

Safety at Speed - S@S
**IMPLEMENTATION OF MODELS FOR
HUMAN ERROR
DELIVERABLE No. D1.3.1**

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1. EXECUTIVE SUMMARY SUITABLE FOR PUBLICATION

The work reported in this document constitutes the methodological foundation of a 'design tool' that safety analysts can use in the preliminary design phase of a High Sped Craft for cost effective evaluations of design options that should diminish the probability of occurrence of Collision, Grounding and Striking events.

This document has to be seen in connection with two other reports (i.e., D132 and D133) that, altogether, provide a global approach for comparing costs and risks associated with:

- different Ship Control Centre (SCC) design alternatives for high-speed crafts,
- different design alternatives for the technological systems of high-speed crafts,
- different operational alternatives with influence on the organisational and onboard human factors standard,
- the manoeuvrability of high speed crafts in restricted waters and those of conventional vessels,

with respect to Collision, Grounding and Striking events. Ultimately, this design tool shows how a small number of design parameters changes can predict build and operational costs.

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2. INTRODUCTION

The work reported in this document is about the implementation of a risk-cost model, related to human error, which allows a safety-design analyst to evaluate the effect of different design solutions and operational solutions for tackling collision, grounding and striking events during the preliminary design phase of a HSC.

Similarly, two other documents [D132 and D133] will help safety analysts in evaluating the best design options when addressing automation and mechanical failures and manoeuvrability errors.

D131, 132 and 133 will jointly provide a common approach for assessing costs and risks related to specific configurations of design parameters that minimize the risk of these events at a convenient cost. This common approach is documented in D134 where an integrated model for controllability is described.

PART ONE - HUMAN ERROR MODEL

3. RISK MODEL

The foundation of the risk model for tackling collision, grounding and striking hazards is a fault tree analysis that was carried out in Task 1.2 and progressively refined along a number of iterations. The final structure is a combination of semantic networks (i.e., classifications) in its upper part, and fault trees (FTs) in its lower part (Figure 1), where the three main hazards Grounding, Collision and Striking are initially categorized according to likely scenarios and then analysed according to the fault tree logic.

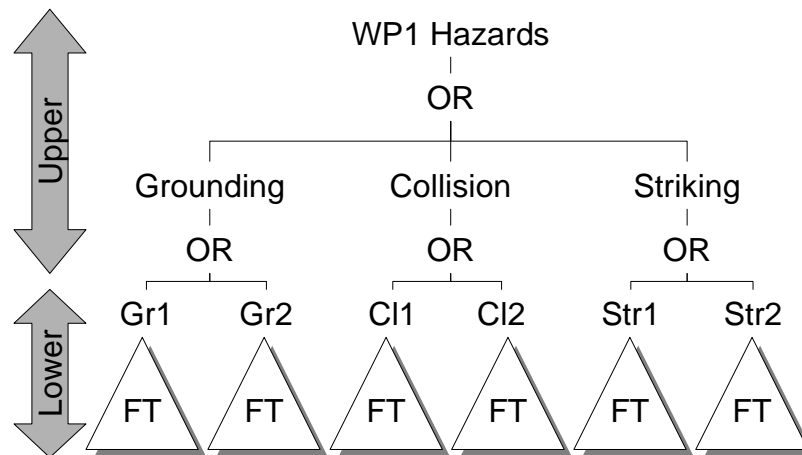


Figure 1: Overall view of WP1 hazards structure.

The upper part of the structure is schematised in the following hierarchical list:

1. Grounding
 - 1.1. Powered grounding
 - 1.2. Drift grounding
2. Collision
 - 2.1. In open sea
 - 2.2. In restricted waters
3. Striking
 - 3.1. With a floating object
 - 3.2. With a fixed object/infrastructure
 - 3.2.1. In open sea
 - 3.2.2. In restricted waters.

The whole structure is reported in D134. According to this logic of fault trees, the very bottom of each fault tree is a set of basic events (BE). These BEs can be divided into three groups:

- BEs related to Human Errors (sub-task 1.3.1)
- BEs related to Automation & Mechanical Failure (sub-task 1.3.2)
- BEs related to Manoeuvring Errors (sub-task 1.3.3)

The list of BEs related to Human Error is reported in Appendix 1.

3.1 Model for Human Error

This section of D131 describes the formulation of a model for calculation of probabilities of human factors related basic events. The model is based on a list of *human factors related parameters*, which can be adjusted individually and independently of each other. These parameters will be set in the final tool by the end user.

The setting of the human factors related parameters will have an influence on the probability of the *human factors related basic events*. A *human factors quotient (HFQ)* will therefore be calculated as a single value expression of the setting of the parameters. The human factors quotient is in the range between 0 and 1 where 0 represents the worst possible setting of all human factors related parameters and 1 is the best possible setting of the parameters. We would expect, that the worst possible setting (0) would generate an increased probability of human error compared to a residual value while the best possible setting (1) would generate a decreased probability of human error compared to the residual value. A set of *coefficients* is needed for calculation of the human factors quotient. These coefficients are obtained by expert judgement of the importance of each parameter with respect to the probability of human error in general. The method used in this expert judgement is pair wise comparison, and the data can be collected by means of Internet based questionnaires.

The residual *probability* – and the influence from variations in HFQ on the probability – ought to be determined from statistics in the literature, experiments or empirical findings, but since this is a very comprehensive and extremely time consuming task given the number of basic events, a rough estimate (or “qualified guess”) can be made by experts. It is – in this section 3 of D131

– described in detail how the expert estimation should be conducted and how median values from the expert estimation should be calculated and inserted in a *basic event / HFQ level matrix* for further use in the *fault trees*. The expert estimation can be performed by means of Internet based questionnaires.

3.2 Human factors related parameters

The first element of the model is the list of human factors related parameters. Parameters can in general be divided into design parameters and operational parameters. The human factors related parameters are mainly operational parameters with a few exemptions. Each parameter has a scale at ordinal level with conceptually meaningful values (e.g. very low, low, medium, high and very high) and a unidirectional or bi-directional scale at interval level where these conceptual values are linked to corresponding quantifiable numerical values in the interval between 0 and 4.

Each parameter will – when it is adjusted – have some kind of influence on the performance of the human operator in positive or negative direction. If – for example – the quality of training is changed from medium to very high, we would expect a positive influence on the performance of the human operator while a change from medium to very low would be expected to induce a negative influence on the performance. Moreover, in the case of a positive influence on the performance we would expect a decrease in the probability of human error while a negative influence on the performance most likely would have an increase of the likelihood of human error as the result.

3.3 The calculation of the human factor quotient (HFQ)

Since each parameter can be adjusted independently, we would expect, that the effect of the adjustment of several different parameters could either outweigh each other or enhance each other depending on the direction in which the parameters are adjusted. The eventual effect on human performance and human error is unchanged if – for example – the quality of training is changed from medium to high and the amount of training is changed from medium to low. In this case the change in value of quality of training and amount of training will outweigh each other. However, this is only the case if the quality of training and the amount of training has the exactly the same importance with regards to human performance. Further, it is assumed, that the interval level scales in use all have *equal units* (e.g. that the distance between 0 and 1 is the same as between 1 and 2 etc.).

It is obvious from the list of human factors related parameters, that they most likely have unequal importance with regards to human performance and human error, and that the above mentioned example – where two parameters are adjusted under the assumption that they are equally important – is extremely simplified and not in accordance with the true functionality of the parameters. It is therefore important, that each parameter is assigned with a coefficient describing the relative value of the parameter compared to all other parameters. In practice these coefficients will rank the parameters from the least important to the most important.

The coefficients are assigned empirically by means of expert judgement and with use of pair wise comparison as questionnaire method. If more than one expert is used, the coefficient is calculated as the mean of all expert ratings. It is recommended, that a reasonable number of domain experts with hands on knowledge from HSC operation (e.g. crewmembers or management from shipping companies operating High Speed Crafts) is used. At least twelve experts from two companies (six from each company) should be recruited. The coefficients should be calculated and expressed as a value in the interval between 0 and 1.

It is – given the coefficients ($C_{[1..n]}$) assigned to value of each parameter ($P_{[1..n]}$ where n is the total number of parameters) – possible to calculate the outcome (the overall effect on human performance and human error) by means of this formula:

$$HFQ = \frac{(C_1 * P_1 + C_2 * P_2 + C_3 * P_3 + \dots + C_n * P_n)}{(4 * n)}$$

This value – which is denominated the human factor quotient – will be in the range between 0 and 1 where 0 is the worst possible outcome and 1 is the best possible outcome of the setting of the parameters. We would expect, that the worst possible outcome (0) would generate an increased probability of human error compared to a residual value while the best possible outcome (1) would generate a decreased probability of human error compared to the residual value.

3.4 Basic Events

Some of the basic events in the fault trees are related to human factors (other are related to technical factors etc.). The probability of these human factors related basic events would change if the human factors quotient were changed. The human factors quotient is changed whenever one or more human factors related parameters are changed. Each basic event will have a residual probability based on a setting of parameters considered as being default. This default setting is not automatically "medium". The list of BEs related to Human Error is reported in Appendix 1

3.5 Expert estimation of probabilities

The residual probability – and the influence from variations in HFQ on the probability – ought to be determined from statistics in the literature, experiments or empirical findings, but since this is a very comprehensive and extremely time consuming task given the number of basic events, a rough estimate (or "qualified guess") can be made by experts.

The HFQ is – for simplification – transformed into a five level scale:

Table 1: HFQ value and HFQ level

HFQ value	HFQ level
0.00-0.20	Very low
0.20-0.40	Low
0.40-0.60	Medium
0.60-0.80	High
0.80-1.00	Very high

If the HFQ is calculated for the setting of parameters for a vessel (or a shipping company) and the result is for example 0.65, it corresponds to the HFQ level "high". Two vessels or two different shipping companies could have different HFQ value from their respective setting of parameters (e.g. 0.65 and 0.78) but still be at the same HFQ level. However, the use of a HFQ level instead of a HFQ value will make the expert estimation task easier and more straightforward.

The probability is estimated as:

Number voyages per occurrence (of the basic event), and the probability value is given as the number of occurrences (of the basic event) per voyage.

It is in order to simplify this estimation feasible if the expert judgement of probability is made on the basis of a six level scale. It is assumed – again for simplification – that the

vessel has 10 single voyages every day 7 days a week, 30 days per month and 365 days per year.

Table 2: Probability level and probability value

Probability level	Probability value
Less than once every year	$\infty^{-1} \leq p < 2.74 \cdot 10^{-4}$
At least once every year but less than once every month	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$
At least once every month but less than once every week	$3.33 \cdot 10^{-3} \leq p < 1.43 \cdot 10^{-2}$
At least once every week but less than once every day	$1.43 \cdot 10^{-2} \leq p < 0.10 \cdot 10^0$
At least once every day but less than once every voyage	$0.10 \cdot 10^0 \leq p < 1.00 \cdot 10^0$
At least once every voyage	$1.00 \cdot 10^0 \leq p \leq \infty$

3.5.1 Data collection

A reasonable number of domain experts with hands on knowledge from HSC operation (e.g. crewmembers or management from shipping companies operating High Speed Crafts) are selected. At least twelve experts from two companies (six from each company) should be recruited.

The concept of HFQ is explained to the subjects, and they are introduced to the list of parameters and the five level HFQ scale.

Further, they are instructed to evaluate the absolute probabilities of a set of human factors related basic events having in mind that the occurrence of the basic event not necessarily will cause an accident, near miss or safety critical event. Perhaps it is not even recognised at all. The final outcome will depend on the probability of other circumstances (basic events) e.g. the presence of other vessels, shallow water etc. A realistic evaluation could therefore be rather high, and probabilities such as “at least once every voyage given 10 voyages per day 365 days per year” can occur pretty often.

Subjects are then introduced to and familiarized with the probability level scale and the assumption about 10 voyages per day 365 days per year.

Each expert is then individually asked to estimate the probability for each combination of basic event and HFQ level.

The data collection for this deliverable was performed in June and July 2003. 76 questionnaires were sent out to 5 shipping companies. 25 questionnaires was filled in and returned. This gives an answering rate of 33%. Three questionnaires had to be discarded due to technical errors in the instruction material. Out of the remaining 22 questionnaires unfortunately 21 questionnaires had technical errors in the “personal

data" section making some of the personal data unusable. Only one single questionnaire was 100% free from technical errors. However, the quality of the other data of the 21 defective questionnaires was presumably not affected by the error in the "personal data" section, and it is therefore usable.

The persons answering the 22 questionnaires used for collection of data in this deliverable can be characterised as follows:

- 22 males and 0 females
- Lowest age 26 years
- Highest age 58 years
- Average age 44,2 years
- Minimum HSC experience (monohull as well as catamaran) 1 year
- Maximum HSC experience (monohull as well as catamaran) 30 years
- Average HSC experience (monohull as well as catamaran) 6,8 years
- Minimum seagoing experience 10 years
- Maximum seagoing experience 43 years
- Average seagoing experience 25,2 years
- 7 persons from Scandinavia
- 15 persons from UK/Ireland

Figure 2: Example from questionnaire

How would you evaluate the probability of the basic event “*helmsman error*” on a vessel characterised by the following HFQ levels:

HFQ level	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please mark only one probability per HFQ level.

3.5.2 Calculation of the probability based on the expert estimation

The results from the expert estimation can be used to calculate a median value representing the absolute probability for each combination of basic event and HFQ level.

The median is for each combination of basic event and HFQ level calculated in the following way:

1. Rank all answers from the panel of experts from the lowest to the highest probability.
2. If there is an odd number of answers (e.g. from an odd number of experts) then use the value, which is exactly in the middle. If there are for example 15 answers then use answer number 8.
3. If there is an even number of answers (e.g. from an even number of experts) then use the value, which is the higher of the two values exactly in the middle. If there are for example 12 answers and they are ranked from the lowest at position 1 to the highest at position 12 then use answer number 7.

The results of the calculation of medians can be illustrated in a basic event / HFQ level matrix as illustrated below. Please notice, that the inserted values only are used as randomly selected examples to illustrate the principals of the matrix. They are not based on any expert estimation or empirical data collection.

Figure 3: Event/HFQ level matrix (example)

Basic event	HFQ level = very low	HFQ level = low	HFQ level = medium	HFQ level = high	HFQ level = very high
Assume other ship will change course.	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$0.10 \cdot 10^0 \leq p < 1.00 \cdot 10^0$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$
Bad eval. of obj drift speed, course	$0.10 \cdot 10^0 \leq p < 1.00 \cdot 10^0$	$0.10 \cdot 10^0 \leq p < 1.00 \cdot 10^0$	$0.10 \cdot 10^0 \leq p < 1.00 \cdot 10^0$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$
Bad eval. of other ship speed, course	$0.10 \cdot 10^0 \leq p < 1.00 \cdot 10^0$	$0.10 \cdot 10^0 \leq p < 1.00 \cdot 10^0$	$0.10 \cdot 10^0 \leq p < 1.00 \cdot 10^0$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$\infty^{-1} \leq p < 2.74 \cdot 10^{-4}$
Confused by other ship's movement	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$0.10 \cdot 10^0 \leq p < 1.00 \cdot 10^0$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$\infty^{-1} \leq p < 2.74 \cdot 10^{-4}$
Failure in using extern. com. device	$1.00 \cdot 10^0 \leq p \leq \infty$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$
Failure in using intern. com. device	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$1.00 \cdot 10^0 \leq p \leq \infty$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$\infty^{-1} \leq p < 2.74 \cdot 10^{-4}$
Failure to cross-check equipment	$1.00 \cdot 10^0 \leq p \leq \infty$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$	$2.74 \cdot 10^{-4} \leq p < 3.33 \cdot 10^{-3}$
Failure to keep stbd side of channel	$1.00 \cdot 10^0 \leq p \leq \infty$	$1.00 \cdot 10^0 \leq p \leq \infty$	$1.00 \cdot 10^0 \leq p \leq \infty$	$1.00 \cdot 10^0 \leq p \leq \infty$	$\infty^{-1} \leq p < 2.74 \cdot 10^{-4}$
Failure to make use of navig. equip.	$1.00 \cdot 10^0 \leq p \leq \infty$	$1.00 \cdot 10^0 \leq p \leq \infty$	$1.00 \cdot 10^0 \leq p \leq \infty$	$1.00 \cdot 10^0 \leq p \leq \infty$	$\infty^{-1} \leq p < 2.74 \cdot 10^{-4}$

The values in the matrix above are – when they are derived from an expert judgement according to the methodology described above – directly applicable used as input for further calculation in the fault trees. It is worth noticing, that the probabilities are intervals and not single values, and that the algorithms used in the fault trees for further calculation should take this into consideration. It is also worth noticing, that the human factors quotient should be calculated from the setting of parameters before the correct probability can found in the matrix.

3.6 Overview of the model

The model for calculation of probabilities of human factors related basic events can be summarized in the following way:

Preparation of model:

1. Coefficients for each parameter should be calculated by expert judgement (pair wise comparison)
2. Probabilities for each combination of basic event and human factors quotient level should be calculated by expert estimation

Application of model:

1. Parameters should be adjusted by the end user
2. Human factors quotient (HFQ) should be calculated on basis of the setting of parameters and the HFQ level should be identified on the basis of this calculation
3. Probabilities (intervals) from the column in the basic event / HFQ level matrix corresponding to the in step 2 calculated HFQ level should be used in the fault trees

Step 1 and 2 in the preparation of the model can be fulfilled by the use of Internet based questionnaires.

Step 1, 2 and 3 in the application of the model ought to be implemented in the final tool.

4. COST MODEL

The cost model related to basic events has been implemented in order to calculate the change on costs attributable to the change of parameters' characteristics.

According to the cost estimation methodology prepared by WP5, the total cost associated to a parameter can be split in:

- Build Cost (C_b);
- Through Life Costs (C_{tl}).

The total cost (C_T) is:

$$C_T = C_b + C_{tl}$$

The majority of human factors related parameters have no impact on the build cost because they are entirely related to the operation of the vessel (operational parameters). A change in these parameters will therefore have no influence on the build cost whatsoever.

However, a few parameters do have influence on the build cost, and this is further analyse and described in D132 as shown in table 4 in this document.

The majority of human factors related parameters have, due to their characteristics as operational parameters, influence on the operational costs of the vessel. This influence depends on the organisational structure of the shipping company, laws and regulations in the area of operation, official demands for manning as well as demands from labour organisations, costs for training and education of seafarers in the area of operation, procedures and administrative principals within the company, the general human factors standard of the company etc. etc. All these variables are unique to the given shipping company. The parameters' influence on the operational costs is therefore indefinable as one single, unified model. Actually a model should be tailor made for each and every shipping company. The shipping company must - each time the risk/cost model is in use - therefore recalculate the operational cost of the majority of the parameters. This is indicated in table 4 by the note "Data from ship owner".

However, a few parameters do have influence on the operational cost, and this is further analyse and described in D132 as shown in table 4 in this document. These parameters are the same that have influence on the build costs as described earlier.

It is important to notice, that an increase in the level of the operational human factors related parameters will most probably require increase in operational costs such as (but not limited to):

- Increase in manning
- Increase in salaries
- Increase in expenses for training and education
- Increase in expenses for recruitment, testing and selection of personnel
- Increase in expenses for administration, on shore support etc.

PART TWO - USER'S GUIDE

5. USERS GUIDE

5.1 General overview

1. Adjust all nominal values in **table 1** - both operational parameters and design parameters - according to the expected design and operation of the vessel. Operational parameters are set in cooperation with the ship owner according to the existing standards and principals in the company or the expected or planned standard for the human factors level on the new vessel. The default value is medium except sub-parameter B1 where it is "only one" and E4 where it is "1-2/week".
2. Calculate the Human Factors Quotient (HFQ) as described in the algorithm. Use the ordinal values corresponding to the settings of parameters made in **step 1**.
3. Find relevant intervals of probabilities of Basic Events (BE) by lookup in **table 4**. Use the calculated HFQ to determine the entry column in the table.
4. Calculate the probability of grounding and/or collision by combined use of the probability intervals of the human factors related basic events and the probabilities of automation and mechanical failures (D132) and manoeuvrability errors (D133) as entry data in the computer based model of the fault trees.
5. If the calculated probability is unacceptable, resume **steps 1 through 6** with the appropriate corrections of parameters in order to change the probability to the desired level.
6. Calculate the cost (building costs and operational costs) as described in **table 2**.
7. Many of the parameters are linked to the cost through a factor which have to be applied to the building or operational cost.
8. If the cost is unacceptable please resume **steps 1 and 2** with the appropriate corrections of parameters in order to change the cost to the desired level.
9. WP2 have a parameter - comfort level on board - which relates on the human factor. Specify the level of comfort on board given by WP2.

5.1.1 Step 1 - Adjustment of parameters

Choose the appropriate setting of the nominal value of each sub-parameter in **table 3** below according to the expectations for the design and operation of the vessel. The nominal value corresponds to an ordinal value according to the table. This ordinal value will be used in **step 4** for the calculation of the human factors quotient (HFQ).

Example

Table 1: Parameters, sub-parameters and their associated coefficients, nominal and ordinal values

PARAMETER	SUB-parameters	Code	Coefficient C ₁ ...C ₃₂	Nominal value	Ordinal value
Training and education of Crew	Amount of training and education	A1	0,68114	None Little Medium High Very high	0 1 2 3 4
	Overall quality of training and education	A2	0,78798	Very low Low Medium High Very high	0 1 2 3 4
Selection of crew – qualifications	Number of well spoken working languages on board	B1	0,55025	Only one Two or more	4 0
	Amount of experience	B2	0,69928	None Little Medium High Very high	0 1 2 3 4
	Amount of training and education	B3	0,66889	None Little Medium High Very high	0 1 2 3 4
	Overall quality of training and education	B4	0,78030	Very low Low Medium High Very high	0 1 2 3 4
Selection of crew – personality and attitudes	Amount of bridge discipline	C1	0,80152	Very low Low Medium High Very high	0 1 2 3 4
	Ability to cope with operational pressures	C2	0,91486	Very low Low Medium High Very high	0 1 2 3 4
	Ability to cope with boredom (e.g. due to routine work)	C3	0,61343	Very low Low Medium High Very high	0 1 2 3 4
	Amount of concern about safety	C4	0,94741	Very low Low Medium High Very high	0 1 2 3 4
	Amount of risk taking attitude	C5	0,55917	Very low Low Medium High Very high	4 3 2 1 0
	Level of confidence (in self, others, automation/technology)	C6	0,78826	Very low Low Medium High Very high	0 2 4 2 0
	Level of exposure to domestic issues	C7	0,59776	Very low Low Medium High Very high	4 3 2 1 0

PARAMETER	SUB-parameters	Code	Coefficient C _{1...C₃₂}	Nominal value	Ordinal value
Selection of crew – medical and physical condition	Level of overall medical and physical condition	D1	0,50431	Very poor Poor Medium Good Very good	0 1 2 3 4
Operation and procedures	Amount of daily time and/or scheduling pressure	E1	0,64357	Very low Low Medium High Very high	2 3 4 2 0
	Amount of commercial and/or organizational pressure	E2	0,62323	Very low Low Medium High Very high	2 3 4 2 0
	Amount of individual workload in the daily routine work	E3	0,69240	Very low Low Medium High Very high	2 3 4 2 0
	Amount of especially demanding planned situations (e.g. fire drills)	E4	0,64900	Less than 1/month 1-3/month 1-2/week 3-6/week 1 or more/day	0 2 4 2 0
	Amount of resources for maintenance, repair, retrofit, new equipment etc.	E5	0,65035	Very low Low Medium High Very high	0 1 2 3 4
Safety culture	Level of overall safety culture on board	F1	1,00000	Very low Low Medium High Very high	0 1 2 3 4
	Level of overall safety culture in company/land organization	F2	0,94658	Very low Low Medium High Very high	0 1 2 3 4
Company practice	Overall quality of working terms and conditions – long term (vacation, salary, promotion possibilities etc.)	G1	0,49750	Very low Low Medium High Very high	0 1 2 3 4
	Overall quality of working terms and conditions – daily basis (working hours, rest periods, working environment, accommodation etc.)	G2	0,55092	Very low Low Medium High Very high	0 1 2 3 4
Bridge discipline	Level to which extend bridge discipline is regulated by procedures and/or practice	H1	0,87869	Very low Low Medium High Very high	0 2 4 4 2
Design of equipment and means for navigation	Level of automation	I1	0,58765	Very low Low Medium High Very high	0 2 4 4 2
	Level of transparency	I2	0,64441	Very low Low Medium High Very high	0 1 2 3 4

PARAMETER	SUB-parameters	Code	Coefficient $C_{1...C_{32}}$	Nominal value	Ordinal value
HMI principles	Overall quality of interaction design and ergonomics	J1	0,48984	Very low Low Medium High Very high	0 1 2 3 4
User's manual	Availability of user manuals	K1	8,34E-08	None Little Medium High Very high	0 1 2 3 4
	Overall quality of user manuals	K2	0,06010	Very poor Poor Medium Good Very good	0 1 2 3 4
Means for communication	Availability of means for communication	L1	0,35392	None Little Medium High Very high	0 1 2 3 4
	Overall quality of means for communication	L2	0,39065	Very poor Poor Medium Good Very good	0 1 2 3 4
Procedures for communication	Level to which extend onboard communication is regulated by procedures and/or practice	M1	0,36867	Very low Low Medium High Very high	0 2 4 4 2
Comfort on board	Level of comfort directly related to WP2	N1	1	Low Medium High	-1 0 1

5.1.2 Step 2 – Calculate the Human Factors Quotient (HFQ)

Calculate the Human Factors Quotient (HFQ) as described in the algorithm. Use the ordinal values corresponding to the settings of parameters made in **step 1**.

The HFQ will be in the range between 0 and 1 where 0 is the worst possible outcome and 1 is the best possible outcome of the setting of the parameters.

$$\text{HFQ} = (C_1 \cdot P_1 + C_2 \cdot P_2 + C_3 \cdot P_3 + \dots + C_{32} \cdot P_{32}) / (128)$$

Where:

$C_1 \dots C_{32}$ are the coefficients according to **table 1**.

$P_1 \dots P_{32}$ are the ordinal values of the settings of the parameters A1 through M1 in **table 1**.

5.1.3 Step 3 – Find probability of Basic Events (BE)

The HFQ value (for example 0.56) corresponds to a HFQ level according to the **table 2** below.

HFQ value	HFQ level
0.00-0.20	Very low
0.20-0.40	Low
0.40-0.60	Medium
0.60-0.80	High
0.80-1.00	Very high

Table 2: HFQ value and corresponding HFQ level

Find the relevant intervals of probabilities of Basic Events (BE) by lookup in **table 3**. Use the HFQ level corresponding to the calculated HFQ value to determine the entry column in the table.

Table 3

BE#	Basic Event	HFQ Very low		Low		Medium		High		Very high	
		P(min)	p(max)	p(min)	p(max)	p(min)	p(max)	p(min)	p(max)	p(min)	p(max)
1	Fail to make use of navigation equipment	0,08882	0,08882	0,02919	0,02919	0,00571	0,00571	0,00147	0,00147	0,00023	0,00023
2	Fail to make use of radar	0,01048	0,01048	0,00524	0,00524	0,00200	0,00200	0,00026	0,00026	0,00015	0,00015
3	Fail to observe relative courses	0,09255	0,09255	0,04783	0,04783	0,00429	0,00429	0,00160	0,00160	0,00023	0,00023
4	Fail to plot relative courses	0,08882	0,08882	0,04037	0,04037	0,00571	0,00571	0,00240	0,00240	0,00041	0,00041
5	Helmsman error	0,05155	0,05155	0,01286	0,01286	0,00524	0,00524	0,00174	0,00174	0,00081	0,00081
6	Overconfident	0,08882	0,08882	0,04783	0,04783	0,00714	0,00714	0,00200	0,00200	0,00081	0,00081
7	Only one navigator present on bridge	0,37391	0,37391	0,09255	0,09255	0,06646	0,06646	0,04037	0,04037	0,01801	0,01801
8	Misinterpretation of collision rules	0,01801	0,01801	0,00952	0,00952	0,00214	0,00214	0,00020	0,00020	0,00013	0,00013
9	Intentionally does not change course	0,01143	0,01143	0,00381	0,00381	0,00027	0,00027	0,00010	0,00010	0,00002	0,00002
10	Passing to close to the other ship	0,04410	0,04410	0,01095	0,01095	0,00214	0,00214	0,00019	0,00019	0,00015	0,00015
11	Significant error made by OOW	0,04410	0,04410	0,01048	0,01048	0,00214	0,00214	0,00021	0,00021	0,00012	0,00012
12	Second navigational officer on the bridge fails to notice error	0,05528	0,05528	0,01801	0,01801	0,00254	0,00254	0,00023	0,00023	0,00013	0,00013
13	Watch-keeping failure	0,07391	0,07391	0,02174	0,02174	0,00320	0,00320	0,00081	0,00081	0,00021	0,00021
14	Involved in wrong communication	0,04037	0,04037	0,01143	0,01143	0,00293	0,00293	0,00027	0,00027	0,00014	0,00014
15	Assume that the other ship would fulfil its obligation to give way and change its course	0,01429	0,01429	0,00952	0,00952	0,00081	0,00081	0,00020	0,00020	0,00017	0,00017
16	Assume that the other ship would change its course though it is not supposed to give way	0,00187	0,00187	0,00081	0,00081	0,00015	0,00015	0,00007	0,00007	0,00012	0,00012
17	Bad evaluation of the drift speed and course of floating object	0,01429	0,01429	0,00667	0,00667	0,00200	0,00200	0,00026	0,00026	0,00013	0,00013
18	Bad evaluation of speed and course of other ship	0,01381	0,01381	0,00714	0,00714	0,00107	0,00107	0,00018	0,00018	0,00012	0,00012
19	Confused by other ship's movement	0,02919	0,02919	0,00810	0,00810	0,00187	0,00187	0,00024	0,00024	0,00017	0,00017
20	Failure in the use of external communication	0,01143	0,01143	0,00714	0,00714	0,00200	0,00200	0,00026	0,00026	0,00013	0,00013

Table 3

		HFQ Very low		Low		Medium		High		Very high	
21	Failure in the use of internal communication	0,01333	0,01333	0,00762	0,00762	0,00307	0,00307	0,00081	0,00081	0,00025	0,00025
22	Fail to perform cross-check of equipment	0,09255	0,09255	0,02919	0,02919	0,00524	0,00524	0,00107	0,00107	0,00041	0,00041
23	Fail to keep to starboard side of channel	0,00905	0,00905	0,00667	0,00667	0,00174	0,00174	0,00023	0,00023	0,00014	0,00014
	Failure to anchor in time										
	Failure to connect tug in time										
	Failure to make VHF contact										
	Failure to self repair in time										
	Etc.										
	...caused by "Malfunction or break down of equipment such as anchor equipment or fuel system due to insufficient maintenance"										
24	fuel system due to insufficient maintenance"	0,01801	0,01801	0,01190	0,01190	0,00320	0,00320	0,00041	0,00041	0,00020	0,00020

5.1.4 Step 4 - Calculate the probability of grounding and/or collision

Calculate the probability of grounding and/or collision by combined use of the probability intervals of the human factors related basic events and the probabilities of automation and mechanical failures (D132) and manoeuvrability errors (D133) as entry data in the computer based model of the fault trees.

5.1.5 Step 5 - Is the probability acceptable?

If the calculated probability is unacceptable, resume **steps 1 through 5** with the appropriate corrections of parameters in order to change the probability to the desired level.

5.1.6 Step 6 - Calculation of cost

Calculate the cost (building costs and operational costs) as described in **table 4** by consulting relevant sections of D132 and by using input from the shipping company whenever it is required. The note "Data from ship owner" in the table indicates the requirement of calculations and recalculations.

The shipping company should be reminded, that an increase in the level of the operational human factors related parameters will most probably require increase in operational costs such as (but not limited to):

- Increase in manning
- Increase in salaries
- Increase in expenses for training and education
- Increase in expenses for recruitment, testing and selection of personnel
- Increase in expenses for administration, on shore support etc.

Table 4: Parameters, sub-parameters and their associated nominal values, building costs and operational costs

PARAMETER	SUB-parameters	Code	Nominal value	Building costs	Operational costs
Training and education of Crew	Amount of training and education	A1	None Little Medium High Very high		0 50.000 100.000 150.000 200.000
	Overall quality of training and education	A2	Very low Low Medium High Very high		0,70 0,85 1,00 1,100 1,25
Selection of crew – qualifications	Number of well spoken working languages on board	B1	Only one Two or more		1.500.000 1.000.000
	Amount of experience	B2	None Little Medium High Very high		0,70 0,85 1,00 1,10 1,25
	Amount of training and education	B3	None Little Medium High Very high		0,70 0,85 1,00 1,10 1,25
	Overall quality of training and education	B4	Very low Low Medium High Very high		0,70 0,85 1,00 1,10 1,25
Selection of crew – personality and attitudes	Amount of bridge discipline	C1	Very low Low Medium High Very high		1,00 1,00 1,00 1,00 1,00
	Ability to cope with operational pressures	C2	Very low Low Medium High Very high		1,00 1,00 1,00 1,00 1,00
	Ability to cope with boredom (e.g. due to routine work)	C3	Very low Low Medium High Very high		1,00 1,00 1,00 1,00 1,00
	Amount of concern about safety	C4	Very low Low Medium High Very high		1,00 1,00 1,00 1,00 1,00
	Amount of risk taking attitude	C5	Very low Low Medium High Very high		1,00 1,00 1,00 1,00 1,00
	Level of confidence (in self, others, automation/technology)	C6	Very low Low Medium High Very high		1,00 1,00 1,00 1,00 1,00
	Level of exposure to domestic issues	C7	Very low Low Medium High Very high		1,00 1,00 1,00 1,00 1,00

PARAMETER	SUB-parameters	Code	Nominal value	Building costs	Operational costs					
Selection of crew – medical and physical condition	Level of overall medical and physical condition	D1	Very poor		1,50					
			Poor		1,25					
			Medium		1,00					
			Good		0,85					
			Very good		0,70					
Operation and procedures	Amount of daily time and/or scheduling pressure	E1	Very low		1,10					
			Low		1,05					
			Medium		1,00					
			High		0,95					
			Very high		0,90					
	Amount of commercial and/or organizational pressure	E2	Very low		1,10					
			Low		1,05					
			Medium		1,00					
			High		0,95					
	Amount of individual workload in the daily routine work	E3	Very low		1,10					
			Low		1,05					
			Medium		1,00					
			High		0,95					
	Amount of especially demanding planned situations (e.g. fire drills)	E4	Less than 1/month		10.000					
			1-3/month		24.000					
			1-2/week		100.000					
			3-6/week		250.000					
	Amount of resources for maintenance, repair, retrofit, new equipment etc.	E5	1 or more/day		400.000					
			Very low		0,33					
			Low		0,66					
Medium			1,00							
High			1,50							
Safety culture	Level of overall safety culture on board	F1	Very low		0,90					
			Low		0,95					
			Medium		1,00					
			High		1,05					
			Very high		1,10					
Level of overall safety culture in company/land organization	F2	Very low		0,90						
		Low		0,95						
		Medium		1,00						
		High		1,05						
		Very high		1,10						
Company practice	Overall quality of working terms and conditions – long term (vacation, salary, promotion possibilities etc.)	G1	Very low		0,90					
			Low		0,95					
			Medium		1,00					
			High		1,05					
Overall quality of working terms and conditions – daily basis (working hours, rest periods, working environment, accommodation etc.)	G2	Very low		0,90						
		Low		0,95						
		Medium		1,00						
		High		1,05						
Very high	1,10									
					Bridge discipline	Level to which extend bridge discipline is regulated by procedures and/or practice	H1	Very low		0,90
								Low		0,95
								Medium		1,00
High	1,05									
Very high	1,10									
Design of equipment and means for navigation	Level of automation	I1	Very low	See D132 Section 4.2.5.1 Section 4.2.6.1	See D132 Section 4.2.5.2 Section 4.2.6.2					
			Low							
			Medium							
			High							
Level of transparency	I2	Very low	See D132 Section 4.2.5.1 Section 4.2.6.1	See D132 Section 4.2.5.2 Section 4.2.6.2						
		Low								
		Medium								
		High								
Very high	1,10									
					HMI principles	Overall quality of interaction design and ergonomics	J1	Very low	See D132 Section 4.2.5.1 Section 4.2.6.1 Section 4.2.7.1 Section 4.2.8.1	See D132 Section 4.2.5.2 Section 4.2.6.2 Section 4.2.7.2 Section 4.2.8.2
								Low		
								Medium		
High										
Very high										

PARAMETER	SUB-parameters	Code	Nominal value	Building costs	Operational costs
User's manual	Availability of user manuals	K1	None Little Medium High Very high	See D132 Section 4.2.1.1 Section 4.2.2.1 Section 4.2.3.1 Section 4.2.4.1 Section 4.2.5.1 Section 4.2.6.1 Section 4.2.7.1 Section 4.2.8.1 Section 4.2.9.1 Section 4.2.10.1	See D132 Section 4.2.1.2 Section 4.2.2.2 Section 4.2.3.2 Section 4.2.4.2 Section 4.2.5.2 Section 4.2.6.2 Section 4.2.7.2 Section 4.2.8.2 Section 4.2.9.2 Section 4.2.10.2
	Overall quality of user manuals	K2	Very poor Poor Medium Good Very good	See D132 Section 4.2.1.1 Section 4.2.2.1 Section 4.2.3.1 Section 4.2.4.1 Section 4.2.5.1 Section 4.2.6.1 Section 4.2.7.1 Section 4.2.8.1 Section 4.2.9.1 Section 4.2.10.1	See D132 Section 4.2.1.2 Section 4.2.2.2 Section 4.2.3.2 Section 4.2.4.2 Section 4.2.5.2 Section 4.2.6.2 Section 4.2.7.2 Section 4.2.8.2 Section 4.2.9.2 Section 4.2.10.2
Means for communication	Availability of means for communication	L1	None Little Medium High Very high	See D132 Section 4.2.7.1 Section 4.2.8.1	See D132 Section 4.2.7.2 Section 4.2.8.2
	Overall quality of means for communication	L2	Very poor Poor Medium Good Very good	See D132 Section 4.2.7.1 Section 4.2.8.1	See D132 Section 4.2.7.2 Section 4.2.8.2
Procedures for communication	Level to which extend onboard communication is regulated by procedures and/or practice	M1	Very low Low Medium High Very high		1,00 1,00 1,00 1,00 1,00

5.1.7 Step 7 - Cost factor!

Many of the parameters are related to a cost factor. This factor have to be applied to the cost obtained from D132, section 4.2.x.x, related to either the building or the maintenance.

Bridge building cost factor =	1,16
Maintenance cost factor =	1,00*
Operational costs =	1.700.000
Total costs =	<u>1.700.000**</u>

*Costs obtained from WP1, D132

**Depending on building and maintenance costs

The bridge building cost factor and the Maintenance cost factor have to be multiplied to the bridge building cost and the maintenance cost.

5.1.8 Step 8 - Is the cost acceptable?

If the cost is unacceptable please resume steps 1 and 2 with the appropriate corrections of parameters in order to change the cost to the desired level.

5.1.9 Select the comfort level on board.

WP2 have a parameter - comfort level on board - which relates on the human factor. Specify the level of comfort on board given by WP2.

CONCLUSIONS

The work done in Task 1.3.1 and reported in this document still needs refinements in some of its parts, in particular:

- Improvements in the guidelines for calculation of costs, and – if possible – also in the cost model. A “single case” example could be build with input from a shipping company within or outside the consortium.
- Data in the user guide section needs further refinement on the basis of additional empirical data collected by means of questionnaires.
- Improvement of the presentation of the personal data in section 3.5.1.

Moreover, because of the heterogeneity of the topics covered in WP1 (human errors, mechanical and automation failures, manoeuvring errors) and the different methods suggested to tackle them, an merging process is running for the development of the controllability model to be finally incorporated into WP5. This is the main content of D134.

6. APPENDIX 1: HUMAN FACTORS RELATED BASIC EVENTS

Table 5: Human Factors related basic events (BEs)

Fail to make use of navigation equipment
Fail to make use of radar
Fail to observe relative courses
Fail to plot relative courses
Helmsman error
Overconfident
Only one navigator present on bridge
Misinterpretation of collision rules
Intentionally does not change course
Passing to close to the other ship
Significant error made by OOW
Second navigational officer on the bridge fails to notice error
Watch-keeping failure
Involved in wrong communication
Assume that the other ship would fulfil its obligation to give way and change its course
Assume that the other ship would change its course though it is not supposed to give way
Bad evaluation of the drift speed and course of floating object
Bad evaluation of speed and course of other ship
Confused by other ship's movement
Failure in the use of external communication
Failure in the use of internal communication
Fail to perform cross-check of equipment
Fail to keep to starboard side of channel
Failure to anchor in time
Failure to connect tug in time
Failure to make VHF contact
Failure to self repair in time
Etc.

...caused by "Malfunction or break down of equipment such as anchor equipment or fuel system due to insufficient maintenance"

7. APPENDIX 2: THE QUESTIONNAIRE

SAFETY AT SPEED

Human factors survey

What is Safety at Speed?

Many traditional ships have been replaced with high-speed vessels, which, however, pose a challenge. The problem can be simply stated: How can the risks to ship, passengers and crew inherent in operation of high-speed craft be limited?

The Safety-at-Speed EU-project has the ultimate objectives of enabling the design of advanced high-speed craft such that they meet the required safety level at the lowest possible through-life cost, and to enable a rational assessment of the cost implications of the variation of safety related parameters.

In present-day design methodologies for advanced HSC there is no support for the assessment of the balance between the issues of safety and cost. Hence, it is in practical terms not possible to complete a design at or near the through-life-cost optimum. For current designs, the tendency is to base design decisions on best practice, and while these designs fulfill current safety design requirements, it is unknown whether the resulting vessels are over-specified in one or more aspects – and hence in reality, are too expensive to build and operate.

The aim of the project is to develop a formalised methodology for design for safety of HSC, using state-of-the-art techniques and tools. The final report of the project is a description of the methodology, accompanied by supporting tools and information, which will enable HSC designers to reach an optimal solution with regard to overall safety and through-life cost.

FORCE Technology supplies the project with their knowledge of human factor, primary related to the navigator. To gain an expert judgement of human factor based aspects we need to have a close approach to the "real life" and how procedures are handled on board. That's why we have contacted you. In the following we have presented a number of questions as we kindly ask you to fill in.

To ensure the highest quality of our questionnaire, we would be pleased if you could return the filled in questionnaire as soon as possible and before July the 1st 2003.

Thank you for your cooperation.

Best regards,

Jeppe Skovbakke Juhl & Thomas Koester

General instructions

You are now kindly asked to answer three sets of questions.

The first set of questions is related to your personal data about experience etc. These data will be used on an aggregated level mainly to describe the population of participants in the survey. When presented to the partners in the EU-project in documents, drafts etc. and to the public in papers, reports etc. we guarantee that all data will be fully anonymize. We would like to have information on how to contact you (name, address, e-mail etc.) in case we have questions for your answers to the questionnaires.

The second set of questions is an evaluation of the relative importance of 32 human factors related parameters. The evaluation is done by a technique called pair wise comparison, and you are in a number of questions asked to compare no more than two parameters and evaluate which one of them is the most important with respect to the overall human factors standard on board a monohull high speed craft (HSC).

The third and last set of questions is an evaluation of the absolute expected frequency (the probability) of 24 different events related to human factors on board a monohull HSC. You are asked to use a five level scale for evaluation.

If you encounter any doubt or problems during the filling in if the questionnaires or if you have any questions please contact the survey committee:

<p>Thomas Koester Psychologist, MA</p> <p>PhD fellow Training and Ports</p> <p>FORCE Technology, Kgs. Lyngby Hjortekærsvej 99 2800 Kgs. Lyngby Denmark</p> <p>Phone: +45 72 15 77 00 Direct: +45 72 15 78 76 Fax: +45 72 15 77 01 e-mail: tsk@force.dk <mailto:tsk@force.dk> WWW: www.force.dk <http://www.force.dk/></p> 	<p>Jepp Skovbakke Juhl B.Sc.(Naval Architecture)</p> <p>Project Manager Ship and Offshore</p> <p>FORCE Technology, Kgs. Lyngby Hjortekærsvej 99 2800 Kgs. Lyngby Denmark</p> <p>Phone: +45 72 15 77 00 Direct: +45 72 15 77 48 Fax: +45 72 15 77 01 e-mail: jjp@force.dk <mailto:jjp@force.dk> WWW: www.force.dk <http://www.force.dk/></p> 
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When you have finished the questionnaire please send it to the survey committee by using the enclosed envelope. It is very important that all pages of the questionnaire are kept stapled together.

Thank you very much for your contribution!

Safety at Speed – Questionnaire 2 Evaluation of parameters

In this part of the survey, you are kindly asked to evaluate the relative importance of a number of parameters and sub-parameters related to human factors onboard high speed crafts.

The questionnaire contains 61 sets of comparisons. In each comparison, you are asked to compare exactly two parameters or sub-parameters according to their relative importance with respect to the human factors standard on board a high speed craft.

Which one of the two parameters or sub-parameters is most important for the overall level of the human factors standard on board the vessel?

The scale in use is a nine point scale as illustrated in the example below. The value of each point on the scale equals a number in the interval between –4 and +4 with 0 as middle point. These values are not reproduced in the questionnaire but only shown in the example for the sake of simplicity. However, you should have these values in mind when you use the scale throughout the questionnaire. The value indicate an important point: The distance between each value in the scale is exactly the same (+/- 1). This means that the difference in importance between “moderately more important” and “strongly more important” is exactly the same as between “strongly more important” and “ very strongly more important” etc. etc.

The questionnaire is divided into two steps: First you are asked to evaluate the importance of sub-parameters and second you are asked to evaluate the importance of parameters. Please have a look at the whole structure of parameters and sub-parameters in Appendix A before you begin answering the questions. It is very important that you have a general understanding of the structure before you start answering questions.

Example on how to fill in the questionnaire (attached values are not shown in the questionnaire, but please have them in mind when answering the questions):

1 = Amount of bridge discipline					2 = Ability to cope with boredom			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
-4	-3	-2	-1	0	+1	+2	+3	+4

Questions

STEP 1 – COMPARISON OF SUB-PARAMETERS

Which one of the two sub-parameters is most important for the overall level of the human factors standard on board the vessel?

Training and education of crew

1 = Amount of training and education

2 = Overall quality of training and education

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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Selection of crew – qualifications

1 = Number of well spoken working languages on board

2 = Amount of experience

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Number of well spoken working languages on board

2 = Amount of training and education

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Number of well spoken working languages on board

2 = Overall quality of training and education

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Amount of experience

2 = Amount of training and education

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Amount of experience					2 = Overall quality of training and education			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

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1 = Amount of training and education					2 = Overall quality of training and education			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

7

SELECTION OF CREW – PERSONALITY AND ATTITUDES

1 = Amount of bridge discipline					2 = Ability to cope with operational pressures			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of bridge discipline					2 = Ability to cope with boredom			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of bridge discipline					2 = Amount of concern about safety			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of bridge discipline					2 = Amount of risk taking attitude			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of bridge discipline					2 = Level of confidence			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of bridge discipline					2 = Level of exposure to domestic issues			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Ability to cope with operational pressures					2 = Ability to cope with boredom			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Ability to cope with operational pressures					2 = Amount of concern about safety			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Ability to cope with operational pressures					2 = Amount of risk taking attitude			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Ability to cope with operational pressures					2 = Level of confidence			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Ability to cope with operational pressures					2 = Level of exposure to domestic issues			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Ability to cope with boredom					2 = Amount of concern about safety			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Ability to cope with boredom					2 = Amount of risk taking attitude			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Ability to cope with boredom					2 = Level of confidence			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Ability to cope with boredom					2 = Level of exposure to domestic issues			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of concern about safety					2 = Amount of risk taking attitude			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of concern about safety					2 = Level of confidence			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of concern about safety					2 = Level of exposure to domestic issues			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of risk taking attitude					2 = Level of confidence			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of risk taking attitude					2 = Level of exposure to domestic issues			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Level of confidence					2 = Level of exposure to domestic issues			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

Operation and procedures

1 = Amount of daily time and/or scheduling pressure					2 = Amount of commercial and/or organizational pressure			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of daily time and/or scheduling pressure					2 = Amount of individual workload in the daily routine work			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of daily time and/or scheduling pressure					2 = Amount of especially demanding planned situations (e.g. fire drills)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of daily time and/or scheduling pressure					2 = Amount of resources for maintenance, repair, retrofit, new equipment etc.			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of commercial and/or organizational pressure					2 = Amount of individual workload in the daily routine work			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of commercial and/or organizational pressure					2 = Amount of especially demanding planned situations (e.g. fire drills)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of commercial and/or organizational pressure					2 = Amount of resources for maintenance, repair, retrofit, new equipment etc.			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Amount of individual workload in the daily routine work **2 = Amount of especially demanding planned situations (e.g. fire drills)**

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Amount of individual workload in the daily routine work **2 = Amount of resources for maintenance, repair, retrofit, new equipment etc.**

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Amount of especially demanding planned situations (e.g. fire drills) **2 = Amount of resources for maintenance, repair, retrofit, new equipment etc.**

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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Safety culture

1 = Level of safety culture on board **2 = Level of safety culture in company/land organization**

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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Company practice

1 = Overall quality of working terms and conditions - LONG TERM - (vacation, salary, promotion possibilities etc.) **2 = Overall quality of working terms and conditions - DAILY BASIS - (working hours, rest periods, working environment, accommodation etc.)**

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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Design of equipment and means for navigation

1 = Level of automation

2 = Level of transparency

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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User's manual

1 = Availability of user manuals

2 = Overall quality of user manuals

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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Means for communication

1 = Availability of means for communication

2 = Overall quality of means for communication

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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STEP 2 – COMPARISON OF PARAMETERS

Which one of the two parameters is most important for the overall level of the human factors standard on board the vessel?

1 = Training and education of crew

2 = Selection of crew, qualifications

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Training and education of crew

2 = Selection of crew, personality and attitudes

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Training and education of crew

**2 = Selection of crew, medical and physical condition
 (level of overall medical and physical condition)**

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Training and education of crew

2 = Operation and procedures

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Training and education of crew

2 = Safety culture

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Training and education of crew					2 = Company practice			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Training and education of crew					2 = Bridge discipline (level to which extend bridge discipline is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Training and education of crew					2 = Design of equipment and means for navigation			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Training and education of crew					2 = HMI principles (overall quality of interaction design and ergonomics) HMI = Human Machine Interaction			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Training and education of crew					2 = User's manual			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Training and education of crew					2 = Means for communication			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Training and education of crew					2 = Procedures for communication (level to which extend onboard communication is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - qualifications					2 = Selection of crew, personality and attitudes			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - qualifications					2 = Selection of crew, medical and physical condition (level of overall medical and physical condition)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - qualifications					2 = Operation and procedures			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - qualifications					2 = Safety culture			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - qualifications					2 = Company practice			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - qualifications					2 = Bridge discipline (level to which extend bridge discipline is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - qualifications					2 = Design of equipment and means for navigation			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - qualifications					2 = HMI principles (overall quality of interaction design and ergonomics) HMI = Human Machine Interaction			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - qualifications					2 = User's manual			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - qualifications					2 = Means for communication			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - qualifications					2 = Procedures for communication (level to which extend onboard communication is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - personality and attitudes					2 = Selection of crew, medical and physical condition (level of overall medical and physical condition)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - personality and attitudes					2 = Operation and procedures			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - personality and attitudes					2 = Safety culture			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - personality and attitudes					2 = Company practice			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - personality and attitudes					2 = Bridge discipline (level to which extend bridge discipline is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - personality and attitudes					2 = Design of equipment and means for navigation			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - personality and attitudes					2 = HMI principles (overall quality of interaction design and ergonomics) HMI = Human Machine Interaction			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - personality and attitudes					2 = User's manual			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - personality and attitudes					2 = Means for communication			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew - personality and attitudes					2 = Procedures for communication (level to which extend onboard communication is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew, medical and physical condition					2 = Operation and procedures			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew, medical and physical condition					2 = Safety culture			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew, medical and physical condition					2 = Company practice			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew, medical and physical condition					2 = Bridge discipline (level to which extend bridge discipline is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew, medical and physical condition					2 = Design of equipment and means for navigation			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew, medical and physical condition					2 = HMI principles (overall quality of interaction design and ergonomics) HMI = Human Machine Interaction			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew, medical and physical condition					2 = User's manual			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew, medical and physical condition					2 = Means for communication			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Selection of crew, medical and physical condition					2 = Procedures for communication (level to which extend onboard communication is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Operation and procedures					2 = Safety culture			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Operation and procedures					2 = Company practice			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Operation and procedures					2 = Bridge discipline (level to which extend bridge discipline is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Operation and procedures					2 = Design of equipment and means for navigation			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Operation and procedures					2 = HMI principles (overall quality of interaction design and ergonomics) HMI = Human Machine Interaction			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Operation and procedures					2 = User's manual			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Operation and procedures					2 = Means for communication			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Operation and procedures					2 = Procedures for communication (level to which extend onboard communication is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Safety culture					2 = Company practice			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Safety culture					2 = Bridge discipline (level to which extend bridge discipline is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Safety culture					2 = Design of equipment and means for navigation			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Safety culture					2 = HMI principles (overall quality of interaction design and ergonomics) HMI = Human Machine Interaction			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Safety culture					2 = User's manual			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Safety culture					2 = Means for communication			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Safety culture					2 = Procedures for communication (level to which extend onboard communication is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Company practice					2 = Bridge discipline (level to which extend bridge discipline is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Company practice					2 = Design of equipment and means for navigation			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Company practice					2 = HMI principles (overall quality of interaction design and ergonomics) HMI = Human Machine Interaction			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Company practice					2 = User's manual			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Company practice					2 = Means for communication			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Company practice					2 = Procedures for communication (level to which extend onboard communication is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Bridge discipline (level to which extend bridge discipline is regulated by procedures and/or practice)					2 = Design of equipment and means for navigation			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Bridge discipline (level to which extend bridge discipline is regulated by procedures and/or practice)					2 = HMI principles (overall quality of interaction design and ergonomics) HMI = Human Machine Interaction			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Bridge discipline
 (level to which extend bridge discipline
 is regulated by procedures and/or practice)

2 = User's manual

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Bridge discipline
 (level to which extend bridge discipline
 is regulated by procedures and/or practice)

2 = Means for communication

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Bridge discipline
 (level to which extend bridge discipline
 is regulated by procedures and/or practice)

2 = Procedures for communication
 (level to which extend onboard communication
 is regulated by procedures and/or practice)

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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2 = HMI principles
 (overall quality of interaction design and ergonomics)
 HMI = Human Machine Interaction

1 = Design of equipment and means for navigation

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Design of equipment and means for navigation

2 = User's manual

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = Design of equipment and means for navigation

2 = Means for communication

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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**2 = Procedures for communication
 (level to which extend onboard communication
 is regulated by procedures and/or practice)**

1 = Design of equipment and means for navigation

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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**1 = HMI principles
 (overall quality of interaction design and ergonomics)
 HMI = Human Machine Interaction**

2 = User's manual

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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**1 = HMI principles
 (overall quality of interaction design and ergonomics)
 HMI = Human Machine Interaction**

2 = Means for communication

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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**1 = HMI principles
 (overall quality of interaction design and ergonomics)
 HMI = Human Machine Interaction**

**2 = Procedures for communication
 (level to which extend onboard communication
 is regulated by procedures and/or practice)**

1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1
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1 = User's manual					2 = Means for communication			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = User's manual					2 = Procedures for communication (level to which extend onboard communication is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

1 = Means for communication					2 = Procedures for communication (level to which extend onboard communication is regulated by procedures and/or practice)			
1 extremely more important than 2	1 very strongly more important than 2	1 strongly more important than 2	1 moderately more important than 2	1 and 2 equally important	2 moderately more important than 1	2 strongly more important than 1	2 very strongly more important than 1	2 extremely more important than 1

Safety at Speed – Questionnaire 3 Evaluation of events

Instructions

You are now – in the second part of the survey – kindly asked to evaluate the absolute expected frequency (the probability) of 24 human factors related events on board a monohull high speed craft (HSC). The majority of these events are related to the work performed by the officer on watch.

Please assume that the monohull HSC used as example in this questionnaire travels 10 single voyages between the same two harbours every day 7 days per week and 365 days per year.

It is likely to assume, that the expected frequency of the events in some cases would depend on the overall human factors standard of the vessel.

If the overall human factors standard is very low you will anticipate more human errors than if the standard is very high. You are therefore asked to evaluate on the basis of five different levels of human factors standard on board the vessel.

You will find a list of 32 human factors related parameters in Appendix A. Please consider the human factors standard of the vessel as being based on the overall value – weighted by relative importance – of exactly these 32 parameters.

If all these parameters are set to be at their worst possible value, it corresponds to the lowest possible human factors standard onboard the vessel. If all the parameters are set to be at their best possible value, it corresponds to the highest possible human factors standard onboard the vessel.

Please evaluate the expected frequency of the human factors related events using the five level scale. What will the expected frequency of the event in question be on a monohull HSC where the 32 parameters are set to be very low and the overall human factors standard therefore in general is very low? What will the expected frequency be if the parameters are improved a little generating an overall low human factors standard? Or if they are improved even more generating an overall medium standard etc. etc.?

If you – for some reason – is unable to evaluate the expected frequency please leave the row of boxes empty and continue with the next level of human factors standard / the next question.

Example

How often would you think that the officer on watch is *the only navigator present on the bridge* of a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	X
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	X	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	X	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	X	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	X	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

Questions

1. How often would you think that the officer on watch would *fail to make use of navigational equipment* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

2. How often would you think that the officer on watch will *fail to make use of RADAR* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

3. How often would you think that the officer on watch would *fail to observe relative courses* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

4. How often would you think that the officer on watch will *fail to plot relative courses* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

5. How often would you think that the officer on watch will perform a *helmsman error* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

6. How often would you think that the officer on watch is *overconfident* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

7. How often would you think that the officer on watch is *the only navigator present on the bridge* of a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

8. Assuming that collision rules are used at least once every voyage, how often would you think that the officer on watch will make a *misinterpretation of these collision rules* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

9. Assuming that risk of collision (with vessel, floating or fixed object) or grounding occurs at least once every voyage, how often would you think that the officer on watch *intentionally does not change course* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

10. Assuming that encounter with another ship occurs at least once every voyage, how often would you think that the officer on watch navigates her or his monohull HSC in a way that it is *passing too close to the other ship* when the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

11. How often would you think that the officer on watch *makes a significant error* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

12. Assuming that the officer on watch makes an error at least once every voyage, how often would you think that the *second navigational officer on the bridge fails to notice this error* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

13. How often would you think that the officer on watch *makes a watch keeping failure* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

14. How often would you think that the officer on watch *is involved in wrong communication* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

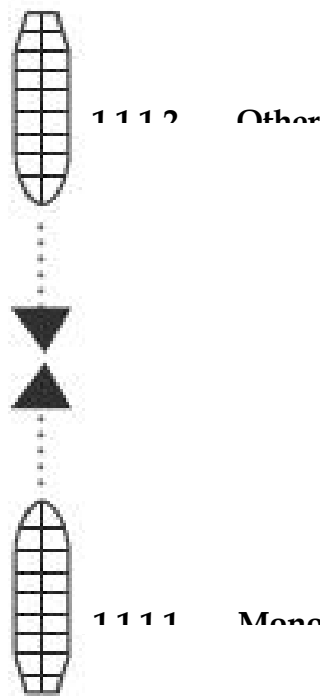
Please tick only one box per level of human factors standard onboard.

15. Assuming that risk of collision with another ship occurs at least once every voyage, how often would you think that the officer on watch - on a monohull HSC where the overall human factors standard onboard is defined according to the table below - would assume that the other ship would fulfil its obligation to give way and change its course (please see the example illustrated below):

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

Below: Example of situation with monohull HSC and other ship.

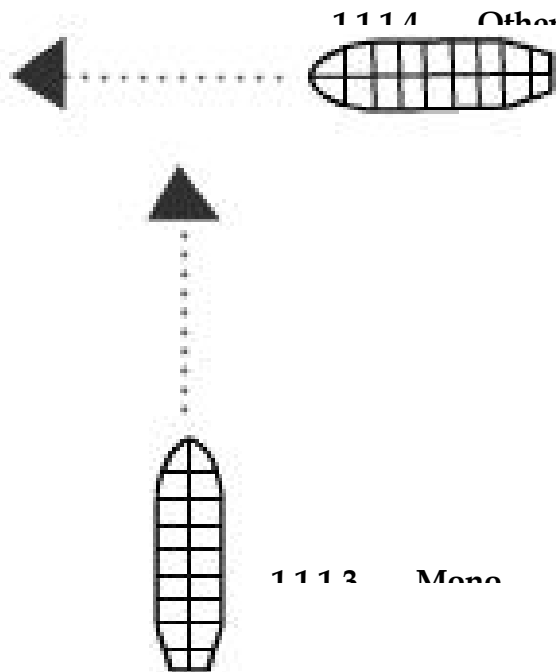


16. Assuming that risk of collision with another ship occurs at least once every voyage, how often would you think that the officer on watch - on a monohull HSC where the overall human factors standard onboard is defined according to the table below - would assume that the other ship would change its course even though it is not supposed to give way (please see the example illustrated below):

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

Below: Example of situation with monohull HSC and other ship.



17. Assuming that risk of collision with a floating object (e.g. container, timber) occurs at least once every voyage, how often would you think that the officer on watch will perform a *bad evaluation of the drift speed and course of the floating object* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

18. Assuming that risk of collision with another ship occurs at least once every voyage, how often would you think that the officer on watch would perform a *bad evaluation of the speed and course of the other ship* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

19. Assuming that risk of collision with another ship occurs at least once every voyage, how often would you think that the officer on watch will be *confused by the other ship's movement* on a monohull HSC where the overall human factors standard onboard is:

Overall human	Less than once every	At least once every	At least once every	At least once every	At least once every	At least once every

factors standard onboard	year	year but less than once every month	month but less than once every week	week but less than once every day	day but less than once every voyage	voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

20. Assuming that external communication devices (e.g. VHF, telephone, fax) is used at least once every voyage, how often would you think that the officer on watch would make a *failure in the use of the external communication devices* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

21. Assuming that external communication devices (e.g. intercom, VHF, telephone) is used at least once every voyage, how often would you think that the officer on watch would make a *failure in the use of the internal communication devices* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

22. Assuming that procedures requires cross-check of equipment at least once every voyage, how often would you think that the officer on watch will *fail to perform this cross-check of equipment* on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard onboard	Less than once every year	At least once every year but less than once every month	At least once every month but less than once every week	At least once every week but less than once every day	At least once every day but less than once every voyage	At least once every voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

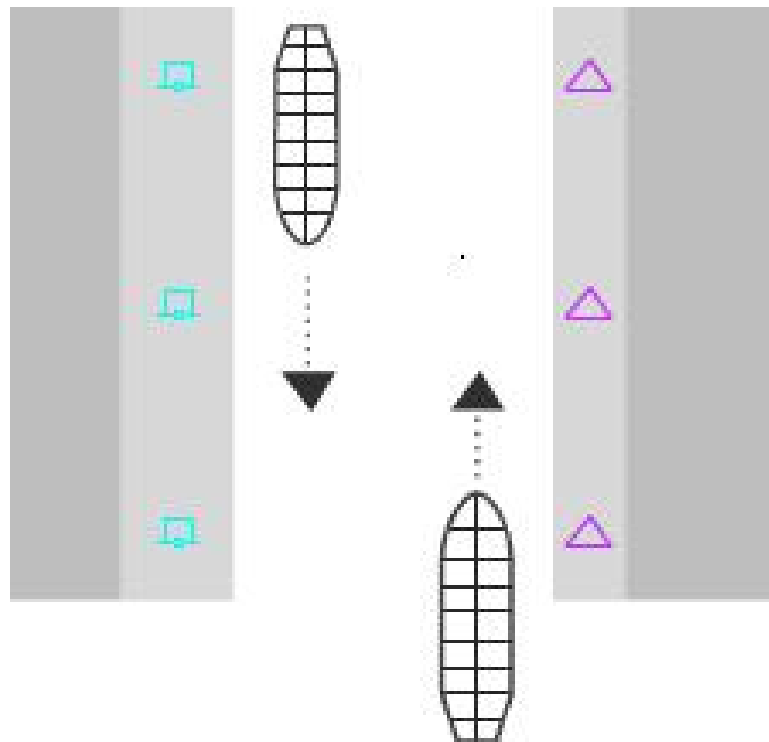
23. Assuming that the vessel sails in a channel at least once every voyage, how often would you think that the officer on watch will *fail to keep to the starboard side of a channel* on a monohull HSC where the overall human factors standard onboard is:

Overall human	Less than once every	At least once every	At least once every	At least once every	At least once every	At least once every

factors standard onboard	year	year but less than once every month	month but less than once every week	week but less than once every day	day but less than once every voyage	voyage
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

Below: Example - keeping to the starboard side of the channel.



24. How often would you think that you will *experience malfunction or break down of equipment such as anchor equipment or fuel system* due to insufficient maintenance on a monohull HSC where the overall human factors standard onboard is:

Overall human factors standard	Less than once every year	At least once every year but less than once	At least once every month but less than once	At least once every week but less than once	At least once every day but less than once	At least once every voyage

onboard		every month	every week	every day	every voyage	
Very low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tick only one box per level of human factors standard onboard.

APPENDIX A

PARAMETER	SUB-parameters	code
Training and education of Crew	Amount of training and education	A1
	Overall quality of training and education	A2
Selection of crew – qualifications	Number of well spoken working languages on board	B1
	Amount of experience	B2
	Amount of training and education	B3
	Overall quality of training and education	B4
Selection of crew – personality and attitudes	Amount of bridge discipline	C1
	Ability to cope with operational pressures	C2
	Ability to cope with boredom (e.g. due to routine work)	C3
	Amount of concern about safety	C4
	Amount of risk taking attitude	C5
	Level of confidence (in self, others, automation/technology)	C6
	Level of exposure to domestic issues	C7
Selection of crew – medical and physical condition	Level of overall medical and physical condition	D1
Operation and procedures	Amount of daily time and/or scheduling pressure	E1
	Amount of commercial and/or organizational pressure	E2
	Amount of individual workload in the daily routine work	E3
	Amount of especially demanding planned situations (e.g. fire drills)	E4
	Amount of resources for maintenance, repair, retrofit, new equipment etc.	E5
Safety culture	Level of overall safety culture on board	F1
	Level of overall safety culture in company/land organization	F2
Company practice	Overall quality of working terms and conditions – long term (vacation, salary, promotion possibilities etc.)	G1
	Overall quality of working terms and conditions – daily basis (working hours, rest periods, working environment, accommodation etc.)	G2
Bridge discipline	Level to which extend bridge discipline is regulated by procedures and/or practice	H1
Design of equipment and means for navigation	Level of automation	I1
	Level of transparency	I2
HMI principles	Overall quality of interaction design and ergonomics	J1
User's manual	Availability of user manuals	K1
	Overall quality of user manuals	K2
Means for communication	Availability of means for communication	L1
	Overall quality of means for communication	L2
Procedures for communication	Level to which extend onboard communication is regulated by procedures and/or practice	M1