasis is given in keeping a good lookout and high vigilance of the crew using the passive anti-piracy measures

(action codes 2 and 3). Observations show that defensive counter-piracy action is requested when the pirates have already boarded the vessel (committed attacks) in a ratio approximately two to one (15% of the 2,712 committed and 8% of the 817 attempted attacks) (Psarros et al., 2011).

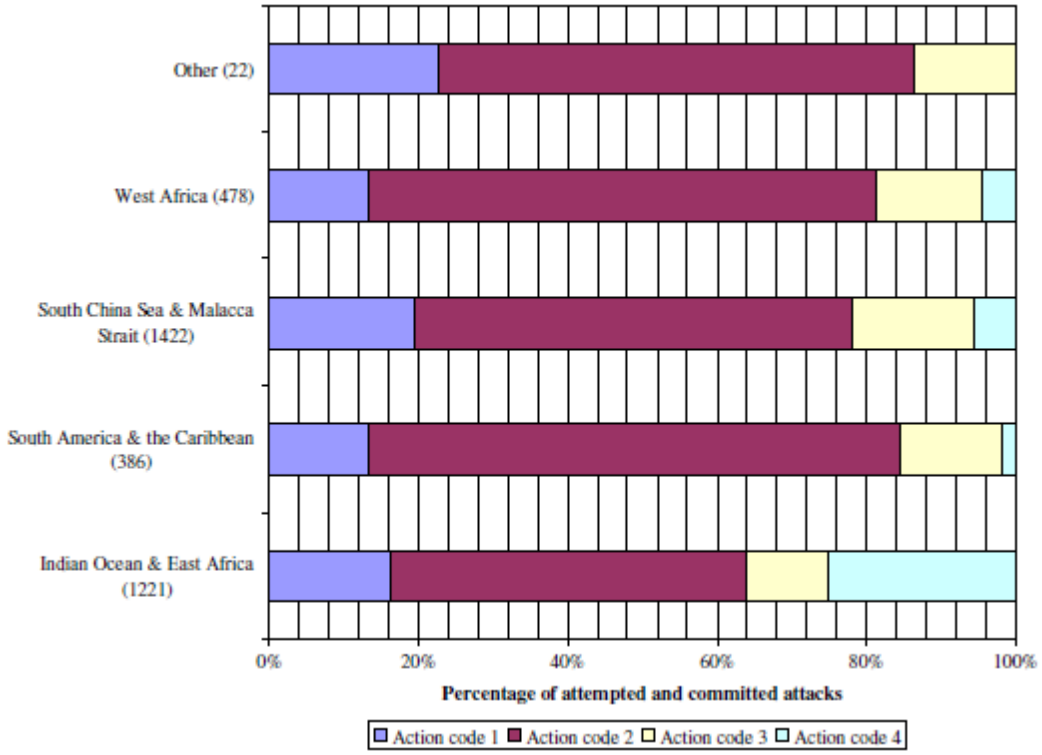

Figure 9: Preventive counter-piracy measures taken by master, crew and navy per geographical area (Source: Psarros et al., 2011)

On the one hand, inherently secure system designs against the threats of piracy and armed robbery are yet to be developed, even though significant improvements have been made in vessel design for safer transportation. On the other hand, reporting methods of maritime security incidents show gaps in content and consistency. Available reports show general information with no sufficiently detailed data to display and analyse critical security factors from occurrences.

Analysis of incident factors can also be useful in conjunction with Probabilistic Risk Analysis (PRA) (Same procedure used by MAIB to investigate collisions). PRA is a quantitative risk assessment method for estimating risk failure based on systems process mapping and decomposition into components (Bier, 1993; Bedford and Cook, 2001). PRA can be combined with factor analysis to quantify the probability of boarding for a particular factor, thus enabling the assessor to provide corrective actions (Bichou, 2008).

2.12 Conclusion

From the extensive information available above and a review of various operational documents, a list of key critical security factors is derived and is listed below:

1. Geographical location
2. Vessel Type/Target
3. Speed
4. Freeboard
5. Sea State
6. Time of Day
7. Crew Safety
8. Anti-piracy Equipment
9. Vessel status
10. Vessel Routing and Passage Plan
11. Contingency planning
12. Watch-keeping vigil and enhanced lookouts
13. Boarding Access
14. Pirate capabilities.
15. Weapons used by pirates

The factors mentioned are observed to affect the frequency and type of piracy incidents. However, most of these studies have assessed factors from an administrative management point of view. Data presented in the IMB database needs to be extracted and quantified with respect to operative decision making to find the correlation between each other and their relevance to pirate attacks from vessel initiated action. The next chapter defines each factor, explaining the quantification process and establishing a hypothesis that needs to be answered.

Chapter 3 Hypothesis

The previous chapter provided us with factors through an extensive literature review. This part of the study aims to find whether the critical security factors extracted from previous research and operational elements correlate with the effects of pirate attacks. We look to find which factors are quantifiable and thus, define the vulnerability and likelihood a vessel is prone to a pirate boarding or hi-jacking. These factors will be used to create a framework, which will be able to assess the degree of operational risk a vessel undertakes. Once the risk is defined, mitigation techniques can be devised.

3.1 Variables

The variables of the identified factors have to be quantified in order to run a binary logistic regression analysis and further to be used in the Analytical Hierarchy Process to present a weightage based system for a relevant risk assessment framework. The list of factors and their quantifiable units are stated below:

Dependent variable: The Dependent variable is measured under the different modes of piracy attack. The types of piracy attacks are identified and segregated into four categories; Hi-jacking, Armed Robbery and Theft, Kidnapping and Attempted Boarding. The variables are defined as TA1, TA2, TA3 and TA4 respectively (Appendix IV). These factors are quantified using nominal variables [1, 0], where 1 = 'Yes' and 0 = 'No'

$$\text{TA1} = \begin{Bmatrix} 1 = 'Hijacking\ occured' \\ 0 = 'Hi-jacking\ did\ not\ occur' \end{Bmatrix}$$

$$\text{TA2} = \begin{Bmatrix} 1 = 'Armed\ Robbery\ and\ Theft\ occured' \\ 0 = 'Armed\ Robbery\ and\ Theft\ did\ not\ occur' \end{Bmatrix}$$

$$\text{TA3} = \begin{Bmatrix} 1 = 'Kidnapping\ occured' \\ 0 = 'Kidnapping\ did\ not\ occur' \end{Bmatrix}$$

$$\text{TA4} = \begin{Bmatrix} 1 = ' Attempted\ Boarding' \\ 0 = ' No\ Attempt\ to\ Board' \end{Bmatrix}$$

Each case has been classified according to the type of piracy attack in the following manner. No case is identified in two or more different types of piracy modes of attack, as the case reports from IMB identify the cases only under one of these categories. This eliminates multi-co linearity between the four variables and enables proper evaluation of each case regarding to the respective piracy mode of attack.

Independent Variables:

1. Geographical location: The data provided in the IMB reports provides a classification of 4 different regions, as listed below. The geographical location selection is provided by nominal variables [1, 0]. The regions are distributed into four regions; Indian Ocean and East Africa, South America and Caribbean, South China Sea and Malacca Straits, and West Africa (Figure10). These variables are annotated by G1, G2 G3 and G4 respectively. These factors are quantified using nominal variables [1, 0], where 1 = 'Yes' and 0 = 'No'.

$$G1 = \begin{Bmatrix} 1 =' Attack\ occured\ in\ the\ Indian\ Ocean\ and\ East\ Africa\ region' \\ 0 =' Attack\ did\ not\ occur\ in\ this\ region' \end{Bmatrix}$$

$$G2 = \begin{Bmatrix} 1 =' Attack\ occured\ in\ the\ South\ America\ and\ Caribbean\ region' \\ 0 =' Attack\ did\ not\ occur\ in\ this\ region' \end{Bmatrix}$$

$$G3 = \begin{Bmatrix} 1 =' Attack\ occured\ in\ the\ South\ China\ Sea\ and\ Malacca\ Straits\ region' \\ 0 =' Attack\ did\ not\ occur\ in\ this\ region' \end{Bmatrix}$$

$$G4 = \begin{Bmatrix} 1 =' Attack\ occured\ in\ the\ West\ Africa\ and\ Mediterranean\ region' \\ 0 =' Attack\ did\ not\ occur\ in\ this\ region' \end{Bmatrix}$$

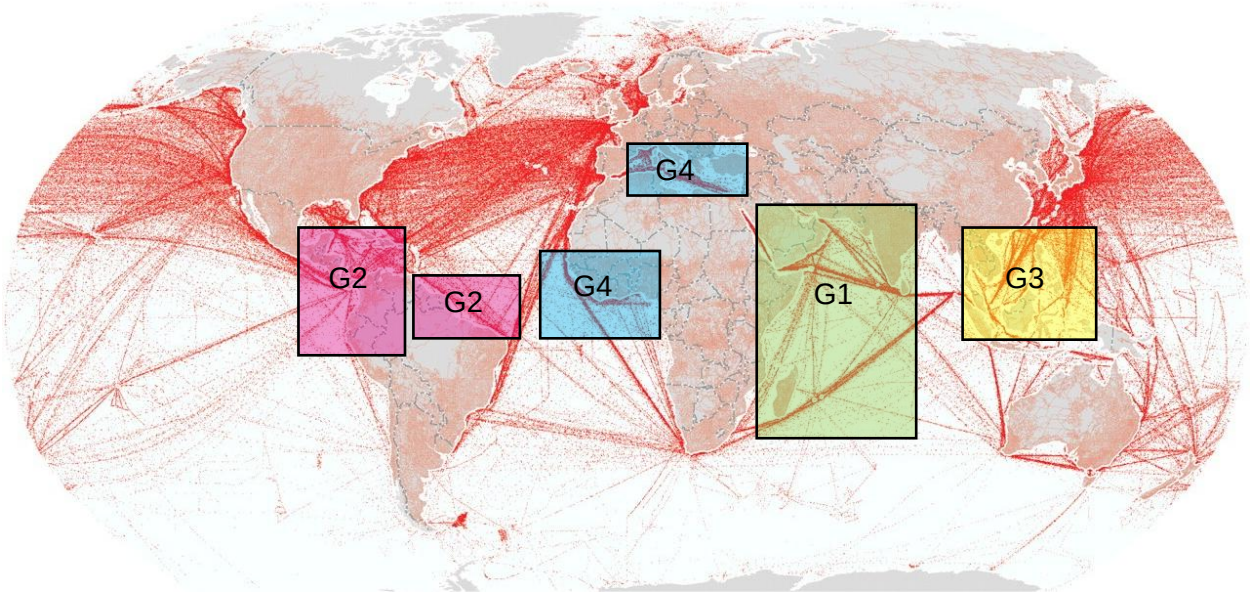

Figure 10: Geographical representation of High Risk Areas (Source: National Geographic, 2012)

A case by case representation of the geographical location of the attack is represented through selection using nominal variables.

2. Vessel Type/Target: The general classification of all sea-going vessels is included in this definition. Vessel characteristics and particulars are not considered. Vessel type is categorized into four different variables i.e. Bulk Carriers, Tankers, Containers and Others, these are denoted by V1, V2, V3 and V4. The 'others' category includes small craft, fishing trawlers, tugs, pipeline facilities and drill rigs. These factors are quantified using nominal variables [1, 0], where 1 = 'Yes' and 0 = 'No'.

$$V1 = \begin{Bmatrix} 1 =' Attack\ occured\ on\ a\ Bulk\ Carrier' \\ 0 =' Attack\ did\ not\ occur\ this\ vessel\ type' \end{Bmatrix}$$

$$V2 = \begin{Bmatrix} 1 =' Attack\ occured\ on\ a\ Tanker' \\ 0 =' Attack\ did\ not\ occur\ this\ vessel\ type' \end{Bmatrix}$$

$$V3 = \begin{Bmatrix} 1 =' Attack\ occured\ on\ a\ Container' \\ 0 =' Attack\ did\ not\ occur\ this\ vessel\ type' \end{Bmatrix}$$

$$V4 = \begin{Bmatrix} 1 =' Attack\ occured\ on\ Other\ vessel\ types' \\ 0 =' Attack\ did\ not\ occur\ on\ vessels\ in\ this\ category' \end{Bmatrix}$$

3. Speed: It is well known that vessels proceeding with speeds greater than 18 knots have been difficult to board (BMP4, 2011). The vessel speed in this case is assumed on a case to case scenario. Majority of the cases do not give details of the vessel speed whilst the incident took place. However, information on the status of the vessel is available i.e. whether it is underway, anchored, berthed or drifting. This helps to identify if the vessel was moving when the incident occurred. The vector of speed is then assumed to be greater or lesser than 18 knots, by virtue of average speeds that have been recorded for vessels of a similar type. These Assumptions helps allocate the distribution of speed using nominal variables [1, 0], where 1 = 'Yes' and 0 = 'No'.

$$\text{Speed (knots)} = \begin{Bmatrix} 1 =' Speed\ is\ greater\ than\ 18\ knots' \\ 0 =' Speed\ is\ less\ than\ 18\ knots' \end{Bmatrix}$$

4. Freeboard: The freeboard of vessel is the height of the deck above the waterline. The higher the deck is from the water the more difficult it is for pirates

to board. BMP4 (2011) states that vessels with freeboards greater than 8 metres are difficult to board. Free board is quantified as a nominal variable, where the height of the freeboard is either greater or lesser than 8 meters depending on the trade and the shipping route the vessels take. General shipping trade follows an East-West pattern, vessels travel fully laden going in this direction, thus having a lower freeboard. Vessels travelling in the opposite direction normally travel in ballast condition, enabling them to have a higher freeboard. This also applies to oil tankers and container vessels. Vessels in the 'Other' category are small vessels that have relatively small freeboards. Oil tankers generally have a lower freeboard than that of bulk carrier due to the pumping arrangements onboard. The quantification of freeboard is done by using nominal variables [1, 0], where 1 = 'Yes' and 0 = 'No'.

Freeboard (metres) = $\begin{Bmatrix} 1 =' Freeboard\ is\ greater\ than\ 8\ metres' \\ 0 =' Freeboard\ is\ less\ than\ 8\ metres' \end{Bmatrix}$

5. Sea state: The effect of weather and sea state affects the operations and attack strategy of pirates considerably. Pirates on most occasion use smaller, faster and more maneouvrable boats to conduct an attack. Hence monsoons and high winds make it difficult for the pirates to launch an attack. BMP 4 (2011) shows that in a sea state of greater than Beaufort scale 3 (Appendix V) makes it difficult for an attack to take place. The sea state is an educated assumption based on the wind speed, which can then be read from the Beaufort scale on the date and time of the attack (TND, 2013). Nominal variables are used to define the factor, [1, 0], where 1 = 'Yes' and 0 = 'No'.

Sea State (Beaufort scale) = $\begin{Bmatrix} 1 =' Sea\ State\ is\ greater\ than\ Beaufort\ Scale\ 3' \\ 0 =' Sea\ State\ is\ less\ than\ Beaufort\ Scale\ 3l' \end{Bmatrix}$

6. Time of Day: This factor accounts for the time period in which the attack takes place. It is defined by the period of darkness or period of daylight. Period of daylight is defined as the period from sunrise to sunset and the period of darkness is defined as the period from sunset to sunrise. However, there are some days where the back scatter of the full moon provides enough lighting during this period (Moon phases, 2013). Therefore, 'Full Moon' has been included as a separate score. The model draws on three specific time periods of each case. Full Moon, Night and Day light denoted by the variables T1, T2 and T3 respectively. The factors are defined using nominal variables [1, 0], where 1

= ‘Yes’ and 0 = ‘No’. In cases where the attack takes place during the period of a full moon, both night and full moon variables are selected.

$$T1 = \begin{Bmatrix} 1 =' Attack\ occurs\ during\ the\ period\ of\ Full\ Moon' \\ 0 =' Attack\ does\ not\ occur\ during\ this\ period' \end{Bmatrix}$$

$$T2 = \begin{Bmatrix} 1 =' Attack\ occurs\ during\ the\ Night' \\ 0 =' Attack\ does\ not\ occur\ during\ this\ period' \end{Bmatrix}$$

$$T3 = \begin{Bmatrix} 1 =' Attack\ occurs\ during\ Daylight' \\ 0 =' Attack\ does\ not\ occur\ during\ this\ period' \end{Bmatrix}$$

7. Crew Safety: The factor of crew safety is defined using two different criteria. Firstly, the presence of armed guards (AG) onboard and secondly the presence of a vessel safe-house or citadel (CS). Both criteria are judged through nominal variables [1, 0], where 1 = ‘Yes’ and 0 = ‘No’.

$$AG = \begin{Bmatrix} 1 =' Armed\ Guards\ present\ onboard' \\ 0 =' Armed\ Guards\ are\ not\ present\ onboard' \end{Bmatrix}$$

$$CS = \begin{Bmatrix} 1 =' Vessel\ has\ a\ designated\ Citadel' \\ 0 =' Vessel\ does\ not\ have\ a\ designated\ citadel' \end{Bmatrix}$$

8. Anti Piracy Equipment and Physical Barriers are factorised in accordance with the recommendations provided for by the BMP 4 guidelines. This includes the use of fire hoses and turrets (PE1), barbed wire/razor (PE2) and Accommodation/Bridge protection and security (PE3). These factors encapsulate the necessary requirements to handle and prepare all equipment in a state of readiness. Fire hoses should be rigged and placed on the ship rail, turrets should be facing the sea. Razor wire should be placed along the ships rail and any other railings around the accommodation. Bridge and accommodation portholes should glazed with bullet proofing laminate, open access from deck should be firmly secured and all equipment on deck that can be used against the vessel for violent acts or boarding access should be secured. The use of Deck and Navigation lights shall be Masters Prerogative (Figure11). All factors are defined as nominal variables [1, 0], where 1 = ‘Yes’ and 0 = ‘No’.

PE1 = $\begin{Bmatrix} 1 =' Vessel\ has\ rigged\ Fire\ hoses\ and\ turrets' \\ 0 =' Vessel\ did\ not\ rig\ fire\ hoses\ and\ turrets' \end{Bmatrix}$

PE2 = $\begin{Bmatrix} 1 =' Vessel\ has\ rigged\ Razor\ Wire' \\ 0 =' Vessel\ did\ not\ rig\ Razor\ Wire' \end{Bmatrix}$

PE3 = $\begin{Bmatrix} 1 =' Vessel\ has\ provided\ for\ Bridge\ and\ Accommodation\ Protection' \\ 0 =' Vessel\ has\ not\ provide\ for\ Birdge\ and\ Accommodation\ Protection' \end{Bmatrix}$

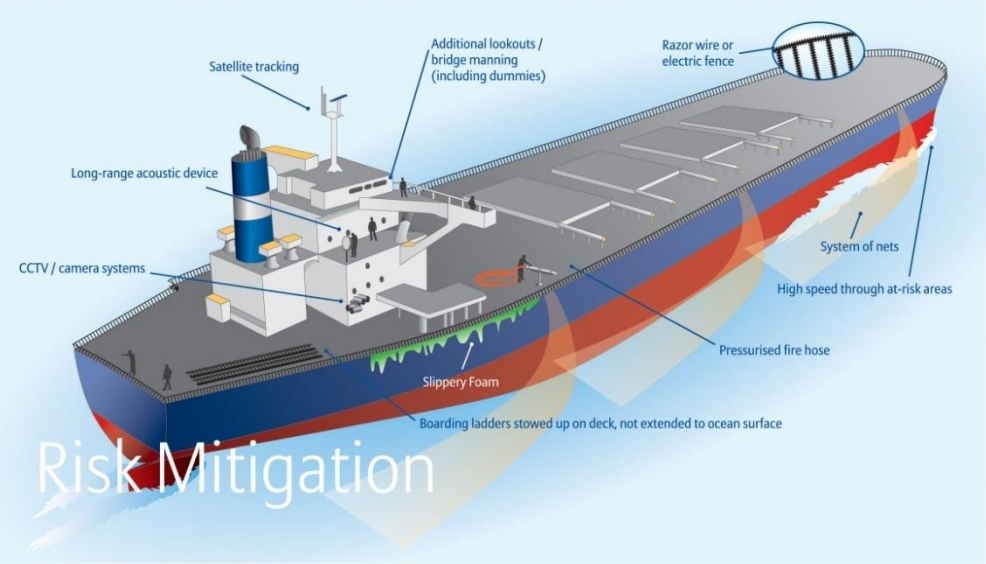

Figure 11: Anti-piracy equipment used for risk mitigation (Source: Allianz, 2009)

9. Vessel Status during the attack is defined by three variables; Underway, Anchorage, Drifting and Berthed. Vessel Underway (S1) implies that the vessel is using her engines whilst in transit in the HRA. Vessel at Anchorage (S2) indicates no movement of vessel, except the swinging arc created by the change of tide at the anchorage ground. A vessel at anchorage does not have any speed. Vessel Drifting (S3) is a vessel that is conditioned to activate its engines on short notice, in case of emergency, but remains adrift without engine power. The speed of a vessel adrift is allocated to the vector of the ocean current at that given time. A Vessel Berthed (S4) indicates that the vessel is made fast to the jetty, without movement. These factors are defined by nominal variables [1, 0], where 1 = 'Yes' and 0 = 'No'.

S1 = $\begin{Bmatrix} 1 =' Vessel\ is\ Underway' \\ 0 =' Vessel\ is\ not\ Underway' \end{Bmatrix}$

S2 = $\begin{Bmatrix} 1 =' Vessel\ is\ at\ Anchor' \\ 0 =' Vessel\ is\ not\ at\ Anchor' \end{Bmatrix}$

S3 = $\left\{ \begin{matrix} 1 =' Vessel\ is\ Drifting' \\ 0 =' Vessel\ is\ not\ Drifting' \end{matrix} \right\}$

S4 = $\left\{ \begin{matrix} 1 =' Vessel\ is\ Berthed' \\ 0 =' Vessel\ is\ not\ Berthed'' \end{matrix} \right\}$

10. Vessel routing and Passage Planning are very important aspects; special emphasis is placed on these plans when a vessel has to transit a HRA. Vessels generally plan voyages in accordance to the weather and the shortest distance possible to its destination. However, planning voyages for HRA transit needs proper planning and flexibility. During the voyage a vessel receives updated piracy reports from the Piracy Reporting Centre in the region, this enables the vessel to highlight incident position on the charts and plot courses accordingly. The Passage Plan regions defined are those generally taken by vessels to avoid HRA. India-Pakistan-Iran Coastline (VPP1), Arabian Sea and Lakshadweep Island transit (VPP1), Oman-Yemen Coastline and IRTC (VPP3) (Appendix VI), East Africa Coastline (VPP4), West Africa Transit (VPP5), South America and Caribbean Transit (VPP6) and South China Sea-Singapore/Malacca Straits (VPP6). The case scenario identifies which passage plan was followed when the attack occurred. These factors are defined by nominal variables [1, 0], where 1 = 'Yes' and 0 = 'No'.

VPP 1 = $\left\{ \begin{matrix} 1 =' Vessel\ undertook\ the\ India/Pakistan/Iran\ Coastline\ Passage\ Plan' \\ 0 =' Vessel\ did\ not\ take\ this\ passage\ plan'' \end{matrix} \right\}$

VPP 2 = $\left\{ \begin{matrix} 1 =' Vessel\ undertook\ the\ Arabian\ Sea/\ Lakshadweep\ Is.\ \ Passage\ Plan' \\ 0 =' Vessel\ did\ not\ take\ this\ passage\ plan'' \end{matrix} \right\}$

VPP 3 = $\left\{ \begin{matrix} 1 =' Vessel\ undertook\ the\ Oman/Yemen\ IRTC\ coastline\ \ Passage\ Plan' \\ 0 =' Vessel\ did\ not\ take\ this\ passage\ plan'' \end{matrix} \right\}$

VPP 4 = $\left\{ \begin{matrix} 1 =' Vessel\ undertook\ the\ East\ Africa\ coastline\ \ Passage\ Plan' \\ 0 =' Vessel\ did\ not\ take\ this\ passage\ plan'' \end{matrix} \right\}$

VPP 5 = $\left\{ \begin{matrix} 1 =' Vessel\ undertook\ the\ West\ Africa\ tranist\ \ Passage\ Plan' \\ 0 =' Vessel\ did\ not\ take\ this\ passage\ plan'' \end{matrix} \right\}$

VPP 6 = $\left\{ \begin{matrix} 1 =' Vessel\ undertook\ the\ S.America, Carribean\ transit\ \ Passage\ Plan' \\ 0 =' Vessel\ did\ not\ take\ this\ passage\ plan'' \end{matrix} \right\}$

VPP 7 = $\left\{ \begin{matrix} 1 =' Vessel\ undertook\ the\ SCS, Singapore/Malacca\ Straits\ \ Passage\ Plan' \\ 0 =' Vessel\ did\ not\ take\ this\ passage\ plan'' \end{matrix} \right\}$

11. Contingency Planning uses two criteria to explain its relevance. Contingency Planning is the prerogative of the master. Practical aspects involve using vessel manoeuvring techniques (M1) to counter attacks. Secondly, established Reporting Points (M2) along the HRA has become mandatory for vessels, especially those transiting Gulf of Aden. However the reporting criteria are only relevant when the vessel is underway. The use of both criteria has been provided in each incident report. Nominal variables are used for selection of each contingency plan defined as [1, 0], where 1 = 'Yes' and 0 = 'No'.

$$M1 = \begin{Bmatrix} 1 =' Vessel\ used\ Manoeuvring\ to\ avoid\ attack' \\ 0 =' Vessel\ did\ not\ take\ this\ contingency\ measure'' \end{Bmatrix}$$

$$M2 = \begin{Bmatrix} 1 =' Vessel\ used\ reporting\ points\ to\ avoid\ attack' \\ 0 =' Vessel\ did\ not\ take\ this\ contingency\ measure'' \end{Bmatrix}$$

12. Watch-keeping vigil and enhanced lookouts are of paramount importance. Due to various limitations of Shipboard Radars, i.e. shadow/blind sectors and screen speckles, detection of small craft becomes difficult. Even if the radar detects smaller size vessels, the crew has to be alert to identify the threat present. Hence having extra personnel manning the bridge enables the responsible officer of the watch to get an all round view of the surrounding waters. The factor is quantified by assessing the number of watch-keepers as recommended by STCW '95 regulations for watchkeeping at sea, anchor and berth (IMO, 1978). At sea the requirement while transiting HRA for daylight hours under Bridge watchkeeping level 3 requires 3 persons and night time navigation requires 4 persons with the use of night vision binoculars. At port and anchorage, vessels keep ISPS MARSEC level 3, hence during cargo and anchor watch; there must be at least 2-3 persons. Other extra precautions include the use of dummies and structures that give the impression that the vessel is alert and armed.

13. Boarding Access: There are three direct access points on a vessel. The Forecastle, i.e. the forward part of the vessel, hawse pipe and anchor chain; Amidships access via the vessel accommodation ladders and Aft; using the rudder or grappling hooks to climb vessels that are trimmed by the stern. These are nominal variables defined as [1, 0], where 1 = 'Yes' and 0 = 'No'. Pirates can use multiple access points, depending on the type of attack and the status of the vessel and the vessel construction.

$$BA1 = \begin{Bmatrix} 1 =' Pirates\ boarded\ the\ vessel\ from\ the\ forecastle' \\ 0 =' Pirates\ did\ not\ use\ this\ access\ point' \end{Bmatrix}$$

BA2 = $\begin{Bmatrix} 1 =' Pirates\ boarded\ the\ vessel\ from\ amidships' \\ 0 =' Pirates\ did\ not\ use\ this\ access\ point' \end{Bmatrix}$

BA3 = $\begin{Bmatrix} 1 =' Pirates\ boarded\ the\ vessel\ from\ the\ aft' \\ 0 =' Pirates\ did\ not\ use\ this\ access\ point' \end{Bmatrix}$

14. Pirate capabilities project the characteristics of the attack; the features included are the number of pirate boats and the number of pirates. The number of boats and pirates are numerically quantified by extracting data from IMB piracy reports.

15. The type of weapons used by pirates in an attack is classified into two categories light (W1) and heavy (W2) weapons. Light weapons include knives, machetes, sticks bars etc. Heavy weapons include RPG's, Automatic and Semi-Automatic machine guns. The choice of weapons are nominal variables decided by [1, 0], where 1 = 'Yes' and 0 = 'No'.

W1 = $\begin{Bmatrix} 1 =' Pirates\ use\ Light\ Weapons\ for\ attack' \\ 0 =' Pirates\ do\ not\ use\ this\ type\ of\ weapon\ for\ the\ attack' \end{Bmatrix}$

W2 = $\begin{Bmatrix} 1 =' Pirates\ use\ Heavy\ Weapons\ for\ attack' \\ 0 =' Pirates\ do\ not\ use\ this\ type\ of\ weapon\ for\ the\ attack' \end{Bmatrix}$

3.3 State the Null hypothesis (H_0)

H_0 = there is no effect or any link between the critical security factors and a pirate attack.

3.4 State the Hypothesis statement (H_1)

H_1 = There is a positive relationship between the Geographical region and the type of piracy attack.

H_2 = There is a positive relationship between the Vessel Type and the type of piracy attack.

H_3 = There is a positive relationship between Speed and the type of piracy attack.

H_4 = There is a positive relationship between Freeboard and the type of piracy attack.

H_5 = There is a positive relationship between Sea State and the type of piracy attack.

H_6 = There is a positive relationship between Time of Day and the type of piracy attack.

H_7 = There is a positive relationship between Armed Guards and the type of piracy attack.

H_8 = There is a positive relationship between Citadel and the type of piracy attack.

H_9 = There is a positive relationship between Anti-piracy Equipment and the type of piracy attack.

H_{10} = There is a positive relationship between the status of the vessel and the type of piracy attack.

H_{11} = There is a positive relationship between the vessel passage plan and the type of piracy attack.

H_{12} = There is a positive relationship between vessel manoeuvring and the type of piracy attack.

H_{13} = There is a positive relationship between reporting points and the type of piracy attack.

H_{14} = There is a positive relationship between lookouts and the type of piracy attack.

H_{15} = There is a positive relationship between boarding access and the type of piracy attack.

H_{16} = There is a positive relationship between pirate capabilities and the type of piracy attack.

H_{17} = There is a positive relationship between weapons and the type of piracy attack.

3.5 Conclusion

With the factors defined and quantified. The hypothesis statements are derived and are tested using Binary-Logistic Regression to find the correlation in the next chapter. The results from this analysis are then prioritised using the Analytic Hierarchy Process Questionnaire. The next chapter describes the research design and the results attained using these methods.

Chapter 4 Research Design

From the previous chapter we establish the type of data that needs to be analysed. The factors are defined and quantified. To test the hypothesis statement presented, we use data from the IMB and HCSS piracy database and analyse using econometric and surveying methods.

4.1 Methodology – Research Process and Data Mining

The study is carried out in three distinct phases. Firstly, existing factors are incorporated and listed from IMB and The Hague Centre of Strategic Studies (HCSS) piracy database. The eluding critical security factors are then extracted from operational documentation of various shipping companies and a meta-analysis of previous studies and experiments is conducted. Secondly, the list of critical factors are quantified and put through a binary logistic regression analysis based on binomial distribution (Keller, 2012). The results of this analysis help identify the relevant and the most appropriate factors that are correlated with different types of pirate attacks.

Once the relevant key factors are filtered, a separate weightage system must be developed to acknowledge the hierarchy of the indicators. Currently, we find that priority based ranking of operational factors regarding piracy are not incorporated into risk assessment, thus the importance of each factor related to evaluating risk is not defined.

The Analytical Hierarchy Process (AHP) shall be used to develop the weightage criteria. AHP uses two pair factor comparison to solve multi-criteria decision problems. This is a structured technique that is based on mathematics and psychology to accurately assess relative importance of judgement of each factor (Anderson et. al., 2012). The results derived from this process, prioritise each factor according to the preference of the interviewee. Since all interviewees are experiences seafaring person, they are deemed a reliable source that provides for comparison of the critical security factors based on operational expertise.

After identifying the priorities and factors, they will be combined with the HCSS measurement criteria for risk evaluation. The measurement criterion is based on the level of severity on a points-based scale. The criterion has to be evaluated and reconditioned to make the framework accurate. Mitigation techniques, in accordance with the IMO BMP 4 manual and large vessel handling manoeuvres shall be prescribed based on the result of the risk assessment. This will be an advisory supplement to the framework.

On completion, the whole process of the framework will be tested using historical near misses and hijacking incidents as case studies to highlight the practical working of the

framework. The results achieved by the framework can be used to compare the incident report and result.

4.2 Subjects and Questionnaire Description

AHP preference allocation and factor prioritisation for weightage purposes will be done by conducting comparative interviews and questionnaires of industry experts, predominantly operational personnel i.e. seafarers or defence personnel that have experience in risk management whilst transiting high risk areas. The interviews are designed to assign a priority and preference criteria to the prominent factors of risk. The level of expertise required by each candidate to answer the questionnaire has to be an operations management role with a dedicated contingency planning responsibility. Eight interviews with questionnaires designed with the AHP method were conducted to obtain reasonable accuracy.

This method is favoured over other historical assessments and theory based analysis of key factors because it will take into account operational aspects from personnel with extensive experience of transiting through high risk areas e.g. navigational information, weather conditions, vessel characteristics and prevention techniques. Previous methods of assessments and analysis have used administrative and theoretical based assessment schemes focusing on a subjective criterion. Due to this a variety of risk assessments have been created, where factors are continuously repeated, causing distorted risk scores. Using the binary logit regression, repeated factors are removed, to ensure that multi-co linearity does not exist. It also enables quantification of qualitative variables and variables for which data is not readily available. Hence, in this way relevant factors are selected.

4.3 Binary Logistic Regression Analysis

The Binary Logistic/Logit regression is a method used to predict the outcome of categorical dependent variable. Factors identified in the hypothesis are measured using two predictor variables, [1, 0], where 1 = ‘Yes’ and 0 = ‘No’. The characteristic of each piracy report obtained from the IMB and the HCSS database is recorded by the selection of one predictor variable for each factor and their corresponding variable (Appendix IV). The binary logit regression method assesses two absolute ends to the spectrum. This way the method estimates the empirical values of the factors for a given qualitative response.

The output of a single trial is modelled, as a function of the predictor variables, using a logistic function, where the dependent variable is binary i.e. the number of categories

is two. Logistic regression measures the relationship between a categorical dependent variable and one or more independent variables, which are usually continuous, by using probability scores as the predicted values of the dependent variable (Keller, 2012).

Using the Logistic regression function, with predictor variables between 0 and 1, we get the expression:

$$F\ (t) = \frac{e^t}{e^t + 1} = \frac{1}{1 + e^{-t}}$$

The function of *F* (*t)* is viewed as a linear function with *t* explained as an explanatory variable *x* for the coefficients of the function.

$$t = \beta_0 + \beta_1 x \ldots + \beta_n x + \varepsilon$$

n= Number of variables [1, 2, 3…n]

Where, β is the coeffiecient of the intercept and of each critical security factor in the logistic function. The regression equation is given below:

Logistic Function = $\boldsymbol{F(x)} = \frac{e^{(\beta_0 + \beta_1 x \ldots + \beta_n x)}}{e^{(\beta_0 + \beta_1 x \ldots + \beta_n x)} + 1} = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x \ldots + \beta_n x)}}$ Equation 1

The above function interprets the likelihood of success or failure for each case factor. This graphically represented in Figure 12.

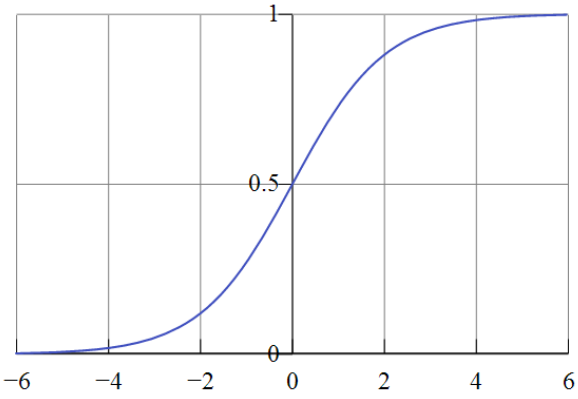

Figure 12: Logistic function with $\boldsymbol{\beta_0 + \beta_1 x \ldots + \beta_n x}$ on the *x-axis* and *F(x)* on the *y-axis* (Source: Keller, 2012)

The inverse of the logistic function provides for the logit function:

$$\boldsymbol{g\ (x) = \ln \frac{F\ (x)}{1 - F(x)} = \beta_0 + \beta_1 x \ldots + \beta_n x}$$ Equation 2

The expression for *F(x)* shows the likelihood that the empirical value of the dependent variable will equal to the value of the logistic function of the linear regression expression. This is important as the values of the linear regression function is not subject to the two predictor values, but varies from negative ∞ to positive ∞, which then translates to the likelihood of *F(x)* function between the range of 0 and 1. The logit function (Equation 2) illustrates the probability of the dependent variable equalling the exponential function of the linear regression. Thus, allowing the logit function to serve as a link between the probability and the linear regression function (Keller, 2012).

The Binary Logistic regression is carried out on the relationship between four different dependent variables categorised as type of pirate attack and 39 independent variables (critical security factors). The regression is conducted separately on each of these variables.

4.3.1 Regression Analysis of Variable TA1 – Hi-jacking

The results of the regression analysis for Hijacking (TA1) are given in (Table 4). The binary-logistic regression expression obtained from the results is as follows:

$$t = -20.704 + 2.098G1 + 0.288G2 + 3.839G3 - 0.55V1 - 1.019V2 - 0.141V3 - 2.44V4 + 0.111Speed + 0.484FB1 + 2.472FB2 - 2.222Seastate + 1.616T1 - 0.891T2 - 0.659AG + 1.439CS - 2.391PE1 + 0.212PE2 + 0.667PE3 - 3.36S1 - 3.69S2 - 1.525S3 - 3.072S4 + 0.170VPP1 - 2.043VPP2 + 0.215VPP3 + 0.142VPP4 + 2.956VPP5 + 3.781VPP6 - 0.556VPP7 - 1.456M1 + 18.708M2 + 0.593Watchkeeping - 1.244BA1 - 0.381BA2 - 0.979BA3 + 0.05nbrofboats - 0.018nbrofpirates + 1.966W1 - 0.53W2.$$

This equation is then substituted into the logistics function equation above (see Equation1)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	G1	2.098	1.625	1.665	1	.197	8.147
	G2	.288	1.123	.066	1	.798	1.334
	G3	3.839	1.708	5.053	1	.025	46.459
	V1	-.550	1.681	.107	1	.744	.577
	V2	-1.019	1.689	.364	1	.547	.361
	V3	-.141	1.741	.007	1	.935	.868
	V4	-2.440	1.971	1.533	1	.216	.087
	Speed knots	.111	.662	.028	1	.867	1.117
	FB1	.484	.727	.444	1	.505	1.623
	FB2	2.472	.616	16.083	1	.000	11.846
	Sea State	-2.222	1.038	4.583	1	.032	.108
	T1	1.616	1.346	1.442	1	.230	5.033
	T2	-.891	.693	1.652	1	.199	.410
	AG	-.659	.866	.579	1	.447	.517
	CS	1.439	.635	5.133	1	.023	4.217
	PE1	-2.391	1.420	2.836	1	.092	.091
	PE2	.212	.991	.046	1	.831	1.236
	PE3	.667	.545	1.497	1	.221	1.948
	S1	-3.360	3.143	1.143	1	.285	.035
	S2	-3.690	3.107	1.410	1	.235	.025
	S3	-1.525	3.432	.198	1	.657	.218
	S4	-3.072	3.309	.862	1	.353	.046
	VPP1	.170	1.663	.010	1	.919	1.185
	VPP2	-2.043	1.677	1.484	1	.223	.130
	VPP3	.215	1.639	.017	1	.895	1.240
	VPP4	.142	1.392	.010	1	.919	1.152
	VPP5	2.956	1.912	2.390	1	.122	19.219
	VPP6	3.781	2.344	2.603	1	.107	43.858
	VPP7	-.556	1.576	.125	1	.724	.573
	M1	-1.456	1.351	1.161	1	.281	.233
	M2	18.708	22645.666	.000	1	.999	133271076.847
	Watchkeeping	.593	.313	3.591	1	.058	1.809
	BA1	-1.244	.587	4.481	1	.034	.288
	BA2	-.381	.611	.390	1	.532	.683
	BA3	-.979	.703	1.940	1	.164	.376
	Nbrofboats	.050	.495	.010	1	.920	1.051
	Nbrofpirates	-.018	.087	.042	1	.837	.982
	W1	1.966	.572	11.822	1	.001	7.144
	W2	-.530	.760	.485	1	.486	.589
	Constant	-20.704	22645.666	.000	1	.999	.000

a. Variable(s) entered on step 1: G1, G2, G3, V1, V2, V3, V4, Speedknots, FB1, FB2, SeaState, T1, T2, AG, CS, PE1, PE2, PE3, S1, S2, S3, S4, VPP1, VPP2, VPP3, VPP4, VPP5, VPP6, VPP7, M1, M2, Watchkeeping, BA1, BA2, BA3, Nbrofboats, Nbrofpirates, W1, and W2.

Table 4: Binary-Logistic Regression Results Dependent Variable Hijacking (TA1) (Source: Author)

The analysis for the regression of the TA1 variable (Hi-jacking) shows overwhelming evidence to prove the validity of the model. This is supported by results obtained in the omnibus tests of the model coefficients, showing a significance of .000 and a high 'Cox-Snell' (0.277) and 'Nagelkerke' R-square value (0.445) that proves that a significant part of the data explains the link between the dependent and independent variables (Appendix VII). The "Nagelkerke R Square" statistic and the "Cox & Snell R Square," are "pseudo" R-square values, that tell us something along the lines of an OLS R-square, but not directly comparable to it. It's an approximation, the higher the value the better.

Table 4 shows that some of the critical security factors have a significant link and show overwhelming evidence that is linked to the probability of a vessel being hi-jacked. These factors are Geographical region (G3), Low Freeboard (FB2), Sea State, Citadel (CS), Watchkeeping, Boarding Access (BA1) and Weaponry (W1) with significance levels of .025, .000, .032, .023, .058, .034 and .001 respectively. The remaining factors show weak or little to no evidence of correlation.

However, the most surprising result shows that the factor speed shows weak evidence to prove the vulnerability of vessel to hi-jacking. This is explained using Pearson's correlation, evaluating Speed with status of the vessels (Table 5). The results show the presence of multi-colinearity between the factors, with speed being highly correlated to the vessel being underway (S1) (significance .01).

Correlations

		Speedknots	S1	S2	S3	S4
Speedknots	Pearson Correlation	1	.165*	-.130*	-.015	-.035
	Sig. (2-tailed)		.010	.044	.814	.585
	N	239	239	239	239	239

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5: Pearson Correlation between Speed and the Status of the vessel (Source: Author)

Observing the correlation between hijacking and status of the vessel, we find that Hijacking- is highly correlated to the vessel being underway (Table 6). Thus it can be concluded that when the vessel is underway with a speed lower than 18knots there is a larger probability of the vessel being hi-jacked. Hence speed is a critical security factor that affects the vulnerability of vessel to a hi-jacking.

Correlations

		TA1	S1	S2	S3	S4
TA1	Pearson Correlation	1	-.160*	.111	.104	.009
	Sig. (2-tailed)		.013	.088	.109	.889
	N	240	239	239	239	239

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 6: Pearson Correlation between Hijacking and the Status of the vessel (Source: Author)

4.3.2 Regression Analysis of Variable TA2 – Armed Robbery and Theft

The results of the regression analysis for Armed Robbery and Theft (TA2) are provided in Table 7. The binary-logistic regression expression obtained from the results is as follows:

$$t = 1.586 - 1.399G1 - 0.395G2 + 0.041G3 + 0.355V1 - .184V2 + 0.422V3 + 0.374V4 - 2.368Speed - 0.650FB1 - 1.44FB2 + 1.117Seastate - 1.126T1 + 0.781T2 + 1.022AG - 1.856CS + 1.749PE1 - 1.013PE2 - 0.158PE3 + 0.858S1 + 0.955S2 + 0.737S3 + 0.857S4 + 1.086VPP1 - 0.24VPP2 + 0.174VPP3 - 0.368VPP4 - 2.648VPP5 - 0.217VPP6 - 1.092VPP7 - 1.374M1 + 0.931M2 - 0.428Watchkeeping + 0.579BA1 - 0.542BA2 - 0.03BA3 - 1.42nbrofboats + 0171nbrofpirates - 0.501W1 + 1.062W2.$$

This equation is then substituted into the logistics function equation above (see Equation1)

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1[a]	G1	-1.399	1.367	1.048	1	.306	.247
	G2	-.395	.929	.181	1	.671	.674
	G3	.041	1.039	.002	1	.969	1.041
	V1	.355	1.323	.072	1	.789	1.426
	V2	-.184	1.275	.021	1	.885	.832
	V3	.422	1.404	.090	1	.764	1.525
	V4	.374	1.426	.069	1	.793	1.454
	Speedknots	-2.368	1.541	2.363	1	.124	.094
	FB1	-.650	.568	1.311	1	.252	.522
	FB2	-1.440	.478	9.067	1	.003	.237
	SeaState	1.117	.561	3.961	1	.047	3.057
	T1	-1.126	1.167	.931	1	.335	.324
	T2	.781	.554	1.988	1	.159	2.183
	AG	1.022	.677	2.275	1	.131	2.778
	CS	-1.856	.555	11.183	1	.001	.156
	PE1	1.749	.967	3.273	1	.070	5.746
	PE2	-1.013	.761	1.775	1	.183	.363
	PE3	-.158	.429	.136	1	.712	.854
	S1	.858	2.156	.158	1	.691	2.358
	S2	.955	2.151	.197	1	.657	2.600
	S3	.737	2.553	.083	1	.773	2.090
	S4	.857	2.309	.138	1	.711	2.355
	VPP1	1.086	1.315	.682	1	.409	2.962
	VPP2	-.240	1.227	.038	1	.845	.787
	VPP3	.174	1.264	.019	1	.890	1.190
	VPP4	-.368	1.227	.090	1	.764	.692
	VPP5	-2.648	1.287	4.230	1	.040	.071
	VPP6	-.217	1.471	.022	1	.883	.805
	VPP7	-1.092	1.126	.942	1	.332	.335
	M1	-1.374	.982	1.958	1	.162	.253
	M2	.931	2.206	.178	1	.673	2.538
	Watchkeeping	-.428	.258	2.748	1	.097	.652
	BA1	.579	.448	1.666	1	.197	1.783
	BA2	-.542	.514	1.111	1	.292	.582
	BA3	-.030	.560	.003	1	.957	.970
	Nbrofboats	-1.420	.556	6.516	1	.011	.242
	Nbrofpirates	.171	.077	5.003	1	.025	1.187
	W1	-.501	.473	1.121	1	.290	.606
	W2	1.062	.607	3.065	1	.080	2.893
	Constant	1.586	2.917	.296	1	.587	4.886

a. Variable(s) entered on step 1: G1, G2, G3, V1, V2, V3, V4, Speedknots, FB1, FB2, SeaState, T1, T2, AG, CS, PE1, PE2, PE3, S1, S2, S3, S4, VPP1, VPP2, VPP3, VPP4, VPP5, VPP6, VPP7, M1, M2, Watchkeeping, BA1, BA2, BA3, Nbrofboats, Nbrofpirates, W1, and W2.

Table 7: Binary-Logistic Regression Results Dependent Variable Armed Robbery and Theft (TA2) (Source: Author)

The analysis for the regression of the TA2 variable (Armed Robbery and Theft) shows overwhelming evidence to prove the validity of the model. This results obtained in the omnibus tests of the model coefficients, showing a significance of .000 and a high 'Cox-Snell' (0.4) and 'Nagelkerke' R-square (0.534) value that proves that a significant part of the data explains the link between the dependent and independent variables (Appendix VIII).

Table 7 shows that some of the critical security factors have a significant link and show overwhelming evidence that is linked to the probability of a vessel being hi-jacked. These factors are Low Freeboard (FB2), Sea State, Citadel (CS) and Number of boats with significance levels of .003, .047, .001, and .011 respectively. The remaining factors show weak or little to no evidence and are not statistically significant.

When these factors are tested for multi-colinearity, it is observed that the status of the vessel and the boarding access are highly correlated (Table 8).

		S1	S2	S3	S4	BA1	BA2	BA3
S1	Pearson Correlation	1	-.788**	-.093	-.214**	-.346**	.288**	.277**
	Sig. (2-tailed)		.000	.154	.001	.000	.000	.000
	N	239	239	239	239	239	239	239
S2	Pearson Correlation	-.788**	1	-.145*	-.336**	.255**	-.254**	-.257**
	Sig. (2-tailed)	.000		.025	.000	.000	.000	.000
	N	239	239	239	239	239	239	239
S3	Pearson Correlation	-.093	-.145*	1	-.039	-.057	.146*	.082
	Sig. (2-tailed)	.154	.025		.544	.379	.024	.207
	N	239	239	239	239	239	239	239
S4	Pearson Correlation	-.214**	-.336**	-.039	1	.201**	-.075	-.060
	Sig. (2-tailed)	.001	.000	.544		.002	.245	.355
	N	239	239	239	239	239	239	239

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 8: Pearson Correlation between Status of vessel and Boarding Access (Source: Author)

The results show a high correlation between the different boarding accesses, when the vessel is underway (S1). Pirates are able to board the ship from any location, which is attributed to the high correlation between TA2 and the number of boats used for the attack. A similar trend is observed when the vessel is at anchor (S2). When vessels are drifting there seems to be a greater accessibility for pirates to attack from mid-ship position (BA2). For vessels at berth (S4) the easiest access point for pirates is from the

forecastle (BA1). Vessels at berth generally have deck watch keepers that are overlooking the safety aspects of cargo operations; this enables easy access and entrance from the forecastle without being noticed.

Observing the correlation between armed robbery and theft and boarding access of the vessel, we find that armed robbery and theft is highly correlated when the vessel is underway or at anchor (Table 9). However there is evidence that a vessel is highly susceptible to being boarded when berthed and drifting, albeit from a single access point i.e. from the forecastle and amidships respectively. Thus boarding access is a critical security factor that affects the vulnerability of vessel to a hi-jacking.

		TA2	S1	S2	S3	S4
TA2	Pearson Correlation	1	-.275**	.228**	-.070	.110
	Sig. (2-tailed)		.000	.000	.280	.091
	N	240	239	239	239	239

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 9: Pearson Correlation between Hijacking and the Status of the vessel (Source: Author)

4.3.3 Regression Analysis of Variable TA3 – Kidnapping

The results of the regression analysis Kidnapping (TA3) are provided in Table10. The binary-logistic regression expression obtained from the results is as follows:

$$t = -50.466 - 23.720G1 + 7.937G2 + 2.784G3 - 28.412V1 - 7.230V2 + 1.324V3 + 29.874V4 + 5.476Speed + 2.34FB1 - 6.943FB2 - 2.624Seastate + 11.966T1 + 22.653T2 - 32.901AG - 1.506CS - 27.974PE1 + 13.350PE2 - 22.302PE3 - 27.449S1 - 7.350S2 - 14.36S3 - 8.237S4 + 30.929VPP1 + 13.03VPP2 + 15.791VPP3 + 18.408VPP4 + 40.54VPP5 - 3.076VPP6 + 6.565VPP7 + 24.733M1 + 7.256M2 - 0.832Watchkeeping + 1.45BA1 - 1.79BA2 - 13.594BA3 - 0.178nbrofboats + 0.586nbrofpirates - 12.337W1 + 19.205W2.$$

This equation is then substituted into the logistics function equation above (see Equation1)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	G1	-23.720	29737.581	.000	1	.999	.000
	G2	7.937	15455.650	.000	1	1.000	2800.286
	G3	2.784	25894.886	.000	1	1.000	16.181
	V1	-28.412	29001.358	.000	1	.999	.000
	V2	-7.230	22170.699	.000	1	1.000	.001
	V3	1.324	29743.232	.000	1	1.000	3.757
	V4	29.874	25095.500	.000	1	.999	94226061536
	Speedknots	5.476	29391.260	.000	1	1.000	239.008
	FB1	2.340	15455.761	.000	1	1.000	10.384
	FB2	-6.943	11885.991	.000	1	1.000	.001
	SeaState	-2.624	10021.435	.000	1	1.000	.073
	T1	11.966	25675.436	.000	1	1.000	157311.042
	T2	22.653	30083.440	.000	1	.999	6887839080.95
	AG	-32.901	14991.967	.000	1	.998	.000
	CS	-1.506	17434.132	.000	1	1.000	.222
	PE1	-27.974	16156.227	.000	1	.999	.000
	PE2	13.350	24208.089	.000	1	1.000	627863.930
	PE3	-22.302	12333.365	.000	1	.999	.000
	S1	-27.449	76870.929	.000	1	1.000	.000
	S2	-7.350	67499.510	.000	1	1.000	.001
	S3	-14.360	85180.678	.000	1	1.000	.000
	S4	-8.237	73182.805	.000	1	1.000	.000
	VPP1	30.929	69953.756	.000	1	1.000	270530547023
	VPP2	13.030	41267.116	.000	1	1.000	456092.256
	VPP3	15.791	46008.353	.000	1	1.000	7211828.190
	VPP4	18.408	62941.716	.000	1	1.000	98728470.163
	VPP5	40.540	37387.448	.000	1	.999	403843256914
	VPP6	-3.076	47571.050	.000	1	1.000	.046
	VPP7	6.565	38291.803	.000	1	1.000	709.474
	M1	24.733	19617.075	.000	1	.999	55130962181
	M2	7.256	58035.089	.000	1	1.000	1416.903
	Watchkeeping	-.832	11331.403	.000	1	1.000	.435
	BA1	1.450	8746.148	.000	1	1.000	4.262
	BA2	-1.790	11458.403	.000	1	1.000	.167
	BA3	-13.594	16395.060	.000	1	.999	.000
	Nbrofboats	-.178	6554.616	.000	1	1.000	.837
	Nbrofpirates	.586	1257.111	.000	1	1.000	1.797
	W1	-12.337	29967.627	.000	1	1.000	.000
	W2	19.205	11694.439	.000	1	.999	219136873.494
	Constant	-50.466	81033.861	.000	1	1.000	.000

a. Variable(s) entered on step 1: G1, G2, G3, V1, V2, V3, V4, Speedknots, FB1, FB2, SeaState, T1, T2, AG, CS, PE1, PE2, PE3, S1, S2, S3, S4, VPP1, VPP2, VPP3, VPP4, VPP5, VPP6, VPP7, M1, M2, Watchkeeping, BA1, BA2, BA3, Nbrofboats, Nbrofpirates, W1, and W2.

Table 10:Binary-Logistic Regression Results Dependent Variable Kidnapping (TA3) (Source: Author)

The analysis for the regression of the TA3 variable (Kidnapping) shows overwhelming evidence to prove the validity of the model. This results obtained in the omnibus tests of the model coefficients, showing a significance of .038 and a high 'Cox-Snell' (0.21) and 'Nagelkerke' R-square (1.00) value that proves that all the data explains the link between the dependent and independent variables (Appendix IX). This is an ideal scenario, which is not plausible, since the model cannot depict perfect viability.

Table 10 shows that none of the critical security factors have a significant link and show weak or little to no evidence that is linked to the probability of a kidnapping taking place. The model doesn't explain correlation between any the critical security factors nor does it evidence for multi-colinearity. The Nagelkerke R-square value depicts an ideal regression analysis, which is not realistically possible. This is because kidnapping incidents is a result of sequential events that occur after a boarding incident i.e. first a hi-jacking or armed robbery and theft incident and eventually to a kidnapping for a ransom. Another reason of low significance of correlation between the critical security factors and kidnapping is that these incidents are rare, as pirates aspire to get ransom for the cargo or the vessel.

4.3.4 Regression Analysis of Variable TA4 – Attempted Boarding

The results of the regression analysis for Attempted Boarding (TA4) are provided in Table11. The binary-logistic regression expression obtained from the results is as follows:

$$t = -58.06 + 0.368G1G2 + 0.923G3 - 1.701V1 + 19.707V2 + 18.295V3 + 19.475V4 + 1.877Speed - 0.326FB1 - 1.00FB2 + 0.65Seastate - 23.43T1 + 0.23T2 - 1.166AG + 0.833CS - 0.215PE1 + 0.84PE2 + 0.42PE3 + 20.647S1 + 20.479S2 + 19.682S3 + 19.452S4 - 21.823VPP1 - 1.219VPP2 - 1.818VPP3 - 0.774VPP4 - 1.054VPP5 - 3.538VPP6 - 0.838VPP7 + 1.106M1 + 17.331M2 + 0.058Watchkeeping - 0.799BA1 + 0.709BA2 + 0.21BA3 + 0.858nbrofboats - 0.1nbrofpirates - 1.796W1 + 0.234W2.$$

This equation is then substituted into the logistics function equation above (see Equation1)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	G1	.368	1.514	.059	1	.808	1.445
	G2	.923	1.003	.848	1	.357	2.518
	G3	-1.701	1.402	1.470	1	.225	.183
	V1	19.804	14965.024	.000	1	.999	398852096.331
	V2	19.707	14965.024	.000	1	.999	362038221.215
	V3	18.295	14965.024	.000	1	.999	88205357.099
	V4	19.475	14965.024	.000	1	.999	286898618.432
	Speedknots	1.877	1.652	1.291	1	.256	6.536
	FB1	-.326	.782	.174	1	.676	.722
	FB2	-1.000	.690	2.099	1	.147	.368
	SeaState	.650	.820	.627	1	.428	1.915
	T1	-23.430	12939.036	.000	1	.999	.000
	T2	.230	.666	.119	1	.730	1.258
	AG	-1.166	.812	2.059	1	.151	.312
	CS	.833	.644	1.672	1	.196	2.299
	PE1	-.215	1.035	.043	1	.835	.806
	PE2	.840	.961	.763	1	.382	2.315
	PE3	.420	.645	.424	1	.515	1.522
	S1	20.647	20145.201	.000	1	.999	926188257.559
	S2	20.479	20145.201	.000	1	.999	783391263.064
	S3	19.682	20145.201	.000	1	.999	352908532.663
	S4	19.452	20145.201	.000	1	.999	280518058.520
	VPP1	-21.823	7324.985	.000	1	.998	.000
	VPP2	-1.219	1.341	.827	1	.363	.295
	VPP3	-1.818	1.187	2.347	1	.125	.162
	VPP4	-.774	1.264	.375	1	.541	.461
	VPP5	-1.054	1.689	.390	1	.533	.349
	VPP6	-3.538	1.830	3.736	1	.053	.029
	VPP7	-.838	1.585	.280	1	.597	.432
	M1	1.106	.798	1.920	1	.166	3.022
	M2	17.331	19679.190	.000	1	.999	33643812.776
	Watchkeeping	.058	.413	.020	1	.888	1.060
	BA1	-.799	.590	1.835	1	.176	.450
	BA2	.709	.601	1.391	1	.238	2.032
	BA3	.210	.663	.101	1	.751	1.234
	Nbrofboats	.858	.493	3.024	1	.082	2.357
	Nbrofpirates	-.100	.096	1.080	1	.299	.905
	W1	-1.796	1.181	2.313	1	.128	.166
	W2	.234	.611	.147	1	.701	1.264
	Constant	-58.060	31891.178	.000	1	.999	.000

a. Variable(s) entered on step 1: G1, G2, G3, V1, V2, V3, V4, Speedknots, FB1, FB2, SeaState, T1, T2, AG, CS, PE1, PE2, PE3, S1, S2, S3, S4, VPP1, VPP2, VPP3, VPP4, VPP5, VPP6, VPP7, M1, M2, Watchkeeping, BA1, BA2, BA3, Nbrofboats, Nbrofpirates, W1, and W2.

Table 11: Binary-Logistic Regression Results Dependent Variable Attempted Boarding (TA4) (Source: Author)

The analysis for the regression of the TA4 variable (Attempted Boarding) shows overwhelming evidence to prove the validity of the model. This results obtained in the omnibus tests of the model coefficients, showing a significance of .000 and a high 'Cox-Snell' (0.373) and 'Nagelkerke' R-square (0.576) value that proves that a significant part of the data explains the link between the dependent and independent variables (Appendix X).

Table 11 shows that the critical security factors have no significant link and show weak or little to no evidence that links the probability of an attempted boarding. Majority of the factors exhibit multi-colinearity and hence the factors have to be compared using bi-variate correlation. Bi-variate correlation is used to test the correlation on one independent variable with the dependent variable i.e. TA4 attempted boarding. Results of the correlation are given in the Table 12:

		TA4
G1	Sig. (2-tailed)	.268
G2	Sig. (2-tailed)	.094
G3	Sig. (2-tailed)	.000
G4	Sig. (2-tailed)	.010
V1	Sig. (2-tailed)	.734
V2	Sig. (2-tailed)	.272
V3	Sig. (2-tailed)	.985
V4	Sig. (2-tailed)	.558
Speedknots	Sig. (2-tailed)	.007
FB1	Sig. (2-tailed)	.765
FB2	Sig. (2-tailed)	.098
SeaState	Sig. (2-tailed)	.157
T1	Sig. (2-tailed)	.198
T2	Sig. (2-tailed)	.002
T3	Sig. (2-tailed)	.002
AG	Sig. (2-tailed)	.316
CS	Sig. (2-tailed)	.000
PE1	Sig. (2-tailed)	.000
PE2	Sig. (2-tailed)	.000
PE3	Sig. (2-tailed)	.000
S1	Sig. (2-tailed)	.000
S2	Sig. (2-tailed)	.000
S3	Sig. (2-tailed)	.858
S4	Sig. (2-tailed)	.063

VPP1	Sig. (2-tailed)	.010
VPP2	Sig. (2-tailed)	.004
VPP3	Sig. (2-tailed)	.396
VPP4	Sig. (2-tailed)	.013
VPP5	Sig. (2-tailed)	.000
VPP6	Sig. (2-tailed)	.273
VPP7	Sig. (2-tailed)	.001
M1	Sig. (2-tailed)	.000
M2	Sig. (2-tailed)	.295
Watchkeeping	Sig. (2-tailed)	.021
BA1	Sig. (2-tailed)	.001
BA2	Sig. (2-tailed)	.000
BA3	Sig. (2-tailed)	.003
Nbrofboats	Sig. (2-tailed)	.000
Nbrofpirates	Sig. (2-tailed)	.004
W1	Sig. (2-tailed)	.000
W2	Sig. (2-tailed)	.001

Table 12: Bi-variate correlation results for Attempted Boarding (TA4) and independent variables (Source: Author)

The results of the bi-variate correlation demonstrate that a number critical security factors affect the vulnerability of a vessel to an attempted attack. The significance two-tailed tests show high correlation as compared to the binary-logistic regression. The factors that are highlighted by the correlation test are: Geographical Region (G3), Geographical Region (G4), Speed, Time of Day (T2), Time of Day (T3), Citadel (CS), Piracy Equipment – Fire Hoses and Spray Turret (PE1), Piracy Equipment – Barbed Wire (PE2), Piracy Equipment – Accommodation and Bridge protection (PE3), Status of the vessel – Underway (S1), Status of the vessel – Anchor (S2), Vessel Passage Plan – India/Pakistan/Iran Coastline (VPP1), Vessel Passage Plan – Oman/Yemen coastline (VPP2), Vessel Passage Plan – East Africa coastline (VPP4), Vessel Passage Plan – West Africa coastline (VPP5), Vessel Passage Plan – South China Sea/Singapore/Malacca Straits, Contingency Planning – Manoeuvring (M1), Contingency Planning – Reporting points (M2), Boarding Access – Forecastle (BA1), Boarding Access – Amidships (BA2), Boarding Access – Aft (BA3), number of boats, number of pirates, Weaponry – Heavy weapons (W1), Weaponry – light weapons (W2).

4.3.5 Results

The binary-logistic regression analysis of the four dependent variables provides us with a collective group of variables that show high correlation and significance to various pirate attacks. Some variables that are widely thought of as factors that help deter pirate attacks have been found to give weak evidence or little or none at all. Armed Guards have been discussed in depth and have been observed to be effective in preventing hi-jacking and boarding attempts; however this factor does not seem to figure as significantly in the regression analysis. There are two explanations offered for this variability. Firstly, armed guards may not be carried on all vessels as it is the prerogative of the owner to do so, some flags do not allow guards or arms onboard their vessels. Secondly, those ships employing armed guards will not disclose this fact unless an incident occurs. Onboard security is part of the Shipboard Security Plan (SSP) and thus it is generally given on a need to know basis.

The results also show that vessel type and passage planning does not affect the frequency of pirate attacks. Different vessel types transit and trade over various HRA's, some vessels enter and exit these HRA's more frequently than others, hence the vessel type does not correlate with the frequency of piracy attacks. Pirates do not target specific types of vessels, but only those with a non-vigilant crew or those that lack security of certain critical operative factors that make the vessel vulnerable. The vessels passage plan is not correlated to the frequency of pirate attacks. However it is observed that the general practice on vessels is to plot the coordinates of recent attacks and adapt the passage plan accordingly to avoid areas where attacks have occurred. This may be useful, but it is not significant enough to discourage pirates from attacking vessels that are distant from land. Pirates have been known to attack 16NM of the coast of India and 500NM into the Indian Ocean.

Number of pirates, number of pirate boats and weaponry are the other factors that don't affect the likelihood of a pirate attack. The number of pirates generally depends on the purpose or type of attack i.e. generally more number of pirates and boats are required to carry out a hijacking than that for armed robbery and theft. The type of weapons used also depends on the type of pirate attack being carried out. Heavy weapons are used more for attempted boarding's and hijackings while the vessel is in transit and light weapons for robbery and theft while the vessel is anchored or at berth. These factors are classified as Pirate Modus Operandi and hence do not figure as vessel operational factors to reduce piracy. However, it is interesting to find out if evaluating these factors affects the mitigation decisions taking by vessels. Since this is outside of the scope of this report, Pirate Modus Operandi is not prioritised.

Overall, the results show that we can reject the Null hypothesis. The following hypotheses; H_1, H_3, H_4, H_5, H_8, H_9, H_{10}, H_{13}, H_{14} and H_{15} hold true showing a high

correlation to the probability of a vessel being attacked. The conclusion of this chapter summarises the list of factors that impact the likelihood of a piracy attack.

4.3.6 Conclusion

The results from the binary-logistic regression enable us to collate and summarise each variable that affects vessel vulnerability and likelihood of a pirate attack in the following manner:

1. Geographical region: Various geographical regions have been identified in the analysis; however the region G3 i.e. South China Sea/ Singapore/ Malacca Straits is highly correlated to the various types of pirate attacks, especially towards hi-jacking and attempted boarding.
2. Freeboard: There is a high correlation of attacks when the freeboard of the vessel is less than 8m.
3. Sea State: the type of attack and success of an attack is affected by the state of the sea, if the sea state is greater than Beaufort Scale 3.
4. Citadel: Having a designated safe house or citadel is a factor that reduces the effect pirates have on hi-jacking and preventing harm to the crew.
5. Boarding Access: knowing the possible entry point pirates use for various pirate attacks, the crew can take precautionary measures to lower boarding attempts.
6. Status of the vessel: It is observed there are more boarding attempts and hi-jacking on vessels underway and more armed robbery and theft on vessel at anchor or at berth.
7. Anti-piracy equipment: on most occasions the guidelines laid down in BMP4 help deter pirates from boarding, Fire hoses and spray turrets have been the most effective in doing so.
8. Speed: speed has significance in preventing attack, but most vessels have speeds lower than 18 knots and hence use other preventive measures to deter pirate attacks.
9. Reporting Points: Reporting schemes In HRA's help authorities keep track of vessels and also enable effective communication between vessel-coast station and vice versa, to provide information regarding recent attack and convoy information.
10. Lookout: The more number of lookouts posted during transit in HRA's, the quicker the response is for a vessel to take preventive and contingency action

In the next section we use a pair-wise questionnaire using the method of Analytic Hierarchy Process to prioritise and rank these factors in order to define weightage and importance of each factor in the risk assessment framework.

4.4 Analytic Hierarchy Process

The Analytic Hierarchy Process uses highly correlated factors identified by binary-logistic regression in a pair-wise comparison to prioritise and rank the factors. The hierarchy design is distributed into three phases, namely Overall Goal, Criteria and Decision Alternatives (Figure 13).

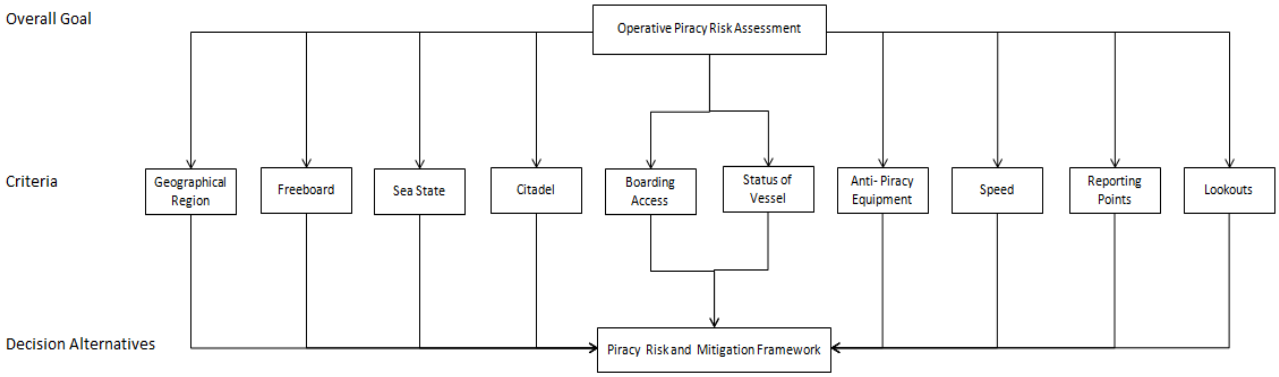

Figure 13: Hierarchy for Piracy Risk and Mitigation Framework (Source: Author)

Using AHP in a questionnaire format (Appendix XI), the respondent identifies the relevance of each criterion in accordance with the overall goal. Each factor is evaluated in comparison with the other. The respondent must judge how much more important the selected criterion is. For example, in the comparison between Geographical Region-Freeboard, if the respondent indicates that the Freeboard is more important as compared to the geographical region, then the respondent assigns the degree of importance between the pair of factors on a 1-9 point scale. Table 13 explains the scale as converted into a numerical rating. If the respondent thinks that Freeboard is 'much more important' than the geographical region a numerical rating of 7 is given. If they are adjudged as 'equally important' then a numerical rating of 1 is given. There are 45 pair-wise comparisons for 10 factors. The questionnaire responses of the eight respondents are given in Appendix XII.

Verbal Judgment	Rating
Very much more important	9
Much more important	7
More important	5
Equally to moderately important	3
Equally important	1

Table 13: Comparison Scale for the Importance of Criteria using Analytic Hierarchy Process (Source: Author)

The relative importance of such a decision making criteria can vary between respondents. Not all the respondents have the same preferences; however some similarities can be observed. To determine the priorities and rankings of each pair-wise comparison we construct a pair-wise comparison matrix (Table 14).

Pairwise Comparison Matrix										
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Geographical Area										
Freeboard										
Sea State										
Citadel										
Boarding Access										
Status of Vessel										
Anti-piracy Equipment										
Speed										
Reporting Points										
Lookouts										

Table 14: Pair-Wise Comparison Matrix (Source: Author)

Each of the numerical ratings must be entered into the matrix. For example, using the comparison matrix from the respondent, Captain Sagar Naik (Table 15), a numerical rating of 3 is given for the comparison Freeboard-Sea State, with Freeboard being the more important factor. Hence we enter 3 into the row labelled Freeboard and the column, Sea State in the matrix. Looking at the comparison Sea State-Speed a numerical of rating of 5 is given with the Speed being the important criterion; hence we enter 5 into the row labelled speed and column labelled sea state. Diagonal element compared to each other will always be equal to 1. For example Speed-Speed comparison will be equal to each other. Hence the column and row labelled speed will have a numerical rating of 1. The remaining cell entries are made by filling in the inverse numerical ratings. For example in the case comparison of Freeboard-Sea State with a rating of 3, this implies that the Sea State- Freeboard comparison should have a

rating of 1/3. This is because Capt. Naik has already indicated preference of Freeboard over Sea State. The complete pair-wise comparison matrix is given below (Table 15).

Pairwise Comparison Matrix										
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Geographical Area	1	1	1	1	1	1	1/3	1/3	1	1
Freeboard	1	1	3	1	3	1	1	1	1	1
Sea State	1	1/3	1	1	1	1	1	1/5	3	5
Citadel	1	1	1	1	5	3	1	1/3	5	1
Boarding Access	1	1/3	1	1/5	1	1	1	1/3	1	1
Status of Vessel	1	1	1	1/3	1	1	1	1	3	1
Anti-piracy Equipment	3	1	1	1	1	1	1	1	3	1
Speed	3	1	5	1/3	3	1	1	1	5	3
Reporting Points	1	1	1/3	1/5	1	1/3	1/3	1/5	1	1
Lookouts	1	1	1/5	1	1	1	1	1/3	1	1

Table 15: Pair-Wise Comparison Matrix (Source: Questionnaire Respondent Captain Sagar Naik)

Using the pair-wise comparison matrix, we can now calculate the priority of each criterion in terms of the overall goal of establishing an Operative Piracy Risk Assessment. The process used is known as Synthesisation. It is a mathematical process used to judge the relative importance of each factor. The following steps provide a good approximation of the synthesisation results.

1. Sum the values in each column of the pair-wise comparison matrix (Table 16)

Pairwise Comparison Matrix										
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Geographical Area	1	1	1	1	1	1	1/3	1/3	1	1
Freeboard	1	1	3	1	3	1	1	1	1	1
Sea State	1	1/3	1	1	1	1	1	1/5	3	5
Citadel	1	1	1	1	5	3	1	1/3	5	1
Boarding Access	1	1/3	1	1/5	1	1	1	1/3	1	1
Status of Vessel	1	1	1	1/3	1	1	1	1	3	1
Anti-piracy Equipment	3	1	1	1	1	1	1	1	3	1
Speed	3	1	5	1/3	3	1	1	1	5	3
Reporting Points	1	1	1/3	1/5	1	1/3	1/3	1/5	1	1
Lookouts	1	1	1/5	1	1	1	1	1/3	1	1
Sum	14.00	8.67	14.53	7.07	18.00	11.33	8.67	5.73	24.00	16.00

Table 16: Pair-Wise Comparison Matrix - Sum of Numerical values (Source: Author)

2. Divide each element in the matrix by its column total. The result is known as the normalised pair-wise comparison matrix (Table 17).
3. Compute the average of the elements in each row of the normalised pair-wise comparison matrix. These averages provide the priorities of the matrix (Table 17, last column).

Synthesisation											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Priority
Geographical Area	0.071	0.115	0.069	0.142	0.056	0.088	0.038	0.058	0.042	0.063	0.074
Freeboard	0.071	0.115	0.206	0.142	0.167	0.088	0.115	0.174	0.042	0.063	0.118
Sea State	0.071	0.038	0.069	0.142	0.056	0.088	0.115	0.035	0.125	0.313	0.105
Citadel	0.071	0.115	0.069	0.142	0.278	0.265	0.115	0.058	0.208	0.063	0.138
Boarding Access	0.071	0.038	0.069	0.028	0.056	0.088	0.115	0.058	0.042	0.063	0.063
Status of Vessel	0.071	0.115	0.069	0.047	0.056	0.088	0.115	0.174	0.125	0.063	0.092
Anti-piracy Equipment	0.214	0.115	0.069	0.142	0.056	0.088	0.115	0.174	0.125	0.063	0.116
Speed	0.214	0.115	0.344	0.047	0.167	0.088	0.115	0.174	0.208	0.188	0.166
Reporting Points	0.071	0.115	0.023	0.028	0.056	0.029	0.038	0.035	0.042	0.063	0.050
Lookouts	0.071	0.115	0.014	0.142	0.056	0.088	0.115	0.058	0.042	0.063	0.076

Table 17: Normalised pair-wise comparison matrix (Source: Author)

The synthesisation procedure shows that according to the observations received from Captain Naik, the AHP determines that Speed has the highest priority with 0.166 and Reporting Points with the lowest priority of 0.05.

An important aspect of AHP, as mentioned in previous chapters, is to make sure the respondent provide a consistency of comparison while evaluating the important criterion. The AHP is a very sensitive evaluation technique; hence if it is not carried out carefully, it could lead to distorted results. The key to using AHP effectively is to analyse the consistency of the pair-wise judgement. For example if factor A compared to factor B has a rating of 2 and if factor B compared to factor C has a rating of 4, then perfect consistency between factor A and factor C will exist if there is a rating of 2 x 4 = 8. If there is a rating of 5 or 6 by the decision maker, some inconsistency exists. Thus with numerous factors an exact consistency is difficult to achieve.

AHP provides a method of calculating the consistency using a consistency ratio (CR). The ratio is designed on a threshold value of 0.10. Any value greater than 0.10 indicates an inconsistency in the pair-wise comparison, if the CR is 0.10 or less the pair-wise comparison is considered to be reasonably accurate and hence synthesisation can be continued. To calculate the consistency of the questionnaire the following procedure is incorporated:

1. Each value of the pair-wise comparison matrix is multiplied by the priority calculated in the normalised pair-wise comparison matrix for each factor. The sum values across the rows are calculated, known as the weighted sum. For example, the values received from the questionnaire by Capt. Naik we get the following computation:

$$0.074\begin{bmatrix}1\\1\\1\\1\\1\\1/3\\1/3\\1\\1\\1\end{bmatrix}+0.118\begin{bmatrix}1\\1\\3\\1\\3\\1\\1\\1\\1\\1\end{bmatrix}+0.105\begin{bmatrix}1\\1\\1\\1\\1\\1/3\\1/3\\1\\1\\1\end{bmatrix}+0.138\begin{bmatrix}1\\1/3\\1\\1\\1\\1\\1\\1/5\\3\\5\end{bmatrix}+0.063\begin{bmatrix}1\\1/3\\1\\1/5\\1\\1\\1\\1/3\\1\\1\end{bmatrix}+0.092\begin{bmatrix}1\\1\\1\\1/3\\1\\1\\1\\1\\3\\1\end{bmatrix}$$

$$+\quad 0.116\begin{bmatrix}3\\1\\1\\1\\1\\1\\1\\1\\3\\1\end{bmatrix}+0.166\begin{bmatrix}3\\1\\5\\1/3\\3\\1\\1\\1\\5\\3\end{bmatrix}+0.05\begin{bmatrix}1\\1\\1/3\\1/5\\1\\1/3\\1/3\\1/5\\1\\1\end{bmatrix}+0.076\begin{bmatrix}1\\1\\1/5\\1\\1\\1\\1\\1/3\\1\\1\end{bmatrix}=\begin{bmatrix}0.812\\1.336\\1.194\\1.526\\0.700\\1.008\\1.248\\1.955\\0.547\\0.805\end{bmatrix}$$

2. Divide the values obtained from the previous step with the priority for each criterion, the resulting solution will provide the weighted sum average.

   Geographical Region = $\frac{0.812}{0.074}$ = 10.946

   Freeboard = $\frac{1.336}{0.118}$ = 11.288

   Sea State = $\frac{1.194}{0.105}$ = 11.350

   Citadel = $\frac{1.526}{0.138}$ = 11.023

   Boarding Access = $\frac{0.700}{0.063}$ = 11.132

   Status of Vessel = $\frac{1.008}{0.092}$ =10.909

Anti-piracy Equipment = $\frac{1.248}{0.116}$ = 10.752

Speed = $\frac{1.955}{0.166}$ = 11.769

Reporting Points = $\frac{0.547}{0.05}$ =10.933

Lookouts = $\frac{0.805}{0.076}$ = 10.544

3. The average value from Step 2 is computed, this average is denoted as$\boldsymbol{\lambda\, max}$.

   $\lambda\, max = \frac{\mathbf{10.46+11.288+11.350+11.023+11.132+10.909+10.752+11.769+10.933+10.544}}{\mathbf{10}}$

   = 11.065

4. Compute the Consistency Index (CI) as follows

   $CI = \frac{\boldsymbol{\lambda\, max - n}}{\boldsymbol{n-1}}$

   where n is the number of factors being compared. Hence we get:

   CI = $\frac{11.065 - 10}{9}$ = 0.118

5. Compute the Consistency Ratio (CR)

   CR = $\frac{CI}{RI}$

   Where RI is the consistency index of a randomly generated pair-wise comparison matrix. It depends on the number of items being compared and is given in Table 18.

TABLE 2.2
The *R.I.* for Different Size Matrices

Number of elements	3	4	5	6	7	8	9	10	11	12	13
R.I.	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49	1.51	1.54	1.56

Table 18: RI for different size matrices (Source: Gwo-Hshiung, 2011)

From the Table for n= 10, the RI value is 1.49, therefore

CR = $\frac{0.118}{1.49}$ = 0.079

Since the CR is less than 0.1, we can conclude that the responses are reasonably accurate.

The same procedure has been applied to the other eight respondents (Appendix XIII). The results show accurate consistency with values of 0.1 of less, from all eight respondents who underwent the AHP questionnaire. The responses show accurate consistency and hence the priority rankings of each critical security factor from each questionnaire can be used to construct a risk and mitigation framework.

4.4.1 Results

The observations of the priority ranking from responses from each AHP questionnaire show some similarities in the thought process of each individual; however there is a contrast between the two ranks of Master and Chief Officer for each critical factor (Table 19).

		Priority Rankings									
Rank	Name	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Master	Sagar Naik	0.074	0.118	0.105	0.138	0.063	0.092	0.116	0.166	0.050	0.076
Master	K. Subbarao	0.048	0.069	0.038	0.094	0.031	0.052	0.085	0.412	0.061	0.111
Master	Murugan Nadar	0.023	0.113	0.075	0.151	0.029	0.024	0.106	0.352	0.061	0.068
Average		0.048	0.100	0.072	0.128	0.041	0.056	0.102	0.310	0.057	0.085

		Priority Rankings									
Rank	Name	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Chief Officer	Gajendra Rai	0.139	0.134	0.158	0.028	0.062	0.134	0.046	0.152	0.033	0.114
Chief Engineer/Yacht Master	Gerhard Dekker	0.062	0.093	0.040	0.111	0.069	0.112	0.076	0.220	0.054	0.161
Chief Officer	Sudeept Nayan	0.032	0.116	0.087	0.096	0.025	0.034	0.110	0.356	0.064	0.081
Chief Officer	Pushkar Lamba	0.030	0.117	0.087	0.100	0.027	0.035	0.097	0.369	0.061	0.077
Chief Officer	Ameya Tamhane	0.046	0.041	0.041	0.147	0.023	0.060	0.121	0.330	0.063	0.128
Average		0.062	0.100	0.083	0.097	0.041	0.075	0.090	0.286	0.055	0.112

Table 19: Priority rankings comparison between Masters and Chief Officers (Source: Author)

Looking at the results each rank i.e. Master and Chief Officer, observe that speed has the highest priority ranking and boarding access has the lowest priority ranking. However contrasting results are seen, such that Masters give a higher priority to Citadel (0.128), Anti-piracy Equipment (0.102) and Speed (0.310). Chief Officers on the other hand prioritise Geographical Area (0.062), Sea State (0.083), Status of Vessel (0.075)

and Lookouts (0.112). Both ranks agree on the prioritization of the factors Freeboard, Boarding Access and Reporting Points, with 0.100, 0.041 and 0.056 respectively.

On average Masters prioritise factors in the following order:

1. Speed (0.310)
2. Citadel (0.128)
3. Anti-Piracy Equipment (0.102)
4. Freeboard (0.100)
5. Lookouts (0.085
6. Sea State (0.072
7. Reporting Points (0.057
8. Status of Vessel (0.056)
9. Geographical Area (0.048)
10. Boarding Access (0.041)

On the other hand, Chief Officers on average, rank the critical security factors in the following order:

1. Speed (0.286)
2. Lookouts (0.112)
3. Freeboard (0.100)
4. Citadel (0.097)
5. Anti-Piracy Equipment (0.090)
6. Sea State (0.083)
7. Status of Vessel (0.075)
8. Geographical Area (0.062)
9. Reporting points (0.055)
10. Boarding Access (0.041)

Reviewing the results collectively as a sample, we notice similar prioritise and rankings (Figure14).

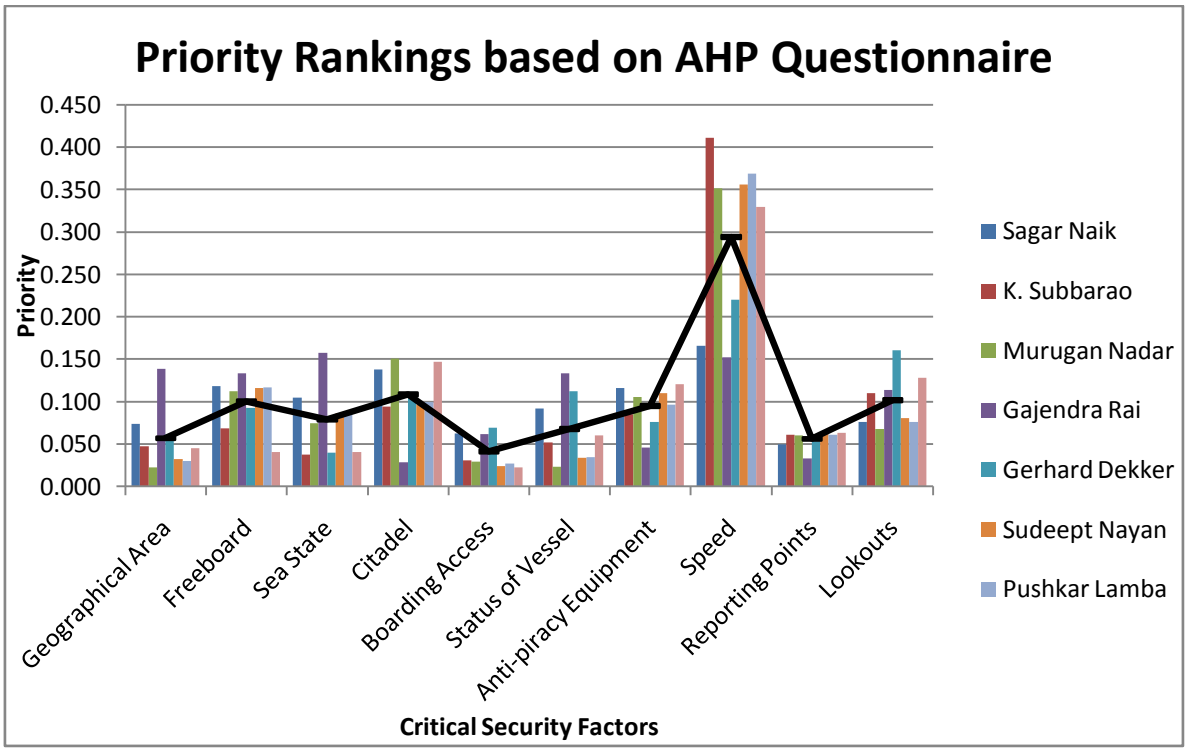

Figure 14: Priority ranking results from each AHP questionnaire (Source: Author)

Speed has the highest priority and Boarding Access the lowest priority. Freeboard and Boarding Access have the same priority values as observed in the results obtained for Masters and Chief Officer, 0.100 and 0.041 respectively. The averages and priority rankings obtained from the collective group sample provides for the following order of critical security factors:

1. Speed (0.295)
2. Citadel (0.108)
3. Lookouts (0.102)
4. Freeboard (0.100)
5. Anti-Piracy Equipment (0.095)
6. Sea State (0.079)
7. Status of Vessel (0.068)
8. Geographical Area (0.057)
9. Reporting Points (0.056)
10. Boarding Access (0.041)

The prioritisation and rankings of the entire group follow more closely on the results obtained from the group sample of Masters. This order will be used to select decision alternatives offered by the Piracy Risk and Mitigation Framework.

4.4.2 Conclusion

From the results obtained we see the difference between the outcomes of the binary logit regression and AHP. The regression analysis provides us with the factors that are highly correlated to different types of attacks and sifts the ones that are not important allowing us to focus on the factors that can operationally enhance vessel security. The importance of these factors in relation to the type of piracy attacks enables us to rank them in order of importance.

AHP on the other hand defines the weightage each factors has in relation to the operational risk of pirate attacks. The decision alternatives used in the Piracy Risk and Mitigation Framework use the priorities and ranking of the critical security factors obtained from the collective group results as mentioned above. On the basis of these rankings the next chapter will provide a risk assessment framework that measures the likelihood and vulnerability of a vessel being attacked. The framework developed will then offer mitigation techniques and decision alternatives to strengthen the vessels operational features to prepare and prevent piracy attacks.

Chapter 5 Piracy Risk and Mitigation Framework

The first step to mandate a Piracy Risk and Mitigation Framework is to identify the factors relevant to assess risk. The previous chapters have comprehensively identified the critical security factors and provided for a priority and ranking. Second, the framework needs to evaluate the vessel risk. This is measured by vulnerability and likelihood. The vulnerability factors are defined as the operative factors inherent to the vessel. The likelihood factors are defined as operative factors external to the vessel. Once these two variables have been scored according to severity, recommended mitigation methods are highlighted (Appendix XIV).

5.1 Vulnerability

The vulnerability of a vessel takes into account six criteria. Based on the AHP questionnaire results the criteria are: Speed, Freeboard, Sea State, Lookout, Citadel and Anti-piracy Equipment. These criteria are scored using Table 20. The intervals are chosen on the basis of average vessel speeds of different types of commercial vessels (Faber et al., 2012). From this information we gauge the maximum and minimum speeds, using our reference speed of 18 knots as established in the hypothesis. Similarly, information on freeboard is drawn from the International Load Line Convention to get the impression of the range of vessel freeboard in loaded or ballast condition (IMO, 1966).

The sea state score range is based on the range provided in the Beaufort scale. This range uses the sea state reference of BF 3 provided in the Hypothesis. The score for the range of the number lookouts is given according to the limits provided in STCW'95 for bridge watch level 1, 2 and 3 (IMO, 1978), where the minimum number of watch-keepers cannot be less than 2 persons. The citadel criterion is explained by a maximum score of 1 'citadel present' and a minimum score of 5 'citadel not present'. Anti-piracy equipment is scored on the aspects of the types of equipment that the vessel has installed i.e. the maximum score of 1 for implementing all the equipment as provided by BMP4 and minimum score of 5 where no equipment is placed on standby. The types of equipment BMP4 takes into account are: Fire Hoses, Spray Turrets, Barbed Wire, Bridge and Accommodation Protection (by the means of dummies, locking systems, sandbagging, bullet proofing etc.).

The sum of the products of the scores and priority gives the total vulnerability score for the vessel. This score is rounded up to the nearest multiple of 0.5. The total vulnerability score ranges between a minimum of 1 and a maximum of 4. The higher the score the more vulnerable the vessel is.

Risk Factor	Priority	Possible Scores
Speed	0.295	1 = more than 18 knots
		2 = 15 -18 knots
		3 = 11 -14 knots
		4 = 7-10 knots
		5 = less than 7 knots
Freeboard	0.100	1 = more than 8 meters
		2 = 7 - 8 meters
		3 = 5 - 6 meters
		4 = 3 - 4 meters
		5 = less than 3 meters
Sea State	0.079	1 = more than BF scale 3
		2 = BF scale 3
		3 = BF scale 2
		4 = BF scale 1
		5 = BF scale 0
Lookouts	0.102	1 = more than 5 watchkeepers
		2 = 5 watchkeepers
		3 = 4 watchkeepers
		4 = 3 watchkeepers
		5 = 2 watchkeepers
Citadel	0.108	1 = Citadel present
		5 = Citadel not present
Anti-piracy Equipment	0.095	1 = 4 types of euqipment rigged
		2 = 3 types of equipment rigged
		3 = 2 types of equipment rigged
		4 = 1 type of equipment rigged
		5 = No protection
Total Vulnerability Score		Sum of the product of score and priority for all factors

Table 20: Score Sheet for the vulnerability of the assessment (Source: Author)

5.2 Likelihood

The likelihood of a pirate attack against a vessel is assessed on the basis of four criteria: Status of vessel, Geographical Area, Reporting Points and Boarding Access. The scoring criteria are given in Table 21. The score of the Status of the vessel depends on the condition of dynamic movement of the vessel. A score of 4 is given for a stationary vessel and a score of 1 given to the vessel when underway. The status of drifting is scored lower than an anchored vessel, as the response to get the vessel from a condition of standby to underway is more rapid.

The Geographical area is scored on the basis of the percentage attacks carried out within the time frame of the data set. A data set of 239 reports are used, of which 22% of the attacks occur in the Indian Ocean/East Africa Region, 16% South America and Caribbean, 44% South China Sea and Malacca Straits and 19% West Africa and the Mediterranean. The higher the percentage, the more the likelihood of the vessel getting attacked in that region, the higher the score i.e. score 5.

Reporting Points are classified into two categorical scores. A score of 1 is given ‘vessel reports to all reporting points’ enroute’ and a score of 5 given when a ‘vessel does not

report' to all reporting points enroute. Boarding Access is scored on the percentage of the attacks that have taken place from the stipulated points on the vessel. From the data set of 239, 230 attacks report the aspect of boarding access, with 49% of the attacks strategized from the forecastle, 27% from the mid-ship and 24% from the aft.

Risk Factor	Priority	Possible Scores
Status of Vessel	0.068	1 = underway
		2 = drifting
		3 = anchored
		4 = berthed
Geographical Area	0.057	1 = out of High Risk Area
		2 = South America and Carribean
		3 = West Africa and Mediterranean
		4 = Indian Ocean and East Africa
		5 = South China Sea/Malacca Straits
Reporting Points	0.056	1 = Vessel reports to all points
		5 = Vessel does not report to all points
Boarding Access	0.041	1 = attackers use don't attempt boarding
		2 = use the aft access
		3 = use midship accesss
		4 = use forecastle access
Total Likelihood Score		Sum of the product of score and priority for all factors

Table 21: Score sheet for likelihood assessment (Source: Author)

The sum of the products of the score and priority gives the total likelihood score for the vessel. This score is rounded up to the nearest multiple of 0.125. The total vulnerability score ranges between a minimum of 0.25 and a maximum of 1. The higher the score the more vulnerable the vessel is. The likelihood score has to be converted to a scale comparable to the vulnerability score for the overall risk assessment. The scale comparison of converted scores is provided in Table 22:

Scores	Converted Value
0.250	1.0
0.375	1.5
0.500	2.0
0.625	2.5
0.750	3.0
0.875	3.5
1.000	4.0

Table 22: Conversion Table for scaled comparison between the vulnerability and likelihood scores (Source: Author)

5.3 Overall Risk Assessment

The two scores obtained are combined using the risk matrix in Figure 15. Each cell covers a particular combination of a vulnerability and likelihood score. The colour represents the change in degree to risk as the vessel vulnerability and likelihood increase simultaneously. Each level of risk requires a different level of mitigation. The more the combination warrants into the Red colour the less risk averse the vessel is. For example, if the vulnerability of the vessel gives a total score of 1 and the likelihood gives a score of 1. An 'X' will be present in that cell (bottom-left-hand corner).

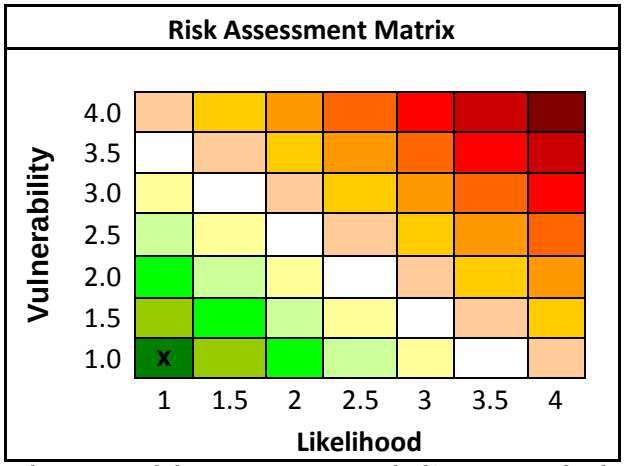

Figure 15: Risk Assessment Matrix (Source: Author)

After entering the required scores, the matrix calculates the relative status of vessel in accordance with piracy risk and produces mitigation advice in the 'Recommended Action' cell.

5.4 Mitigation

The Recommended Action Cell produces three degrees of mitigation advice based on the risk assessment matrix (Figure 16).

STOP - Risk cannot be justified. Carry out additional risk control measures and score risk after implementation. Apply additional Antipiracy Equipment, Lookouts, Estblishing a safe muster point/Citadel and Increasing Vessel Speed	**TOLERABLE** - Risk is undertaken only if a benefit is desired or if cost of reduction would exceed the improvement. Consider streghtening the current security measures and score risk after implementation.	**GO AHEAD** - Risk is considered acceptable. Excercise prudent seamanship - Crew training in anti-piracy measures, Reporting Points, Obtain recent Piracy reports, keep in contact with DPA

Figure 16: Different levels of Recommended Action (Source: Author)

From the example case previously mentioned the Recommended Action Cell would show the green coloured cell (Figure 17).

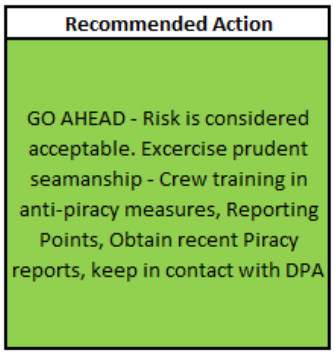

Figure 17: Recommended Action Cell (Source: Author)

The vessel carrying risk assessment, prior to entering the HRA, is fully prepared showing least amount of risk. It has taken all the necessary measures. However Company Operating Manuals should also be consulted, to further prepare the vessel. Other mitigation responses are provided in orange and red coloured cells demarcating different recommendations for different risk analysis.

Orange Cell Tolerable Risk: a vessel in this range requires a medium level of security. In such cases, the vessel must strengthen its security measures. To do this the vessel must consult BMP4 guidelines, establishing certain requirements and providing inherent advice to increase precautionary measures. These measures include Mustering points, Manoeuvring Practices, Anti-piracy equipment, Lighting, Watchkeeping/Lookouts and barriers to access points. Once these provisions have been accounted for the vessel can reassess the risk using the same method.

Red Cell: A vessel falling into the *provisio* of the red cell must reconstruct its ISPS criteria, and mandate an application of security measures. It must ensure it has satisfactory methods of ensuring that precautionary measures are in place. The vessel in addition, will have to follow the recommended action allotted in the Green and Orange Cells as well.

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5.5. Case Studies

5.5.1 Case 1

Incident Number 3473: A Container vessel underway with pilot on board underway near Ecuador was boarded by around six armed persons with shotguns in speed boats.

Upon investigation it was discovered container seals were broken but nothing was stolen. Using the case study information from the IMB report dated 27/05/2013, the Risk Assessment and the corresponding recommendations are given below (Figure 18 and 19):

Vulnerability

Risk Factor	Priority	Possible Scores	Score	Product
Speed	0.295	1= more than 18 knots 2 = 15 -18 knots 3 = 11 -14 knots 4 = 7-10 knots 5 = less than 7 knots	1	0.295
Freeboard	0.100	1= more than 8 meters 2 = 7 - 8 meters 3 = 5 - 6 meters 4 = 3 - 4 meters 5 = less than 3 meters	3	0.3
Sea State	0.079	1= more than BF scale 3 2 = BF scale 3 3 = BF scale 2 4 = BF scale 1 5 = BF scale 0	4	0.316
Lookouts	0.102	1= more than 5 watchkeepers 2 = 5 watchkeepers 3 = 4 watchkeepers 4 = 3 watchkeepers 5 = 2 watchkeepers	4	0.408
Citadel	0.108	1= Citadel present 5 = Citadel not present	5	0.54
Anti-piracy Equipment	0.095	1= 4 types of euqipment rigged 2 = 3 types of equipment rigged 3 = 2 types of equipment rigged 4 = 1 type of equipment rigged 5 = No protection	1	0.095
Total Vulnerability Score		Sum of the product of score and priority for all factors		2.0

Likelihood

Risk Factor	Priority	Possible Scores	Score	Product
Status of Vessel	0.068	1= underway 2 = drifting 3 = anchored 4 = berthed	1	0.068
Geographical Area	0.057	1= out of High Risk Area 2 = South America and Carribean 3 = West Africa and Mediterranean 4 = Indian Ocean and East Africa 5 = South China Sea/Malacca Straits	2	0.114
Reporting Points	0.056	1= Vessel reports to all points 5 = Vessel does not report to all points	1	0.056
Boarding Access	0.041	1= attackers use don't attempt boarding 2 = use the aft access 3 = use midship accesss 4 = use forecastle access	3	0.123
Total Likelihood Score		Sum of the product of score and priority for all factors		0.375
Converted Score				1.5

Scores	Converted Value
0.250	1.0
0.375	1.5
0.500	2.0
0.625	2.5
0.750	3.0
0.875	3.5
1.000	4.0

Figure 18: Case 3473 Risk Assessment (Source: Author)

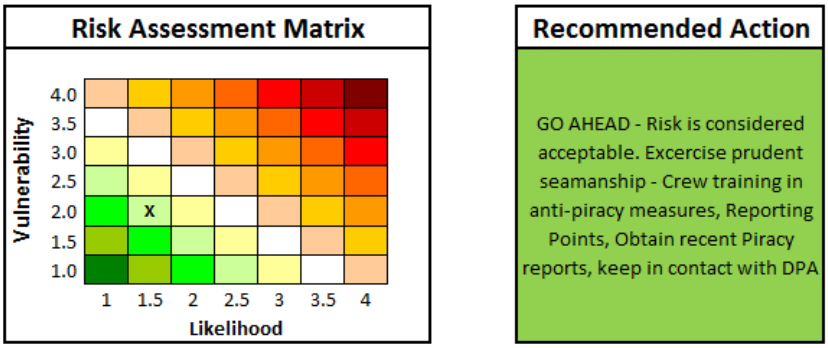

Figure 19: Case 3473 Risk Assessment Matrix and Recommended Action (Source: Author)

From the Assessment it is observed that even though the Framework shows that the risk faced by the vessel was acceptable, armed pirates still boarded the vessel and tried to steal goods from the containers, crew and the vessel went unharmed. This shows that if the fundamental risks are accounted for pirates generally tire and leave the vessel, however it is unknown if the pirates came with an intention to Hi-Jack the vessel or steal equipment. Thus other external factors apart from the vessel operative factors

play a role in types of piracy attacks. Operatively, the vessel has done, its best to take precautions to mitigate piracy, however pirates were still able to come onboard.

5.5.2 Case 2

Incident Number 3472: A fishing vessel while carrying out fishing activities was attacked and hijacked by pirates and sailed into Indonesian territorial waters. On 25.05.2013 the Indonesian Marine Police detained the fishing vessel. Using the case study information from the IMB report dated 07/05/2013, the Risk Assessment and the corresponding recommendations are given below (Figure 20 and 21).

Vulnerability

Risk Factor	Priority	Possible Scores	Score	Product
Speed	0.295	1 = more than 18 knots 2 = 15 -18 knots 3 = 11 -14 knots 4 = 7-10 knots 5 = less than 7 knots	4	1.18
Freeboard	0.100	1 = more than 8 meters 2 = 7 - 8 meters 3 = 5 - 6 meters 4 = 3 - 4 meters 5 = less than 3 meters	4	0.4
Sea State	0.079	1 = more than BF scale 3 2 = BF scale 3 3 = BF scale 2 4 = BF scale 1 5 = BF scale 0	2	0.158
Lookouts	0.102	1 = more than 5 watchkeepers 2 = 5 watchkeepers 3 = 4 watchkeepers 4 = 3 watchkeepers 5 = 2 watchkeepers	5	0.51
Citadel	0.108	1 = Citadel present 5 = Citadel not present	5	0.54
Anti-piracy Equipment	0.095	1 = 4 types of euqipment rigged 2 = 3 types of equipment rigged 3 = 2 types of equipment rigged 4 = 1 type of equipment rigged 5 = No protection	5	0.475
Total Vulnerability Score		Sum of the product of score and priority for all factors		3.5

Likelihood

Risk Factor	Priority	Possible Scores	Score	Product
Status of Vessel	0.068	1 = underway 2 = drifting 3 = anchored 4 = berthed	1	0.068
Geographical Area	0.057	1 = out of High Risk Area 2 = South America and Carribean 3 = West Africa and Mediterranean 4 = Indian Ocean and East Africa 5 = South China Sea/Malacca Straits	5	0.285
Reporting Points	0.056	1 = Vessel reports to all points 5 = Vessel does not report to all points	1	0.056
Boarding Access	0.041	1 = attackers use don't attempt boarding 2 = use the aft access 3 = use midship accesss 4 = use forecastle access	3	0.123
Total Likelihood Score		Sum of the product of score and priority for all factors		0.500
Converted Score				2.0

Scores	Converted Value
0.250	1.0
0.375	1.5
0.500	2.0
0.625	2.5
0.750	3.0
0.875	3.5
1.000	4.0

Figure 20: Case 3472 Risk Assessment (Source: Author)

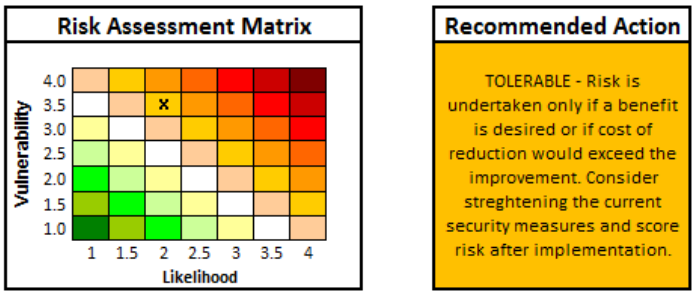

Figure 21: Case 3472 Risk Assessment Matrix and Recommended Action (Source: Author)

The risk assessment that has been carried out for this fishing vessel shows the lack of security measures taken by the vessel. The vessel is small, with a low freeboard, few lookouts and no anti-piracy equipment, while transiting a HRA (South China Sea/Malacca Straits) that is known for robbery, theft, and hi-jacking. The Risk Assessment matrix classifies this vessel higher up on the borderline between the Tolerable and Risk Averse category. In this case the fishing vessel should have taken more precautions and strengthened its security measures. Posting more lookouts and deploying anti-piracy equipment may have helped avoid the hi-jacking. Being on the borderline, it is evident that there a high probability that such a vessel would be prone to a hi-jacking. Re-assessing its probability after taking the recommended actions into account the possibility of the attack would have significantly been reduced.

5.6 Conclusion

The case studies show the practical usage of the Piracy Risk and Mitigation framework. It incorporates the usage of Risk Assessment and mitigation techniques, to fore-warn the vessel's crew about security measures that should be applied to the vessel, to make the transit in HRA safer and to avoid the possibility of being attacked by pirates. The framework employs a scoring technique that provides recommendations based on subjective prioritisation. The objective scores are converted into values that take into account the operational aspects faced by vessels considering piracy attacks. The inclusion of prioritising these factors enables a realistic approach to prevent attempted attacks and provide practical risk mitigation methods.

The framework can be used to re-assess the vessels vulnerability and likelihood after the precautionary measures are in place in order to check the robustness of the vessel as it proceeds through the HRA. The framework should be used as a method of support that identifies the operational weaknesses of a vessel against pirate attacks. These weaknesses can then be strengthened in relation to prior knowledge and experiences of the seafarers, whilst transiting the HRA.

Chapter 6 Concluding Remarks

Assessing the risk of piracy is of paramount importance to the shipping industry. The effects of piracy are heavily reliant on time and thus impact the transportation of goods and the efficiency of the supply chain in different regions. Piracy has spread throughout major shipping routes, causing bottlenecks in the supply chain. Piracy in some instances has gained significance due to the growth of trade in various region e.g. West Africa. This impact comes at a financial, social and operational cost. Due to the vast distribution of piracy, these factors have to be considered largely because of their effects on the supply chain. For the safety of the crew and the seamless transportation of goods, measures need to be provided to the vessel, in order for it to prevent and counter piracy attacks, having a proper framework for assessing risk and assigning anti-piracy measures for mitigation enables these vessels to transport goods without interference.

Results obtained through data mining, econometric analysis i.e. binary-logistic regression and the AHP questionnaire enables us to draw several conclusions. Firstly, data mining shows that there are a plethora of factors that contribute to the effects of piracy, most of them being administrative and financial. The HCSS and IMB piracy reports database, on the other hand provide operational factors, of which some are segregated from the online reports and others extracted from them. The HCSS database does not mention the importance of individual critical security factors for risk analysis, but the categorization of the factors allows for easier analysis of each case study. Additional factors are added to the analysis using the IMB reports, ISPS and STCW operative regulations.

Secondly, econometric analysis, using binary-logistic regression and correlation, provides some surprising results. The results are based on a qualitative quantification of the factors. The method, allows us to operationalise the indicators to observe their impact of the different types of piracy attacks. The analysis shows that certain operative factors mentioned in the HCSS database are significant for assessing risk e.g. geographical region, however certain additional factors that are not mentioned show a high correlation to piracy attacks, e.g. The presence of anti-piracy equipment, citadel etc.

Thirdly, the questionnaire developed through the AHP process provides a prioritisation of each factor. The results show that the vessels inherent factors are very important for avoiding pirate attacks, speed being the most important. The seniority in rank of seafarers, show as more conservative approach, this could be due to the burden of responsibility or the effect of experience. The priority rankings brings a degree of significance to the factors in the piracy risk and mitigation framework, hence allowing the framework to take into account the operational characteristics of the vessel when

scoring the key indicators to assess risk. Once the risk defined by the framework, mitigation techniques are advised based on general operational qualities a vessel can enhance to prevent pirate attacks, however ship-owners are free to amend these provisions as in accordance to their Quality Management Manuals.

Finally, the framework can be used to assess risk of vessels reasonably well. It provides the user with mitigation advice and allows the user to account for the importance of each factor necessary to reduce operational risk of a vessel. Nevertheless, the framework forms a base of support that needs to be used in conjunction with the ISPS and QSMS configurations of each ship-owner.

Chapter 7 Limitations and Recommendations

The framework is constructed based some limitations. The data is of paramount importance to construct the framework, with under-reporting of incidents, the question of transparency of data and piracy reporting causes difficulty in assessing the menace. Secondly, the data that is used to construct this piracy framework is based on occurrences and the factors that lead to the incident; however it does not include the vessels where precautionary measures were taken, but did not experience piracy. The knowledge of this information can provide for a robust definition of critical security factors. Thirdly, the methodology used to find factors with high correlation can also be carried out with multinomial regression, however in this method a reference category needs to be defined. The results produced from this method are relative to the reference category.

The availability of knowledge about vessel security, on the other hand requires secrecy, vessel operators are unwilling to divulge details about security preparations onboard their vessels due to regulatory stipulations enacted by the ISPS. Hence, security information regarding convoys, arms and armed guards will not be divulged in detail. The use of armed guards has become a norm for most ship-owners. Statistics also show that using armed guards has significantly reduced the amount of pirate attacks. However due to the nature and regulatory requirement of the ISPS, the security preparations onboard vessels is difficult to attain, thus if a vessel carry armed guard onboard or not is the prerogative of the ship-owner and in some instances the flag-state. It is for the same reason piracy reporting points, would rather have the vessel send position updates, rather than the vessel passage plan. This holds true regardless of whether the vessel is in convoy or not.

To make the framework a reasonably effective approach to measure and analyse risk, it needs to account for the external factors that impact piracy. Operative techniques used by vessels are generally based on experience of the seafarer and shore-based operational executives. Thus the preparations involved by the vessels to counter-piracy, also account for the pirate modus operandi. Factors like weapons, number of pirates, number of boats, attack strategy, distance from target vessel etc, become external factors that become important to deal with whilst assessing risk. The behavioural implications of pirates, though difficult to assess as these factors are not known to the vessel, before the attack commences can provide for a holistic framework.

The effect of assigning better methods of coordinating ship operations e.g. passage planning, bunker planning and lay-time, can have a significant effect on speed and duration the vessel spends in port and anchorages located in the HRA. Studies that recognise the effect of these operational functions will help provide shelter for vessels in sailing or transiting these regions. However the effect of such operational elements,

depend on cost benefit analysis and the operational costs required to strategise such operations, especially in the liner trade.

The effects of piracy on socio-economic, financial and operational costs regarding the vessel and supply chain need to be included to give a holistic scenario for measuring risk. Costing factors associated with piracy, are external factors that are not included while assessing risk. Some factors e.g. use of armed guards or the purchase of specialised anti-piracy equipment, can be quantified using cost techniques that can be implemented into the risk assessment matrix. However ship-owners should be wary that in such instances, it is not always wise to equate security with minimum cost, rather to find the best solution for security without compromising on heavy costs e.g. reducing war-risk insurance policy, because the vessel has transited through HRA multiple times without being attacked.

Looking at the inherent limitation of the framework, two major limitations are noticed. Firstly, the scoring of certain factors like geographic region and reporting points will need to change with the changing face of piracy. Piracy distribution and the number attacks are shifting to different regions, hence the percentage of attacks in certain regions may change in the next 10-15 years, thus the ratio between regions would need to be changed. In the case of pirate boarding access, the vessel design and construction is also changing rapidly, hence pirate boarding access points may also change. Secondly, the calculation of the likelihood of the attack needs to be re-addressed without using a conversion scale. The scoring distribution between vulnerability and likelihood should be of equal weight.

Due to the constraint of time a relatively small sample was used for the AHP questionnaires. To improve the priority accuracy rankings, a larger sample population for AHP would be beneficial to compare priorities; land-based personnel with operational experience should also be included in sample along with Navy veterans. Though results maybe similar, it generates more accurate results.

Finally, ship-owners should not solely rely on the framework or any other risk assessment method, but use it more as a supporting instrument to help identify vessel vulnerability. This can be used to configure or tailor make mitigation and reporting techniques for vessel operators.

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APPENDIX

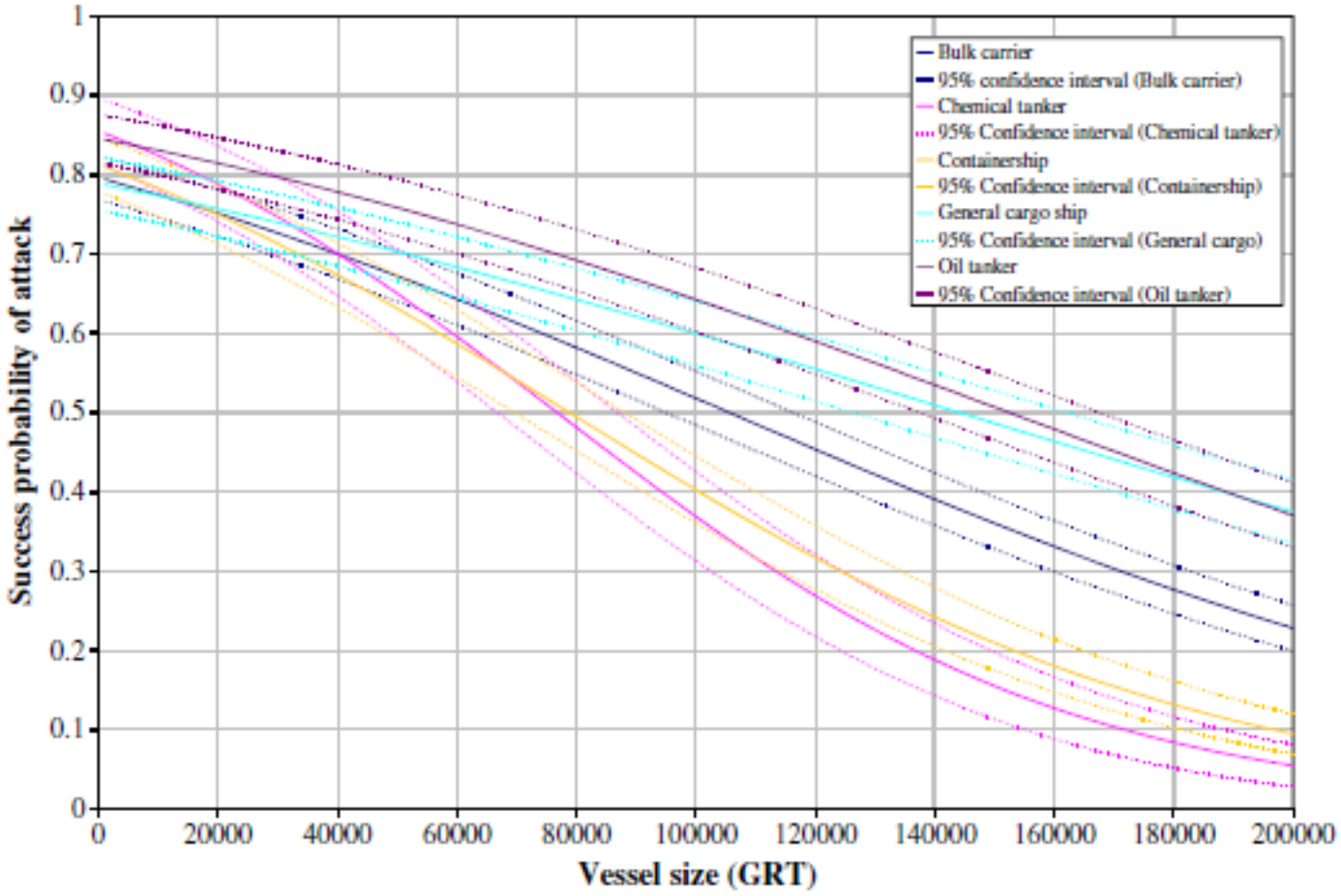
Appendix I: High rated CSF's through Triangulation Methodology (Thai, 200)

CSF 1	Well defined and clear security accountability and responsibility at all levels of the organization
CSF 2	Documented security processes and procedures
CSF 3	Security threats, critical resources to be secured and impacts of successful security threats identified, analysed and evaluated
CSF 4	Minimum security requirements for resources to be secured and risk acceptance level established
CSF 5	Security risk levels clearly defined
CSF 6	Security risk mitigation strategies and plans in place and clearly understood by operators
CSF 7	Resource allocation plan to mitigate security risks based on security risk levels
CSF 8	Contributions of employees, business partners and related agencies to security policy, strategies, and plans taken as essential inputs
CSF 9	Emphasis of monitoring and review in all security processes and procedures, at all organizational levels
CSF 10	Continuous review and improvement of security policy, strategies, plans, processes and procedures
CSF 11	Use of specific organizational structures (security improvement committee, work teams) to support security improvement
CSF 12	Long-term benefits of security recognized by senior management executives
CSF 13	Security policy, strategies and plans actively directed by senior management executives
CSF 14	Allocation of adequate resources to security improvement efforts, including training
CSF 15	Preparedness of the senior management executives to remove the root causes of security problems
CSF 16	Employees encouraged to find and provide feedback on security problems
CSF 17	Employee involvement in design and planning of security policy, strategies and plans

Appendix II: Low scoring CSF through Triangulation Methodology (Thai, 2009)

CSF 18	Security training viewed as long-term investment and service quality improvement facilitator
CSF 19	Security policy, strategies, and plans integrated in overall business policy, strategies, and plans
CSF 20	Security processes and procedures integrated in daily operation processes and procedures
CSF 21	Technology-based solutions to security problems understood by senior management as not the only answer
CSF 22	Security of information viewed as important as security of physical resources (assets, people, etc.)
CSF 23	Availability of detailed contingency plans to follow in the event of security breaches or incidents, continuously reviewed and updated
CSF 24	Availability of detailed recovery plans

Appendix III: Success Probability of Attack –Vessel Size (Psarros et al., 2011)



Appendix IV: Binary-Logistic Regression Data Set

Incident #	Date	Time (LT)	Type of Piracy Attack				Region				Type of vessel / Target			Speed (knots)	Freeboard (m)		Sea State	Time of Day			Crew Safety	
			Hi-jacking (TA1)	Armed Robbery and Theft (TA2)	Kidnapping (TA3)	Attempted Boarding (TA4)	Indian Ocean and East Africa (G1)	South America and Caribbean (G2)	South China Sea and Malacca Straits (G3)	West Africa and Mediterranean Sea (G4)	Bulk Carrier (V1)	Tankers (V2)	Container (V3)	Others (V4)	Speed (greater than 18 knots)	High (FB1)	Low (FB2)	Sea State (Greater than Beaufort scale 3)	Full Moon (T1)	Night (T2)	Day Light (T3)	Armed Guards (AG)	Citadel (CS)
3484	6/10/2013	4:30:00	0	1	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0
3483	6/8/2013	11:54:00	1	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0
3480	6/5/2013	8:30:00	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0
3479	6/4/2013	23:59:00	0	1	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	1	0	1
3478	6/3/2013	14:15:00	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	0	0	1	0	1
3475	6/3/2013	3:45:00	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0
3476	6/3/2013	13:10:00	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0
3481	6/1/2013	21:55:00	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0
3474	5/27/2013	3:40:00	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0
3473	5/27/2013	5:10:00	0	1	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	1	0	1	0
3482	5/24/2013	21:30:00	0	1	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0
3470	5/24/2013	2:50:00	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0
3471	5/23/2013	5:45:00	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
3469	5/23/2013	1:00:00	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
3461	5/22/2013	2:30:00	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1
3465	5/21/2013	2:10:00	0	0	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0
3468	5/21/2013	2:15:00	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0
3464	5/19/2013	15:15:00	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	0	1	0	1
3462	5/19/2013	8:25:00	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1
3463	5/18/2013	3:55:00	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	0	0
3467	5/15/2013	1:00:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0
3459	5/12/2013	4:15:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0
3460	5/12/2013	2:03:00	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1
3458	5/9/2013	12:00:00	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
3455	5/7/2013	13:58:00	0	0	0	1	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1
3472	5/7/2013	23:00:00	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0	0	0
3456	5/5/2013	21:55:00	1	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	1	0	1
3453	5/5/2013	6:00:00	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1
3457	5/5/2013	22:45:00	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1
3454	5/4/2013	12:34:00	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1
3452	5/4/2013	10:40:00	0	0	0	1	0	1	0	0	0	0	1	0	1	1	0	0	0	0	1	0	1
3451	4/30/2013	20:00:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0
3466	4/29/2013	2:00:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0	0	0
3448	4/27/2013	15:50:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0
3449	4/26/2013	17:30:00	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
3446	4/25/2013	21:45:00	0	0	1	0	0	1	0	0	0	0	1	0	1	1	0	0	1	1	0	0	1
3443	4/24/2013	4:30:00	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0
3444	4/24/2013	23:45:00	0	0	0	1	0	1	0	0	0	0	1	0	1	1	0	0	0	1	0	0	0
3450	4/24/2013	3:30:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0
3441	4/23/2013	4:07:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1
3447	4/22/2013	22:40:00	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
3440	4/18/2013	1:10:00	0	0	0	1	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0
3439	4/17/2013	2:10:00	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	1
3438	4/16/2013	5:00:00	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
3437	4/16/2013	1:12:00	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1
3436	4/15/2013	5:40:00	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1
3435	4/13/2013	4:30:00	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
3434	4/13/2013	2:30:00	0	0	0	1	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	1
3433	4/11/2013	23:30:00	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0
3432	4/9/2013	4:30:00	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	1	0	0	0
3431	4/6/2013	13:00:00	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0
3429	4/3/2013	3:30:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0
3418	4/2/2013	10:40:00	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	1	1
3428	3/27/2013	15:30:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0
3426	3/26/2013	4:05:00	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0
3427	3/26/2013	19:45:00	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	1	1
3425	3/25/2013	1:30:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	1
3422	3/24/2013	1:40:00	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Incident #	Date	Time (LT)	Type of Piracy Attack				Region				Type of vessel / Target			Speed (knots)	Freeboard (m)		Sea State	Time of Day			Crew Safety	
			Hi-jacking (TA1)	Armed Robbery and Theft (TA2)	Kidnapping (TA3)	Attempted Boarding (TA4)	Indian Ocean and East Africa (G1)	South America and Caribbean (G2)	South China Sea and Malacca Straits (G3)	West Africa and Mediterranean Sea (G4)	Bulk Carrier (V1)	Tankers (V2)	Container (V3)	Others (V4)	Speed (greater than 18 knots)	High (FB1)	Low (FB2)	Sea State (Greater than Beaufort scale 3)	Full Moon (T1)	Night (T2)	Day Light (T3)	Armed Guards (AG)	Citadel (CS)
3424	3/24/2013	3:00:00	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	1	0
3423	3/24/2013	4:00:00	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0
3421	3/23/2013	2:00:00	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0
3420	3/22/2013	22:00:00	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
3419	3/21/2013	2:20:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0
3417	3/16/2013	23:08:00	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	1	0
3416	3/14/2013	12:30:00	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	1	1
3415	3/14/2013	4:02:00	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0
3414	3/12/2013	12:30:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0			0	0
3413	3/4/2013	20:30:00	0	0	0	1	1	0	0	0	0	1	0	0	0	0	1	0	1	0	1	1
3412	3/4/2013	4:00:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0
3430	3/4/2013	9:07:00	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0
3410	2/27/2013	3:20:00	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0
3411	2/27/2013	12:00:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0
3409	2/24/2013	23:45:00	0	1	0	0	0	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0
3408	2/22/2013	19:00:00	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	1
3403	2/20/2013	0:48:00	0	1	0	0	0	0	1	0	1	0	0	0	2	1	0	0	1	0	0	0
3405	2/20/2013	21:00:00	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0
3402	2/20/2013	6:00:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0	0
3399	2/18/2013	19:45:00	0	0	0	1	1	0	0	0	1	0	0	0	0	0	1	0	1	0	1	1
3400	2/18/2013	23:10:00	0	0	0	1	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1
3404	2/18/2013	4:00:00	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
3395	2/18/2013	3:15:00	1	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0
3396	2/17/2013	6:15:00	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0
3392	2/15/2013	2:10:00	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0
3391	2/14/2013	23:40:00	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0
3394	2/14/2013	1:00:00	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
3390	2/13/2013	4:40:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0
3389	2/12/2013	5:40:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0	0
3388	2/12/2013	1:50:00	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0
3387	2/11/2013	6:35:00	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1
3393	2/10/2013	18:30:00	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	1
3398	2/7/2013	7:00:00	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0
3386	2/7/2013	22:25:00	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0
3385	2/6/2013	2:45:00	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	1
3382	2/4/2013	1:24:00	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	0	1	0
3383	2/3/2013	7:00:00	1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	1
3381	2/2/2013	4:30:00	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1
3445	1/31/2013	18:30:00	0	1	0	0	0	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0
3380	1/31/2013	21:30:00	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	1
3384	1/31/2013	13:50:00	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0
3379	1/31/2013	4:30:00	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0
3377	1/29/2013	0:30:00	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
3376	1/27/2013	0:20:00	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0
3378	1/24/2013	3:00:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0
3375	1/23/2013	6:00:00	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0
3406	1/22/2013	19:00:00	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1
3374	1/22/2013	2:00:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	0
3373	1/17/2013	23:45:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	0
3372	1/16/2013	22:00:00	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	1
3371	1/16/2013	3:00:00	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1
3370	1/15/2013	0:30:00	1	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0
3369	1/12/2013	1:05:00	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0
3367	1/9/2013	5:20:00	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	1	1
3366	1/8/2013	22:50:00	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	1	0	1	1	1
3368	1/8/2013	23:20:00	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	0	1
3365	1/6/2013	2:00:00	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1

Incident #	Piracy Equipment as per BMP 4			Status of ship during attack				Vessel Passage Plan							Contingency Plan		Watchkeeping	Boarding Access			Pirate Capability			
																					No. of boats	No. of pirates	Weaponery	
	Fire Hoses and Spray Turrets (PE1)	Barbed Wire (PE2)	Accommodation and Birdge Protection (PE3)	Underway (S1)	Anchorage (S2)	Drifting (S3)	Berthed (S4)	India/Pakistan/Iran Coastline (VPP1)	Arabian Sea Lis. Transit (VPP2)	Oman/ Yemen Coastline (VPP3)	East Africa Coastline (VPP4)	West Africa Transit (VPP5)	S.America/Caribbean transit (VPP6)	South China Sea/ Singapore/Malacca Straits (VPP7)	Maneouvring Procedures (M1)	Alarm/ Reporting (M2)	Number of lookouts	Forecastle (BA1)	Mid-Ship (BA2)	Aft (BA3)	No. of boats	No. of pirates	Light weapons (W1)	Heavy weapons (W2)
3326	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	2	0	1	0	1	5	0	0
3321	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	2	0	1	0	1	3	1	0
3320	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0
3317	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	1	0	1	6	0	0
3318	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	1	0	1	0	0	0
3316	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	3	0	1	1	1	10	0	1
3314	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	3	0	0
3315	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	3	1	0	0	1	6	0	0
3319	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	7	0	0
3311	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	4	0	1	0	1	8	0	1
3308	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	3	1	0	0	1	12	1	0
3309	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	4	0	1	1	2	14	0	1
3310	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	1	3	1	0	0	2	6	0	0
3307	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	6	1	0
3306	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	2	0	1	1	2	12	0	1
3304	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	1	3	1	0
3303	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	4	0	0
3302	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	1	0	1	2	0	0
3299	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	3	1	0	0	1	3	1	0
3301	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	1	6	1	0
3300	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	1	0	1	6	0	0
3297	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	4	0	0
3296	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	0	0	0	0
3295	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	2	0	0	0	1	0	0	1
3294	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	1	0	1	0
3293	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	1	0	1	0
3292	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	1	0	0	0
3291	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	0	0	0	1	0	0	1
3290	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	0	0	0	1	0	0	1
3289	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	1	0	1	0
3287	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	0	0	0
3286	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	4	0	1
3285	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	4	1	0
3284	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	2	0	1	1	2	16	0	1
3281	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0
3283	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	0	0	0
3282	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	0	1	0
3280	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	1	0	0	0
3295	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	1	0	1	0
3294	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	1	0	1	0
3293	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	0	0
3279	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	1	0	0	0
3278	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	1	0	0	1
3292	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	0	1	0
3291	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	0	0
3290	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	1	0	2	16	0	0
3229	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	1	0
3226	0	1	1	1	0	0	0	0	1	1	0	0	0	0	0	1	3	0	0	1	1	4	0	0
3228	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	3	0	0	0	1	0	0	0
3227	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	3	0	0	0	1	0	0	0
3224	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0
3223	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	1	0
3222	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1	2	1	0	0	1	0	0	0
3220	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	0	0	1
3221	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	0	0	1	1	0	1	0
3219	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	0	0	1
3218	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	0	0
3217	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1	3	0	0	0	1	0	0	0
3216	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	0	0	0	0
3215	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
3214	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
3213	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0	0	1	0	0	1
3212	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	1	3	0	0	0	1	0	0	1
3211	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	2	0	0	0	1	0	0	1
3210	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	2	0	0	0	1	0	0	1
3208	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	0	0
3209	1	1	1	1	0	0	0	0	1	1	0	0	0	0	1	1	4	0	0	0	1	0	0	1
3207	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	2	15	1	0
3205	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	2	0	1	0	1	0	0	0
3206	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0	0	1	0	0	1
3203	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	1	3	0	0	0	1	0	0	1
3204	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0	0	1	0	0	0
3202	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1	3	0	0	0	6	18	0	0
3200	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	1	0	0	0
3201	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	3	1	0	0	1	0	0	0
3198	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	3	0	0	1	3	12	0	0
3199	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	3	0	1	1	2	10	0	0
3197	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	2	1	0	0	1	4	0	0
3196	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	3	0	0	1	3	15	0	0
3195	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	2	1	0	0	1	0	0	0
3194	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	2	0	1	1	1	0	1	0
3193	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1	4	0	0	1	1	4	0	0
3192	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	5	1	0

Incident #	Date	Time (LT)	Type of Piracy Attack				Region					Type of vessel / Target			Speed (knots)	Freeboard (m)		Sea State	Time of Day			Crew Safety	
			Hi-jacking (TA1)	Armed Robbery and Theft (TA2)	Kidnapping (TA3)	Attempted Boarding (TA4)	Indian Ocean and East Africa (G1)	South America and Caribbean (G2)	South China Sea and Malacca Straits (G3)	West Africa and Mediterranean Sea (G4)	Bulk Carrier (V1)	Tankers (V2)	Container (V3)	Others (V4)	Speed (greater than 18 knots)	High (FB1)	Low (FB2)	Sea State (Greater than Beaufort scale 3)	Full Moon (T1)	Night (T2)	Day Light (T3)	Armed Guards (AG)	Citadel (CS)
3364	1/4/2013	23:15:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0
3363	1/3/2013	4:00:00	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0
3362	12/29/2012	23:00:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0
3361	12/23/2012	19:45:00	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0
3360	12/20/2012	22:35:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3359	12/18/2012	10:30:00	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1
3358	12/15/2012	14:58:00	0	0	0	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	1
3354	12/15/2012	4:30:00	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1
3356	12/14/2012	21:05:00	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0
3353	12/13/2012	23:10:00	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	1	1
3355	12/11/2012	3:00:00	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	1	1
3357	12/11/2012	1:50:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	1
3352	12/10/2012	23:45:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0
3351	12/8/2012	11:35:00	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0
3350	12/5/2012	3:00:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0
3349	12/1/2012	21:00:00	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0
3347	11/30/2012	22:50:00	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	1	1
3348	11/30/2012	1:45:00	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3346	11/30/2012	1:10:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0
3345	11/29/2012	22:35:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3342	11/27/2012	19:50:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1
3343	11/27/2012	4:05:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0
3341	11/25/2012	5:10:00	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	0	1	0	0
3337	11/24/2012	0:55:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3339	11/24/2012	1:35:00	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
3338	11/21/2012	23:25:00	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	1	1
3333	11/21/2012	5:00:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0
3335	11/21/2012	22:23:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0
3334	11/20/2012	12:00:00	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
3344	11/18/2012	5:00:00	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	0	0
3336	11/17/2012	16:00:00	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1
3332	11/16/2012	15:30:00	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	1	0	0	1	0	1
3331	11/13/2012	20:40:00	0	1	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	1	0	1	1
3330	11/11/2012	5:30:00	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3340	11/11/2012	1:50:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3329	11/6/2012	19:30:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0
3328	11/3/2012	21:00:00	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0
3327	11/2/2012	5:45:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0
3324	10/27/2012	1:18:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1
3325	10/27/2012	23:30:00	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0
3323	10/27/2012	0:30:00	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0
3326	10/24/2012	20:15:00	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	1
3321	10/21/2012	12:20:00	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0			0	0
3320	10/20/2012	1:30:00	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0
3317	10/18/2012	2:20:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0
3318	10/17/2012	12:00:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0
3316	10/17/2012	2:00:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0
3314	10/16/2012	4:05:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0
3315	10/16/2012	0:35:00	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	0
3319	10/15/2012	0:30:00	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	1	0	0	0
3311	10/10/2012	12:10:00	0	0	0	1	1	0	0	0	0	0	0	1	1	0	1	0	0	0	1	1	1
3308	10/8/2012	2:35:00	1	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	1
3309	10/5/2012	23:30:00	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0
3310	10/5/2012	3:00:00	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0
3307	10/5/2012	5:45:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0
3306	10/4/2012	20:30:00	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0
3304	9/29/2012	19:30:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1

Incident #	Date	Time (LT)	Type of Piracy Attack				Region				Type of vessel / Target			Speed (knots)	Freeboard (m)		Sea State	Time of Day			Crew Safety	
			Hi-jacking (TA1)	Armed Robbery and Theft (TA2)	Kidnapping (TA3)	Attempted Boarding (TA4)	Indian Ocean and East Africa (G1)	South America and Caribbean (G2)	South China Sea and Malacca Straits (G3)	West Africa and Mediterranean Sea (G4)	Bulk Carrier (V1)	Tankers (V2)	Container (V3)	Others (V4)	Speed (greater than 18 knots)	High (FB1)	Low (FB2)	Sea State (Greater than Beaufort scale 3)	Full Moon (T1)	Night (T2)	Day Light (T3)	Armed Guards (AG)	Citadel (CS)
3303	9/25/2012	0:35:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	1	0
3302	9/24/2012	5:45:00	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3299	9/21/2012	1:35:00	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1
3301	9/19/2012	4:00:00	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0
3300	9/16/2012	2:00:00	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1
3297	9/14/2012	14:15:00	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0
3296	9/11/2012	13:00:00	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0
3295	9/9/2012	19:35:00	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0
3294	9/8/2012	2:35:00	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3293	9/7/2012	3:18:00	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0
3292	9/5/2012	0:53:00	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0	1
3291	9/4/2012	12:00:00	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0
3290	9/3/2012	20:45:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3289	8/31/2012	4:15:00	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	1	0	0	0
3287	8/28/2012	3:00:00	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0
3286	8/21/2012	2:30:00	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1
3285	8/19/2012	5:00:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0	0	0
3284	8/18/2012	23:10:00	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0
3281	8/17/2012	4:45:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0
3283	8/17/2012	5:00:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3282	8/17/2012	5:00:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0	0	0
3280	8/16/2012	5:00:00	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0
3235	8/10/2012	2:00:00	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0
3234	8/9/2012	21:00:00	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0
3233	8/6/2012	2:30:00	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0
3279	8/6/2012	0:50:00	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0
3278	8/3/2012	22:20:00	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0
3232	8/2/2012	2:30:00	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	1	0	0	0
3231	7/31/2012	2:40:00	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
3230	7/30/2012	1:40:00	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0
3229	7/28/2012	4:00:00	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	1	0	0	0
3226	7/27/2012	2:30:00	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	1
3228	7/27/2012	23:30:00	1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	0	0
3227	7/27/2012	13:45:00	0	0	0	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1
3224	7/23/2012	10:40:00	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0
3223	7/22/2012	5:10:00	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3222	7/18/2012	23:40:00	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0
3220	7/17/2012	1:45:00	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0
3221	7/17/2012	3:00:00	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0
3219	7/15/2012	3:55:00	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	1	0	0	0
3218	7/13/2012	12:00:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	1	0	0
3217	7/12/2012	20:25:00	0	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
3216	7/9/2012	15:20:00	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0
3215	7/4/2012	6:55:00	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0
3214	7/3/2012	23:50:00	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0
3213	7/2/2012	3:00:00	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
3212	6/30/2012	5:20:00	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0
3211	6/30/2012	5:15:00	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0
3210	6/30/2012	1:10:00	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0
3208	6/27/2012	4:30:00	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	1	0	0	0
3209	6/27/2012	10:30:00	0	0	0	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1
3207	6/26/2012	22:15:00	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
3205	6/25/2012	1:10:00	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0
3206	6/25/2012	19:16:00	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
3203	6/20/2012	5:05:00	0	0	0	1	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0
3204	6/20/2012	12:00:00	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0
3202	6/18/2012	11:05:00	0	0	0	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1
3200	6/17/2012	0:30:00	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0
3201	6/17/2012	13:30:00	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0
3198	6/12/2012	6:00:00	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	1	1
3199	6/12/2012	8:20:00	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	1
3197	6/10/2012	19:45:00	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	0
3196	6/9/2012	11:00:00	0	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1
3195	6/6/2012	23:20:00	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0	0	0
3194	6/5/2012	19:00:00	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0
3193	6/4/2012	17:35:00	0	0	0	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	1
3192	6/4/2012	2:30:00	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	1	1	1	0	0	0

Incident #	Piracy Equipment as per BMP 4			Status of ship during attack				Vessel Passage Plan							Contingency Plan		Watchkeeping	Boarding Access			Pirate Capability			
	Fire Hoses and Spray Turrets (PE1)	Barbed Wire (PE2)	Accommodation and Birdge Protection (PE3)	Underway (S1)	Anchorage (S2)	Drifting (S3)	Berthed (S4)	India/Pakistan/Iran Coastline (VPP1)	Arabian Sea L.Is. Transit (VPP2)	Oman/ Yemen Coastline (VPP3)	East Africa Coastline (VPP4)	West Africa Transit (VPP5)	S.America/ Caribbean transit (VPP6)	South China Sea/ Singapore/Malacca Straits (VPP7)	Maneouvring Procedures (M1)	Alarm/ Reporting (M2)	Number of lookouts	Forecastle (BA1)	Mid-Ship (BA2)	Aft (BA3)	No. of boats	No. of pirates	Weaponary	
																					No. of boats	No. of pirates	Light weapons (W1)	Heavy weapons (W2)
3484	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	0	4	0	1
3483	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	1	2	1	0
3480	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
3479	1	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	2	0	1	0	0	0	0	0
3478	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	4	0	0	0	2	10	0	0
3475	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	2	0	0
3476	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	1	2	0	0
3481	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	2	1	0	0	1	2	1	0
3474	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	2	1	0	0	1	3	0	0
3473	1	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1	3	0	1	0	1	6	0	1
3482	1	1	0	1	0	0	0	0	0	0	0	1	0	0	1	1	2	0	1	0	1	8	0	1
3470	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	3	1	0
3471	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	0	0	0	0
3469	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2	1	0	0	0	2	1	0
3461	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	1	2	11	0	0
3465	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	3	1	0	0	1	3	0	0
3468	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0	1	3	0	0
3464	1	1	1	1	0	0	0	1	0	1	0	0	0	0	1	1	4	0	0	1	4	12	0	0
3462	1	1	1	1	0	0	0	0	1	1	0	0	0	0	1	1	4	0	1	1	1	5	0	1
3463	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	1	2	0	0
3467	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	3	0	0
3459	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	1	5	0	0
3460	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	3	1	0	0	1	3	0	0
3458	1	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	3	1	1	1	1	8	0	0
3455	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	3	0	0	1	1	7	0	0
3472	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	1	0	0	0	0	0
3456	1	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1	3	0	0	0	1	3	0	0
3453	1	1	1	1	0	0	0	0	1	1	0	0	0	0	1	1	4	0	1	1	4	12	0	0
3457	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	4	1	0	1	1	13	0	1
3454	1	1	1	0	0	1	0	0	0	0	0	1	0	0	0	1	3	1	1	0	1	8	0	1
3452	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	3	0	1	1	1	7	0	1
3451	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	3	1	0	0	1	0	0	0
3466	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	0	0	0	0
3448	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2	1	0	0	1	2	0	0
3449	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	3	0	1	0	1	4	0	0
3446	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	3	0	1	1	2	14	0	1
3443	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	2	0	0
3444	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	2	1	0	0	1	2	0	1
3450	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	3	0	0	0	3	15	0	1
3441	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	3	1	0	0	1	5	0	1
3447	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	0	0	0
3440	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	1	0	1	3	0	0
3439	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	4	1	0	0	1	3	0	0
3438	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	4	0	1	0	1	7	0	0
3437	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	3	1	0	1	1	4	0	1
3436	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2	1	0	0	1	3	0	0
3435	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	1	0	1	0	1	0
3434	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	3	1	1	1	1	3	1	0
3433	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	3	1	1	0	1	0	1	0
3432	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
3431	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	3	0	0	0	0	0	0	0
3429	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	2	1	0	0	1	2	0	1
3418	1	1	1	1	0	0	0	0	0	0	1	0	0	0	1	1	2	1	1	1	1	8	0	0
3428	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	4	1	0	0	1	0	0	0
3426	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	3	0	0
3427	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	4	0	1	0	1	6	1	0
3425	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	5	0	1
3422	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0

Incident #	Piracy Equipment as per BMP 4			Status of ship during attack				Vessel Passage Plan							Contingency Plan			Watchkeeping	Boarding Access			Pirate Capability			
																						No. of boats	No. of pirates	Weaponary	
	Fire Hoses and Spray Turrets (PE1)	Barbed Wire (PE2)	Accommodation and Birdge Protection (PE3)	Underway (S1)	Anchorage (S2)	Drifting (S3)	Berthed (S4)	India/Pakistan/Iran Coastline (VPP1)	Arabian Sea L.Is. Transit (VPP2)	Oman/ Yemen Coastline (VPP3)	East Africa Coastline (VPP4)	West Africa Transit (VPP5)	S.America/ Caribbean transit (VPP6)	South China Sea/ Singapore/Malacca Straits (VPP7)	Maneouvring Procedures (M1)	Alarm/ Reporting (M2)	Number of lookouts	Forecastle (BA1)	Mid-Ship (BA2)	Aft (BA3)	No. of boats	No. of pirates	Light weapons (W1)	Heavy weapons (W2)
3424	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	2	0	0	1	0	2	0	0
3423	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	3	1	0	0	0	1	1	0
3421	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	5	1	0
3420	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	3	0	0	0	1	0	0	0
3419	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	1	4	0	0
3417	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	2	1	0	0	1	2	0	0
3416	1	1	1	1	0	0	0	1	1	1	0	0	0	0	0	1	3	1	1	0	4	16	0	1
3415	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	1	3	1	0
3414	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	1	0	0	0
3413	1	1	1	1	0	0	0	0	1	1	0	0	0	0	0	1	3	0	1	1	4	24	0	1
3412	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	3	0	0	0	1	0	0	0
3430	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	0	0	0	0
3410	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	2	0	0
3411	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0
3409	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	2	1	0	0	1	4	0	0
3408	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	3	1	1	1	1	6	0	0
3403	0	1	1	0	0	1	0	0	0	0	0	0	0	1	0	1	3	0	0	0	1	0	0	0
3405	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0
3402	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	2	1	0
3399	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	3	0	1	1	2	8	0	0
3400	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	2	0	0
3404	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0
3395	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	3	0	1	0	1	2	1	0
3396	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	3	1	0	0	1	2	0	0
3392	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	9	1	0	0	1	3	1	0
3391	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	2	1	0	0	0	0	0	0
3394	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	1	2	0	0
3390	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	0	0	0	0
3389	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0
3388	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	1	0	0	1	1	0
3387	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	3	0	1	0	1	3	0	0
3393	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3	0	0	1	1	12	0	0
3398	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3	0	0	1	2	17	0	1
3386	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	2	0	1	0	1	3	0	0
3385	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	1	3	1	0
3382	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	3	0	1	0	1	4	0	1
3383	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	1	4	0	0
3381	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	0	0	1	1	6	0	0
3445	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	2	0	0	0	1	4	0	1
3380	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	3	1	1	1	5	25	0	1
3384	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	3	0	0
3379	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	8	1	0
3377	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	1	0	0	1
3376	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	1	8	1	0
3378	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	1	0	0	1
3375	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	1	0
3406	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	3	0	1	1	1	6	0	1
3374	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	3	0	0
3373	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	4	0	0
3372	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	3	1	0	0	1	4	0	1
3371	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	1	5	1	0
3370	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	3	1	0
3369	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	2	1	0
3367	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	3	1	0	0	1	2	0	1
3366	1	1	1	1	0	0	0	0	1	1	0	0	0	0	0	1	4	1	1	1	1	6	0	0
3368	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	1	0	1	5	1	0
3365	1	1	1	1	0	0	0	0	1	0	1	0	0	0	1	1	3	0	1	1	1	6	0	1

Incident #	Piracy Equipment as per BMP 4			Status of ship during attack				Vessel Passage Plan							Contingency Plan		Watchkeeping	Boarding Access			Pirate Capability			
																					No. of boats	No. of pirates	Weaponary	
	Fire Hoses and Spray Turrets (PE1)	Barbed Wire (PE2)	Accommodation and Bridge Protection (PE3)	Underway (S1)	Anchorage (S2)	Drifting (S3)	Berthed (S4)	India/Pakistan/Iran Coastline (VPP1)	Arabian Sea L.Is. Transit (VPP2)	Oman/ Yemen Coastline (VPP3)	East Africa Coastline (VPP4)	West Africa Transit (VPP5)	S.America/ Caribbean transit (VPP6)	South China Sea/ Singapore/Malacca Straits (VPP7)	Maneouvring Procedures (M1)	Alarm/ Reporting (M2)	Number of lookouts	Forecastle (BA1)	Mid-Ship (BA2)	Aft (BA3)	No. of boats	No. of pirates	Light weapons (W1)	Heavy weapons (W2)
3364	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	2	1	0	0	1	4	0	0
3363	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	1	2	0	0
3362	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	3	0	0
3361	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3	0	1	1	1	4	0	1
3360	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	0	0	0	0
3359	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0	1	4	0	0	0	0	4	0	0
3358	1	1	1	1	0	0	0	0	0	1	1	0	0	0	1	1	3	0	1	1	1	6	0	0
3354	1	1	1	1	0	0	0	0	0	1	1	0	0	0	1	1	3	0	0	1	2	6	0	0
3356	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	0	1	0	1	3	0	0
3353	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	3	0	0	1	1	5	0	1
3355	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	4	1	1	1	2	17	0	0
3357	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	1	1	1	8	0	1
3352	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	1	4	0	0
3351	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	1	2	0	1	0	2	6	0	0
3350	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	3	1	0	0	1	4	0	0
3349	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	3	0	0
3347	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	3	0	1	0	1	4	0	0
3348	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	1	3	0	0
3346	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	9	1	0
3345	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	3	0	0
3342	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	4	0	0
3343	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	5	1	0
3341	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	3	1	0	0	1	3	0	0
3337	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	1	5	0	0
3339	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	0	0	1	1	4	1	0
3338	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	3	0	1	1	3	6	0	1
3333	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	4	0	0
3335	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	5	1	0
3334	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	0	0	0	0
3344	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	3	0	1	1	1	11	0	0
3336	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	0	1	1	2	10	0	0
3332	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	2	0	1	0	1	5	0	0
3331	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	3	0	0	1	2	12	0	1
3330	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	2	0	0	1	1	2	1	0
3340	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	6	1	0
3329	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	1	0	1	10	1	0
3328	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	4	0	0
3327	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	0	0
3324	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	1	0	1	4	0	0
3325	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	1	3	0	0
3323	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	1	3	1	0
3326	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	2	0	1	0	1	5	0	0
3321	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	2	0	1	0	1	3	1	0
3320	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0
3317	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	1	0	1	6	0	0
3318	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	1	0	1	0	0	0
3316	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	3	0	1	1	1	10	0	1
3314	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	3	0	0
3315	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	3	1	0	0	1	6	0	0
3319	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	7	0	0
3311	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	4	0	1	0	1	8	0	1
3308	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	3	1	0	0	1	12	1	0
3309	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	4	0	1	1	2	14	0	1
3310	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	1	3	1	0	0	2	6	0	0
3307	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	6	1	0
3306	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	2	0	1	1	2	12	0	1
3304	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	1	3	1	0

Incident #	Piracy Equipment as per BMP 4			Status of ship during attack					Vessel Passage Plan							Contingency Plan		Watchkeeping	Boarding Access			Pirate Capability			
																						No. of boats	No. of pirates	Weaponary	
	Fire Hoses and Spray Turrets (PE1)	Barbed Wire (PE2)	Accommodation and Birdge Protection (PE3)	Underway (S1)	Anchorage (S2)	Drifting (S3)	Berthed (S4)	India/Pakistan/Iran Coastline (VPP1)	Arabian Sea L.Is. Transit (VPP2)	Oman/ Yemen Coastline (VPP3)	East Africa Coastline (VPP4)	West Africa Transit (VPP5)	S.America/ Caribbean transit (VPP6)	South China Sea/ Singapore/Malacca Straits (VPP7)	Maneouvring Procedures (M1)	Alarm/ Reporting (M2)	Number of lookouts	Forecastle (BA1)	Mid-Ship (BA2)	Aft (BA3)	No. of boats	No. of pirates	Light weapons (W1)	Heavy weapons (W2)
3303	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	4	0	0
3302	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	1	0	1	2	0	0
3299	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	3	1	0	0	1	3	1	0
3301	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	1	6	1	0
3300	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	1	0	1	6	0	0
3297	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	4	0	0
3296	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	0	0	0	0
3295	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	2	0	0	0	1	0	0	1
3294	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	1	0	1	0
3293	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	1	0	1	0
3292	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	1	0	0	0
3291	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	0	0	0	1	0	0	1
3290	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	0	0	0	1	0	0	1
3289	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	1	0	1	0
3287	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	0	0	0
3286	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	4	0	1
3285	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	4	1	0
3284	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	2	0	1	1	2	16	0	1
3281	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0
3283	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	0	0	0
3282	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	0	1	0
3280	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	1	0	0	0
3235	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	1	0	1	0
3234	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	1	0	1	0
3233	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	0	0
3279	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	1	0	0	0
3278	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	1	0	0	1
3232	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	0	1	0
3231	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	2	1	0	0	1	0	0	0
3230	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	1	0	2	16	0	0
3229	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	1	0
3226	0	1	1	1	0	0	0	0	1	1	0	0	0	0	0	1	3	0	0	1	1	4	0	0
3228	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	3	0	0	0	1	0	0	0
3227	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	3	0	0	0	1	0	0	0
3224	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0
3223	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	1	0
3222	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	0	0	0
3220	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	0	0	1
3221	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	3	0	0	1	1	0	1	0
3219	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	1	0	0	1
3218	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	0	0
3217	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1	3	0	0	0	1	0	0	0
3216	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	0	0	0	0
3215	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
3214	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
3213	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0	0	1	0	0	1
3212	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	1	3	0	0	0	1	0	0	1
3211	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	2	0	0	0	1	0	0	1
3210	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	2	0	0	0	1	0	0	1
3208	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	0	0
3209	1	1	1	1	0	0	0	0	1	1	0	0	0	0	1	1	4	0	0	0	1	0	0	1
3207	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	2	15	1	0
3205	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	2	0	1	0	1	0	0	0
3206	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0	0	1	0	0	1
3203	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	1	3	0	0	0	1	0	0	1
3204	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0	0	1	0	0	0
3202	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1	3	0	0	0	6	18	0	0
3200	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	1	0	0	0
3201	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	3	1	0	0	1	0	0	0
3198	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	3	0	0	1	3	12	0	0
3199	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	3	0	1	1	2	10	0	0
3197	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	2	1	0	0	1	4	0	0
3196	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	3	0	0	1	5	15	0	0
3195	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	0	0
3194	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	1	1	1	0	1	0
3193	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1	4	0	0	1	1	4	0	0
3192	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	1	5	1	0

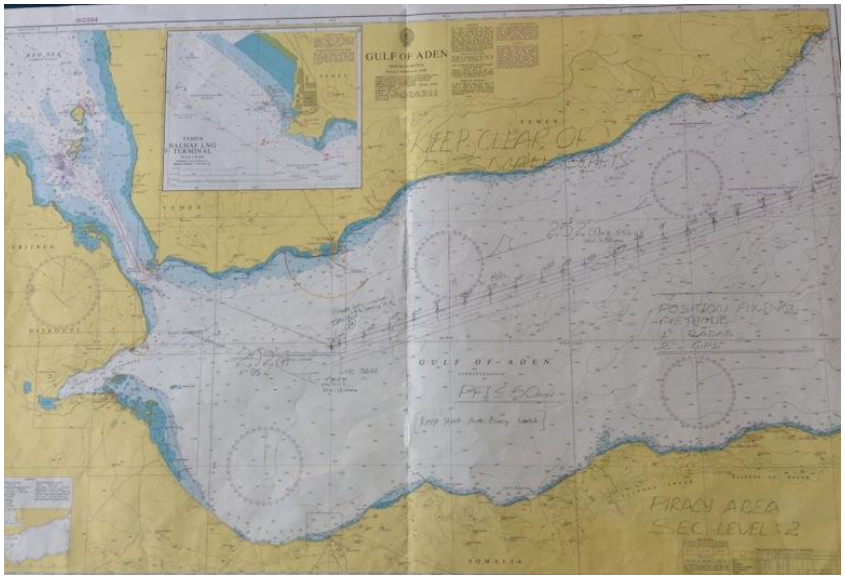
Appendix V: Beaufort Scale

Specifications and equivalent speeds									
Beaufort wind scale	**Mean Wind Speed**		**Limits of wind speed**		**Wind descriptive terms**	**Probable wave height in metres***	**Probable maximum wave height in metres***	**Sea state**	**Sea descriptive terms**
	Knots	**ms^{-1}**	**Knots**	**ms^{-1}**					
0	0	0	<1	<1	Calm	-	-	**0**	Calm (glassy)
1	2	1	1–3	1-2	Light air	0.1	0.1	**1**	Calm (rippled)
2	5	3	4–6	2-3	Light breeze	0.2	0.3	**2**	Smooth (wavelets)
3	9	5	7–10	4-5	Gentle breeze	0.6	1.0	**3**	Slight
4	13	7	11–16	6-8	Moderate breeze	1.0	1.5	**3–4**	Slight–Moderate
5	19	10	17–21	9-11	Fresh breeze	2.0	2.5	**4**	Moderate
6	24	12	22–27	11-14	Strong breeze	3.0	4.0	**5**	Rough
7	30	15	28–33	14-17	Near gale	4.0	5.5	**5–6**	Rough–Very rough
8	37	19	34–40	17-21	Gale	5.5	7.5	**6–7**	Very rough–High
9	44	23	41–47	21-24	Severe gale	7.0	10.0	**7**	High
10	52	27	48–55	25-28	Storm	9.0	12.5	**8**	Very High
11	60	31	56–63	29-32	Violent storm	11.5	16.0	**8**	Very High
12	-	-	64+	33+	Hurricane	14+	-	**9**	Phenomenal

*****

1. These values refer to well-developed wind waves of the open sea.
2. The lag effect between the wind getting up and the sea increasing should be borne in mind.
3. To convert knots to mph multiply by 1.15, for m/s multiply by 0.514.

Appendix VI: Voyage Plan-Oman/Yemen Coastline, Gulf of Aden/IRTC (M.T. Champion Express)



Appendix VII: Regression with Hi-Jacking (TA1) as dependent variable

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	76.842	39	.000
	Block	76.842	39	.000
	Model	76.842	39	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	153.541[a]	.277	.445

a. Estimation terminated at iteration number 20 because maximum iterations have been reached. Final solution cannot be found.

Classification Table[a]

		Observed	Predicted		
			TA1		Percentage Correct
			no	yes	
Step 1	TA1	no	184	8	95.8
		yes	24	21	46.7
	Overall Percentage				86.5

a. The cut value is .500

Appendix VIII: Regression with Armed Robbery and Theft (TA2) as dependent variable

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	121.256	39	.000
	Block	121.256	39	.000
	Model	121.256	39	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	207.089[a]	.400	.534

a. Estimation terminated at iteration number 7 because parameter estimates changed by less than .001.

Classification Table[a]

	Observed		Predicted		
			TA2		Percentage Correct
			no	yes	
Step 1	TA2	no	87	28	75.7
		yes	20	102	83.6
	Overall Percentage				79.7

a. The cut value is .500

Appendix IX: Regression with Kidnapping (TA3) as dependent variable

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	55.962	39	.038
	Block	55.962	39	.038
	Model	55.962	39	.038

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	.000[a]	.210	1.000

a. Estimation terminated at iteration number 20 because maximum iterations have been reached. Final solution cannot be found.

Classification Table[a]

	Observed		Predicted		
			TA3		Percentage Correct
			no	yes	
Step 1	TA3	no	231	0	100.0
		yes	0	6	100.0
	Overall Percentage				100.0

a. The cut value is .500

Appendix X: Regression with Attempted Boarding (TA4) as dependent variable

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	110.473	39	.000
	Block	110.473	39	.000
	Model	110.473	39	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	136.364[a]	.373	.576

a. Estimation terminated at iteration number 20 because maximum iterations have been reached. Final solution cannot be found.

Classification Table[a]

			Predicted		
			TA4		Percentage Correct
			no	yes	
Step 1	TA4	no	177	9	95.2
		yes	18	33	64.7
	Overall Percentage				88.6

a. The cut value is .500

Appendix XI: Analytic Hierarchy Process Questionnaire

ERASMUS UNIVERSITY
CENTRE FOR MARITIME ECONOMICS AND LOGISTICS (MEL)

MEL Erasmus | Center for Maritime Economics & Logistics

ANALYTIC HIERARCHY PROCESS

EXPERT JUDGEMENT QUESTIONNAIRE

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The Questionnaire consists of 4 pages including the cover page. The questionnaire should not take more than 15 minutes. Candidates are requested to fill their details on the cover page.

Rank:
Candidate Name:
Department:

Questionnaire: Identifying the priority scale for critical security factors to be used for the Piracy Risk and Mitigation Framework.

Given the intensity of pirate activity, assessing the correct critical security factors for risk analysis and preparing effective contingency plans to prevent piracy has become paramount for any ship owner. This Questionnaire is designed to assign priority weight-age to each critical security factor that has been established from previous econometric results. We would like to draw on the operational experience you gained by transiting high risk areas. The questions compare and test the relevance of each factor against the others. The responses below are measured on a perspective 9 point scale, deriving the most important criterion between each pair of factors.

The example below is about factors that play a role in the purchase of a car. Two such factors are mileage and colour. The Mileage has been assigned a score of 9. This represents the decision made on two criteria, showing that the importance of mileage is very much more important and the colour marginally less important. However if a score of 3 was selected, the decision shows that both criteria are of equal importance. The connotation of the comparison scale is mentioned in the table below (Table 1).

Example: Deciding factor to purchase a Car

Mileage	9	7	5	3	5	7	9	Colour

From the comparison scale given below it is observed that the Mileage is extremely more important than Colour.

Table1: Comparison Scale for the Importance of Criteria using Analytic Hierarchy Process

Verbal Judgment	Rating
Very much more important	9
Much more important	7
More important	5
Equally to moderately important	3
Equally important	1

The critical security factors that are compared are described below. Please take into consideration these descriptions whilst answering the questions.

Geographical Area	This includes High Risk and Extended High Risk Areas as defined by the IMB. West Africa and Mediterranean Sea, South America and Caribbean, Indian Ocean and East Africa, South China Sea and Malacca Straits.
Freeboard	Vessels with freeboard greater than 8m are less prone to an attack
Sea State	Sea State greater than beaufort scale 3, causes difficulty to operate skiffs
Citadel	'Safe Houses' provided in the vessel whilst transiting HRA
Boarding Access	Forecastle (Anchor chain), Midship (accommodation ladder) and Aft
Status of Vessel	Underway, Anchored, Drifting or Berthed
Anti - Piracy Equipment	Identified by IMB BMP4 (Fire Hoses, Barbed Wire, Armed Guards, Bridge protection)
Speed	Vessels operating above 18knots are less prone to an attack
Reporting Points	Singapore/Johor VTS, UKMTO, MSCHOA , AMVER and IRTC
Extra Lookouts	Bridge Management (Watchkeeping status III)

Please mark on the scale, the degree of importance amongst each pair-wise comparison. Only one answer per comparison is required.

	Geographical Area	9	7	5	3	1	3	5	7	9	Freeboard
	Geographical Area	9	7	5	3	1	3	5	7	9	Sea State
	Geographical Area	9	7	5	3	1	3	5	7	9	Citadel
	Geographical Area	9	7	5	3	1	3	5	7	9	Boarding Access
	Geographical Area	9	7	5	3	1	3	5	7	9	Status of Vessel
	Geographical Area	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Geographical Area	9	7	5	3	1	3	5	7	9	Speed
	Geographical Area	9	7	5	3	1	3	5	7	9	Reporting Points
	Geographical Area	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Freeboard	9	7	5	3	1	3	5	7	9	Sea State
	Freeboard	9	7	5	3	1	3	5	7	9	Citadel
	Freeboard	9	7	5	3	1	3	5	7	9	Boarding Access
	Freeboard	9	7	5	3	1	3	5	7	9	Status of Vessel
	Freeboard	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Freeboard	9	7	5	3	1	3	5	7	9	Speed
	Freeboard	9	7	5	3	1	3	5	7	9	Reporting Points
	Freeboard	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Sea State	9	7	5	3	1	3	5	7	9	Citadel
	Sea State	9	7	5	3	1	3	5	7	9	Boarding Access
	Sea State	9	7	5	3	1	3	5	7	9	Status of Vessel
	Sea State	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Sea State	9	7	5	3	1	3	5	7	9	Speed
	Sea State	9	7	5	3	1	3	5	7	9	Reporting Points
	Sea State	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Citadel	9	7	5	3	1	3	5	7	9	Boarding Access
	Citadel	9	7	5	3	1	3	5	7	9	Status of Vessel
	Citadel	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Citadel	9	7	5	3	1	3	5	7	9	Speed
	Citadel	9	7	5	3	1	3	5	7	9	Reporting Points
	Citadel	9	7	5	3	1	3	5	7	9	Extra Lookouts

	Boarding Access	9	7	5	3	1	3	5	7	9	Status of Vessel
	Boarding Access	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Boarding Access	9	7	5	3	1	3	5	7	9	Speed
	Boarding Access	9	7	5	3	1	3	5	7	9	Reporting Points
	Boarding Access	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Status of Vessel	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Status of Vessel	9	7	5	3	1	3	5	7	9	Speed
	Status of Vessel	9	7	5	3	1	3	5	7	9	Reporting Points
	Status of Vessel	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Speed
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Reporting Points
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Speed	9	7	5	3	1	3	5	7	9	Reporting Points
	Speed	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Reporting Points	9	7	5	3	1	3	5	7	9	Extra Lookouts

Appendix XII: Eight Responses to the AHP Questionnaire

ERASMUS UNIVERSITY
CENTRE FOR MARITIME ECONOMICS AND LOGISTICS (MEL)

MEL Erasmus | Center for Maritime Economics & Logistics

ANALYTIC HIERARCHY PROCESS

EXPERT JUDGEMENT QUESTIONNAIRE

Rahie Masoom Bali
Email: rahiebali_86@hotmail.com
Phone Number: +31634344356

The Questionnaire consists of 4 pages including the cover page. The questionnaire should not take more than 15 minutes. Candidates are requested to fill their details on the cover page.

Rank: Master
Candidate Name: Sagar Naik
Department: Deck

Please mark on the scale, the degree of importance amongst each pair-wise comparison. Only one answer per comparison is required.

	Geographical Area	9	7	5	3	1	3	5	7	9	Freeboard
	Geographical Area	9	7	5	3	1	3	5	7	9	Sea State
	Geographical Area	9	7	5	3	1	3	5	7	9	Citadel
	Geographical Area	9	7	5	3	1	3	5	7	9	Boarding Access
	Geographical Area	9	7	5	3	1	3	5	7	9	Status of Vessel
	Geographical Area	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Geographical Area	9	7	5	3	1	3	5	7	9	Speed
	Geographical Area	9	7	5	3	1	3	5	7	9	Reporting Points
	Geographical Area	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Freeboard	9	7	5	3	1	3	5	7	9	Sea State
	Freeboard	9	7	5	3	1	3	5	7	9	Citadel
	Freeboard	9	7	5	3	1	3	5	7	9	Boarding Access
	Freeboard	9	7	5	3	1	3	5	7	9	Status of Vessel
	Freeboard	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Freeboard	9	7	5	3	1	3	5	7	9	Speed
	Freeboard	9	7	5	3	1	3	5	7	9	Reporting Points
	Freeboard	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Sea State	9	7	5	3	1	3	5	7	9	Citadel
	Sea State	9	7	5	3	1	3	5	7	9	Boarding Access
	Sea State	9	7	5	3	1	3	5	7	9	Status of Vessel
	Sea State	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Sea State	9	7	5	3	1	3	5	7	9	Speed
	Sea State	9	7	5	3	1	3	5	7	9	Reporting Points
	Sea State	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Citadel	9	7	5	3	1	3	5	7	9	Boarding Access
	Citadel	9	7	5	3	1	3	5	7	9	Status of Vessel
	Citadel	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Citadel	9	7	5	3	1	3	5	7	9	Speed
	Citadel	9	7	5	3	1	3	5	7	9	Reporting Points
	Citadel	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Boarding Access	9	7	5	3	1	3	5	7	9	Status of Vessel
	Boarding Access	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Boarding Access	9	7	5	3	1	3	5	7	9	Speed
	Boarding Access	9	7	5	3	1	3	5	7	9	Reporting Points
	Boarding Access	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Status of Vessel	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Status of Vessel	9	7	5	3	1	3	5	7	9	Speed
	Status of Vessel	9	7	5	3	1	3	5	7	9	Reporting Points
	Status of Vessel	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Speed
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Reporting Points
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Speed	9	7	5	3	1	3	5	7	9	Reporting Points
	Speed	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Reporting Points	9	7	5	3	1	3	5	7	9	Extra Lookouts

ERASMUS UNIVERSITY
CENTRE FOR MARITIME ECONOMICS AND LOGISTICS (MEL)

MEL Erasmus | Center for Maritime Economics & Logistics

ANALYTIC HIERARCHY PROCESS

EXPERT JUDGEMENT QUESTIONNAIRE

Rahie Masoom Bali
Email: rahiebali_86@hotmail.com
Phone Number: +31634344356

The Questionnaire consists of 4 pages including the cover page. The questionnaire should not take more than 15 minutes. Candidates are requested to fill their details on the cover page.

Rank: Chief Officer
Candidate Name: Gajendra Rai
Department: Deck

Please mark on the scale, the degree of importance amongst each pair-wise comparison. Only one answer per comparison is required.

Geographical Area	9	7	5	3	1X	3	5	7	9	Freeboard
Geographical Area	9	7	5	3	1X	3	5	7	9	Sea State
Geographical Area	9	7	5X	3	1	3	5	7	9	Citadel
Geographical Area	9	7	5	3X	1	3	5	7	9	Boarding Access
Geographical Area	9	7	5	3	1X	3	5	7	9	Status of Vessel
Geographical Area	9	7	5	3X	1	3	5	7	9	Anti-Piracy Equipment
Geographical Area	9	7	5	3	1X	3	5	7	9	Speed
Geographical Area	9	7	5X	3	1	3	5	7	9	Reporting Points
Geographical Area	9	7	5	3	1X	3	5	7	9	Extra Lookouts
Freeboard	9	7	5	3	1X	3	5	7	9	Sea State
Freeboard	9	7X	5	3	1	3	5	7	9	Citadel
Freeboard	9	7	5	3	1X	3	5	7	9	Boarding Access
Freeboard	9	7	5	3	1X	3	5	7	9	Status of Vessel
Freeboard	9	7	5	3X	1	3	5	7	9	Anti-Piracy Equipment
Freeboard	9	7	5	3	1X	3	5	7	9	Speed
Freeboard	9	7	5X	3	1	3	5	7	9	Reporting Points
Freeboard	9	7	5	3	1X	3	5	7	9	Extra Lookouts
Sea State	9	7	5X	3	1	3	5	7	9	Citadel
Sea State	9	7	5X	3	1	3	5	7	9	Boarding Access
Sea State	9	7	5	3	1X	3	5	7	9	Status of Vessel
Sea State	9	7	5X	3	1	3	5	7	9	Anti-Piracy Equipment
Sea State	9	7	5	3	1X	3	5	7	9	Speed
Sea State	9	7	5X	3	1	3	5	7	9	Reporting Points
Sea State	9	7	5	3	1X	3	5	7	9	Extra Lookouts
Citadel	9	7	5	3	1	3X	5	7	9	Boarding Access
Citadel	9	7	5	3	1	3X	5	7	9	Status of Vessel
Citadel	9	7	5	3	1X	3	5	7	9	Anti-Piracy Equipment
Citadel	9	7	5	3	1	3	5	7X	9	Speed
Citadel	9	7	5	3	1X	3	5	7	9	Reporting Points
Citadel	9	7	5	3	1	3	5X	7	9	Extra Lookouts
Boarding Access	9	7	5	3	1	3X	5	7	9	Status of Vessel
Boarding Access	9	7	5	3	1X	3	5	7	9	Anti-Piracy Equipment
Boarding Access	9	7	5	3	1	3X	5	7	9	Speed
Boarding Access	9	7	5	3	1X	3	5	7	9	Reporting Points
Boarding Access	9	7	5	3	1X	3	5	7	9	Extra Lookouts
Status of Vessel	9	7	5	3X	1	3	5	7	9	Anti-Piracy Equipment
Status of Vessel	9	7	5	3	1X	3	5	7	9	Speed
Status of Vessel	9	7	5X	3	1	3	5	7	9	Reporting Points
Status of Vessel	9	7	5	3	1X	3	5	7	9	Extra Lookouts
Anti-Piracy Equipment	9	7	5	3	1	3	5X	7	9	Speed
Anti-Piracy Equipment	9	7	5	3	1X	3	5	7	9	Reporting Points
Anti-Piracy Equipment	9	7	5	3	1X	3	5	7	9	Extra Lookouts
Speed	9	7	5X	3	1	3	5	7	9	Reporting Points
Speed	9	7	5	3	1X	3	5	7	9	Extra Lookouts
Reporting Points	9	7	5	3	1	3X	5	7	9	Extra Lookouts

ERASMUS UNIVERSITY
CENTRE FOR MARITIME ECONOMICS AND LOGISTICS (MEL)

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ANALYTIC HIERARCHY PROCESS

EXPERT JUDGEMENT QUESTIONNAIRE

Rahie Masoom Bali
Email: rahiebali_86@hotmail.com
Phone Number: +31634344356

The Questionnaire consists of 4 pages including the cover page. The questionnaire should not take more than 15 minutes. Candidates are requested to fill their details on the cover page.

Rank: Yacht Master/Chief Engineer
Candidate Name: Gerhard Dekkers
Department: Engineering

Please mark on the scale, the degree of importance amongst each pair-wise comparison. Only one answer per comparison is required.

	Geographical Area	9	7	5	3	1	3	5	7	9	Freeboard
	Geographical Area	9	7	5	3	1	3	5	7	9	Sea State
	Geographical Area	9	7	5	3	1	3	5	7	9	Citadel
	Geographical Area	9	7	5	3	1	3	5	7	9	Boarding Access
	Geographical Area	9	7	5	3	1	3	5	7	9	Status of Vessel
	Geographical Area	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Geographical Area	9	7	5	3	1	3	5	7	9	Speed
	Geographical Area	9	7	5	3	1	3	5	7	9	Reporting Points
	Geographical Area	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Freeboard	9	7	5	3	1	3	5	7	9	Sea State
	Freeboard	9	7	5	3	1	3	5	7	9	Citadel
	Freeboard	9	7	5	3	1	3	5	7	9	Boarding Access
	Freeboard	9	7	5	3	1	3	5	7	9	Status of Vessel
	Freeboard	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Freeboard	9	7	5	3	1	3	5	7	9	Speed
	Freeboard	9	7	5	3	1	3	5	7	9	Reporting Points
	Freeboard	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Sea State	9	7	5	3	1	3	5	7	9	Citadel
	Sea State	9	7	5	3	1	3	5	7	9	Boarding Access
	Sea State	9	7	5	3	1	3	5	7	9	Status of Vessel
	Sea State	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Sea State	9	7	5	3	1	3	5	7	9	Speed
	Sea State	9	7	5	3	1	3	5	7	9	Reporting Points
	Sea State	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Citadel	9	7	5	3	1	3	5	7	9	Boarding Access
	Citadel	9	7	5	3	1	3	5	7	9	Status of Vessel
	Citadel	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Citadel	9	7	5	3	1	3	5	7	9	Speed
	Citadel	9	7	5	3	1	3	5	7	9	Reporting Points
	Citadel	9	7	5	3	1	3	5	7	9	Extra Lookouts

	Boarding Access	9	7	5	3	1	3	5	7	9	Status of Vessel
	Boarding Access	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Boarding Access	9	7	5	3	1	3	5	7	9	Speed
	Boarding Access	9	7	5	3	1	3	5	7	9	Reporting Points
	Boarding Access	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Status of Vessel	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Status of Vessel	9	7	5	3	1	3	5	7	9	Speed
	Status of Vessel	9	7	5	3	1	3	5	7	9	Reporting Points
	Status of Vessel	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Speed
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Reporting Points
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Speed	9	7	5	3	1	3	5	7	9	Reporting Points
	Speed	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Reporting Points	9	7	5	3	1	3	5	7	9	Extra Lookouts

ERASMUS UNIVERSITY
CENTRE FOR MARITIME ECONOMICS AND LOGISTICS (MEL)

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ANALYTIC HIERARCHY PROCESS

EXPERT JUDGEMENT QUESTIONNAIRE

Rahie Masoom Bali
Email: rahiebali_86@hotmail.com
Phone Number: +31634344356

The Questionnaire consists of 4 pages including the cover page. The questionnaire should not take more than 15 minutes. Candidates are requested to fill their details on the cover page.

Rank: Master
Candidate Name: K V Subba Rao
Department: Head, Department of Maritime Studies, and Former Head, Edexcel (UK) Centre 93004 (India)

Please mark on the scale, the degree of importance amongst each pair-wise comparison. Only one answer per comparison is required.

	Geographical Area	9	7	5	3	1	3	5	7	9	Freeboard
	Geographical Area	9	7	5	3	1	3	5	7	9	Sea State
	Geographical Area	9	7	5	3	1	3	5	7	9	Citadel
	Geographical Area	9	7	5	3	1	3	5	7	9	Boarding Access
	Geographical Area	9	7	5	3	1	3	5	7	9	Status of Vessel
	Geographical Area	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Geographical Area	9	7	5	3	1	3	5	7	9	Speed
	Geographical Area	9	7	5	3	1	3	5	7	9	Reporting Points
	Geographical Area	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Freeboard	9	7	5	3	1	3	5	7	9	Sea State
	Freeboard	9	7	5	3	1	3	5	7	9	Citadel
	Freeboard	9	7	5	3	1	3	5	7	9	Boarding Access
	Freeboard	9	7	5	3	1	3	5	7	9	Status of Vessel
	Freeboard	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Freeboard	9	7	5	3	1	3	5	7	9	Speed
	Freeboard	9	7	5	3	1	3	5	7	9	Reporting Points
	Freeboard	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Sea State	9	7	5	3	1	3	5	7	9	Citadel
	Sea State	9	7	5	3	1	3	5	7	9	Boarding Access
	Sea State	9	7	5	3	1	3	5	7	9	Status of Vessel
	Sea State	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Sea State	9	7	5	3	1	3	5	7	9	Speed
	Sea State	9	7	5	3	1	3	5	7	9	Reporting Points
	Sea State	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Citadel	9	7	5	3	1	3	5	7	9	Boarding Access
	Citadel	9	7	5	3	1	3	5	7	9	Status of Vessel
	Citadel	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Citadel	9	7	5	3	1	3	5	7	9	Speed
	Citadel	9	7	5	3	1	3	5	7	9	Reporting Points
	Citadel	9	7	5	3	1	3	5	7	9	Extra Lookouts

	Boarding Access	9	7	5	3	1	3	5	7	9	Status of Vessel
	Boarding Access	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Boarding Access	9	7	5	3	1	3	5	7	9	Speed
	Boarding Access	9	7	5	3	1	3	5	7	9	Reporting Points
	Boarding Access	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Status of Vessel	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Status of Vessel	9	7	5	3	1	3	5	7	9	Speed
	Status of Vessel	9	7	5	3	1	3	5	7	9	Reporting Points
	Status of Vessel	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Speed
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Reporting Points
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Speed	9	7	5	3	1	3	5	7	9	Reporting Points
	Speed	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Reporting Points	9	7	5	3	1	3	5	7	9	Extra Lookouts

ERASMUS UNIVERSITY
CENTRE FOR MARITIME ECONOMICS AND LOGISTICS (MEL)

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ANALYTIC HIERARCHY PROCESS

EXPERT JUDGEMENT QUESTIONNAIRE

Rahie Masoom Bali
Email: rahiebali_86@hotmail.com
Phone Number: +31634344356

The Questionnaire consists of 4 pages including the cover page. The questionnaire should not take more than 15 minutes. Candidates are requested to fill their details on the cover page.

Rank: Master
Candidate Name: Murugan Nadar
Department: Deck

Please mark on the scale, the degree of importance amongst each pair-wise comparison. Only one answer per comparison is required.

	Geographical Area	9	7	5	3	1	3	**5**	7	9	Freeboard
	Geographical Area	9	7	5	3	1	**3**	5	7	9	Sea State
	Geographical Area	9	7	5	3	1	3	5	**7**	9	Citadel
	Geographical Area	9	7	5	3	**1**	3	5	7	9	Boarding Access
	Geographical Area	9	7	5	3	**1**	3	5	7	9	Status of Vessel
	Geographical Area	9	7	5	3	1	3	5	**7**	9	Anti-Piracy Equipment
	Geographical Area	9	7	5	3	1	3	5	7	**9**	Speed
	Geographical Area	9	7	5	3	1	**3**	5	7	9	Reporting Points
	Geographical Area	9	7	5	3	1	**3**	5	7	9	Extra Lookouts
	Freeboard	9	7	5	3	**1**	3	5	7	9	Sea State
	Freeboard	9	7	5	3	**1**	3	5	7	9	Citadel
	Freeboard	9	7	5	3	**1**	3	5	7	9	Boarding Access
	Freeboard	9	7	**5**	3	1	3	5	7	9	Status of Vessel
	Freeboard	9	7	**5**	3	1	3	5	7	9	Anti-Piracy Equipment
	Freeboard	9	7	5	3	1	3	5	**7**	9	Speed
	Freeboard	9	7	5	**3**	1	3	5	7	9	Reporting Points
	Freeboard	9	7	5	3	**1**	3	5	7	9	Extra Lookouts
	Sea State	9	7	5	3	1	**3**	5	7	9	Citadel
	Sea State	9	7	**5**	3	1	3	5	7	9	Boarding Access
	Sea State	9	7	**5**	3	1	3	5	7	9	Status of Vessel
	Sea State	9	7	5	3	1	3	**5**	7	9	Anti-Piracy Equipment
	Sea State	9	7	5	3	1	3	**5**	7	9	Speed
	Sea State	9	7	5	3	**1**	3	5	7	9	Reporting Points
	Sea State	9	7	5	3	**1**	3	5	7	9	Extra Lookouts
	Citadel	9	7	**5**	3	1	3	5	7	9	Boarding Access
	Citadel	9	**7**	5	3	1	3	5	7	9	Status of Vessel
	Citadel	9	7	5	**3**	1	3	5	7	9	Anti-Piracy Equipment
	Citadel	9	7	5	3	1	3	**5**	7	9	Speed
	Citadel	9	7	5	**3**	1	3	5	7	9	Reporting Points
	Citadel	9	7	5	**3**	1	3	5	7	9	Extra Lookouts
	Boarding Access	9	7	5	3	**1**	3	5	7	9	Status of Vessel
	Boarding Access	9	7	5	3	1	3	**5**	7	9	Anti-Piracy Equipment
	Boarding Access	9	7	5	3	1	3	5	7	**9**	Speed
	Boarding Access	9	7	5	3	1	**3**	5	7	9	Reporting Points
	Boarding Access	9	7	5	3	1	**3**	5	7	9	Extra Lookouts
	Status of Vessel	9	7	5	3	1	3	**5**	7	9	Anti-Piracy Equipment
	Status of Vessel	9	7	5	3	1	3	5	**7**	9	Speed
	Status of Vessel	9	7	5	3	1	**3**	5	7	9	Reporting Points
	Status of Vessel	9	7	5	3	1	**3**	5	7	9	Extra Lookouts
	Anti-Piracy Equipment	9	7	5	3	1	3	**5**	7	9	Speed
	Anti-Piracy Equipment	9	7	5	3	**1**	3	5	7	9	Reporting Points
	Anti-Piracy Equipment	9	7	5	3	**1**	3	5	7	9	Extra Lookouts
	Speed	9	7	5	3	1	3	5	**7**	9	Reporting Points
	Speed	9	7	5	3	1	3	**5**	7	9	Extra Lookouts
	Reporting Points	9	7	5	3	**1**	3	5	7	9	Extra Lookouts

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ANALYTIC HIERARCHY PROCESS

EXPERT JUDGEMENT QUESTIONNAIRE

Rahie Masoom Bali
Email: rahiebali_86@hotmail.com
Phone Number: +31634344356

The Questionnaire consists of 4 pages including the cover page. The questionnaire should not take more than 15 minutes. Candidates are requested to fill their details on the cover page.

Rank: Chief Officer
Candidate Name: Sudeept Nayan
Department: Deck

Please mark on the scale, the degree of importance amongst each pair-wise comparison. Only one answer per comparison is required.

Geographical Area	9	7	5	3	1X	3	5	7	9	Freeboard
Geographical Area	9	7	5	3	1	3	5X	7	9	Sea State
Geographical Area	9	7	5	3	1	3X	5	7	9	Citadel
Geographical Area	9	7	5	3	1X	3	5	7	9	Boarding Access
Geographical Area	9	7	5	3	1X	3	5	7	9	Status of Vessel
Geographical Area	9 x	7	5	3	1	3	5X	7	9	Anti-Piracy Equipment
Geographical Area	9 x	7	5	3	1	3	5	7X	9	Speed
Geographical Area	9	7	5	3	1	3	5X	7	9	Reporting Points
Geographical Area	9	7	5	3	1	3X	5	7	9	Extra Lookouts
Freeboard	9	7	5	3	1X	3	5	7	9	Sea State
Freeboard	9	7	5	3X	1	3	5	7	9	Citadel
Freeboard	9	7	5X	3	1	3	5	7	9	Boarding Access
Freeboard	9	7	5	3X	1	3	5	7	9	Status of Vessel
Freeboard	9	7	5	3	1X	3	5	7	9	Anti-Piracy Equipment
Freeboard	9	7	5	3	1	3	5	7X	9	Speed
Freeboard	9	7	5	3X	1	3	5	7	9	Reporting Points
Freeboard	9	7	5	3X	1	3	5	7	9	Extra Lookouts
Sea State	9	7	5	3	1X	3	5	7	9	Citadel
Sea State	9	7	5	3X	1	3	5	7	9	Boarding Access
Sea State	9	7	5	3X	1	3	5	7	9	Status of Vessel
Sea State	9	7	5	3	1X	3	5	7	9	Anti-Piracy Equipment
Sea State	9	7	5	3	1	3	5X	7	9	Speed
Sea State	9	7	5	3	1X	3	5	7	9	Reporting Points
Sea State	9	7	5	3	1X	3	5	7	9	Extra Lookouts
Citadel	9	7	5X	3	1	3	5	7	9	Boarding Access
Citadel	9	7	5X	3	1	3	5	7	9	Status of Vessel
Citadel	9	7	5	3	1X	3	5	7	9	Anti-Piracy Equipment
Citadel	9	7	5	3	1	3	5	7X	9	Speed
Citadel	9	7	5	3	1	3X	5	7	9	Reporting Points
Citadel	9	7	5	3	1X	3	5	7	9	Extra lookouts

Boarding Access	9	7	5	3	1X	3	5	7	9	Status of Vessel
Boarding Access	9	7	5	3	1	3	5X	7	9	Anti-Piracy Equipment
Boarding Access	9	7	5	3	1	3	5	7	9X	Speed
Boarding Access	9	7	5	3	1	3X	5	7	9	Reporting Points
Boarding Access	9	7	5	3	1	3	5X	7	9	Extra Lookouts
Status of Vessel	9	7	5	3	1	3	5X	7	9	Anti-Piracy Equipment
Status of Vessel	9	7	5	3	1	3	5X	7	9	Speed
Status of Vessel	9	7	5	3	1X	3	5	7	9	Reporting Points
Status of Vessel	9	7	5	3	1	3X	5	7	9	Extra Lookouts
Anti-Piracy Equipment	9	7	5	3	1	3	5X	7	9	Speed
Anti-Piracy Equipment	9	7	5	3X	1	3	5	7	9	Reporting Points
Anti-Piracy Equipment	9	7	5	3	1X	3	5	7	9	Extra Lookouts
Speed	9	7	5 X	3	1	3	5	7	9	Reporting Points
Speed	9	7	5X	3	1	3	5	7	9	Extra Lookouts
Reporting Points	9	7	5	3	1X	3	5	7	9	Extra Lookouts

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ANALYTIC HIERARCHY PROCESS

EXPERT JUDGEMENT QUESTIONNAIRE

Rahie Masoom Bali
Email: rahiebali_86@hotmail.com
Phone Number: +31634344356

The Questionnaire consists of 4 pages including the cover page. The questionnaire should not take more than 15 minutes. Candidates are requested to fill their details on the cover page.

Rank: Chief Officer
Candidate Name: Pushkar Lamba
Department: Deck

Please mark on the scale, the degree of importance amongst each pair-wise comparison. Only one answer per comparison is required.

Geographical Area	9	7	5	3	1X	3	5	7	9	Freeboard
Geographical Area	9	7	5	3	1	3	5X	7	9	Sea State
Geographical Area	9	7	5	3	1	3X	5	7	9	Citadel
Geographical Area	9	7	5	3	1X	3	5	7	9	Boarding Access
Geographical Area	9	7	5	3	1X	3	5	7	9	Status of Vessel
Geographical Area	9 x	7	5	3	1	3	5X	7	9	Anti-Piracy Equipment
Geographical Area	9 x	7	5	3	1	3	5	7	9X	Speed
Geographical Area	9	7	5	3	1	3	5X	7	9	Reporting Points
Geographical Area	9	7	5	3	1	3X	5	7	9	Extra Lookouts
Freeboard	9	7	5	3	1X	3	5	7	9	Sea State
Freeboard	9	7	5	3X	1	3	5	7	9	Citadel
Freeboard	9	7	5X	3	1	3	5	7	9	Boarding Access
Freeboard	9	7	5	3X	1	3	5	7	9	Status of Vessel
Freeboard	9	7	5	3	1X	3	5	7	9	Anti-Piracy Equipment
Freeboard	9	7	5	3	1	3	5	7	9X	Speed
Freeboard	9	7	5	3X	1	3	5	7	9	Reporting Points
Freeboard	9	7	5	3X	1	3	5	7	9	Extra Lookouts
Sea State	9	7	5	3	1X	3	5	7	9	Citadel
Sea State	9	7	5	3X	1	3	5	7	9	Boarding Access
Sea State	9	7	5	3X	1	3	5	7	9	Status of Vessel
Sea State	9	7	5	3	1X	3	5	7	9	Anti-Piracy Equipment
Sea State	9	7	5	3	1	3	5X	7	9	Speed
Sea State	9	7	5	3	1X	3	5	7	9	Reporting Points
Sea State	9	7	5	3	1X	3	5	7	9	Extra Lookouts
Citadel	9	7	5X	3	1	3	5	7	9	Boarding Access
Citadel	9	7	5X	3	1	3	5	7	9	Status of Vessel
Citadel	9	7	5	3	1X	3	5	7	9	Anti-Piracy Equipment
Citadel	9	7	5	3	1	3	5X	7	9	Speed
Citadel	9	7	5	3X	1	3	5	7	9	Reporting Points
Citadel	9	7	5	3	1X	3	5	7	9	Extra lookouts

Boarding Access	9	7	5	3	1X	3	5	7	9	Status of Vessel
Boarding Access	9	7	5	3	1	3X	5	7	9	Anti-Piracy Equipment
Boarding Access	9	7	5	3	1	3	5	7	9X	Speed
Boarding Access	9	7	5	3	1	3X	5	7	9	Reporting Points
Boarding Access	9	7	5	3	1	3X	5	7	9	Extra Lookouts
Status of Vessel	9	7	5	3	1	3X	5	7	9	Anti-Piracy Equipment
Status of Vessel	9	7	5	3	1	3	5X	7	9	Speed
Status of Vessel	9	7	5	3	1X	3	5	7	9	Reporting Points
Status of Vessel	9	7	5	3	1	3X	5	7	9	Extra Lookouts
Anti-Piracy Equipment	9	7	5	3	1	3	5X	7	9	Speed
Anti-Piracy Equipment	9	7	5	3X	1	3	5	7	9	Reporting Points
Anti-Piracy Equipment	9	7	5	3	1X	3	5	7	9	Extra Lookouts
Speed	9	7X	5	3	1	3	5	7	9	Reporting Points
Speed	9	7	5X	3	1	3	5	7	9	Extra Lookouts
Reporting Points	9	7	5	3	1X	3	5	7	9	Extra Lookouts

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ANALYTIC HIERARCHY PROCESS

EXPERT JUDGEMENT QUESTIONNAIRE

Rahie Masoom Bali
Email: rahiebali_86@hotmail.com
Phone Number: +31634344356

The Questionnaire consists of 4 pages including the cover page. The questionnaire should not take more than 15 minutes. Candidates are requested to fill their details on the cover page.

Rank: Chief Officer
Candidate Name: Ameya Tamhane
Department: Deck

Please mark on the scale, the degree of importance amongst each pair-wise comparison. Only one answer per comparison is required.

	Geographical Area	9	7	5	3	1	3	5	7	9	Freeboard
	Geographical Area	9	7	5	3	1	3	5	7	9	Sea State
	Geographical Area	9	7	5	3	1	3	5	7	9	Citadel
	Geographical Area	9	7	5	3	1	3	5	7	9	Boarding Access
	Geographical Area	9	7	5	3	1	3	5	7	9	Status of Vessel
	Geographical Area	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Geographical Area	9	7	5	3	1	3	5	7	9	Speed
	Geographical Area	9	7	5	3	1	3	5	7	9	Reporting Points
	Geographical Area	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Freeboard	9	7	5	3	1	3	5	7	9	Sea State
	Freeboard	9	7	5	3	1	3	5	7	9	Citadel
	Freeboard	9	7	5	3	1	3	5	7	9	Boarding Access
	Freeboard	9	7	5	3	1	3	5	7	9	Status of Vessel
	Freeboard	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Freeboard	9	7	5	3	1	3	5	7	9	Speed
	Freeboard	9	7	5	3	1	3	5	7	9	Reporting Points
	Freeboard	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Sea State	9	7	5	3	1	3	5	7	9	Citadel
	Sea State	9	7	5	3	1	3	5	7	9	Boarding Access
	Sea State	9	7	5	3	1	3	5	7	9	Status of Vessel
	Sea State	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Sea State	9	7	5	3	1	3	5	7	9	Speed
	Sea State	9	7	5	3	1	3	5	7	9	Reporting Points
	Sea State	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Citadel	9	7	5	3	1	3	5	7	9	Boarding Access
	Citadel	9	7	5	3	1	3	5	7	9	Status of Vessel
	Citadel	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Citadel	9	7	5	3	1	3	5	7	9	Speed
	Citadel	9	7	5	3	1	3	5	7	9	Reporting Points
	Citadel	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Boarding Access	9	7	5	3	1	3	5	7	9	Status of Vessel
	Boarding Access	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Boarding Access	9	7	5	3	1	3	5	7	9	Speed
	Boarding Access	9	7	5	3	1	3	5	7	9	Reporting Points
	Boarding Access	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Status of Vessel	9	7	5	3	1	3	5	7	9	Anti-Piracy Equipment
	Status of Vessel	9	7	5	3	1	3	5	7	9	Speed
	Status of Vessel	9	7	5	3	1	3	5	7	9	Reporting Points
	Status of Vessel	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Speed
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Reporting Points
	Anti-Piracy Equipment	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Speed	9	7	5	3	1	3	5	7	9	Reporting Points
	Speed	9	7	5	3	1	3	5	7	9	Extra Lookouts
	Reporting Points	9	7	5	3	1	3	5	7	9	Extra Lookouts

Appendix XIII: Eight Respondents AHP – Synthesisation and Consistency Results

Capt. Sagar Naik

Pairwise Comparison Matrix										
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Geographical Area	1	1	1	1	1	1	1/3	1/3	1	1
Freeboard	1	1	3	1	3	1	1	1	1	1
Sea State	1	1/3	1	1	1	1	1	1/5	3	5
Citadel	1	1	1	1	5	3	1	1/3	5	1
Boarding Access	1	1/3	1	1/5	1	1	1	1/3	1	1
Status of Vessel	1	1	1	1/3	1	1	1	1	3	1
Anti-piracy Equipment	3	1	1	1	1	1	1	1	3	1
Speed	3	1	5	1/3	3	1	1	1	5	3
Reporting Points	1	1	1/3	1/5	1	1/3	1/3	1/5	1	1
Lookouts	1	1	1/5	1	1	1	1	1/3	1	1
Sum	14.00	8.67	14.53	7.07	18.00	11.33	8.67	5.73	24.00	16.00

Consistency											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Sum
Geographical Area	0.074	0.118	0.105	0.138	0.063	0.092	0.039	0.055	0.050	0.076	0.812
Freeboard	0.074	0.118	0.316	0.138	0.189	0.092	0.116	0.166	0.050	0.076	1.336
Sea State	0.074	0.039	0.105	0.138	0.063	0.092	0.116	0.033	0.150	0.382	1.194
Citadel	0.074	0.118	0.105	0.138	0.314	0.277	0.116	0.055	0.250	0.076	1.526
Boarding Access	0.074	0.039	0.105	0.028	0.063	0.092	0.116	0.055	0.050	0.076	0.700
Status of Vessel	0.074	0.118	0.105	0.046	0.063	0.092	0.116	0.166	0.150	0.076	1.008
Anti-piracy Equipment	0.223	0.118	0.105	0.138	0.063	0.092	0.116	0.166	0.150	0.076	1.248
Speed	0.223	0.118	0.526	0.046	0.189	0.092	0.116	0.166	0.250	0.229	1.955
Reporting Points	0.074	0.118	0.035	0.028	0.063	0.031	0.039	0.033	0.050	0.076	0.547
Lookouts	0.074	0.118	0.021	0.138	0.063	0.092	0.116	0.055	0.050	0.076	0.805

Synthesisation											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Priority
Geographical Area	0.071	0.115	0.069	0.142	0.056	0.088	0.038	0.058	0.042	0.063	0.074
Freeboard	0.071	0.115	0.206	0.142	0.167	0.088	0.115	0.174	0.042	0.063	0.118
Sea State	0.071	0.038	0.069	0.142	0.056	0.088	0.115	0.035	0.125	0.313	0.105
Citadel	0.071	0.115	0.069	0.142	0.278	0.265	0.115	0.058	0.208	0.063	0.138
Boarding Access	0.071	0.038	0.069	0.028	0.056	0.088	0.115	0.058	0.042	0.063	0.063
Status of Vessel	0.071	0.115	0.069	0.047	0.056	0.088	0.115	0.174	0.125	0.063	0.092
Anti-piracy Equipment	0.214	0.115	0.069	0.142	0.056	0.088	0.115	0.174	0.125	0.063	0.116
Speed	0.214	0.115	0.344	0.047	0.167	0.088	0.115	0.174	0.208	0.188	0.166
Reporting Points	0.071	0.115	0.023	0.028	0.056	0.029	0.038	0.035	0.042	0.063	0.050
Lookouts	0.071	0.115	0.014	0.142	0.056	0.088	0.115	0.058	0.042	0.063	0.076

Weighted sum vector	Average (λ_{max})	Consistency Index (CI) = (λ max - n)/(n-1)		Consistency Ratio = CI/RI	
10.946	**11.065**	λ max	11.065	CI	0.118
11.288		n	10	RI	1.49
11.350		**CI**	**0.118**	**CR**	**0.079**
11.023					
11.132					
10.909					
10.752					
11.769					
10.933					
10.544					

Gajendra Rai

Pairwise Comparison Matrix										
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Geographical Area	1	1	1	5	3	1	3	1	5	1
Freeboard	1	1	1	7	1	1	3	1	5	1
Sea State	1	1	1	5	5	1	5	1	5	1
Citadel	1/5	1/7	1/5	1	1/3	1/3	1	1/7	1	1/5
Boarding Access	1/3	1	1/5	3	1	1/3	1	1/3	1	1
Status of Vessel	1	1	1	3	3	1	3	1	5	1
Anti-piracy Equipment	1/3	1/3	1/5	1	1	1/3	1	1/5	1	1
Speed	1	1	1	7	3	1	5	1	5	1
Reporting Points	1/5	1/5	1/5	1	1	1/5	1	1/5	1	1/3
Lookouts	1	1	1	5	1	1	1	1	3	1
Sum	7.07	7.68	6.80	38.00	19.33	7.20	24.00	6.88	32.00	8.53

Consistency											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Sum
Geographical Area	0.139	0.134	0.158	0.142	0.187	0.134	0.139	0.152	0.165	0.114	1.463
Freeboard	0.139	0.134	0.158	0.198	0.062	0.134	0.139	0.152	0.165	0.114	1.395
Sea State	0.139	0.134	0.158	0.142	0.311	0.134	0.232	0.152	0.165	0.114	1.680
Citadel	0.028	0.019	0.032	0.028	0.021	0.045	0.046	0.022	0.033	0.023	0.296
Boarding Access	0.046	0.134	0.032	0.085	0.062	0.045	0.046	0.051	0.033	0.114	0.647
Status of Vessel	0.139	0.134	0.158	0.085	0.187	0.134	0.139	0.152	0.165	0.114	1.406
Anti-piracy Equipment	0.046	0.045	0.032	0.028	0.062	0.045	0.046	0.030	0.033	0.114	0.481
Speed	0.139	0.134	0.158	0.198	0.187	0.134	0.232	0.152	0.165	0.114	1.612
Reporting Points	0.028	0.027	0.032	0.028	0.062	0.027	0.046	0.030	0.033	0.038	0.351
Lookouts	0.139	0.134	0.158	0.142	0.062	0.134	0.046	0.152	0.099	0.114	1.179

Synthesisation											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Priority
Geographical Area	0.142	0.130	0.147	0.132	0.155	0.139	0.125	0.145	0.156	0.117	0.139
Freeboard	0.142	0.130	0.147	0.184	0.052	0.139	0.125	0.145	0.156	0.117	0.134
Sea State	0.142	0.130	0.147	0.132	0.259	0.139	0.208	0.145	0.156	0.117	0.158
Citadel	0.028	0.019	0.029	0.026	0.017	0.046	0.042	0.021	0.031	0.023	0.028
Boarding Access	0.047	0.130	0.029	0.079	0.052	0.046	0.042	0.048	0.031	0.117	0.062
Status of Vessel	0.142	0.130	0.147	0.079	0.155	0.139	0.125	0.145	0.156	0.117	0.134
Anti-piracy Equipment	0.047	0.043	0.029	0.026	0.052	0.046	0.042	0.029	0.031	0.117	0.046
Speed	0.142	0.130	0.147	0.184	0.155	0.139	0.208	0.145	0.156	0.117	0.152
Reporting Points	0.028	0.026	0.029	0.026	0.052	0.028	0.042	0.029	0.031	0.039	0.033
Lookouts	0.142	0.130	0.147	0.132	0.052	0.139	0.042	0.145	0.094	0.117	0.114

Weighted sum vector	Average (λ_{max})	Consistency Index (CI) = (λ max - n)/(n-1)		Consistency Ratio = CI/RI	
10.536	**10.494**	λ max	10.494	CI	0.055
10.429		n	10	RI	1.49
10.666		**CI**	**0.055**	**CR**	**0.037**
10.446					
10.402					
10.527					
10.383					
10.576					
10.621					
10.355					

Gerhard Dekkers

Pairwise Comparison Matrix										
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Geographical Area	1	1	1	1/3	1	1	1	1/3	1	1/3
Freeboard	1	1	3	1	1	1/3	1	1	3	1/3
Sea State	1	1/3	1	1/3	1	1/3	1/3	1/5	1	1/5
Citadel	3	1	3	1	3	1	1	1/3	1	1
Boarding Access	1	1	1	1/3	1	1	1	1/5	1	1
Status of Vessel	1	3	3	1	1	1	1	1/3	3	1
Anti-piracy Equipment	1	1	3	1	1	1	1	1/3	1	1/3
Speed	3	1	5	3	5	3	3	1	5	1
Reporting Points	1	1/3	1	1	1	1/3	1	1/5	1	1/3
Lookouts	3	3	5	1	1	1	3	1	3	1
Sum	16.00	12.67	26.00	10.00	16.00	10.00	13.33	4.93	20.00	6.53

Consistency											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Sum
Geographical Area	0.062	0.093	0.040	0.037	0.069	0.112	0.076	0.073	0.054	0.054	0.672
Freeboard	0.062	0.093	0.121	0.111	0.069	0.037	0.076	0.220	0.162	0.054	1.006
Sea State	0.062	0.031	0.040	0.037	0.069	0.037	0.025	0.044	0.054	0.032	0.433
Citadel	0.186	0.093	0.121	0.111	0.208	0.112	0.076	0.073	0.054	0.161	1.196
Boarding Access	0.062	0.093	0.040	0.037	0.069	0.112	0.076	0.044	0.054	0.161	0.750
Status of Vessel	0.062	0.279	0.121	0.111	0.069	0.112	0.076	0.073	0.162	0.161	1.228
Anti-piracy Equipment	0.062	0.093	0.121	0.111	0.069	0.112	0.076	0.073	0.054	0.054	0.826
Speed	0.186	0.093	0.201	0.334	0.347	0.337	0.229	0.220	0.270	0.161	2.379
Reporting Points	0.062	0.031	0.040	0.111	0.069	0.037	0.076	0.044	0.054	0.054	0.580
Lookouts	0.186	0.279	0.201	0.111	0.069	0.112	0.229	0.220	0.162	0.161	1.732

Synthesisation											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Priority
Geographical Area	0.063	0.079	0.038	0.033	0.063	0.100	0.075	0.068	0.050	0.051	0.062
Freeboard	0.063	0.079	0.115	0.100	0.063	0.033	0.075	0.203	0.150	0.051	0.093
Sea State	0.063	0.026	0.038	0.033	0.063	0.033	0.025	0.041	0.050	0.031	0.040
Citadel	0.188	0.079	0.115	0.100	0.188	0.100	0.075	0.068	0.050	0.153	0.111
Boarding Access	0.063	0.079	0.038	0.033	0.063	0.100	0.075	0.041	0.050	0.153	0.069
Status of Vessel	0.063	0.237	0.115	0.100	0.063	0.100	0.075	0.068	0.150	0.153	0.112
Anti-piracy Equipment	0.063	0.079	0.115	0.100	0.063	0.100	0.075	0.068	0.050	0.051	0.076
Speed	0.188	0.079	0.192	0.300	0.313	0.300	0.225	0.203	0.250	0.153	0.220
Reporting Points	0.063	0.026	0.038	0.100	0.063	0.033	0.075	0.041	0.050	0.051	0.054
Lookouts	0.188	0.237	0.192	0.100	0.063	0.100	0.225	0.203	0.150	0.153	0.161

Weighted sum vector	Average (λ_{max})	Consistency Index (CI) = (λ max - n)/(n-1)		Consistency Ratio = CI/RI	
10.843	**10.799**	λ max	10.799	CI	0.089
10.804		n	10	RI	1.49
10.753		**CI**	**0.089**	**CR**	**0.0596**
10.731					
10.794					
10.936					
10.832					
10.802					
10.739					
10.756					

Capt. K. Subbarao

Pairwise Comparison Matrix										
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Geographical Area	1	1/3	3	1/3	1	1	1	1/9	1	1/3
Freeboard	3	1	1	1/3	1	3	1	1/7	1	1
Sea State	1/3	1	1	1/3	3	1	1/5	1/7	1/5	1/5
Citadel	3	3	3	1	5	1/3	1	1/7	1	1
Boarding Access	1	1	1/3	1/5	1	1	1/3	1/9	1/3	1/5
Status of Vessel	1	1/3	1	3	1	1	1/3	1/9	1	1/5
Anti-piracy Equipment	1	1	5	1	3	3	1	1/7	1	1
Speed	9	7	7	7	9	9	7	1	9	5
Reporting Points	1	1	1	1	3	1	1	1/9	1	1
Lookouts	3	1	5	1	5	5	1	1/5	1	1
Sum	23.33	16.67	27.33	15.20	32.00	25.33	13.87	2.22	16.53	10.93

Consistency											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Sum
Geographical Area	0.048	0.023	0.113	0.031	0.031	0.052	0.085	0.046	0.061	0.037	0.527
Freeboard	0.144	0.069	0.038	0.031	0.031	0.156	0.085	0.059	0.061	0.111	0.784
Sea State	0.016	0.069	0.038	0.031	0.093	0.052	0.017	0.059	0.012	0.022	0.409
Citadel	0.144	0.206	0.113	0.094	0.156	0.017	0.085	0.059	0.061	0.111	1.045
Boarding Access	0.048	0.069	0.013	0.019	0.031	0.052	0.028	0.046	0.020	0.022	0.348
Status of Vessel	0.048	0.023	0.038	0.283	0.031	0.052	0.028	0.046	0.061	0.022	0.632
Anti-piracy Equipment	0.048	0.069	0.188	0.094	0.093	0.156	0.085	0.059	0.061	0.111	0.964
Speed	0.431	0.480	0.263	0.659	0.280	0.468	0.597	0.412	0.551	0.553	4.694
Reporting Points	0.048	0.069	0.038	0.094	0.093	0.052	0.085	0.046	0.061	0.111	0.696
Lookouts	0.144	0.069	0.188	0.094	0.156	0.260	0.085	0.082	0.061	0.111	1.249

Synthesisation											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Priority
Geographical Area	0.043	0.020	0.110	0.022	0.031	0.039	0.072	0.050	0.060	0.030	0.048
Freeboard	0.129	0.060	0.037	0.022	0.031	0.118	0.072	0.064	0.060	0.091	0.069
Sea State	0.014	0.060	0.037	0.022	0.094	0.039	0.014	0.064	0.012	0.018	0.038
Citadel	0.129	0.180	0.110	0.066	0.156	0.013	0.072	0.064	0.060	0.091	0.094
Boarding Access	0.043	0.060	0.012	0.013	0.031	0.039	0.024	0.050	0.020	0.018	0.031
Status of Vessel	0.043	0.020	0.037	0.197	0.031	0.039	0.024	0.050	0.060	0.018	0.052
Anti-piracy Equipment	0.043	0.060	0.183	0.066	0.094	0.118	0.072	0.064	0.060	0.091	0.085
Speed	0.386	0.420	0.256	0.461	0.281	0.355	0.505	0.451	0.544	0.457	0.412
Reporting Points	0.043	0.060	0.037	0.066	0.094	0.039	0.072	0.050	0.060	0.091	0.061
Lookouts	0.129	0.060	0.183	0.066	0.156	0.197	0.072	0.090	0.060	0.091	0.111

Weighted sum vector	Average (λ_{max})	Consistency Index (CI) = (λ max - n)/(n-1)		Consistency Ratio = CI/RI	
11.013	**11.312**	λ max	11.312	CI	0.146
11.442		n	10	RI	1.49
10.902		**CI**	**0.146**	CR	**0.098**
11.092					
11.157					
12.134					
11.307					
11.402					
11.367					
11.304					

Capt. Murugan Nadar

Pairwise Comparison Matrix										
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Geographical Area	1	1/5	1/3	1/7	1	1	1/7	1/9	1/3	1/3
Freeboard	5	1	1	1	1	5	5	1/7	3	1
Sea State	3	1	1	1/3	5	5	1/5	1/5	1	1
Citadel	7	1	3	1	5	7	3	1/5	3	3
Boarding Access	1	1	1/5	1/5	1	1	1/5	1/9	1/3	1/3
Status of Vessel	1	1/5	1/5	1/7	1	1	1/5	1/7	1/3	1/3
Anti-piracy Equipment	7	1/5	5	1/3	5	5	1	1/5	1	1
Speed	9	7	5	5	9	7	5	1	7	5
Reporting Points	3	1/3	1	1/3	3	3	1	1/7	1	1
Lookouts	3	1	1	1/3	3	3	1	1/5	1	1
Sum	40.00	12.93	17.73	8.82	34.00	38.00	16.74	2.45	18.00	14.00

Consistency											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Sum
Geographical Area	0.023	0.023	0.025	0.022	0.029	0.024	0.015	0.039	0.020	0.023	0.242
Freeboard	0.114	0.113	0.075	0.151	0.029	0.118	0.529	0.050	0.182	0.068	1.428
Sea State	0.068	0.113	0.075	0.050	0.146	0.118	0.021	0.070	0.061	0.068	0.790
Citadel	0.159	0.113	0.224	0.151	0.146	0.165	0.317	0.070	0.182	0.205	1.732
Boarding Access	0.023	0.113	0.015	0.030	0.029	0.024	0.021	0.039	0.020	0.023	0.337
Status of Vessel	0.023	0.023	0.015	0.022	0.029	0.024	0.021	0.050	0.020	0.023	0.249
Anti-piracy Equipment	0.159	0.023	0.373	0.050	0.146	0.118	0.106	0.070	0.061	0.068	1.174
Speed	0.205	0.790	0.373	0.754	0.262	0.165	0.529	0.352	0.425	0.341	4.195
Reporting Points	0.068	0.038	0.075	0.050	0.087	0.071	0.106	0.050	0.061	0.068	0.674
Lookouts	0.068	0.113	0.075	0.050	0.087	0.071	0.106	0.070	0.061	0.068	0.769

Synthesisation											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Priority
Geographical Area	0.025	0.015	0.019	0.016	0.029	0.026	0.009	0.045	0.019	0.024	0.023
Freeboard	0.125	0.077	0.056	0.113	0.029	0.132	0.299	0.058	0.167	0.071	0.113
Sea State	0.075	0.077	0.056	0.038	0.147	0.132	0.012	0.082	0.056	0.071	0.075
Citadel	0.175	0.077	0.169	0.113	0.147	0.184	0.179	0.082	0.167	0.214	0.151
Boarding Access	0.025	0.077	0.011	0.023	0.029	0.026	0.012	0.045	0.019	0.024	0.029
Status of Vessel	0.025	0.015	0.011	0.016	0.029	0.026	0.012	0.058	0.019	0.024	0.024
Anti-piracy Equipment	0.175	0.015	0.282	0.038	0.147	0.132	0.060	0.082	0.056	0.071	0.106
Speed	0.225	0.541	0.282	0.567	0.265	0.184	0.299	0.408	0.389	0.357	0.352
Reporting Points	0.075	0.026	0.056	0.038	0.088	0.079	0.060	0.058	0.056	0.071	0.061
Lookouts	0.075	0.077	0.056	0.038	0.088	0.079	0.060	0.082	0.056	0.071	0.068

Weighted sum vector	Average (λ_{max})	Consistency Index (CI) = (λ max - n)/(n-1)		Consistency Ratio = CI/RI	
10.627	**11.286**	λ max	11.286	CI	0.143
12.661		n	10	RI	1.49
10.597		**CI**	**0.143**	**CR**	**0.096**
11.485					
11.543					
10.536					
11.103					
11.929					
11.099					
11.278					

Sudeept Nayan

Pairwise Comparison Matrix										
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Geographical Area	1	1	1/5	1/3	1	1	1/5	1/7	1/5	1/3
Freeboard	1	1	1	3	5	3	1	1/7	3	3
Sea State	5	1	1	1	3	3	1	1/5	1	1
Citadel	3	1/3	1	1	5	5	1	1/7	3	1
Boarding Access	1	1/5	1/3	1/5	1	1	1/5	1/9	1/3	1/5
Status of Vessel	1	1/3	1/3	1/5	1	1	1/5	1/5	1	1/3
Anti-piracy Equipment	5	1	1	1	5	5	1	1/5	3	1
Speed	7	7	5	7	9	5	5	1	5	5
Reporting Points	5	1/3	1	1/3	3	1	1/3	1/5	1	1
Lookouts	3	1/3	1	1	5	3	1	1/5	1	1
Sum	32.00	12.53	11.87	15.07	38.00	28.00	10.93	2.54	18.53	13.87

Consistency											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Sum
Geographical Area	0.032	0.116	0.017	0.032	0.025	0.034	0.022	0.051	0.013	0.027	0.368
Freeboard	0.032	0.116	0.087	0.289	0.123	0.101	0.110	0.051	0.192	0.242	1.342
Sea State	0.161	0.116	0.087	0.096	0.074	0.101	0.110	0.071	0.064	0.081	0.960
Citadel	0.096	0.039	0.087	0.096	0.123	0.168	0.110	0.051	0.192	0.081	1.042
Boarding Access	0.032	0.023	0.029	0.019	0.025	0.034	0.022	0.040	0.021	0.016	0.261
Status of Vessel	0.032	0.039	0.029	0.019	0.025	0.034	0.022	0.071	0.064	0.027	0.361
Anti-piracy Equipment	0.161	0.116	0.087	0.096	0.123	0.168	0.110	0.071	0.192	0.081	1.204
Speed	0.225	0.811	0.435	0.674	0.221	0.168	0.551	0.356	0.320	0.403	4.163
Reporting Points	0.161	0.039	0.087	0.032	0.074	0.034	0.037	0.071	0.064	0.081	0.678
Lookouts	0.096	0.039	0.087	0.096	0.123	0.101	0.110	0.071	0.064	0.081	0.867

Synthesisation											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Priority
Geographical Area	0.031	0.080	0.017	0.022	0.026	0.036	0.018	0.056	0.011	0.024	0.032
Freeboard	0.031	0.080	0.084	0.199	0.132	0.107	0.091	0.056	0.162	0.216	0.116
Sea State	0.156	0.080	0.084	0.066	0.079	0.107	0.091	0.079	0.054	0.072	0.087
Citadel	0.094	0.027	0.084	0.066	0.132	0.179	0.091	0.056	0.162	0.072	0.096
Boarding Access	0.031	0.016	0.028	0.013	0.026	0.036	0.018	0.044	0.018	0.014	0.025
Status of Vessel	0.031	0.027	0.028	0.013	0.026	0.036	0.018	0.079	0.054	0.024	0.034
Anti-piracy Equipment	0.156	0.080	0.084	0.066	0.132	0.179	0.091	0.079	0.162	0.072	0.110
Speed	0.219	0.559	0.421	0.465	0.237	0.179	0.457	0.394	0.270	0.361	0.356
Reporting Points	0.156	0.027	0.084	0.022	0.079	0.036	0.030	0.079	0.054	0.072	0.064
Lookouts	0.094	0.027	0.084	0.066	0.132	0.107	0.091	0.079	0.054	0.072	0.081

Weighted sum vector	Average (λ_{max})	Consistency Index (CI) = (λ max - n)/(n-1)		Consistency Ratio = CI/RI	
11.455	**11.028**	λ max	11.028	CI	0.114
11.576		n	10	RI	1.49
11.047		**CI**	**0.114**	CR	**0.076640276**
10.825					
10.638					
10.739					
10.936					
11.693					
10.605					
10.763					

Pushkar Lamba

Pairwise Comparison Matrix										
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Geographical Area	1	1	1/5	1/3	1	1	1/5	1/9	1/5	1/3
Freeboard	1	1	1	3	5	3	1	1/9	3	3
Sea State	5	1	1	1	3	3	1	1/5	1	1
Citadel	3	1/3	1	1	5	5	1	1/5	3	1
Boarding Access	1	1/5	1/3	1/5	1	1	1/3	1/9	1/3	1/3
Status of Vessel	1	1/3	1/3	1/5	1	1	1/3	1/5	1	1/3
Anti-piracy Equipment	5	1	1	1	3	3	1	1/5	3	1
Speed	9	9	5	5	9	5	5	1	7	5
Reporting Points	5	1/3	1	1/3	3	1	1/3	1/7	1	1
Lookouts	3	1/3	1	1	3	3	1	1/5	1	1
Sum	34.00	14.53	11.87	13.07	34.00	26.00	11.20	2.48	20.53	14.00

Consistency											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Sum
Geographical Area	0.030	0.117	0.017	0.033	0.027	0.035	0.019	0.041	0.012	0.026	0.358
Freeboard	0.030	0.117	0.087	0.300	0.135	0.104	0.097	0.041	0.184	0.230	1.324
Sea State	0.152	0.117	0.087	0.100	0.081	0.104	0.097	0.074	0.061	0.077	0.950
Citadel	0.091	0.039	0.087	0.100	0.135	0.173	0.097	0.074	0.184	0.077	1.057
Boarding Access	0.030	0.023	0.029	0.020	0.027	0.035	0.032	0.041	0.020	0.026	0.284
Status of Vessel	0.030	0.039	0.029	0.020	0.027	0.035	0.032	0.074	0.061	0.026	0.373
Anti-piracy Equipment	0.152	0.117	0.087	0.100	0.081	0.104	0.097	0.074	0.184	0.077	1.072
Speed	0.274	1.052	0.435	0.499	0.242	0.173	0.484	0.369	0.430	0.383	4.343
Reporting Points	0.152	0.039	0.087	0.033	0.081	0.035	0.032	0.053	0.061	0.077	0.650
Lookouts	0.091	0.039	0.087	0.100	0.081	0.104	0.097	0.074	0.061	0.077	0.811

Synthesisation											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Priority
Geographical Area	0.029	0.069	0.017	0.026	0.029	0.038	0.018	0.045	0.010	0.024	0.030
Freeboard	0.029	0.069	0.084	0.230	0.147	0.115	0.089	0.045	0.146	0.214	0.117
Sea State	0.147	0.069	0.084	0.077	0.088	0.115	0.089	0.081	0.049	0.071	0.087
Citadel	0.088	0.023	0.084	0.077	0.147	0.192	0.089	0.081	0.146	0.071	0.100
Boarding Access	0.029	0.014	0.028	0.015	0.029	0.038	0.030	0.045	0.016	0.024	0.027
Status of Vessel	0.029	0.023	0.028	0.015	0.029	0.038	0.030	0.081	0.049	0.024	0.035
Anti-piracy Equipment	0.147	0.069	0.084	0.077	0.088	0.115	0.089	0.081	0.146	0.071	0.097
Speed	0.265	0.619	0.421	0.383	0.265	0.192	0.446	0.404	0.341	0.357	0.369
Reporting Points	0.147	0.023	0.084	0.026	0.088	0.038	0.030	0.058	0.049	0.071	0.061
Lookouts	0.088	0.023	0.084	0.077	0.088	0.115	0.089	0.081	0.049	0.071	0.077

Weighted sum vector	Average (λ_{max})	Consistency Index (CI) = (λ max - n)/(n-1)		Consistency Ratio = CI/RI	
11.744	**10.988**	λ max	10.988	CI	0.110
11.329		n	10	RI	1.49
10.909		**CI**	**0.110**	**CR**	**0.074**
10.578					
10.543					
10.762					
11.080					
11.758					
10.587					
10.587					

Ameya Tamhane

Pairwise Comparison Matrix										
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts
Geographical Area	1	1	1	1/3	1	1	1	1/7	1	1/3
Freeboard	1	1	1	1/5	3	1/3	1/3	1/5	1	1/5
Sea State	1	1	1	1/3	3	1	1/3	1/5	1/5	1/7
Citadel	3	5	3	1	5	7	1	1/5	5	1
Boarding Access	1	1/3	1/3	1/5	1	1/5	1/5	1/7	1/7	1/5
Status of Vessel	1	3	1	1/7	5	1	1/5	1/7	1	1
Anti-piracy Equipment	1	3	3	1	5	5	1	1/5	5	1
Speed	7	5	5	5	7	7	5	1	5	5
Reporting Points	1	1	5	1/5	5	1	1/5	1/5	1	1/3
Lookouts	3	5	7	1	5	1	1	1/5	3	1
Sum	20.00	25.33	27.33	9.41	40.00	24.53	10.27	2.63	22.34	10.21

Consistency											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Sum
Geographical Area	0.046	0.041	0.041	0.049	0.023	0.060	0.121	0.047	0.063	0.043	0.534
Freeboard	0.046	0.041	0.041	0.029	0.069	0.020	0.040	0.066	0.063	0.026	0.441
Sea State	0.046	0.041	0.041	0.049	0.069	0.060	0.040	0.066	0.013	0.018	0.443
Citadel	0.137	0.204	0.123	0.147	0.115	0.422	0.121	0.066	0.316	0.128	1.779
Boarding Access	0.046	0.014	0.014	0.029	0.023	0.012	0.024	0.047	0.009	0.026	0.243
Status of Vessel	0.046	0.123	0.041	0.021	0.115	0.060	0.024	0.047	0.063	0.128	0.668
Anti-piracy Equipment	0.046	0.123	0.123	0.147	0.115	0.301	0.121	0.066	0.316	0.128	1.485
Speed	0.319	0.204	0.204	0.734	0.161	0.422	0.604	0.330	0.316	0.641	3.937
Reporting Points	0.046	0.041	0.204	0.029	0.115	0.060	0.024	0.066	0.063	0.043	0.691
Lookouts	0.137	0.204	0.286	0.147	0.115	0.060	0.121	0.066	0.190	0.128	1.454

Synthesisation											
	Geographical Area	Freeboard	Sea State	Citadel	Boarding Access	Status of Vessel	Anti-piracy Equipment	Speed	Reporting Points	Lookouts	Priority
Geographical Area	0.050	0.039	0.087	0.035	0.025	0.041	0.097	0.054	0.045	0.033	0.046
Freeboard	0.050	0.039	0.087	0.021	0.075	0.014	0.032	0.076	0.045	0.020	0.041
Sea State	0.050	0.039	0.087	0.035	0.075	0.041	0.032	0.076	0.009	0.014	0.041
Citadel	0.150	0.197	0.110	0.106	0.125	0.285	0.097	0.076	0.224	0.098	0.147
Boarding Access	0.050	0.013	0.012	0.021	0.025	0.008	0.019	0.054	0.006	0.020	0.023
Status of Vessel	0.050	0.118	0.087	0.015	0.125	0.041	0.019	0.054	0.045	0.098	0.060
Anti-piracy Equipment	0.050	0.118	0.110	0.106	0.125	0.204	0.097	0.076	0.224	0.098	0.121
Speed	0.350	0.197	0.183	0.531	0.175	0.285	0.487	0.380	0.224	0.490	0.330
Reporting Points	0.050	0.039	0.183	0.021	0.125	0.041	0.019	0.076	0.045	0.033	0.063
Lookouts	0.150	0.197	0.256	0.106	0.125	0.041	0.097	0.076	0.134	0.098	0.128

Weighted sum vector	Average (λ_{max})	Consistency Index (CI) = (λ max - n)/(n-1)		Consistency Ratio = CI/RI	
11.690	**11.359**	λ max	11.359	CI	0.151
10.786		n	10	RI	1.49
10.833		**CI**	**0.151**	**CR**	**0.10**
12.108					
10.598					
11.086					
12.289					
11.918					
10.934					
11.350					

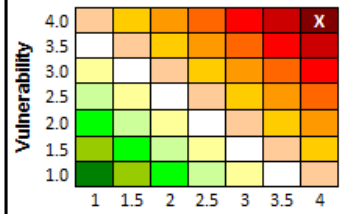
Appendix XIV: Piracy Risk and Mitigation Framework

Vulnerability				
Risk Factor	**Priority**	**Possible Scores**	**Score**	**Product**
Speed	0.295	1 = more than 18 knots 2 = 15 -18 knots 3 = 11 -14 knots 4 = 7-10 knots 5 = less than 7 knots	5	1.475
Freeboard	0.100	1 = more than 8 meters 2 = 7 - 8 meters 3 = 5 - 6 meters 4 = 3 - 4 meters 5 = less than 3 meters	5	0.5
Sea State	0.079	1 = more than BF scale 3 2 = BF scale 3 3 = BF scale 2 4 = BF scale 1 5 = BF scale 0	5	0.395
Lookouts	0.102	1 = more than 5 watchkeepers 2 = 5 watchkeepers 3 = 4 watchkeepers 4 = 3 watchkeepers 5 = 2 watchkeepers	5	0.51
Citadel	0.108	1 = Citadel present 5 = Citadel not present	5	0.54
Anti-piracy Equipment	0.095	1 = 4 types of euqipment rigged 2 = 3 types of equipment rigged 3 = 2 types of equipment rigged 4 = 1 type of equipment rigged 5 = No protection	5	0.475
Total Vulnerability Score		Sum of the product of score and priority for all factors		4.0

Likelihood				
Risk Factor	**Priority**	**Possible Scores**	**Score**	**Product**
Status of Vessel	0.068	1 = underway 2 = drifting 3 = anchored 4 = berthed	4	0.272
Geographical Area	0.057	1 = out of High Risk Area 2 = South America and Carribean 3 = West Africa and Mediterranean 4 = Indian Ocean and East Africa 5 = South China Sea/Malacca Straits	5	0.285
Reporting Points	0.056	1 = Vessel reports to all points 5 = Vessel does not report to all points	5	0.28
Boarding Access	0.041	1 = attackers use don't attempt boarding 2 = use the aft access 3 = use midship accesss 4 = use forecastle access	4	0.164
Total Likelihood Score		Sum of the product of score and priority for all factors		1.000
Converted Score				4.0

Scores	Converted Value
0.250	1.0
0.375	1.5
0.500	2.0
0.625	2.5
0.750	3.0
0.875	3.5
1.000	4.0

Risk Assessment Matrix



Recommended Action

STOP - Risk cannot be justified. Carry out additional risk control measures and score risk after implementation. Apply additional Antipiracy Equipment, Lookouts, Estblishing a safe muster point/Citadel and Increasing Vessel Speed

Vulnerability				
Risk Factor	**Priority**	**Possible Scores**	**Score**	**Product**
Speed	0.295	1 = more than 18 knots 2 = 15 -18 knots 3 = 11 -14 knots 4 = 7-10 knots 5 = less than 7 knots	5	=(E5*C5)
Freeboard	0.1	1 = more than 8 meters 2 = 7 - 8 meters 3 = 5 - 6 meters 4 = 3 - 4 meters 5 = less than 3 meters	5	=(E10*C10)
Sea State	0.079	1 = more than BF scale 3 2 = BF scale 3 3 = BF scale 2 4 = BF scale 1 5 = BF scale 0	5	=(E15*C15)
Lookouts	0.102	1 = more than 5 watchkeepers 2 = 5 watchkeepers 3 = 4 watchkeepers 4 = 3 watchkeepers 5 = 2 watchkeepers	5	=(E20*C20)
Citadel	0.108	1 = Citadel present 5 = Citadel not present	5	=(E25*C25)
Anti-piracy Equipment	0.095	1 = 4 types of euqipment rigged 2 = 3 types of equipment rigged 3 = 2 types of equipment rigged 4 = 1 type of equipment rigged 5 = No protection	5	=(E27*C27)
Total Vulnerability Score		Sum of the product of score and priority for all factors		=MROUND(SUM(F5:

Likelihood				
Risk Factor	**Priority**	**Possible Scores**	**Score**	**Product**
Status of Vessel	0.068	1 = underway 2 = drifting 3 = anchored 4 = berthed	4	=(K5*I5)
Geographical Area	0.057	1 = out of High Risk Area 2 = South America and Carribean 3 = West Africa and Mediterranean 4 = Indian Ocean and East Africa 5 = South China Sea/Malacca Straits	5	=(K9*I9)
Reporting Points	0.056	1 = Vessel reports to all points 5 = Vessel does not report to all points	5	=(K14*I14)
Boarding Access	0.041	1 = attackers use don*t attempt boarding 2 = use the aft access 3 = use midship accesss 4 = use forecastle access	4	=(K16*I16)
Total Likelihood Score		Sum of the product of score and priority for all factors		=MROUND(SUM(L5
Converted Score				=IF(L20=0.25,1,IF(L20

Scores	Converted Value
0.25	1
0.375	1.5
0.5	2
0.625	2.5
0.75	3
0.875	3.5
1	4

Risk Assessment Matrix

Vulnerability	1	1.5	2	2.5	3	3.5	4
4	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=
3.5	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=
3	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=
2.5	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=
2	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=
1.5	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=
1	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=	=IF(F32=

Likelihood

Recommended Action

=IF(AG5=1,AK4,IF(AH5=1,AL4,IF(AI5=1,AM4,0)))