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**Protection Measures for Merchant Ships**

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<b>Written By</b>	Francesca de Rosa (CMRE) Ronald Funk (CMRE) Adrienne Turnbull (CMRE)	2014-07-31
<b>Checked by</b>	WP leader Ronald Funk (CMRE)	2014-07-31
<b>Approved by</b>	Huw Davies (FLIR) - Coordinator	2014-07-31
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## SEC-2013.2.4-2 - Protection Measures for Merchant Ships

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**Project partners:**

- 1 – FLIR – FLIR Systems LTD - EN
- 2 – CMRE – NATO Science and Technology Organisation - BE
- 3 – WMU – World Maritime University - SE
- 4 – UoA – University of the Aegean-Research Unit - GR
- 5 – SAMI – Security Association for the Maritime Industry Limited - EN
- 6 – UNR – Uniresearch B.V. - NL
- 7 – TNO – Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek - NL
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- 9 – Oldendorff – Oldendorff Carriers GMBH & Co KG - DE

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## Executive Summary

### Introduction

The PROMERC Description of Work (DOW) Task (T) 1.4 is an *Operational Effectiveness (OE)* analysis in which “The scenario baseline will be used to analytically assess the operational effectiveness of the counter-measures in the catalogue. The methodology will have been developed in Task 3.1. The outcome of this operational analysis gives insight into the effectiveness of different counter-measures in a realistic context, providing objective measures of effectiveness for each counter-measure-scenario combination. These results provide input for the consolidated counter-measure knowledge base and manual.”

T1.4 will only take into account technical effectiveness of non-military risk mitigation measures, from now on defined as a counter-measure (CM), while external constraints related to Political, Ethical, Economic, Societal and Legal and Environmental (PEESLE) will be addressed in WP2 and reported in D2.1 and D2.2. CM refers to the higher-level functionality that CMs can contribute so there are cases where a single CM is composed of several CM Products (CMPs). For the purposes of this deliverable the CMP level will be used because that is the level at which useful decisions can be made.

The international maritime community has a strong interest in countering maritime piracy and armed robbery. A large number of options to mitigate the risk faced by the ships at sea and to deter possible attackers are currently available, both in form of Standard Operational Procedures (SOPs) and products. “However there is scant information regarding their OE or the cost benefits of their use, particularly when employed in combination as part of a holistic approach addressing the particular vulnerabilities of each vessel, non-lethal response measures and armed security guards, crew training and abilities, shipping business practices and pressures, pirate tactics and the impact of environmental factors (visibility, currents, waves and wind speed) on all”.

### Operational Effectiveness Quantitative Analysis

The piracy event data contained in the IMO database were expanded and analyzed and results were reported in detail in D1.1 and D1.2. Based on those data a quantitative analysis would usually be performed in order to assess the CMPs’ OE and consequent cost-benefit analysis.

The methods investigated to perform the OE assessment are:

1. Risk Analysis
2. Extreme Value Theory
3. Multi-Criteria Decision Analysis (MCDA)

The classical quantitative risk assessment approaches were judged to be inappropriate because of:

1. A lack of reliable and complete data
2. The majority of CMPs are not based on physical equipment
3. Limited time available to complete the analysis

### **Operational Effectiveness: MCDA and Weightings**

After careful consideration of the options available, the Multi-Criteria Decision Analysis (MCDA) approach was selected to assess CMPs in a rigorous and quantifiable ranking the CMP utility. This form of OE is based on the preferences stated in a Stakeholder Workshop which included a CMP ranking session by merchant SMEs.

The procedure to evaluate the CMP ranks and weights used a weighted-sum method based on different criteria provided to the SMEs. Each CMP is ranked against different criteria to which a weight, reflecting the importance compared to the other criteria, has been assigned. Each SME individual ranking is mapped in weight vectors, which are then averaged in order to find the final weight vector. The specific CMP results are documented in this deliverable.

The method and process to repeat the MCDA are also documented in this deliverable.

### **Conclusions and Recommendations**

The conclusions of the D1.3 report are:

1. The lack of reliable and complete data and the project time constrains necessitated the selection of the MCDA approach as the basis to assess the OE CMPs' utility;
2. The MCDA method can take into account company preferences or proprietary data about the CMPs and Defence Layers (DLs);
3. The results of T1.4 are used in conjunction with the WP2 results to do the T3.3 cost-benefit analysis.

The report recommends that:

1. CMP utility should also consider the Life Cycle Cost (LCC) of each CMP in order to select the most utility per unit of investment first with the more costly ones to follow.
2. T1.4 results should be reviewed after Workshop 2 in September 2014.

## Acronym List

BMP4	Best Management Practices (version 4)
C	Consequence
CAT	Category
CBRN	Chemical – Biological - Radiological and Nuclear
CDF	Cumulative Distribution Function
CM	Counter-Measure
CMP	Counter-Measure Product
D	Deliverable
DOW	Description of Work
DL	Defence Layer
E	Effectiveness
EU	European Union
EVT	Extreme Value Theory
GEV	Generalized Extreme Value
GOG	Gulf of Guinea
HOA	Horn of Africa
IMB	International Maritime Bureau
IMO	International Maritime Organization
LRIT	Long-Range Identification and Tracking
M&S	Modelling and Simulation
MCDA	Multi-Criteria Decision Analysis
MSCHOA	Maritime Security Centre – Horn of Africa
OE	Operational Effectiveness
P	Probability
PEESLE	Political-Economic-Ethical-Social-Legal-Environmental
PROMERC	Protection Measures for Merchant Ships
R	Risk
SCS	Shipping Company Standard
SECTRONIC	Security System for Maritime Infrastructures, Ports and Coastal Zones
SME	Subject Matter Expert
SOP	Standard Operational Procedure
SSAS	Ship Security Alert System
T	Task
UKMTO	UK Maritime Trade Operations
V	Vulnerability
VBA	Visual Basic for Applications
WMU	World Maritime University
WP	Work Package
WS	Work Shop