HØGSKOLEN I ÅLESUND

Aalesund University College

Bacheloroppgave

TN-303212 Hovedprosjekt

HSC-Training

Kandidatnummer: 1301, 1302, 1303, 1304

Totalt antall sider inkludert forsiden: 484

Innlevert Ålesund,

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Dato: 2015-12-15

Course description

Code: *Enter course code.*

Name: Hsc Training Standard course.

Length: 38 hrs divided on 5 days.

Language: English.

Grades: Pass / fail.

Exam: In order to complete the course *enter course code "*HSC Training standard course" the student must attend and participate in all lectures and simulator exercises. The student must show basic understanding in the importance of bridge/engine resource management and communication when piloting high speed crafts and basic knowledge in the special characteristics of high speed crafts.

Examiner: *Enter name and contact information of examiner.*

Constitution: The course is divided into class lectures, simulator exercises, common discussions and tasks according to time schedule. Simulator exercises will be 16 hours and lecture time 22 hours, included time for introduction and evaluation after completion of the course.

Learning objectives: After the course, the participant shall be able to demonstrate the competence given in the STCW convention part A (chapter 2 and 3) and the Norwegian Maritime Directory instruction regarding qualification and certificate of seagoing personnel, FOR-2011-12-22-1523, § 65.

After the course, the participant shall be able to conduct safe watch keeping and practice good leadership on the bridge.

The participant shall have competence to assess and maintain the seaworthiness of the vessel.

First revision: 2015-11-17

Current Revision: 2015-11-17

Course description

Code: *Enter course code.*

Name: Hsc Training Refresher course.

Length: 24 hrs divided on 3 days.

Language: English.

Grades: Pass / fail.

Exam: In order to complete the course *enter course code* “HSC Training refresher course” the student must attend all lectures and simulator exercises. The student must show basic understanding in the importance of bridge/engine resource management and communication when piloting high speed crafts and basic knowledge in the special characteristics of high speed crafts.

Examiner: *Enter name and contact information of examiner.*

Constitution: The course is divided into class lectures, simulator exercises, common discussions and tasks according to time schedule. Simulator exercises will be 9 hours and lecture time 15 hours, included time for introduction and evaluation after completion of the course.

Learning objectives: After the course, the participant shall be able to demonstrate the competence given in the STCW convention part A (chapter 2 and 3) and the Norwegian Maritime Directory instruction regarding qualification and certificate of seagoing personnel, FOR-2011-12-22-1523, § 65.

After the course, the participant shall be able to conduct safe watch keeping and practice good leadership on the bridge.

The participant shall have competence to assess and maintain the seaworthiness of the vessel.

First revision: 2015-11-17

Current Revision: 2015-11-17

Scedule Standard course

From	Day 1	Day 2	Day 3	Day 4	Day 5
08:00	Start-up	BRM	BRM	IAMSAR & SAR	Reflection BRM
09:00	Introduction	BRM	BRM	Damage	BRM
10:00	Regulations	BRM	Simulator	Simulator	BRM
11:00	Why HSC-course?	BRM	Simulator	Simulator	Emergencies
12:00	Lunch	Lunch	Lunch	Lunch	Lunch
13:00	Technical characteristics	Simulator	Simulator	Simulator	Repetition
14:00	Safe watchkeeping	Simulator	Simulator	Simulator	Repetition
15:00	Intro BRM/ERM	Simulator	Simulator	Simulator	Course evaluation
16:00	BRM	Simulator	Simulator	Simulator	Extra

Scedule Refresher course

From	Day 1	Day 2	Day 3
08:00	Start-up/Intro/ Regulations	BRM	BRM
09:00	Why HSC/ Technical	BRM	BRM
10:00	Safe Watchkeeping	BRM	Emergency, IAMSAR & SAR
11:00	Intro BRM	BRM	Equipment & Emergencies
12:00	Lunch	Lunch	Lunch
13:00	BRM	Simulator	Simulator
14:00	BRM	Simulator	Simulator
15:00	Simulator	Simulator	Simulator
16:00	Simulator	Simulator	Repetition

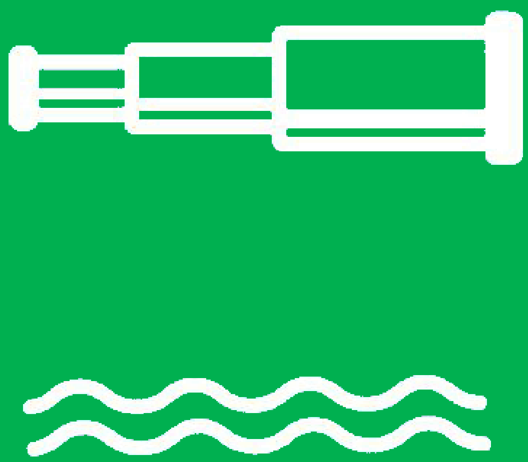
Course Material

HSC Training

MARITIME
OPERATIONS
Aalesund University College

"Revisjon"

Table of Contents



CHAPTER 1

INTRODUCTION

MARITIME
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1. Introduction

1.1 List of abbreviations

AB	**Ab**le seaman
ACV	**A**ir **C**ushion **V**ehicles
AIS	**A**utomatic **I**dentification **S**ystem
ARPA	**A**utomatic **R**adar **P**lotting **A**id
ATA	**A**utomatic **T**racking **A**id
BRM	**B**ridge **R**esource **M**anagement
CFS	**C**hronic **F**atigue **S**yndrome
COLREG	International Regulations for Preventing Collisions at Sea
CRM	**C**rew **R**esource **M**anagement
DP	**D**esignated **P**erson
DSC	**D**ynamically **S**upported **C**raft
DSC	**D**igital **S**elective **C**all
ECDIS	**E**lectronic **C**hart **D**isplay and **I**nformation **S**ystem
EI	**E**motional **I**ntelligence
ENC	**E**lectronic **N**avigational **C**harts
EPDF	**E**lectronic **P**osition **F**ixing **D**evice
EPIRB	**E**mergency **P**osition **I**ndicating **R**adio **B**eacon
ERM	**E**ngine **R**esource **M**anagement
ETA	**E**stimated **T**ime of **A**rrival
EQ	**E**motional **Q**uotient
FIRO	**F**undamental **I**nterpersonal **R**elations **O**rientation
GEOSAR	**Geo**stationary **O**rbiting **S**earch **A**nd **R**escue
GNSS	**G**lobal **N**avigation **S**atellite **S**ystem
GOC	**G**eneral **O**perators *Certificate*
GPS	**G**lobal **P**osition **S**ystem
HSC	**H**igh **S**peed **C**raft
HSC-Code	**H**igh **S**peed **C**raft Code
IAMSAR	**I**nternational **A**eronautical and **M**aritime **S**earch **a**nd **R**escue

ICAO	**I**nternational **C**ivil **A**viation **O**rganization
IMO	**I**nternational **M**aritime **O**rganization
ISM	**I**nternational **S**afety **M**anagement
IQ	**I**ntelligence **Q**uotient
JRCC	**J**oint **R**escue **C**o-ordination **C**enter
KISS	**K**eep **I**t **S**hort and **S**imple
LEOSAR	**L**ow-**E**arth **O**rbiting **S**earch **A**nd **R**escue
LUT	**L**ocal **U**ser **T**erminals
MCA	**M**aritime **C**oastguard **A**gency
MMSI	**M**aritime **M**obile **S**ervice **I**dentity
MOB	**M**an **O**ver **B**oard
NMD	**N**orwegian **M**aritime **D**irectory
OOW	**O**fficer **O**f the **W**atch
OSC	**O**n-**S**cene **C**oordinator
PA	**P**ublic **A**ddress
P&I	**P**rotection and **I**ndemnity
PS	**P**ort **S**ide
PTSD	**P**ost **T**raumatic **S**tress **D**isorder
PTW	**P**ermit **T**o **W**ork
RADAR	**RA**dio **D**etection **A**nd **R**anging
RCC	**R**escue **C**oordination **C**enter
ROC	**R**estricted **O**perators *Certificate*
RSC	**R**escue **S**ub **C**enters
SA	**S**ituational **A**wareness
SAR	**S**earch **A**nd **R**escue
SART	**S**earch **A**nd **R**escue **T**ransponder
SB	**S**tar**b**oard
SES	**S**urface-**E**ffect **S**hips
SITREP	**Sit**uation **rep**ort
SMC	**S**earch and Rescue **M**ission **C**oordinator
SMCP	**S**tandard **M**arine **C**ommunication **P**hrases
SMS	**S**afety **M**anagement **S**ystem
SOLAS	**S**afety **o**f **L**ife **a**t **S**ea
SOP	**S**tandard **O**perating **P**rocedures
SRR	**S**earch and **R**escue **R**egions
STCW	**S**tandards of **T**raining, **C**ertification and **W**atchkeeping

SWATH	**S**mall **W**ater-**A**rea **T**win-**H**ull
VHF	**V**ery **H**igh **F**requency
VTS	**V**essel **T**raffic **S**ervice
UHF	**U**ltra **H**igh **F**requency

1.2 Introduction

The coast of Norway is a beautiful scenery, if not the most beautiful in the world. It combines high mountains with fjords which is one of a kind. Although, this scenery impedes the construction of land based infrastructure which is why the high speed craft (HSC) vessels are of great importance to the Norwegians. HSC vessels give residents on both islands and distant places along the coast the possibility of traveling to towns with reasonable traveling times.

Fig 1-1 "H/F Vingtor" (stp-norway.com).

It all began in 1960s with the development of hydrofoil vessels. These vessels have wing shaped foils fitted on the hull, which lifts the hull from the water surface when sufficient speed is achieved. H/F Vingtor (Fig 1-1) was the first hydrofoil vessel taken into regular traffic in Norway. It was designed to carry 105 passengers at 35 knots, from Stavanger to Bergen – a route which took the vessel four hours to complete (STP Norway, 2013). As comparison, the conventional ferries required ten hours to complete the same route. The ports where the hydrofoil vessels were scheduled to arrive had to have special ramps for the vessels to be able to berth.

The Norwegian Maritime Directory (NMD) regulated the operation of hydrofoil vessels in an early stage. The vessels were only allowed to sail daytime and the weather couldn't be rough. In winter time the vessels were taken out of traffic. At this time, there were no requirements for the crew to undergo any special HSC training (Jensen, 2015).

Fig 1-2 “The Westamaran” (Wikimedia.org).

In the 1970s the shipyards of Norway began developing new HSC vessels of varying design. In 1971 a twin hull catamaran called the Westamaran (Fig 1-2) was launched and thereby started a new era in the HSC history. The Westamaran could sail in more adverse weather than the hydrofoils, could carry more passengers and did not require the ports to have specially designed ramps. Although, the first generation of Westamaran could only reach speeds of 20-30 knots. The development continued, and the second generation could reach speeds of 35-40 knots. There was still no special HSC training required to work onboard these vessels (Jensen, 2015).

The grounding of the Westamaran M/S Sleipner in 1976 was a wakeup call for the Norwegian authorities, and following this incident the focus on establishing HSC unique regulations were increased. But it wasn’t until 1991 when M/S Sea Cat, a Norwegian passenger catamaran, missed a turn and ran ashore at 34 knots that the Norwegian authorities established requirements for HSC training (Jensen, 2015). The requirement was that the deck officers should attend a HSC course and train onboard.

In 1992 the first ever HSC course was developed by the aviation company Braathens Safe, in cooperation with the NMD. The aviation industry was many steps ahead of the HSC industry when it came to the training of crew resource management (CRM). Following the Tenerife airport disaster in 1977, the aviation company United Airlines began providing cockpit resource management. This training focuses on communication and leadership by changing attitudes and behavior.

In the beginning of the 1990s a work group consisting of eight parties with interest in the maritime industry assembled, with the goal of converting the CRM training to a Bridge Resource Management (BRM) training course. This led to the first BRM course being held in 1993 (The Swedish Club, 2007).

After the Sleipner accident in 1999, the Norwegian requirements for HSC training was changed. The onboard training was replaced by simulator training during the HSC course. Also, the course was expanded to also cover the engineers and deck personnel (Jensen, 2015).

In the 2000s the cost of fuel became considerable more expensive. Along with the expansion of Express buses, this pushed the Norwegian HSC traffic into harsh competition. The service speed was reduced to meet the increased fuel price (Skipsrevyen, 2007). As of 2014, there are 65 catamaran vessels registered in Norway (Jensen, 2015). The most common use of catamarans is passenger transport, and the number of such vessels is continuously increasing. New vessels are developed and constructed to replace the old vessels.

1.3 Why do I need HSC Training?

High Speed Craft (HSC) is vessels operating at a high speed. At high speeds the time to detect, analyze and solve situations are reduced which increases the already high demands placed on the crew. Good management, communications, situational awareness and workload management is only a few of the requirements that the crew needs to be able to manage.

There are both national and international regulations which require the personnel on HSC vessels to have undergone HSC training. In Norway, the Norwegian maritime directory (NMD) requires that all of the crew working on passenger- or cargo vessels capable of reaching over 20 knots to attend a “Hurtigbåtkurs” and obtain a certificate. The international regulations (HSC Code) take both the vessels speed and displacement into account when assessing whether the vessel is to be acknowledged as a HSC or not.

In 2010 an amendment to the SOLAS convention (Safety of Life at Seas) was adopted, usually referred to as the Manila amendment. One of the changes was the obligatory BRM & ERM course. As a result, the course plan of the Hurtigbåtkurs was changed and the focus was directed towards BRM and ERM (Bridge Resource Management and Engine Room Resource Management).

This course will cover national and international rules and regulations, mission planning, safe navigational watch keeping, engine room watch keeping for safe operations, emergency procedures, crisis management, risk management and search and rescue organization

1.4 Learning objectives

HSC

After the course, the participant shall be able to demonstrate the competence given in the STCW convention part A (chapter 2 and 3) and the Norwegian Maritime Directory instruction regarding qualification and certificate of seagoing personnel, FOR-2011-12-22-1523, § 65.

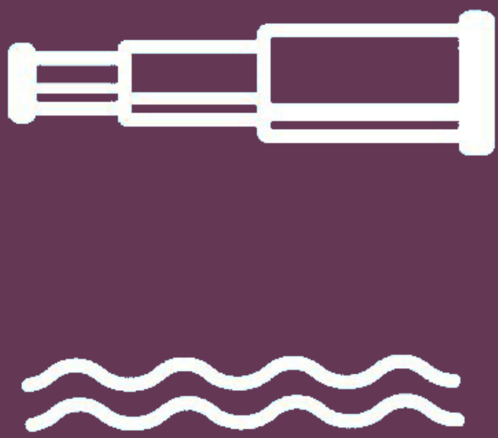
BRM

After the course, the participant shall be able to conduct safe watch keeping and practice good leadership on the bridge.

ERM

The participant shall have competence to assess and maintain the seaworthiness of the vessel.

1.5 Notes



CHAPTER 2

TECHNICAL CHARACTERISTICS AND WATCHKEEPING

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2. Technical characteristics and Watch keeping

2.1 Regulations

Shipping is a truly international industry and there are ships operating all over the world. A basic foundation for international shipping is to have common regulations. The International Maritime Organization (IMO) is a specialized agency of the United Nations. They are responsible for measures to improve the safety and security of international shipping and to prevent pollution from ships by developing international regulations.

It should be in every seaman's interest to know a little about how IMO works. "Safe, secure and efficient shipping on clean ocean" is the IMO slogan. IMO consists of 171 member states and three associate members', with headquarters in London. The organization coordinates the member countries proposals for changes in the regulations. The result of these corrective actions results in conventions, protocols, codes and recommendations.

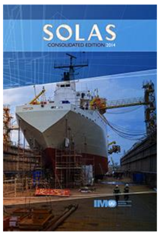
IMO's mission statement:

"The mission of the International Maritime Organization (IMO) as a United Nations specialized agency is to promote safe, secure, environmentally sound, efficient and sustainable shipping through cooperation. This will be accomplished by adopting the highest practicable standards of maritime safety and security, efficiency of navigation and prevention and control of pollution from ships, as well as through consideration of the related legal matters and effective implementation of IMO's instruments with a view to their universal and uniform application."

2.1.1 International regulations

SOLAS

CHAPTER X Safety measures for high-speed craft



Figur 2-1 SOLAS 2014 (imo.org).

International Convention for the Safety of Life at Sea, 1974 (Fig 2-1). This convention is about maritime safety and applies to most of the world's merchant fleets. The Convention entered into force in 1980 but has since been updated by a large number of protocols and amendments. Maritime safety is a broad concept and in SOLAS the various aspects of maritime safety are divided into separate chapters. SOLAS today contains a total of 13 chapters, each specifying minimum requirements with regard to maritime safety aspects.

Chapter X:

- Safety measures for high-speed craft.
- Special rules for high speed craft.
- Detailed rules for those vessels can be found in the HSC Code (High Speed Craft Code).

HSC-Code

International Code of Safety for High-Speed Craft (Fig 2-2).

Figur 2-2 HSC-Code 2000 (imo.org).

The international maritime organizations Code of Safety for Dynamically Supported Craft (DSC) came in 1978. Before this, there were no specific regulations for this type of ship. During 1980-1990s there was a rapid development for the HSC vessels. The fast development of HSC and their peculiarities in speed, design, routes, etc., caused IMO to adopt special regulations for this type of vessel. New materials and a new type of hull design made the vessels lighter, which had a significant increase in speed compared to the normal vessels at the time.

By the late 1980s the HSC code was in need of a revision, and as a result a new International Code of Safety for High Speed Craft was introduced during 1994 (HSC-code 94), with a recommended immediate implementation date of 1 January 1996 under the SOLAS convention. This code was inserted in Chapter X of SOLAS, which caused it to become a legal document. HSC Code 94 was further revised a few years later and is now known as the HSC Code 2000.

HSC code 2000 describes, among other things, construction and equipment requirements along with operational requirements. HSC Code 2000 is built according to guidelines corresponding to SOLAS, but is more focused towards the operating risks of vessels at high speed.

Chapter 18 of the HSC Code 2000 describes the competencies and training required by crew aboard a high-speed craft. It specifies what type of training is required for the different types of high-speed crafts.

STCW

International Convention on Standards of Traning, Certification and Watchkeeping for seafarers was adopted in 1978 and entered into force 1984 (Fig 2-3).

Figur 2-3 STCW-Code (imo.org).

The purpose of the convention is to get an international standards of training, certification and watchkeeping.The convention set out the minimum global standards of knowledge, understanding, experience and professional competence required by the States that are members of it.

In 1995 a thorugh revision was made, and the training requirements were moved to a separate code. This revised convention, STCW 95, entered into force in 1997. Another overall revision carried out in 2010 which came into force in 2012, the Manila admendments.

The main amendments in the Manila editon is following:

• Table A-II/1 Bridge resource management and Application of leadership and teamworking skills

• Table A-II/2 Use of leadership and managerial skill

• Table A-III/1 Engine-room resource management and Application of leadership and teamworking skills

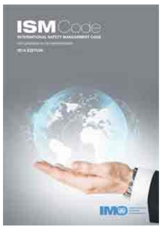
• Table A-III/2 Use of leadership and managerial skill

COLREG

International Regulations for Preventing Collisions at Sea 1972 (Fig 2-4). Rules at sea has existed far back in history, but it was first in 1972 COLREG came and was adopted by the IMO as a convention. In November 1981, IMO's Assembly adopted 55 amendments to the COLREG which became effective on June 1, 1983. The IMO also adopted 9 more amendments which became effective on November 19, 1989.

Figur 2-4 Colreg (imo.org).

ISM-Code



Figur 2-5 ISM-Code (imo.org).

The International Management Code for the Safe operation of ships and for Pollution Prevention (Fig 2-5). The purpose of the code are to ensure safety at sea, prevention of human injury or loss of life and avoidance of damage to the environment, in particular to the marine environment and property.

The Code establishes safety management objectives and requires a safety management system (SMS) to be established by the Company, which is defined as the ship owner or any person, such as the manager or bareboat charterer, who has assumed responsibility for operating the ship. The Company is required to establish and implement a policy for achieving these objectives. This includes providing the necessary resources and shore based support.

The code required procedures and they should be documented and compiled in a safety management manual. A copy of this manual should be kept on board. Every company is expected to have a person ashore how have direct access to the highest level of management. This person are normally called the company's designated person (DP).

2.1.2 National regulations

The international rules are minimum requirements, and each nation preserves its right to implement more strict national rules. In addition to the international regulations, the maritime authorities in some countries, including Norway, have introduced special requirements regarding the training and calls for special endorsement in the navigator license.

The figure 2-6 will explain the mathematical formula in HSC-code that is used to classify a vessel to a HSC or not. The equation compare the vessels maximum speed in meters per second with a constant (3.7) which is multiplied with the maximum displacement in cubic meters power to 0.1667 . If the Speed is equal or exceeding to the result it will be classified as a HSC. In the Norwegian regulations there are different regulations for ships longer or shorter than 24 meter, and the "high speed limit" is set to 20 knots. This means that vessels with passenger or cargo certificate capable of reaching over 20 knots are considered to be HSC.

$$v = 3.7 \times \nabla^{0.1667}$$
$$\nabla = \text{ } maximum\ displacement\ (m^3)$$
$$v = \text{ } service\ speed\ at\ maximum\ displacement\ (m/s)$$

Figur 2-6 Displays the equation for HSC (Stadelman Christopher).

In Norway must HSC comply with Norwegian Maritime Authoritys regulations, such as the following:

- FOR-2011-12-22-1523 Foreskrift om kvalikasjoner og sertifikater for sjøfolk
  § 65.Krav om sikkerhetskurs og kvalifikasjonsbevis for sjøfolk på hurtiggående fartøy
  § 66.Tilleggskrav til skipsfører og dekksoffiserer på hurtiggående fartøy
  Annex 1
- FOR-2009-06-18-666 Foreskrift om bemanning av norske skip
- FOR-1999-04-27-537 Foreskrift om vakthold på passasjer- og lasreskip
- FOR-1998-01-05-6 Forskrift om bygging mv av hurtiggående fartøy

  § 36.Operasjonskrav **Annex 2**

2.2 Technical characteristics

This chapter will give the reader a short description of the technological differences that distinguish a HSC from other vessels.

2.2.1 Hull, rudder and orientation

High-speed craft can come in many various designs, they can be classed in two main categories, displacement and air-supported type. Displacement type vessels include conventional monohull, catamaran, trimaran, Small Water-Area Twin-Hull (SWATH), and air lubricated hulls. The most common one in Norway is the catamaran and monohull type. Air supported crafts include Air Cushion Vehicles (ACV) Surface-Effect Ships (SES) and foil supported craft such as hydrofoils and jetfoils. Each type of vessel has its own unique characteristics, they all suffer from the common problem of limited payload and a sensitivity to wind and sea state.

Monohull

The term monohull cover a multitude of different craft designs. These vessels are characterized by slender narrow hulls, high speed and the ability to operate in varied weather conditions. While highly maneuverable, this type of vessel is sensitive to wind and sea motion unless stabilizers are utilized. . This design offers the most cargo carrying capacity per displaced ton, compared to the other HSC designs. Most conventional monohulls operate on the comparatively lower spectrum of speed. Monohull craft means any craft which is not a multihull craft. Definition of multihull craft is a craft which in any normally achievable operating trim or heel angle, has a rigid hull structure which penetrates the surface of the sea over more than one discrete area.

Catamaran

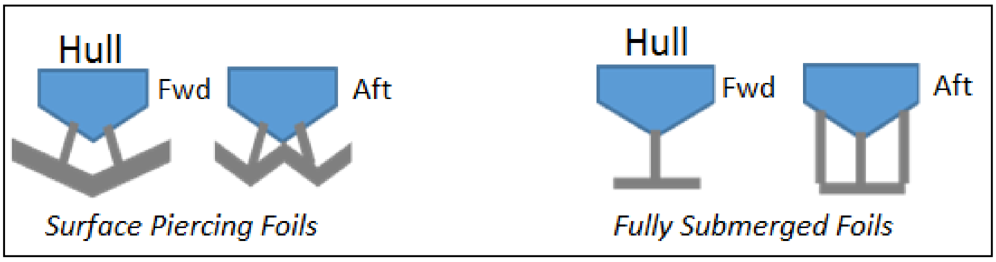
Catamaran is a surface vessel which consists of two slender and separated hulls, with a bridging structure that carries the passenger and cargo. The hulls provide buoyancy and housing of the propulsion machinery, whilst the bridging structure provides the transverse strength of the craft. This kind of vessel has been developed to use inherent advantages which are large deck area, reduced hull resistance, increased safety levels and attractive layout possibilities resulting from the wide beam. Speeds achieved by catamarans vary from very slow, 20 knots or less, to service speeds in excess of 50 knots. The most common propulsion system on catamaran is to have a set up of two water jet units.

Hydrofoil

Hydrofoil craft use a foil system to lift the hull out of sea. The hull is normally clear of the sea at full speed in calm weather and the reduced drag means high speeds can be attained for minimal engine power. Hydrofoil had some operational technical issues, and they were also little economic operational. Few new hydrofoil vessels are built today, mainly because the passenger comfort is bad compared to catamaran vessels. Crafts which are partially supported by hydrofoils in the non-displacement mode but the hull of which remains partially immersed e.g. foil-cats are not hydrofoil craft but either monohulls or multihulls according to the hull configuration.

There are two different foil configurations, surface piercing foil and fully submerged foils. Surface piercing is provided by two sets of fixed V and W shaped foils. Fully submerged foils the foils taking the shape of an inverted T at the bow with a more complex W structure at the stern (Fig 2-7). Fully submerged system relies entirely on the flap systems to maintain hull height above the sea and stability.

Hydrofoils use most engine power for take-off, and when reaching non-displacement mode the fuel cunsumtion will be reduced. Operational speed is between 30 and 40 knots, both conventional propeller and jet propulsion be found on hydrofoils.



Figur 2-7 Typical Foil configurations (Stadelman Christopher).

2.2.2 Machine and propulsion

For marine vessels there are two main approaches for achieving propulsion. The first method is conventional propeller propulsion. The basic principle of conventional propulsion is to have an engine, transmission and propeller which creates thrust. In order to control the thrust a rudder is needed. The engine is connected to the propeller by a shaft, as illustrated in figure 2-8. There's two different types of propellers, either fixed- or controllable pitch.

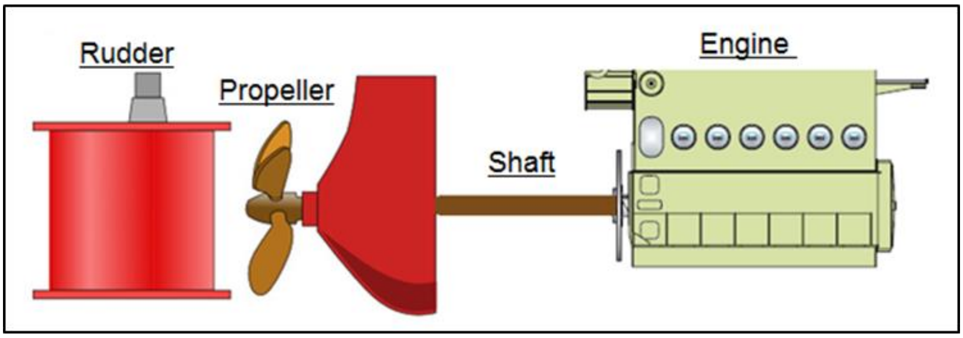


Figure 2-8 Setup of conventional propulsion (Adopted from Weber Reto).

Fixed pitch propeller

Fixed pitch propeller is a propeller where the propeller blades are permanently fitted with predetermined angles. To increase thrust, the engines revolutions are increased. In order to go astern, the direction of the engine needs to be reversed.

Controllable pitch propeller

The pitch and thrust are controlled by rotating the blades about their length axis, with a hydraulic servomotor enclosed in the propeller boss. The engine works in a constant direction, astern movements are achieved by reversing the pitch of the propeller rather than its direction of rotation. The control systems controls the shafts revolution and pitch or just pitch alone at constant revolution.

Setup on a conventional propulsion vessel

The conventional propulsion is often one engine with one propeller which we call the single set-up. The twin set-up uses two or four engines with twin propellers and rudders.

In order to make the conventional propulsion vessel more maneuverable, a tunnel thruster is installed. This is a propeller inside a tunnel that goes through the hull and produces a fixed-direction transverse force.

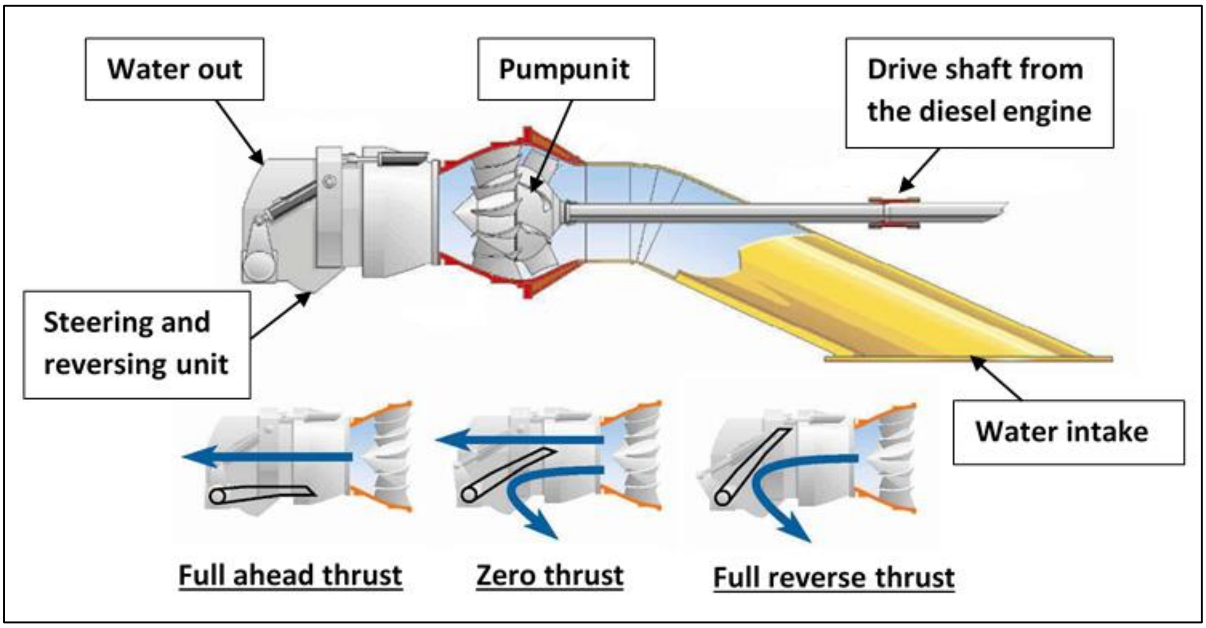
The second way of achieving thrust is by jet drive. Waterjets are very popular with every size of today’s HSC, the most common is to have twin units installed. Water jet propulsion is more effective than propeller propulsion at speed's exceeding 30 knots, when at propeller blades appears great cavity. There are several reasons for choosing waterjets instead of conventional propeller systems, which are listed below:

- Protected propulsion with high efficiency, good maneuverability
- Shallow draft design, when no rudder or propeller have to stand down during the vessel bottom
- Smooth engine load
- Less vibration and lower waterborne noise

By creating a jet stream of a fluid or gas, the jet stream will produce a forward motion in the opposite direction of the jet stream. The function of the water jet can be described as a pump unit squirting water out a nozzle in the opposite direction of the desired motion. By redirecting the jet stream maneuverability of the vessel is achieved.

There are several makes and models of different water jets but they all share the same basic function: accelerating water through a nozzle creating a jet stream of water propelling the vessel.

Figur 2-9 describe roughly a water jet system, by divided it into three stage: the Inlet, the pump unit and the outlet area. The jet takes water from the inlet that is located beneath the water surface. The pump unit is the mechanism that draws water via the inlet, consisting of an impeller located inside the impeller housing. The impeller is the rotating element of the jet and is the part that connects and is powered by the engine. The water jets can be powered through either diesel engines or gas turbines. The water drawn from the inlet reaches the pump and is accelerated when it passes the impeller and forced backwards entering the outlet area.

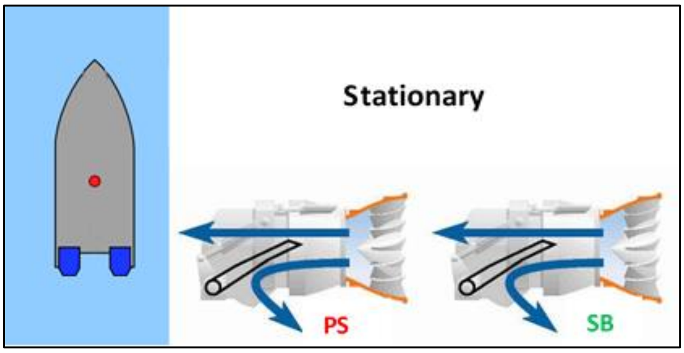


Figur 2-9 Overview of the water jet and the main parts it consists of (adopted from Weber Reto).

Rudders are not fitted since the force of the water leaving the water jet nozzle is too great for a conventional rudder to withstand. Instead of a rudder, there's a steering unit installed in the outlet area which makes the vessel maneuverable. The steering unit provides maneuverability of the vessel by change direction of the jet stream. This is achieved by adding a box outside the nozzle that the jet stream can pass through. The box rotates around its point of attachment and redirects the jet stream in the desired direction. By doing this the thrust will push the boat and steering is achieved, usually ± 30 degrees.

The water jet is equipped with an integrated reversing mechanism attached to the steering unit. Reversing thrust is done the same way as for achieving steering, by change the direction of the jet stream. The direction of thrust is always in the opposite direction of the flow of the jet stream. Achieving thrust in the reversing direction is done by redirecting the jet stream so it points towards the front of the vessel.

Neutral thrust, as shown in figure 2-10, can be created by splitting the jet stream in two parts. One part still pointing in the backwards direction and the other part pointing to the front, the result is equal thrust in opposite directions and they cancel each other out.



Figur 2-10 By splitting the jet stream in two parts makes the ship to be stationary (Adopted from Wikimedia.org).

2.2.3 Maneuvering

The high speed creates a large kinetic energy, and the time for decision making at unexpected situations is very short. The large forces that are available for propulsion also gives the vessels control characteristics. Especially at high speed, the contol is very good. Stopping distances in so called "crash stop" are often, even for a large HSC, only two to three vessel lengths. The decceleration can be very strong at an emergency maneuver.

With proper planning, active prediction of the surrounding environment and a situation adapted speed the risk for emergency maneuvers and ”crash stops” are minimized.

Situations where hard maneuvers are required will emerge at some time. With a well trained crew and fast internal communications the potential risk of injury of passengers and crew members is reduced.

Maneuvering characteristics at low speeds are less favorable because the lower speed usually allows smaller forces to the action of the control arrangements and often there is no real keel on this type of vessel. The low draft in relation to the large superstructures involves a significant risk of disturbing drift at low speeds.

The combination with two water jet units results in excellent maneuvering capacity. It provides the user with several various opportunities to get thrust force in many different combinations. If there are more than two water jet units, is the most common that the middle one are only used for propulsion forward at high speed. So they aren’t fitted with a bucket and nozzle for maneuvering.

2.2.4 Navigations aid

The navigational equipment and its installation shall be to the satisfaction of the Administration. It affords therefore administration for Norway, the Norwegian Maritime Directorate, and the right to make a discretionary assessment of navigation equipment sufficiency. The vessel must have a magnetic compass, a speed and distance measuring systems, depth measuring equipment and radar equipment operating in the X band (3 cm). If the vessel can take more than 100 passengers, it must also have a gyro compass. Radar facility should be suitable for the vessel's intended speed and motion characteristics and the environmental conditions that typically occur in which the vessel operates. Vessels more than 500 gross tonnage, or that can carry more than 450 passengers, should have two radars. Gps must also be on board, and if there are reliable systems like DGPS coverage in the area so should be such a receiver and use it.

RADAR

RAdio Detection And Ranging are essential aid for navigation and collision avoidance. HSC should have at least one azimuth stabilized radar which operating on 9GHz (X-Band). If the vessel is of 500 gross tonnage and upwards, or craft certified to carry more than 450 passengers, should also be equipped whit a second radar either 9 GHz or 3 GHz (S-band). At least one radar shall be provided with facilities for an Automatic Radar Plotting Aid (ARPA) or Automatic Tracking Aid (ATA) suitable for the motion and speed of the craft.

The radar equipment should provide an indication, in relation to the craft, of the position of other surface craft, obstructions, buoys, shorelines and navigational marks, in a manner which will assist in navigation in avoiding collision. The scan rate should not be less than 40 revolutions per minute. The equipment should operate satisfactorily in relative wind speeds of up to 100 knots.

Adequate communication facilities shall be provided between the radar observer and the person in immediate charge of the craft. Each radar installation provided shall be suitable for the intended craft speed, motion characteristics and commonly encountered environmental conditions. The radar observer must be aware of which display is the master and the effects of its range and pulse selection on the slave display.

ECDIS

Electronic Chart Display and Information System is a computer-based navigation system and can be used as an alternative to paper navigation charts, the system complies with IMO regulations. Integrating a variety of real-time information, it is an automated decision aid capable of continuously determining a vessel’s position in relation to land, charted objects, navigation aids and unseen hazards. An ECDIS includes electronic navigational charts (ENC) and integrates position information from the Global Positioning System (GPS) and other navigational sensors, such as radar and AIS. It may also display additional navigation-related information, such as sailing directions.

AIS

Automatic Identification System provides static and voyage related ship data of a SOLAS vessel periodically. Continuously transmits ship's own data to other vessels and VTS stations and also continuously receives data of other vessels and VTS stations. The reporting interval is minimum 6 minutes.

• User ID (MMSI)
• IMO number
• Call sign
• Ship name
• Type of ship and hazardous cargo category
• Overall dimension
• Maximum present static draught
• Destination and ETA
• Type of EPFD

Bridge procedures

• Check own ship data accuracy, including static, voyage-related, and dynamic data

• Procedures for update of voyage and navigational status data

• Caution concerning the making of critical decisions based solely on AIS data

2.3 Safe watchkeeping

2.3.1 Watch keeping in generally

The master of the ship shall ensure that arrangements for watchkeeping are so adapted that safe navigational watch and engine watch is maintained. General principles of safe manning should be used to establish the levels of manning that are appropriate to any ship.

HSC vessel have relatively short length of voyages, there is unlikely to be more than one complete crew on board at one time. The master will often be at the helm with a second deck officer monitoring the radar and any other navigation equipment, the master will have a radar display too (Navigator-conavigator-system). Engineer are often part of the manning, not because they are essential as today many system are fully automated, but because of workload in the wheelhouse which does not allow the master and deck officer any spare time to devote to the machinery. Lookouts should be called from the cabin crew during times of restricted visibility.

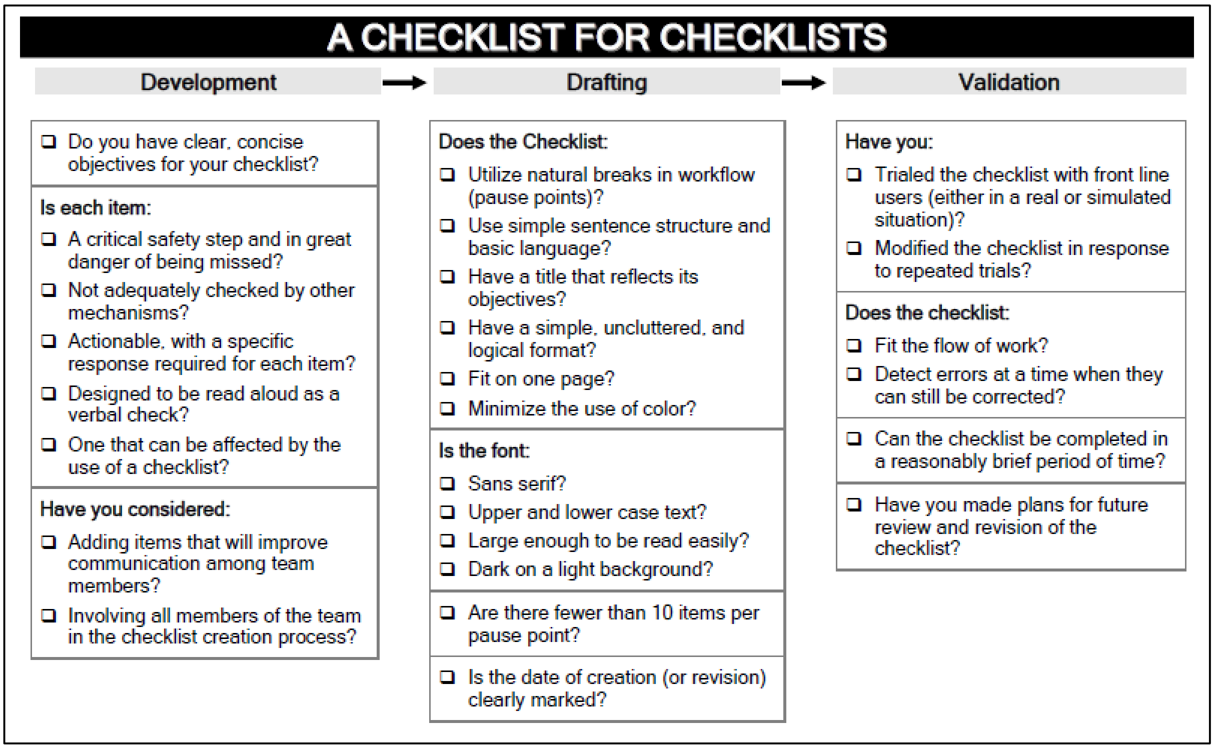
Effective bridge team organization will manage all of the resources that are available and promote good teamwork and communication. Efficient bridge resource and team management should eliminate the risk that an error made by one person results in a dangerous situation.

Composition of the watch should always be appropriately adapted to the prevailing circumstances and conditions.

- The bridge should never be left unmanned
- Weather conditions, visibility and and if there are daylight or darkness
- Proximity to the navigational hazards which may require the officer of the watch to handle additional navigational information
- The high speed result to large kinetic energy and the time for decision-making in unexpected situations will be very short.
- The OOW may not hand over the watch to the relieving officer if there is reason to suspect that the relieving officer is not fit to perform their duties. The master must then be informed.

2.3.2 Checklists

Checklists are of great value to ensure the required procedures are carried out and that nothing is missed. Checklists give confidence that all is well, e.g. prior to departure a properly conducted checklist will verify all the equipment is working and that all necessary equipment is switched on and adjusted to the correct settings. Prior to arrival, a checklist should, amongst other things, verify that sufficient reverse power is available which is a very important check to make. The figure, 2-11, below is a good tool when create a checklist. Chapter 4.3.1 will describe more about checklists.



A CHECKLIST FOR CHECKLISTS

Development → Drafting → Validation

Development

- ❑ Do you have clear, concise objectives for your checklist?

Is each item:
- ❑ A critical safety step and in great danger of being missed?
- ❑ Not adequately checked by other mechanisms?
- ❑ Actionable, with a specific response required for each item?
- ❑ Designed to be read aloud as a verbal check?
- ❑ One that can be affected by the use of a checklist?

Have you considered:
- ❑ Adding items that will improve communication among team members?
- ❑ Involving all members of the team in the checklist creation process?

Drafting

Does the Checklist:
- ❑ Utilize natural breaks in workflow (pause points)?
- ❑ Use simple sentence structure and basic language?
- ❑ Have a title that reflects its objectives?
- ❑ Have a simple, uncluttered, and logical format?
- ❑ Fit on one page?
- ❑ Minimize the use of color?

Is the font:
- ❑ Sans serif?
- ❑ Upper and lower case text?
- ❑ Large enough to be read easily?
- ❑ Dark on a light background?

- ❑ Are there fewer than 10 items per pause point?

- ❑ Is the date of creation (or revision) clearly marked?

Validation

Have you:
- ❑ Trialed the checklist with front line users (either in a real or simulated situation)?
- ❑ Modified the checklist in response to repeated trials?

Does the checklist:
- ❑ Fit the flow of work?
- ❑ Detect errors at a time when they can still be corrected?

- ❑ Can the checklist be completed in a reasonably brief period of time?

- ❑ Have you made plans for future review and revision of the checklist?

Figur 2-11 Description of how to create a checklist (projectcheck.org).

2.3.3 Roles and responsibilities

The bridge team may vary in composition, depending on the navigational situation and the personell resources available. On a HSC vessel it is common that the bridge team consists of master, mate, chief engineer and if necessary also a lookout. There are always at least two on the bridge at the same time.

Cross training between deck and engineer officers is very important for HSC. Because the minimum of crew on board and this will often mean only one engineer, it is essential that deck officers have a good understanding of the engine setup on the craft. If the engineer would become incapacitated by some illness, or if the workload would overwhelm him or her the deck officer may have to take action to keep the craft safe. More than one crew member should be trained to perform all essential operational tasks in both normal and emergency situations.

2.3.4 Internal and external communications

Internal communication

- Navigator — Co-Navigator

These system require a double-watch keeping set up with a minimum of two bridge officers on watch at all times when the ship is underway. The Navigator, who is conning the ship, is required to communicate intentions and orders to the Co-Navigator. The task of the Co-Navigator is to monitor, cross-check and support the Navigator. This means that no course changes or engine orders will be carried out without an agreement and confirmation from the Co-Navigator. In addition, each officer, regardless of rank, is empowered to speak up should he or she have a question or concern.

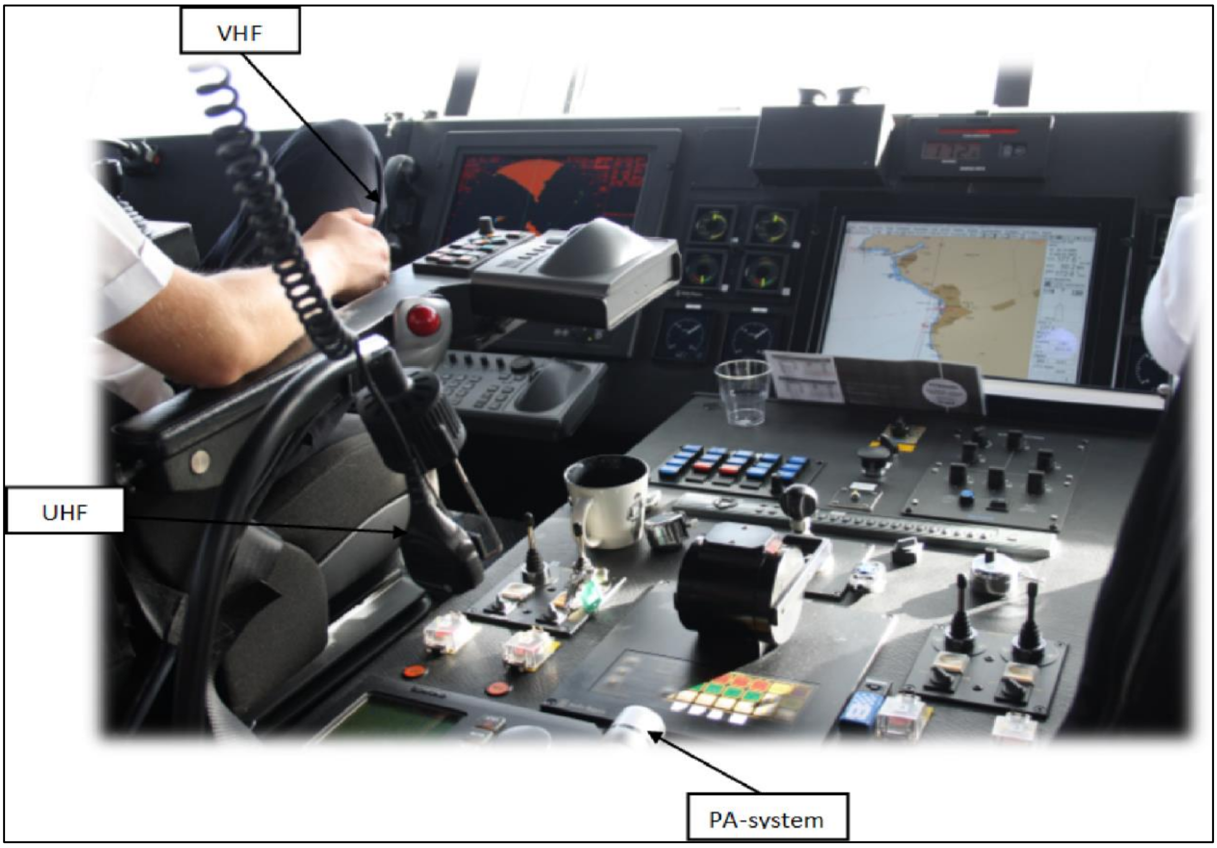
The Navigator have responsible for conning, navigating the ship following the passage plan, manages VHF communications with other ships and collision avoidance practices. Also ensures that the bridge team (including the Pilot) is aware of planned actions and intentions by "Thinking Aloud." The Co-Navigators duty is to monitor and cross-check the actions of the Navigator by supporting, challenging and recommending actions to the Navigator. It's also important to remember to keep the passengers informed. Examples of information may be such as which port is the next or if any delayments has arisen.

External communication

The STCW Code requires the OOW to have knowledge of written and spoken English that is adequate to understand charts, nautical publications, meteorological information and messages concerning the ship's safety and operations, and adequate to communicate with other ships and coast stations. In 2001, the IMO passed a resolution recommending that all seafarers and those involved in maritime training use a common set of English language phrases, called the Standard Marine Communication Phrases, SMCP.

Navigational and safety communications from ship to shore and vice versa, ship to ship, and on board ships must be precise, simple and clear to avoid confusion and error. Many international merchant vessels nowadays have crews speaking several different languages. This can cause communication problems and misunderstandings, leading to hazardous situations for the vessel, the people on board and the environment.

The external communication "Ship to Ship" and "Ship to Shore" is done by the use of VHF radio. The internal crew communication, officer to crew, go by UHF and the information out to passenger goes by the PA-system (Fig 2-12).



Figur 2-12 The location of communication equipment on bridge (Åfeldt Jimmy).

2.3.5 Maintain a safe bridge watch

Bridge routines are a vital ingredient to successful watchkeeping on HSC. They enhance the ability of the crew to work together as a team. The routines should consist of communication procedures which are allied to the appropriate voyage and navigation routines for the particular craft and route.

Duties of watch keeping officers: In order to maintain a safe watch, the following are among your primary duties:

- Your watch keeping duties are to include the following
- Maintaining a proper lookout
- General surveillance of the ship
- Collision avoidance in compliance with COLREGs
- Recording bridge activities
- Making frequent periodic checks on the navigational aids and bridge equipment's

Preparation of a passage plan

Passage plan should be carried out for all the routes the HSC is likely to use, including diversions to ports of refuge. All the passage information should be memorized as far as possible, since the speed of the HSC is so great it's unlikely there will be sufficient time available during the voyage to refer to charts or other general sources of information. The intended voyage shall be planned in advance, with all relevant information taken into account. Before the trip begins, the chief engineer should meet with the ships master to decide on the need for fuel, water, lubricants, chemicals, supplies and other spare parts, tools and supplies and that may be needed for the intended voyage.

Collision prevention

As for all other vessels applies even for HSC the COLREG. HSC vessels should pay extra attention rule 6**,** Safe speed. The rule says that every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions. Just as conventional vessels must always proceed at a safe speed, so must HSCs. It is quite difficult for other to judge the speed of an approaching HSC and for them to decide on the best action to avoid a close situation. Another difficulty for HSC is other HSC, since the time for a possible avoidance maneuver can be very short. The consequences of a grounding or collision with a HSC can be very serious.

Operate radio

Radio communications is important to maintain a safe bridge watch. The operator should have a general operators certificate (GOC), or at least restricted operators certificate (ROC) depending of which area the vessel operate in. Radio operators are responsible for maintaining a continuous radio watch on appropriate frequencies during their periods of duty.

Lookout

Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full assessment of the situation and of the risk of collision.

It's important that the bridge crew is adapted to the characteristics of the HSC, as the navigation requires more attention than navigation onboard a slower non HSC vessel. The lookout should be well trained in his or her duty to avoid colllision. Targets that can be difficult to discover, such as a sailboat, rowboat, windsurfer and various floating objects which may be hard to see.

VTS procedures

The purpose of VTS today is to provide active monitoring, information service, traffic organization, and navigational assistance for vessels in confined and busy waters.

A clear understanding of the distinction between different categories and services of VTS is fundamental:

- Information service
- Navigation assistance service
- Traffic organization service

When talking with a VTS is important of using standard marine communication phrases, including message markers. There are eight types of communication messages that are frequently used in VTS.

These are:

- "INFORMATION. MV Nonam will overtake to the West of you."
- "WARNING. Obstruction in the fairway."
- "ADVICE. (Advise you) stand by on VHF Channel six nine."
- "INSTRUCTION. Do not cross the fairway."
- "QUESTION. (What is) your present maximum draft?"
- "ANSWER. My present maximum draft is zero seven metres."
- "REQUEST. I require two tugs."
- "INTENTION. I will reduce my speed."

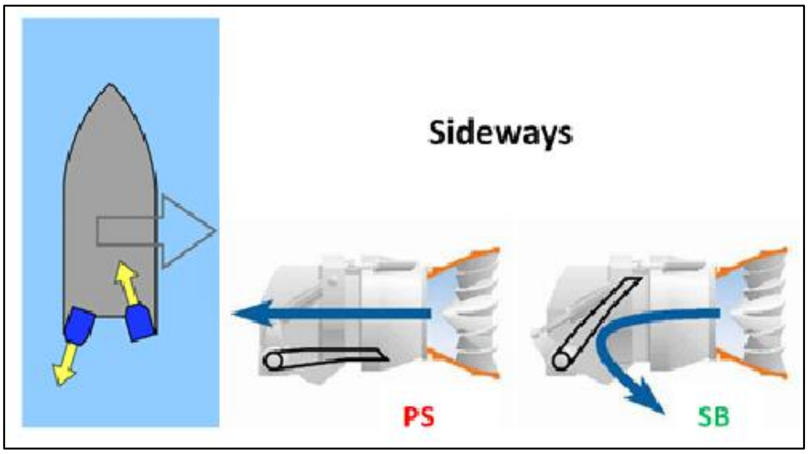
Relation to pilot

In dangerous or congested waters, such as harbors, piloting may be compulsory. As the pilot comes onboard, he or she becomes an important member of the bridge team. A preliminary plan that covers pilotage waters and the roles of the bridge team personnel should be prepared. The responsibility for the safety of the vessel remains with the master or officer of the watch, even when pilot is onboard. It's important to remember that the pilot is only an advisor. However, piloting is not especially common with HSC vessels, they call at only few ports and the crew has strong local knowledge and experience of navigating in those ports. Most of these ferries are issued with a pilotage exemption certificate, which relieves them of the need to take a pilot on board.

Maneuvering

The OOW must know the vessel's maneuvering characteristics and the stopping distance and realize that other ships may have different handling characteristics.

Since the waterjet impeller is fully enclosed in the pump-drive housing, no propeller side force is generated. The only way to move the stern to port or starboard is by using the directed thrust. One unique feature of HSC with twin unit waterjet is the ability to make the vessel move sideways, as the figure 2-13 below shows.



Figur 2-83 How to move the vessel sideways with twin jet units (Adopted from Wikimedia.org).

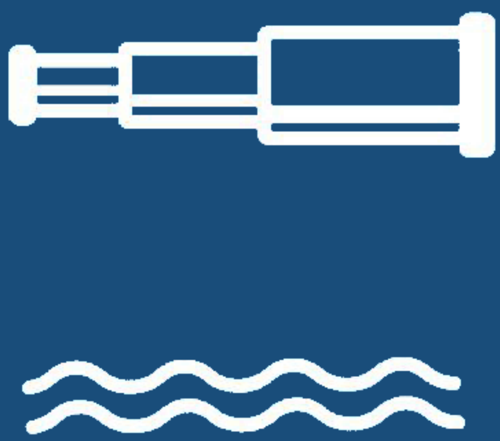
2.3.6 Maintain safe engine watch

Watchkeeping engineer officers, as defined in the STCW Code, should be available for immediate action required in the engine rooms and, when required, physically present in the engine room. The person in charge of the engine room watch is the chief engineer deputy and his or her main role is to always ensure that the operation and maintenance of machineries that affect the safety of the ship is done safely and efficiently. He or she is responsible for the necessary inspection, operation and testing of all machineries and equipment in engine watch responsibility. On HSC is it common that chief engineer is stationed on the bridge (Fig 2-14). During manuevring, a special attention needs to be focused on the state of the vessels engines. When berthing or unberthing several changes to thrust and load on the engines occur in a relative short period of time. Especially if the weather conditions are close to the working limits the engines needs to be working properly and any potential deficiencys spotted early so the navigating officer can take action to reduce the load.

All engines need fuel and bunkering is one of the engineers daily duties. It is good practice to inform the rest of the crew when bunkering is conducted. The risk of fire is increased during this operation, and requires extra attention. Smoking close to bunker connections and tank ventings is prohibited and a good idea is to have a fire extinguisher close at hand. If something would happen the operation needs to be stopped. Think about where the emergency stop should be placed so that the engineer doesn't have to run through a shower of fuel in order to stop the pumping.

Figur 2-14 Chief engineers place on bridge (Åfeldt Jimmy).

2.4 Notes



CHAPTER 3

BRM / ERM

MARITIME
OPERATIONS
Aalesund University College

3. BRM / ERM

What is BRM and why do we need BRM?

Bridge Resource Management is an expression for how we can develop our existing knowledge of human and technical resources and operational possibilities as well as limitations. Bridge Resource Management is of current interest due to human error and the fast developing technique which human struggles to keep up with, along with further globalization. The shipping world is one of the most international businesses and cultural understanding is essential.

3.1 Situational Awareness

3.1.1 Situational awareness

Situational Awareness provides "the primary basis for subsequent decision making and performance in the operation of complex, dynamic systems..." (Endsley, 1995). At its lowest level the operator needs to perceive relevant information from the environment, system, self, etc., next integrate the data in conjunction with task goals, and, at its highest level, predict future events and system states based on this understanding.

Even though most of the situational awareness research has been conducted based on aviator pilots and the aviator cockpit, it is very well applicable to other areas. An aviator cockpit is in many ways similar to a ship's bridge and perhaps even more to a bridge on a high-speed craft. Situational awareness can be divided into three levels, perception, comprehension and projection.

The founder of this theory is Mica Endsley (1995), who is a widely accepted engineer and Chief Scientist of the United States Air Force, has done a comprehensive study on situational awareness.

In order to deal with the constant bombardment on our senses and the huge amount of information constantly forced upon us, it seem like we develop a priority filter based on our current needs. Due to Maslow's extensive study on the human needs, we perform inadequately if we have not satisfied our basic needs such as hunger, thirst and sleep. If we ignore these needs they will soon demand our attention and completely dominate our behavior. Hence we will not pay attention to the surrounding with same vigilance, (A.H. Maslow, 1943).

If a loud alarm sets off it will interrupt our thoughts and trigger an emotion in our brain. This will awaken us and the brain will act fast and react to what ever set off the alarm. An alarm which sets off too often will on the other hand be filtered out, since it will no longer trigger that emotion in our brain to act on instinct.

The interesting part of this is how we can use situational awareness (SA) to actually improve the safe navigation of ships, including crew and passengers well-being, only by being aware of our awareness.

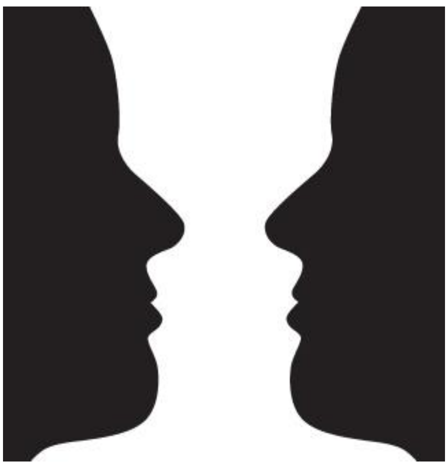
From the very start you were learned to navigate, communicate and sail from A to B. This means that you must know your vessels position, other vessel in the vicinity and the people onboard. To achieve this information you need to monitor the information that is displayed to you and evaluate it and predict the close future.

To be able do this you have to focus on the information that is given to you, both in detail and an overview. Think of it as a flashlight, the flash can be focused close to something and be strong, or further away to get weaker flash with an overview. It is hard to do both.

The three levels are: perception, comprehension and projection. Simply described as receive the information, evaluate it and foresee what consequences it will cause.

Level 1: Perception

This is the lowest level of situational awareness. The navigator perceives information from different channels on the bridge. The displays of the radar, ECDIS and GPS etc provides us with a continous stream of information, both information we need but also information that is irrelevant for the navigation. Not only the screens provide us with information, also radio, conversations on the bridge and the visual world outside the windows are vital for situational awareness.



What do you see in the picture?

The cup or two faces?

The optical illusion shows how perception works. We percept same picture different.

Figure 3-1 Optical illusion (NorthSeattle.edu).

In this level the navigator does not interpret the information. The most common failures are lack of focus, misperception of data, memory failure and distractions.

How we perceive situations is very individual. One situation can be interpreted in several differing point of views depending on the operator and the operators' personal experiences. This is explained with visual illusions, like the one in figure 3-1. One picture can show more than one meaning.

Level 2: Comprehension

Next level of situational awareness is about evaluation and comprehension. The navigator builds a mental model of the situation based on the monitored information. The information is evaluated and weighted in comparison to the surroundings.

Basically level 2 is a model we can understand and evaluate from what we see and hear. Failure can be consequential faults from the first level of perception, some data might be misunderstood or misperceived. What needs to be considered is that of one situation can be interpreted totally different by two navigators. It all depends on experience and personality. Two navigators sitting next to each other on the bridge, or two AB's standing in a situation on deck, can experience the situation totally different depending on what they've experienced before. Therefore the comprehension will differ. It may be differences in early education, or cultural differences that make each persons interpretation unique.

Level 3: Projection

When the navigator is aware of the situation, he/she may be able to achieve a projection of what is going to happen in the near future. The accuracy of the prediction is highly depending on how well the perception and comprehension were monitored and evaluated. Most commonly the prediction follows the laws of physics and nothing unexpected occurs, and the

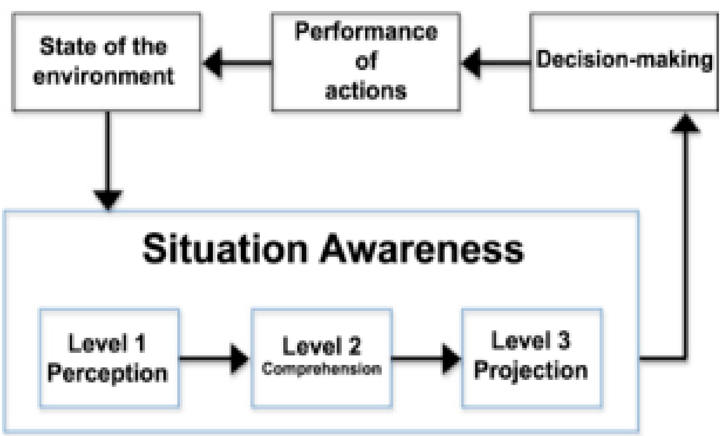


Figure 3-2 Endsleys model of SA (NIST.gov).

accuracy is high. The projection level is simply a skill to see ahead of the situation and maybe being able to avoid unnecessary situations.

Most of the time the crewmember does not actively process these three levels (Fig 3-2). It happens continuously over time, more or less accurate, depending on how aware we are of the situation.

3.1.2 Distractions

The distractions we usually think of when we imagine something that could reduce our situational awareness are probably stress, noise, alarms and fatigue. We all have, or will experience these at some time

There are many distractions around us all the time. How we react or control them are individual and we can learn to handle a lot of it.

Recurring disturbances such as daily noise or an ordinary conversations is not usually a distraction, our mind filters out superfluous information. Although if there is an ongoing conversation at the same time a lot of noise, it may be enough to take focus off the task. Some people can handle a lot of disturbances, while others need complete focus during work.

Stress

There are numerous of research that has been done on stress, how stress affects us positive and negative, psychologically and physically. The results have shown that a right amount of stress in short periods improves the performance and maintains awareness at a high level, (Geis, 2012).

Positive effects are that the mind is alert and pay attention to the surroundings and we become more actively searching for information that could help us comprehend, reflect and evaluate the upcoming situation. A certain amount of stress increases vigilance to the environment. Athough if we are exposed for a longer time to a relatively high level of stress, our body reacts with neglecting information to lower the stress. Meaning the situational awareness is in a risk zone to be reduced.

Negative effects of stress are individual, both how we react and where our stress level is at maximum limit.

When we are exposed to stress for a long time our body is slowly torn apart. We feel tired and unmotivated andanxiousness grows before work. The immune system is affected in a negative way and our mood is affected and is it common to be irritable and edgy towards the other crewmembers.

If you are exposed to a stressful environment beyond your limit you will stop to function. You can no longer receive all necessary information, nevertheless comprehend it and use it. How you react is very different, some become paralyzed, some makes hasty and bad decisions. You are no longer suitable to perform a job.

Onboard a vessel, it's of great importance to know your maximum stress level. You should also be observant of your crewmembers, as some people don't realize when they have met their upper stress level causing them to become safety liability.

The relationship between alertness and stress can be visualized as a diagram (fig 3-3) where you see the difference from being almost not active at all until you are at the most alert and aware. Then it does not require a lot to reach the stress limit. The curve is an illustration of how stress of a certain amount can increase our alertness. When the stresslevel reaches a limit of where we no longer can handle the situation it will have the opposite effect with a rather quick result. It is difficult to put any values at the axis, eg time or pulse, since it is all very individual.

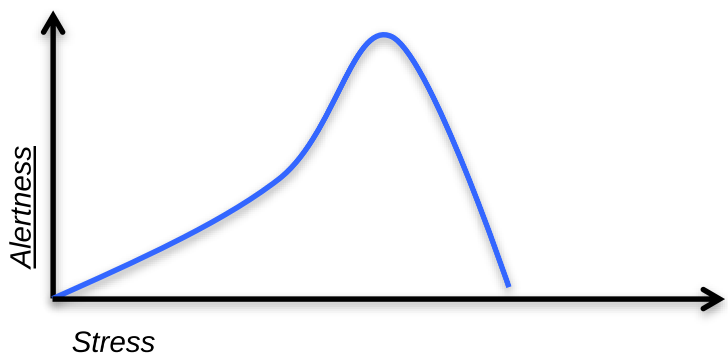


Figure 3-3 Stress related to alertness (adopted from psygrammer.com).

Fatigue

Fatigue is something everyone struggles with from time to time. Either it is just the daily shape or it is a more chronic form of fatigue. It can be both mentally or physically tiredness that affects us in our daily work. Along with a job at sea comes bad weather, engines causing noise and vibrations etc. and the watch keeping may become irregularly due to unexpected events and due to all this the sleep suffers. Suddenly it might be days or even weeks since you had more than just a couple of hours of uninterrupted sleep.

Following abilbites are most likely to be afftected when due to lack of rest:

- Concentration
- Decision making
- Patience
- Judgment
- Tolerance
- Critical thinking

Being tired affects us maybe more than we think. The subjects mentioned above are only a few areas where tiredness reduces our ability to maintain a safe watch. It can be seen as a chain reaction. The lack of concentration may lead to loss of information and the decisions based on the incomplete information will be uncertain.

Imagine a tired AB on deck who is about to load an object on deck. He or she does not realize the situation is about to be dangerous because he or she didn't concentrate. The ABs' judgment is affected and even though he/she carries on with his decision. Suddenly the cargo is loose because of its non-sufficient lashings. The ABs' critical thinking is not on top and suddenly a situation occurs where a life and cargo might be in danger.

These situations do occur all the time on every department, due to either fatigue or haste, or the combination of them both. There is no easy solution and therefore it is important to tell people around you when you feel tired. Let your colleagues know and maybe keep an extra eye on you or relieve you an hour early from watch. The crew is a team, and a team needs to help each other.

Fatigue can develop into a chronic condition. Known as chronic fatigue syndrome (CFS), if this is suspected to be the case a doctor's advice, (RME, 2015). Fatigue is a dangerous condition wich cannot be forseen. The importance of breaks (Fig 3-4) and rest is often not revealed until an accident occurs.

Figur 3-4: Tiredness can kill. (Geograph.org.uk).

3.1.3 Habits and reliable systems

Habits

Well-trained crews often have strong habits and routines, strengthening the workability in the team. Drills to create routines are a vital part of the emergency organization on board a vessel and every crewmember is important. During the daily work a happy crew is a happy ship and people feel generally good working with routines and the feeling of affinity.

The day when routines take over and we no longer reflect over why we do things in a certain way or why, this extreme routine behavior may develop to a lack of situational awareness. The day when an event occurs, the creative and critical thinking might be restricted.

“We have always done it this way and it has worked for many years.” -is a phrase we all have heard in a work related conversation and probably it works just fine, but sometimes it is good to change routines to activate the creative thoughts.

Reliable systems

What comes along with the huge amount of technology and the fast development is a reliability and dependency of instruments. Although every navigator is well aware of that the systems fails and from time to time show misleading values and yet we trust the instruments more and more. Hence we control less and less information from more than one source.

In the perfect world the navigator should automatically cross-check the systems continuously during his watch to make sure the systems are intact. A system that fails is easy to miss and can be undetected for a long while.

To increase the situational awareness up on the bridge it is a good thing to compare the values from the different sources at regular basis, this will also establish the knowledge about different navigational devices.

In 1995 the cruise ship Royal Majesty ran aground 17 nautical miles from her planned and presumed route. At the time the crew had shaped the surrounding after what they thought was their position. The problem was that they had lost their GPS position and the position was calculated on dead reckoning since 36 hours back.

The crew had shaped the situation after what they expected to see, what also is to be noted is that no one in the bridge team reacted or questioned the situation.

When an accident occurs the measurement most often is to improve the technology, more alarms and sophisticated systems, instead of improving the team and sense-making ability in a bridge team.

Information volume

In the screens we see today there is almost no limit for how much information they can show at the same time. A lot of it the operator can choose to show or not to show. But many times there is a big logo, a frame with values or menus and different colors and notifications flashing that you cannot choose to hide or show. On modern bridges you can find up to ten or more screens, all of them clammed full of information and it is up to the operator to filter the relevant information for the specific situation.

The more experienced the operator is, the easier it is to filter the information, but still, it is fairly easy to miss vital details since they have drowned in the information volume.

One difference between an experienced operator and an inexperienced operator is that the experienced operator is more skilled in filtering information and focus on the relevant details. But the one with a lot of experience might have a strong expectation of what is going to happen. So strong that the awareness and vigilance are reduced, in comparison to the inexperienced operator who is on his/her toes but has it more difficult to filter information.

The more technology that is installed on the bridgethe more training the navigators' need to be able to operate it sufficient. This reduces time for training the nature of sense-making and situational awareness.

These issues creates a vicious circle, seen in figure 3-5, where misunderstandings and lack of sense-making cause a situation, more technology is installed and more time is spent on instrument training and even less time is available to fix the real problem.

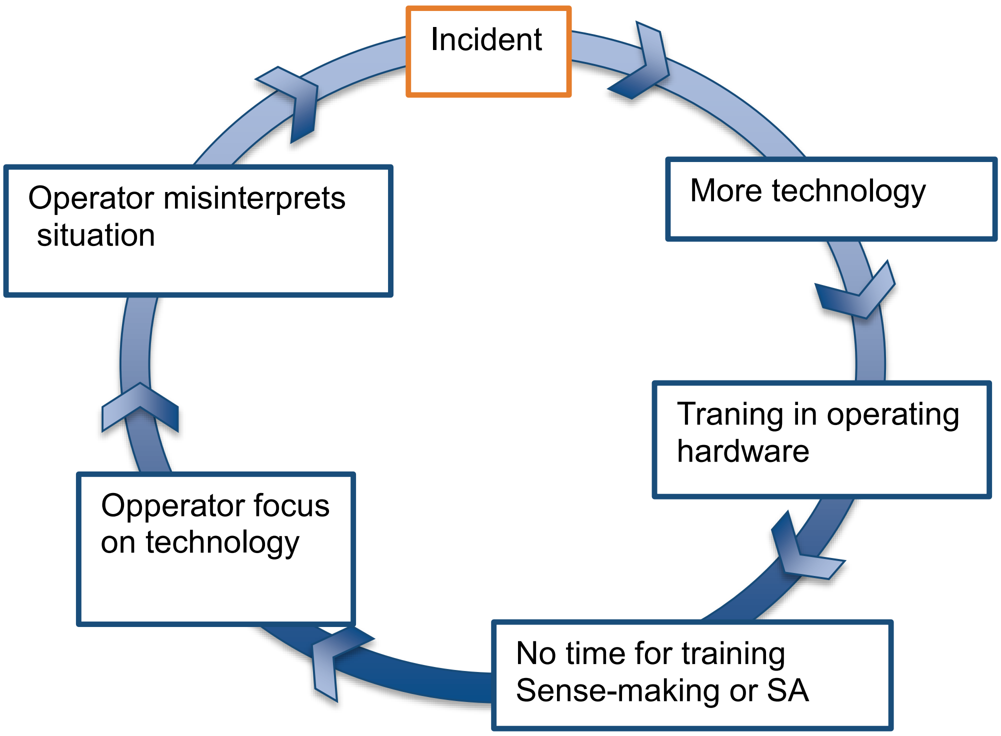


Figure 3-5 Vicious circle of technoloy and awarness (Ekstrand Lovisa).

Handling distractions

In just one day we experience hundreds of distractions. On every watch several distractions of different categories occur. As we get more experienced, we learn to automatically tune most of them out and probably won't recognize them as distractions.

For example, imagine a group of passengers who starts to argue and fight with a crewmember. This will probably engage most parts of the crew and chaos is inevitable. This is a critical distraction that can distract the whole crew including the bridge team and all of a sudden there is little or no focus on the vessel's safe passage.

Stop and Think! – Words that should come to our mind when we are deeply involved in a situation.

If a situation occurs, independently if it's an emergency or in daily work, involving the whole crew or only one crewmember, there is always room for a Stop and Think. This short break to reflect over the situation will help to increase the overall picture and maybe even give the opportunity to see another solution.

If a crewmember receives a phone call from home with bad news, this will affect not only his/her situational awareness but also the people surrounding. The expression "people awareness" is just very important to keep in mind.

It might not always be tiredness or work related stress that distracts us, it can be several causes affecting our situational awareness and capacity to work.

3.1.4 Situational awareness onboard a High Speed Craft

When managing situations in a high speed other conditions need to be taken into consideration.

When travelling with such speed the time for detecting obstacles is dramatically reduced, witch causes that the navigator and the look out need to be alert and react quickly.

After a few hours the awareness will be reduced and the risk of becoming speed-blinded is imminent. Speed-blinded is when you no longer are aware how fast the vessel actually is moving. The speed itself may not be the trouble, but to perceive the surroundings. Especially judging how fast the own ship is moving in relation to other vessels in the vicinity. Vessels in the area may find it uncomfortable with a vessel steaming in narrow waters with a speed of 20 knots or more. Even though a high-speed craft may be well aware of the situation, causing another vessel uncertainty is lack of good seamanship.

3.2 Culture & Communication

3.2.1 Culture

Introduction

Oxford dictionary define Culture as following:

"The arts and other manifestations of human intellectual achievement regarded collectively. "

The expression culture is very wide and includes every human in this world. How it appears in the daily life is very different, some see significant cultural diversities everyday and some don't. How we decide to stance ourselves to the more and more globalized world is completely individual. We can either choose to cooperate or to resist and ignore the ongoing process but it will still happen.

Cultures tend to differ in several important ways. These differences not only sensitize people to the world in different ways, but they also affect their interpretations of people from other cultures.

The past builds a model of experience that tends to play a role in our sense-making of the present.

There are no defined borders between cultures, compare it to a color scale where there is no distinct line between the different colors, only nuances. And it is definitely not only black and white. There can be small differences between two nuances same as it can be minor differences between two people brought up not that far from each other, linguistic differences eventually becomes two completely different languages.

Some think of culture as affinity to a certain group of people, such as religion, language or society class.

Differences commonly thought of when it comes to culture is for example:

- Language
- Religion
- Traditions
- Behavior
- Among other

Language is a clear nuance that can cause problems onboard a vessel. An international crew ought not to be hindered from a safe navigation due to language barriers. It is stated in the ship's policy which working language that should be used on board and extern communication should be in English.

Language can turn into a safety issue. For example, if a misunderstanding leading to a snapped line occurs during a mooring, it may become a life-threatening situation.

It is important to be able to communicate in a safe manner, and the most effective method to make sure the receiver has understood the message is the "closed loop" method.

Religion is another matter we need to deal with and accept on board our vessels. Although it might be hard to understand each other's believes and habits it is to accept and respect that we are different. As long as it is not affecting work of safety onboard the vessel.

Closely related is tradition. Such as food, holidays and hygiene. Either it is religious traditions, family traditions or anything in between. However, gathering the world's corners food in one galley is a hard task, and we all know that the chef is the most important person onboard a vessel.

On board a High Speed Craft there is most often no more than five persons in a crew, hence may not cultural differences and traditions occur to the same extent. Also, crews' on HSCs tend not to be on a shift for more than two weeks in a row of which the time on board is minimized to only work hours and most crewmembers can sleep at home.

How we behave is a clear reflection of how and most often where, we are brought up. As long as we are open minded and accepting, different cultures mixed together on board a vessel should not cause any difficulties. The reason why the expression 'culture' exists is because of comparison.

The shipping industry is one of the most international businesses with a multicultural mix of people working together everyday.

Even though you work on a vessel only sailing in Norway in Norwegian harbors' with mostly Norwegian crew, you will still meet other vessels with international crews passing by.

You will be forced to interact with different cultures at some point in the shipping world. Either it is agents, crewmembers, stevedores or shipping companies.

The key word in cultural understanding is probably acceptance. If we accept that people are raised with other points of view than us, with other values and behavior it will not be very cumbersome, instead it may enrich our work at sea.

There are also different cultures on board different vessels. Sometimes even between different crews. Most people signing on a new vessel try to absorb the environment and the crew's culture. How they are interacting and performing together as a team and how they behave to each other and work together. If there is a very strong hierarchy in the crew it may lead to that nobody challenge an inproper decision. For example, if the captain makes a questionables decision and no one questios it the outcome may have another result as if anybody did.

It is equally important to address and talk to each other with respect as it is to be clear. As for example it is in some cultures where it is very impolite to reprimand someone in front of others. They are afraid to lose face and might be extremely offended. It may for you seem as a normal conversation, while someone else might be offended. This is due to small linguistic differences we actually need to pay attention to.

Four dimensions of culture (Hofstede, 2010):

1. Power distance
2. Individualism versus collectivism
3. Masculinity versus femininity
4. Uncertainty avoidance

Geert Hofstede is a Dutch social psychologist and anthropologist whose research is widely accepted over the world. His research focus a lot on culture and how it infleunces values in workplaces. His definition of culture is "the collective programming of the mind distinguishing the members of one group or category of people from others". Every human is unique and therefore culture only exists and can be used meaningfully by comparison. Hofstede (2010), formed four dimensions to explain how national culture can be expressed

Power distance is about how power is distributed in an organization. When there is low power distance, people strive to equalize the power and the parent leaders prefer a democratic society. The opposite is a large power distance where people accept the hierarchic order and everybody has a predetermined role to fill. This is not a statistic of how the power is distributed but how it is accepted and perceived. Cultures with low power distances are for example Denmark, Sweden and New Zeeland. Cultures with large power distance are for example Southeast Asia and Eastern Europe.

Individualism versus collectivism can be defined as if we see too the individual to take care of itself, or if the individual expect a group or family to look after them in exchange of unquestioned loyalty. The I or we aspect.

Masculinity versus femininity refers to the traditional values of males or females. “Tough versus tender cultures.” The masculine society is much more competitive and heroism, achievement and assertiveness are paramount. Success is rewarded with material values. The opposite of this dimension is the feminine culture that stands for a preference of relations, life quality, modesty, cooperation and caring for the weak. The society is much more about consensus rather than competitative values.

Uncertainty Avoidance dimension expresses by which degree people feel uncomfortable with uncertainty and ambiguity. How people manage stress through minimizing uncertainty. Cultures with a high degree of this dimension prefer structured social contexts and rules. Societies with low uncertainty avoidance are of more relaxed attitude to the future.

Words that permeate this chapter are: <u>acceptance, understanding and open mind..</u>

3.2.2 Communication

The definition of communication will be different depending on who is asked.

“Human communication is the process of influencing a human receiver to create thought and action that is consistent with, and responsive to, the sender’s purpose.” – MCA, 2010

Although, if you ask an engineer what communication is, you will probably get an answer about encoding signals from a transmitter through a medium.

History shows us that inadequate communication is a danger to safe navigation. In almost every accident- or near miss-report communication is mentioned as a cause, either direct cause or contributing cause. It can be total lack of communication, or misunderstandings due to poor communications.

When having a conversation, approximately 80% of the communication comes through body language and only the remaining 20% through speech. We mediate information through movements; it strengthens and clarifies what we are communicating verbally.

Intern communication is the communication between the bridge and the other departments onboard, such as deck or engine. It is usually less formal and no general requirements on language or style. Although how we choose to address each other and the attitude we choose for ourselves have a major impact on the environment onboard.

Work related communication should be held professional and as short and concise as possible. If the method ‘closed loop’ is frequently used on regularly basis we minimize the risk of misunderstandings and loss of relevant information.

In both intern and extern communication the ‘closed loop’ method is widely used to make sure to minimize misunderstandings. The person who wants to communicate initiates a message and sends it through a medium. A medium is where the message transmits through to reach the receiver. The medium can be for example radio-comunication, telephone, Internet or face-to-face conversation. The receiver replies by repeating the message, to ensure the correct information was received. At last the sender confirms the message.

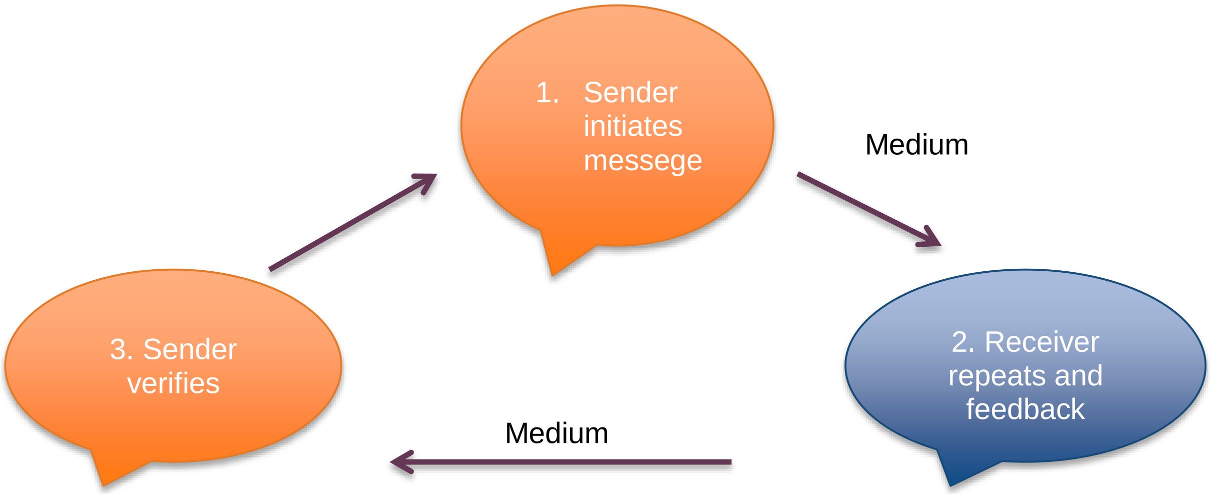


Figure 3-6 Closed loop comunication (Ekstrand Lovisa).

Example:

Sender: Put the pilotladder out on starboard side two meters above the water. Expected pilot boarding in 30 minutes.

Receiver: Pilotladder, starboard side, two meters. 30 minutes.

Sender: Affirmative (Fig 3-6).

There is no room for complications. The sender knows that the message was correctly received. If there were any uncertainties they will re-run the closed loop one more time.

This method is applicable in practically any situation. Launching lifeboats or giving orders to the helmsman, it is a very useful tool both in daily work and in more stressed situations.

Extern communication deals with some extra obstacles that may hinder the exchange of information between two stations. Mostly it is ship to ship, or ship to landstation. Except from radio traffic and technical issues which generates noise, clarity is crucial for good communication. The navigator will meet different nationalities and different skills in English, However to circumvent a situation the navigator need to be consequent in using methods such as closed loop and remember to ‘keep it short and simple’ - KISS. It is stated in international regulations such as IMO SMCP an agreement that extern communication ought to be held in a common language – namely English (IMO, 2010)

As mentioned earlier the body language is said to be about 80% of our communication. Facial expressions, gestures and the whole movement of the body shows most often very clear how we respond to another person. Perhaps we show more than actually meant to, or are aware of. Since the benefit of body language is lost when talking over the radio, it is explicit to be clear and concise. The key is to skip all small words and only communicate one thing at the time.

Being aware of the consequences of poor communication is vital, especially when navigating in high speeds. When a vessel obtains a relatively high speed the time factor is shortened dramatically and there is no spare time for misunderstandings. Even though most navigators’ onboard high-speed crafts are well familiar with the coast and the usual traffic situation, only a minor misunderstanding may lead to devastating consequences.

Two vessels on collision course with a distance of 2NM are both travelling with a speed of approximately 30kts, have about four minutes before collision. If there are any uncertainties between the two fast travelling vessels about intentions or actions a collision might be inevitable. When navigating in such speed daily, it is easy to successively lose perception of how fast the vessel actually is moving.

In the MCA Human Element a Guide to Human Behavior in the Shipping Industry they stated a few measures to be taken to prevent communication failures (MCA, 2010).

- Lack of skills and knowledge.
- Lack of social skills, cultural knowledge and team skills.
- Lack of time.

What can then be done to improve the communication skills is mainly to not ignore the fact that people need communication training. The crew should be encouraged to ask and clarify, to avoid misunderstandings. One colleague may be in another situation and perceive the message differently.

3.3 Human errors

3.3.1 What is Human Error?

The common definition of Human Error is “the failure of a planned action to achieve the desired outcome” (NOPSEMA, 2015). Factors that can increase errors exist at individual, job and organizational level and when these factors are not managed in a good order the risk for errors increase. To prevent errors, you need to be able to plan for error scenarios and how to avoid them. A good understanding of human error and their cause is required.

“Human error itself is rather the effect, or symptom of deeper trouble than a cause of failure.” (Grech, 2008)

There are several types of errors, such as failures of action and failures in planning (NOPSEMA, 2015). Failures of action or unintentional actions are referred to as skill-based errors. This category of error is broken down into slips of action and memory lapses. The failures in planning are more commonly known as mistakes, which divided into rule-based mistakes and knowledge-based mistakes. Below you can find a chart, fig 3-7, showing the human error broken down into its basic components.

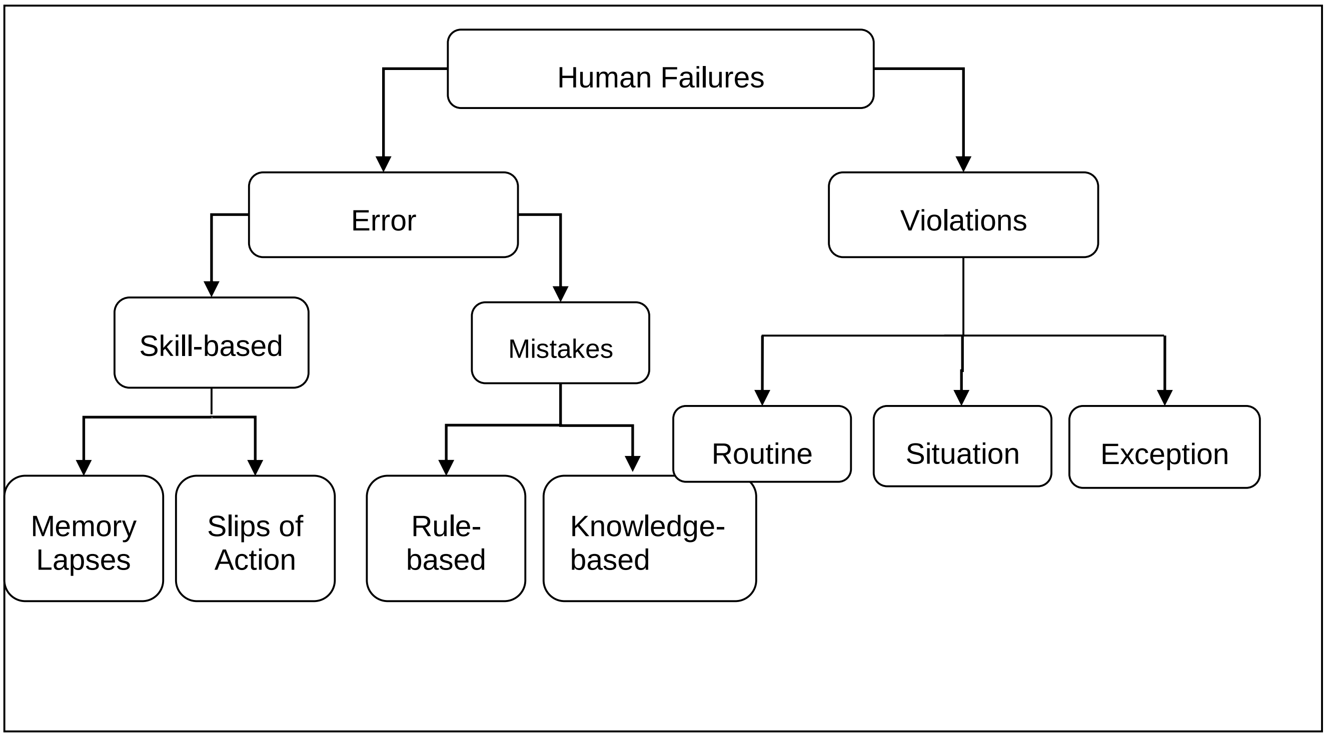


Figure 3-7 Human failuresFlow-chart (Andersson Daniel).

Skill-based errors

When doing routine work, as you've done many times before, it's easy for the mind to drift away – either by thinking of something else or discussing with your co-worker. You have the experience, knowledge and skills to do the task properly but still an error occurs. These errors are known as skill-based errors (Grech, 2008). It's more common for a person with high experience to encounter this error, than a person with less experience.

Just after you have formed your plan, and before you've completed it, you forget what you intend to do. This is called memory lapse, and means you either lose a step in the plan or even the whole plan (Grech, 2008).

The slips of action tend to occur when your mind is on autopilot or when an irregular change of plans occur. You can end up mixing up the planned action, and thereby doing the right action on the wrong object or the wrong action on the right object.

Skill-based errors are not the type of errors which can be corrected by re-training or some disciplinary actions. How to minimize these errors?

- A well structured and human-centered designed workplace.
- Effective fatigue management, with enough time given to complete the tasks.
- Cross checking of critical tasks, for example by PTW (Permit To Work)
- Reducing the distractions and interruptions

Mistakes

When conducting an action with sufficient planning behind it, but the wrong approach is used, the desired result is not met. This is the general definition of mistake (NOPSEMA, 2015).

Mistakes mainly occur due to inexperience or lack of knowledge, and are not deliberately committed. There are two different categories of mistakes, rule-based or knowledge-based.

<u>The rule-based mistakes</u>

Human tends to build their rules and procedures based on personal experiences. When misapplying a good rule or applying a bad rule, you get a rule-based mistake.

You've owned and driven a car daily for five years. You've built your personal driving rules and procedures based on that car. One day, it breaks down and you receive a loan car at the workshop. On the highway, you intend to overtake a lorry – and when judging the required speed and room you have the other cars' characteristics in mind. This causes a misjudgment caused by misapplying of a good rule.

Knowledge-based mistakes

Whereas you have no previous experience in the area to build rules and procedures around, you tend to rely on the basic principles or experiences from other areas. This is called knowledge-based mistakes (NOPSEMA, 2015). One example could be when you are going to plan an unfamiliar route, and you don't know that the chart you are using is out of date. The lack of experience in the area creates a hazardous situation.

How to avoid mistakes?

- Create flow charts, which show step by step procedures for critical tasks, and make sure they are used
- Have regular drills for emergency situations
- Keep the competence high, encourage learning and offer training
- Share experience and knowledge trough out the organization

Violations

Violations are deliberate deviations from given rules and regulations. Consciously taking short cuts or failing to follow the procedure to save time or effort are often done with the best of intentions. Violations are subcategorized into routine- situational- and exceptional violations (NOPSEMA, 2015).

Routine

If the procedures and rules are out of date or inaccurate, they will become an obstacle which impairs the work. It will then become a routine to break these rules or procedures, and it becomes a common norm in the group. A meaningful enforcement is required to avoid the routine violations, which can include updates of the procedures and rules or a more thorough explanation of the thoughts behind it.

Situational

The situational violations occur when the factors of the specific situation requires the human to violate them. Time pressure, workload and workspace design is only a few of the factors that increase the tendency to violate the rules. When working under a time schedule, there are few or no rooms for delays. This can cause the person to disobey the rules, in order to meet the schedule.

Exceptional

During highly unusual events, such as accidents, the rules tend to be broken. One reason may be that the person believes that the rules do not apply any more. It may also be that the person thinks that applying the rule won't solve the situation. One famous situation is the Chernobyl nuclear power plant disaster. A series of tests were done before the accident and during this an operator failure led to dangerous low power levels. The tests should then have been abandoned, but instead of abandoning they proceeded to protect the test plan.

How to avoid violations?

- Improve the routines to eliminate the need of taking shortcuts
- Promote a safety culture, where safety always comes first and efficiency second
- More training for abnormal and emergency situations

3.3.2 What influences the Human Error?

According to a research by the American Bureau of Shipping in 2004, approximately 80% of maritime accidents are caused by human error. 50% of these are initiated by human error and 30% are caused due to humans failing to avoid accident. When analyzing these accidents, factors that enhance the errors become visible. In Grech 2008 the factors are identified and analyzed, below is a summary of these factors.

- Size of the crew
- New technology
- Social factors
- Organizational

Size of the crew

During the last decade, human labor in all sectors around the world has been reduced, including shipping. On a typical large tanker ship in 1970s the crew size was 40-50 people. Today, on a ship of the same size, it's usually less than 20 people in the crew. On a regular HSC ferry the crew is four people, each with distinct roles.

The minimum manning is regulated, and to comply with SOLAS a minimum safe manning certificate is required. In SOLAS there's no specified size or similar mentioned, instead the administration (flag state) makes the decision whether the size is sufficient or not. As ship owners and operators want to reduce operational costs, they'd like the minimum possible manning. The administration is pressured into accepting smaller crews, since they do not want to lose income by losing ships in their registry (Grech, 2008).

Studies has been made on standard onboard operations and their crew requirements versus actual crew numbers, and the crew members are often too few to properly conduct specific tasks (such as loading/un-loading/ mooring etc) without violating the minimum rest periods. The economic situation has pushed the turnaround time for ships in port to a bare minimum, compared to the long port calls in the past. Before, the crew could use time ashore for respite and recovery and even visiting families while cargo operations proceeded onboard.

Nowadays the ships berth at terminals far away from the civilization, loading and unloading is quick; usually all of the crew members need to stay onboard for cargo operations. All of these factors combined have an influence on the fatigue and stress level of the crew members.

New technology

The conventional way of enhancing maritime safety has traditionally been accomplished by applying more advanced technology onboard, such as ARPA and GPS. With more focus being directed at developing the technology, less focus has been on training to the humans who operate these navigational aids (Grech, 2008).

The majority of the systems on the bridge are equipped with some kind of alarm, set to alert the user when predetermined limits are met. Both visual and audio alarms are used, but it is the audio alarms that both historically and today are considered as the alarm. As the existing equipment is developed and more advanced technology is added to the bridge setup, more alarms are added. Usually, the different equipment with sounding alarms is not integrated into one system. This causes a stress factor to the navigator, if more than one alarm goes off at the same time. The navigator then has to use experience to prioritize which alarm to respond first to.

Social factors

The working environment on a ship is different than working on shore, since most of the tasks performed onboard are done in a moving environment. On this moving environment, the crewmembers have little contact with their families and the outside world. They both work and live together with people from different cultures. A large amount of time onboard is spent on waiting, which increases the boredom. Although the majority of these factors do not apply to HSC ferries, due to the working conditions with short onboard periods.

Organizational

To keep the crew motivated to do their work properly and follow the given rules, the organization needs to supply with adequate resources. If the organization has unclear policies and do not follow regulations, this attitude leaks down to the onboard personnel. It requires good cooperation with clear boundaries between decision makers at organizational level and the ship's crew to minimize the risk of human error.

3.3.3 Fatigue and rest periods

Closely linked to human errors is fatigue. Following the Exxon Valdez disaster in 1989, the light was shed on the increased workload caused by reduced manning on board vessels Even though this conclusion was made over 20 years ago, reduced manning and increased workload resulting in fatigue are a continuous cause of many maritime accidents (MCA, 2010).

"Human error is not the conclusion of an investigation; it's the start of it." (Grech, 2008)

The conclusion of why fatigue is caused can seem obvious; people get tired when they have been awake too long. But there are many factors which affects how long "too long" is. A few of these factors are mentioned below.

Workload

As people work longer hours, and have more objectives to cope with, more recovery time is needed. The difficulty of analyzing workload is the need to define the acceptable limits, as both external demands on the worker as well as the persons experience of workload needs to be taken into consideration (MCA, 2010). The workload is not constant, but varies over the period of work. When the workload peaks the person have great difficulties to fulfill all of the demands placed on them, and at other times the person can get a feeling of being excessive. The boredom of feeling excessive can also be a safety risk, since monotony and heavy workload are both as fatigue creating.

Sleep

To recover from the workload, people need sufficient sleep of good quality. If a person is not given this, they will encounter "sleep debt" (MCA, 2010). This makes you less alert and you can misinterpret situations, and even fall asleep in some situations.

The "sleep debt" is mainly caused by two concerns. One of the causes is when sleep is disrupted by noises, motion, temperature and light. The other cause is working in shift, as this causes disruption to the humans natural sleep pattern.

As sleep cannot be stored and the energy gained retrieved at convenient situations, you need to repay the "sleep debt" by seven to eight hours of continuous sleep in two or three days (MCA, 2010).

Diet and exercise

The lack of correct nutrition speeds up the fatigue process. There are differences in what effect the body receives from different types of food. A heavy meal of mainly carbohydrates will increase the feeling of sleepiness, whereas a lighter meal with mainly protein will give you the feeling of wakeful alertness (MCA, 2010).

People who activate themselves and stay fit have a longer endurance, and won't feel fatigued as fast as overweight, unfit persons.

How do you prevent fatigue?

The fatigue issue is effectively dealt with through the design of the vessel and its interior, as well as a thorough operational and procedures plan.

Design

When the vessel is not maneuvering in or out of ports, the noise level onboard is quite constant. The high levels of noise can give you a permanent or temporary hearing impairment, and this is well-known. But the lower levels of noise, with engines and pumps running at constant revolutions, are also a hazard to the health. These, continuous, lower levels of noise increases fatigue and stress levels, which can increase the blood pressure to dangerous levels (MCA 2010). The design of the vessel should include good noise isolation, with some sort of barriers.

The engines onboard provide the vessel with power, but also with a great amount of vibration. Even low levels of vibration are known to give psychological damage of the persons exposed to it. The heart rate, breathing, blood flow and pressure are changed by exposure to vibrations. These symptoms are all sources of fatigue and stress.

The majority of the time spent as watch keeper is spent indoor, which is why a good climate is required. The temperature, ventilation and quality of the air are all factors which can have effect on the fatigue. The problem of temperature is to know what is too hot, and too cold. Too warm climate makes you feel tired and sleepy but being too cold instead will reduce the ability of focusing on mentally challenging activities (MCA, 2010).

Operational

Everyone involved in the organization, from the crew members to the board room, needs to take fatigue seriously. The persons in charge of operations needs to take a special responsibility to make sure fatigue is prevented, by adopting the rest time rules and making sure they are followed. The rest time rules are adopted through both an EU directive and the STCW, and controls the ratio between rest and work onboard vessels.

"EC Directive 1999/95/EC mandates ILO convention 180, article 5:
1. The limits on hours of work and rest shall be as follows:
(a) maximum hours of work shall not exceed:
(i) 14 hours in any 24-hour period; and
(ii) 72 hours in any seven-day period;
OR
(b) minimum hours of rest shall not be less than:

(i) 10 hours in any 24-hour period; and

(ii) 77 hours in any seven-day period.

2. Hours of rest may be divided into no more than two periods, one of which shall be at least six hours in length, and the interval between consecutive periods of rest shall not exceed 14 hours."

To maintain a visible structure in the rest/work ratio, and especially to be able to show that the rules are followed, it's required for the watch keeping personnel to keep records of working hours. It's important that the journal is correctly filled out, and that working hours are not filled out in advance whether you are working those hours or not. The land organization must step in to control and give the support needed to the crew, so they won't feel a need to cheat with the journal.

A good way to make the whole organization involved in the fatigue issue is to form a fatigue management plan. This plan covers responsibilities from the top, with ship owner/manager, to the master, and down to the individual seafarer.

The ship owner should form policies for fatigue management, which is based on the rest period rules. Make it possible for the crew to follow the rules, by giving adequate time for e.g. hand-over and rest periods.

The master needs to make sure these rules are applied on the vessel. A dynamic monitoring of the work/rest arrangements is needed, where the normal routines are sometimes bypassed to make sure everyone is given enough rest.

And the individual seafarer has a personal responsibility for using the rest periods for effective rests. Good quality sleep is needed, which is helped by keeping a good diet and staying fit. And also make sure the journal is correctly filled out, and by the use of the journal keep track of your rest to make sure the ratio between rest and work is good.

3.3.4 Briefing and de-briefing

All group activities should start with a briefing, whether it's a safety drill or it's a watch handover. In all situations where a coordination of the involved participants' actions is required, a briefing will improve the result. As there's an indefinite number of situations that can occur, there are an indefinite number of briefings and de-briefing types (Splash, 2006). A common briefing on the bridge with the crew assembled is shown in fig 3-8.

Figure 3-8 Briefing on board a vessel (Wikimedia.org).

Good practice

We've all been to meetings or lectures with lacking organization behind it. Persons who are essential were not invited, missing documents and not enough material for all of the invited persons.

Seen through the eyes of a seafarer, the essential person may be the pilot, the missing documents are cargo handlings and the material missing can be copies of cargo plans.

Good practice in briefing and de-briefing is to use checklists. The checklists should be relevant to the topic, such as watch hand over, departure or arrival. It's important to keep the documentation and thereby the briefing limited to only cover the most relevant information, with three leading words to describe it as listed in Splash 2006;

- Clear
- Concise
- Factual

When and how should it be done?

For routine briefings and de-briefings, such as handover of the watch, you should take the time needed to make sure the reliever has all the information needed to take over safely. When starting a new shift on board, the master should give the crew the details of the trip. How many passengers are expected and how many that actual are on board, which route the vessel is on and so on. The master should check that all crew members are familiar with the operations of the vessel, understand their roles and are overall fit for duty.

The master could give a “what if” situation for the crew to discuss, to trigger the personnel. What if a passenger falls overboard or becomes sick are examples of topics.

When unplanned situations occur, such as accidents, briefings should be done as soon as possible following the incident. Of course, all information is not known in the initial phase, and the first briefing should be followed up with more briefings when more information is available (Splash, 2006).

The briefings should be adapted to the situation, and will be both formal and in-formal. If someone falls overboard, the fast rescue boat will be immediately manned and seaborne. There’s no time for a thorough briefing, instead a simple and clear confirmation of the situation from the bridge will be given.

The debriefings can initially be done in an informal way. When the situation has cleared up, it’s common for the people involved to feel a need to talk about what has happened. Although, a formal debriefing should be commenced as soon as the operation is over, and all the involved parties should be able to attend to make sure the whole picture is obtained (Splash 2006). If the situation was difficult or long, the involved persons may need a rest before debriefing to clear up the mind. But it should not wait too long either, as the memory of the details will become blurry as time goes.

For the routine situations, debriefings should also be commenced. This will obviously not be as deep and time consuming as the debriefing following an accident. On the last trip of the shift, the master could assemble the crew and discuss some basic questions;

- Did everything go as expected?
- Why did it or why didn’t it?
- Is there anything we need to correct to the next time?
- Questions?

To create a good atmosphere and team feeling in the group, the crew members should be given time to reflect the events of the work shift, and discuss it together. This debriefing does not need to have the feeling of a formal meeting; it could be a casual conversation over a cup of coffee.

3.4 Group Dynamics

3.4.1 Team building

As the shipping industry faces harsher competition the crew size is reduced and higher demands are placed on each individual and their ability to co-operate on board. To improve the relation, build trust and thereby creating a high performing team on board the FIRO theory will be applied and explained throughout this text.

FIRO stands for Fundamental Interpersonal Relations Orientation and is a theory that explains the interactions between people and thereby the dynamics of a group (The Sweden, 2008). Briefly, FIRO is based on three basic needs that all human beings have in common; the need to feel significant, competent and likeable. These needs are expressed through three levels of human interaction: behavior, feelings and self-concept. Under each level, we find three key areas of human concern: inclusion, control and openness.

In order to achieve the self-image we thrive to have, we try to achieve a balance in the amount of inclusion, control and openness to feel significant, competent and likeable. This is visualized in the fig 3-9.

By maintaining these three factors at a good level, we will feel good about ourselves. When we feel good about ourselves, the level of sympathy and flexible towards others increase, and it's easier to keep a high level of co-operation (The Sweden, 2008).

Everyone wants to feel:	Significant	Competent	Likeable
These are expressed through:	Behavior	Feelings	Self-concept
What we want to achieve in a group:	Inclusion	Control	Openness

Figure 3-9 The Basics of the FIRO theory (Andersson Daniel).

When applying the FIRO theory on a group, three main phases must be completed before the group dynamics are fulfilled. There's an inclusion, a control and an openness phase. The foundation of the FIRO theory is that the phases are experienced in this order, and that it cannot be completed in any other order (Petrina, 2015).

The completion of a phase does not mean you won't experience it again. If the group has reached the openness phase, they could fall back to the control or inclusion phase. New group members, new work assignments or old members leaving the group are a few of the reasons why the group would need to go through a phase again. Although, if the group is a well forged one, the time needed to re-run the two first phases are reduced.

To form a group, the members need to be able to solve issues regarding the development of the group. This requires much energy from the members. The energy will be focused on different subjects, depending on which phase and how mature the group is.

In the following section, the three main phases and the two midway phases will be explained. Behavior, thoughts and how the energy of the group is focused are a few of the areas that will be covered.

Inclusion Phase

Focus of the group: Membership (in or out)
Interactions between persons: Socializing
Self-examining questions: Am I accepted? Do I accept the others?
Important questions: Do I fit in this group? Who are the other members? Do I want to be here? Can I be here?

Inclusion phase is the first stage in the development of a new group. Every member is keen to be accepted by the others, and you tend to question yourself;

- Do I want to belong to this group?
- How much am I willing to devote myself to the group?
- What rules apply in this group?

Common behavior

- The members try to get to know each other
- You talk too much, or you're too quiet
- Some people tend to stay in the background and analyze

In the inclusion phase lots of interaction is going on. Endless discussions which lead nowhere takes place, group activities are suggested but most of them will never be followed up. Conflicts are actively avoided, and the members are very polite towards each other. Because of this, it's difficult to find out how to communicate, which norms that apply and which roles belong to who. You do not want to tread on anyone's toes, but feel the need to understand the goals and rules of the group.

The energy in this phase is focused toward questions regarding membership. Different persons require different amounts of inclusion interaction, such as contact and communication. Some groups may spend a lot of time here, trying to form a common platform with norms and attitudes, and will then require much energy (Petrina, 2015).

Control Phase

Focus of the group: Confrontation
Interactions between persons: Independency
Self-examining questions: Am I competent enough? Are the others competent enough?
Important questions: Who are the leader(s)? How much influence do they have? How big responsibilities are I given? Am I strong enough to make myself heard?

The second phase is the control phase. This is the most demanding part of the group process and takes the most time to complete; about 60% of the group building process is spent in the control phase.

The group members are now not afraid of confrontations and take risks that can result in exclusion, such as questioning of each other's knowledge, leadership and competence. The leadership questions are the most important and relevant to develop the group. The energy will be focused towards the sharing of responsibility, handling of conflicts and role seeking. Sub-groups are formed, and the competitions mentioned above are usually between the sub-groups and members (Petrina, 2015).

Common behavior

- Try to gain or to avoid leadership
- Verbal attacks against the leader or other members
- Sub-groups are formed
- A leader is chosen, either naturally or by a majority resolution

Even if a leader is, either naturally or by some sort of active decision, chosen to be the official leader of the group there can be unofficial leaders. The unofficial leaders are persons within an organization that people can turn to for help and advice. These persons can be just as important to the group as the official leaders.

Openness phase

Focus of the group: Relations
Interactions between persons: Co-operation
Self-examining questions: Am I liked? Do I like the others?

Important questions: How close can I come? How strong emotions can I show? Are the group members loyal towards me and the group? How open I be?

After reaching the openness phase, the group is finally functional; members have found their roles and can use their energy to reach common goals. Any conflicts that may arise are dealt with immediately and solutions are discussed together. The common feeling in this phase is satisfaction, and the members focus on maintaining this atmosphere by developing more effective communication, confidence and acceptance of all members.

Common Behavior

- A feeling of trust inside the group
- All members are able to express both positive and negative feelings
- The personal area is reduced, and the physical contact increased

The group members now begin to wonder what the other members of the group think about you and what you think of them. Who are closest to me, how much can I open myself to the others are only a few of the questions you probably will ask yourself.

Conclusion

Group dynamics and team building is very complex, and the methods to build a well functioning group varies. A method which works for "group a" is not a guarantee that it will work for "group b"; it depends on the persons involved and their commitment. Not all groups fulfill the FIRO circle, many groups stay in the control phase and that does not have to be an issue. It's basically situational controlled, where changes in the foundation of the group have a big role. Two crew members who change shift, an officer who is promoted to captain, big changes in schedules and similar alterations can interrupt the process.

It's also important to remember that the group process is not something which normally is completed within a few days, weeks or even months. For some groups one phase may be completed easily, whereas in another group it may take much longer time.

<u>What happens between stages?</u>

Between the three main phases, there are two intermediate phases. The significant difference from the main phases is that in these phases there are no conflicts.

Comfort phase

Between the inclusion phase and the control phase, the group will pass through the comfort phase (Fig 3-10). When the group has solved the membership question and everyone is accepted in the group, they will enter the comfort phase. In the inclusion phase, the conflicts that the members have avoided now follow them into the comfort phase where they will grow. As long as possible, the members will avoid these questions.

Common Behavior

- A group feeling is starting to grow
- Members actively demonstrate their engagement in the group

Idyll phase

After completing the control phase and just before entering the openness phase, the group enters the idyll phase (Fig 3-10). This phase is very similar to the comfort phase, whereas no conflicts take place. Instead, the idyll phase is often proceeded by an intensive conflict which was related to the management of the group.

Common Behavior

- The group identity is formed, and members begin to understand their roles
- Instead of using the energy to solve the tasks, it's used to preserve the feeling of idyll

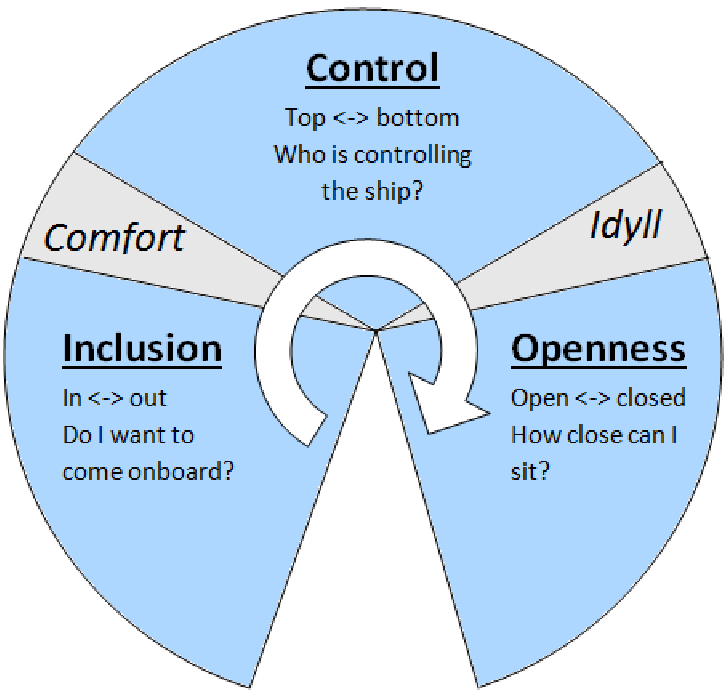


Fig 3-10 "The FIRO circle" (Adopted from okakademi.se).

3.4.2 Conflict Management

Onboard you work tight together with your crew, often under time pressure. Sooner or later, conflicts will happen. This is why there's a strong need for good conflict management at all workplaces. The communication and management of conflicts can be a challenge which can be compared with walking a tightrope. The two opposing views of a situation are to be balanced by the person in charge, and there's very little room for compromises.

It's very common with conflicts at work, and it doesn't always have to be a bad thing. It shows that there's a commitment to the workplace and its future. To prevent conflicts from escalating, a good leadership and management are required. Escalated conflicts that remain unsolved have big impact on the working environment. It can lead to decreased efficiency and creativity, affect the psychical health and the working climate (Arbetsmiljöupplysningen, 2015).

How to prevent conflicts on your vessel?

It's important to have clear policies and social rules. It's easy to think that all conflicts can be solved by the use of common sense, but that's not always the case. Especially not in situations where we are stressed, scared or when the competitive instinct is activated. That's why a code of conduct with clear boundaries is required.

The code of conduct should also include basic social rules, such as always greeting each other and treat each other with respect and dignity. Things such as bad attitude and negative body language with glances, facial expressions and head shakes should not be accepted since they easily can lead to conflicts (HR Bloggen, 2012).

<u>How do you solve conflicts</u>?

1 – Determine what type of conflict

The general view of conflicts and their solution is that there are three different outcomes in a conflict between two parties. There is a lose-win, win-win and lose-lose situation. In many conflicts, both parties only see the lose-win situation, where one wins and the other party loses. This locks our minds into thinking that winning is the most important, and secondly not to be the single loser.

In order to solve the conflict the opposing parties need to realize that the conflict does not have to end in a lose-win but instead end in a win-win situation.

2 – Co-operate about the conflict

If you would ask your co-worker whether or not he/she wants a good co-operation situation onboard, it's most likely you would get a positive answer. Co-operation is commonly based on good communication, respect, helpfulness and similar values. But in enhanced conflicts, these values tend to be forgotten.

The conflict should be regarded as a mutual problem, not as a battle. To turn a battle into a mutual problem the conflicting parties need to co-operate, and begin to discuss how they both could get what they want.

3 – Separate positions and interests

There's a well-known history regarding conflicts, called the orange method. Two persons are arguing who should get the last orange. After a long argument, they begin to dissolve who has the greatest need for the orange. They find out that the first person wants to squeeze the orange to make orange juice, and the second person wants to peel the orange to use for a bakery product. The solution is easy, first the orange is peeled and then it's squeezed – and both persons get what they want.

The essential part of this history is the difference between positions "I want the orange" and the interests "I want to bake a cake with the orange peel" and "I want to make orange juice". Your position is what you say you want to have, in order to fulfill your interest. Your interest is what you actually need. As seen in fig 3-11, there is an area of common interest and needs, which is where we want to be.

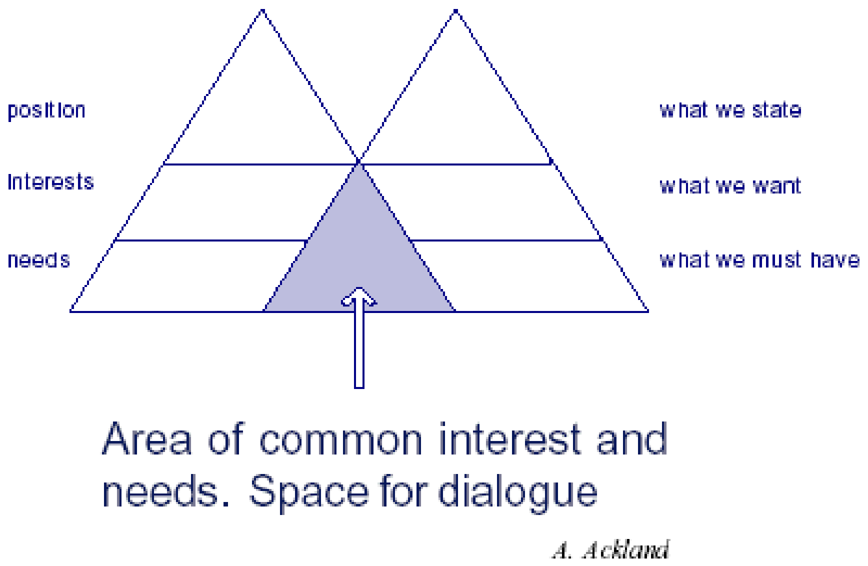


Fig 3-11, "Positions, interests and actual need" (who.int).

The problem is that we in general have conflicts about positions instead of interests and this makes it harder to find solutions.

4 – Turn your opponent into your partner

The interests are essential in conflicts, whereas the positions are merely ideas of how to get the interests fulfilled. It can be hard to let go of positions, since it can be a loss of prestige, but to achieve a good conflict solutions it's essential to be flexible with the positions. It's the interests that you should hold on to.

Remember that the goal is to achieve a win-win situation, as in the history with the orange, which is why you should make your opponent a partner in finding a solution instead of increasing the distance.

3.4.3 Norms, attitudes and values

Norms

To have functional societies and groups, they need to function as a group. This is why all groups have its own set of rules which regulates how to behave, think and feel in specific situations (fig 3-12). Some of these rules are written regulations such as laws, and some are of the unwritten kind. Both the written and the unwritten rules is what we normally refer to as norms (Lätt att lära, 2013). The norms increase the feeling of affinity and enhances co-operation within the group. The disadvantage of norms may be that the persons who break norms are too easily categorized as bad or even nasty persons.

The breaching of norms does not automatically have to be something bad. If a group becomes homogenous, where all members agree on everything and no one dares to oppose these

Figure 3-12 Shaking hands after a sports match is an example of social norm (Wikimedia.org).

norms, the members' creativity will suffer. The group will have problems with development and will eventually stall.

To maintain the system of norms there has to be some kind of punishment for those who breaks the norms (Lätt att lära, 2013). If a person would break the law, they could be sentenced to prison or given a fine. But less aggravated forms of norm breaches are also punished. The punishments can come in many different forms and shapes. If someone would cut the line your standing in at the supermarket, you would probably not say anything but instead give the person an "angry eye". The "angry eye" is in this case the punishment for the norm breach.

Putting this in a group perspective, if a member would commit a mistake in front of the rest of the group, the other members would perhaps laugh in a mockingly way towards the member. More aggravated forms of norm breaches could result in physical abuse and you being frozen out. One example of this is in Germany during world war two; if you opposed to the nazi regime you could be taken to concentration camps (Kitterman, 1991).

During our childhood, norms are both consciously and unconsciously being taught to us. Slowly, we start to understand how to behave in different situations and which norms that are applied, and what happens if you would break the norms. This behavior is growing into your identity and will be passed along to group members.

Attitudes

Your attitudes are a general approach to something or someone. The majority of the attitudes is learned over time and affects your social life. Attitudes are strong beliefs and do not easily change, and they are connected to your feelings and how you act (Stockholm Resilience, 2008).

You can have attitudes against other people, groups, organizations, objects, situations, events and so on. As well as an attitude against pea soup you can have an attitude against a political party, this approach affects your behavior and the behavior may explain your attitude (fig 3-13)

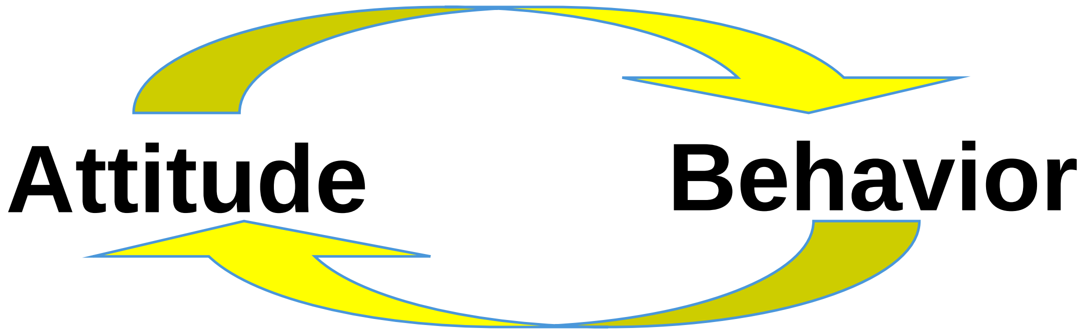


Figure 3-13 Attitudes and behavior (Andersson Daniel).

In the same way as norms are being taught to us, attitudes are also something you are learned. When expressing our conceptions about certain things to a group, the group will either encourage your conceptions or they will correct you. A different learning method is social copying, whereas you copy the attitudes of persons with high influence on you. It may be powerful, knowledgeable, likeable persons but also persons who you find physical appealing.

Persons with high influence have a higher chance of forwarding their behavior than a person with lower influence (Stockholm Resilience, 2008). In most groups, the leader is the person with the most influence and is therefore the one who will have the best chance of influencing the other group members.

The third way of learning attitudes is the classic way, which is that you tend to connect e.g. situations and objects or activities to each other. Both things are appealing to you, and by that you gain a good attitude towards it. That's why some people have a good attitude towards the winter season, since they enjoy skiing.

The amounts of times we are exposed to certain things also have an effect on our attitude to it. The more often we are exposed to something; the better is our attitude towards it (Stockholm Resilience, 2008). This is why we prefer things we are used to. The most of us have heard a new song on the radio, and immediately disliked it, but after listening to it more times ended up loving it.

Human Values

Closely related to your attitude, are your values. The values are, as norms and attitudes, taught to us during our childhood and as we grow we learn more values. They are passed on to us by our parents, friends, teachers, society etc. The human values include honesty, trustworthiness, discipline, love, peace, justice, care for others etc. By standing up for your values, and showing them in both speech and action you become more liable as person (Lätt att lära, 2013). It's important to stand up for the values you chose to adopt as yours.

Example of human values:

- Equal rights for all persons
- Everyone should be treated with respect and dignity
- All persons can learn something from their mistakes

There are both negative and positive human values. The negative values will most likely lose respect from the group, and the positive will make you gain respect (Lätt att lära 2013).
Negative
Persons who says one thing, but ends up doing the opposite, won't gain any respect from the group. As the person did not stand up for their values, but changed it based on the situation.
Positive
Persons who live as they learn, expresses their desire in a fair and equal way without hurting other people. By listening to the other group members they gain trust and respect by the other members.

3.4.4 Emotional Intelligence

Intelligence is commonly known as mental ability and intellect (IQ), that you are able to continually develop your thinking. Mental abilities which intelligence covers are the ability to reason, plan, solve problems, understanding ideas and languages etc. Although, only having a great intellectual intelligence (IQ) is seldom a recipe for success in life. The IQ needs to be combined with emotional intelligence (EQ or EI), as the IQ may help you learn navigation but it's the EI that helps you manage stress and emotions. The Fig 3-14 explains how situations are managed with either IQ or EI as approach, and their differences.

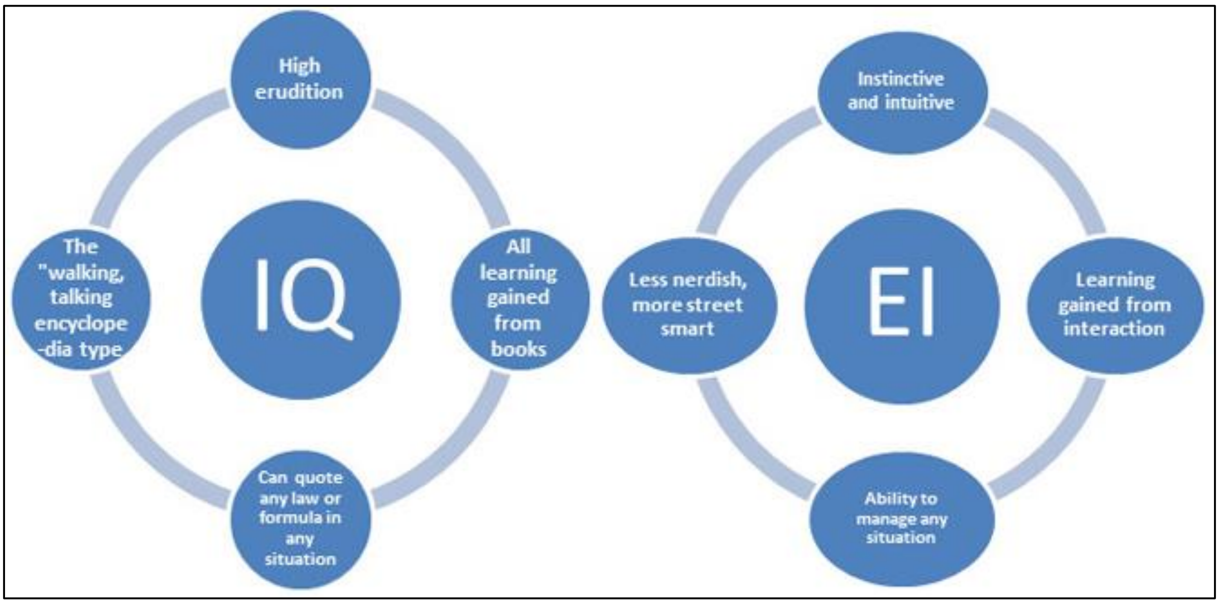


Figure 3-14 Examples of situations managed in IQ and EI perspective and their differences (TrainHR.com).

What does Emotional Intelligence mean?

The basic idea of emotional intelligence is to understand that your emotions can control your behavior and thereby have an impact on other persons, in both a positive and negative way. By understanding this, you can learn to manage those emotions, and even manage other people's emotions.

The four cornerstones of emotional intelligence are:

- **Interpret emotions**
  Know your own emotions, how they affect you and your behavior. Learn your strengths and weaknesses.
- **Manage emotions**
  Be able to control your impulses, control your feelings in a good way, take initiatives, being able to adapt to dynamic situations.
- **Understanding emotions**
  Understanding emotions, needs and thoughts of other people. Generally feeling comfortable in social situations.
- **Emotions in relationships**
  Knowing how to develop and maintain good relationships. You can communicate and work well in groups, and manage conflicts.

Why is it important?

The strongest signals of the human brain are the emotions. A research done in 2013 showed that we make decisions with emotions and then we justify the emotions with logic. If we have both IQ and EI co-operating, obviously we will perform better.

Persons, who have less education but fully developed EI, can succeed far better than a person with a thorough education but who's lacking social skills. Of course, intellectual intelligence is a valuable asset. The IQ helps you perform on an individual level, but a good EI will also help those around you. Basically, EI is to the heart what IQ is to the brain (Forbes, 2012).

3.5 Leadership and Decision making

Leadership is the power to affect peoples thinking, attitude and behavior. Either it is in a social position or in an organizational profession. Everywhere we go we meet leaders, official as well as unofficial leaders and wanted as well as unwanted leaders.

Unfortunately are there no checklists for ‘how to guide people’ or ‘happy-crew-recipe’, instead there is multiple theories, books, and scientific studies.

A good start is always to show the coworkers respect to gain respect.

This chapter is an introduction to leadership, and will hopefully provide an overview and insight in leadership and how to make decisions with focus on a marine environment (MCA, 2014).

3.5.1 Leader vs. Boss

Different leadership styles:

- Enforcing /authoritarian
- Role model / pioneer
- Democratic
- Visionary
- Coaching
- Laissez-faire / passive

It is impossible to say that one of the styles mentioned above is better than another since it very much depends on the situation.

One situation may be more efficient with a more passive leadership while a more stressed situation need an authoritarian leadership. Along with different styles of leading a group there is also various techniques’ that can be applied.

Eg. If we use the word power, in both a negative and positive meaning, it can be used in several ways such as; credit and rewards to motivate: the power to reward people.

Expertise power: using expertise to generate confidence in a group. Reference power: creates a will to mimic a role model. But also coercive power, using threats in a leading position and thereby force people to work.

Traditionally our work at sea is an organization with a naturally clear hierarchy. On board we have a master who is outermost responsible for the crew and the ship, and a good master knows that every crewmember is a link in the chain that is needed to run the ship in a satisfyingly and safe way.

In addition to different style, leadership can be divided into two categories: the leader and the boss (fig 3-15).

The Leader	The Boss
• **Future vision** • **Create consensus** • **Motivate** • **Inspire** • **Appeal to feelings and values**	• Planning • Budget • Goal setting • Organizing • Manning • Controlling • Monitoring
To much leader: • **Long vision without shorter goals and budget** • **No rules or structure** • **Inspired coworkers not using any control systems.** **Consequenses: The Organization with no or a little control, deadlines will not be held and the budget fails.**	To much boss: • Hirarchy • Impersonal • Focus on controlling • Uninspired coworkers Consequences: The organization will be rigid and non innovative. Changes will be hard.

Figure 3-15 Leader vs. Boss (Ekstrand Lovisa).

The ultimate way to reach a successful leadership is to compromise the boss and the leader characteristics and perform it with one leader style which seems best for the present situation.

In addition to the different styles of leadership it is a lot about our personalities as well, everyone is not born to be a natural leader or boss. Some people feel uncomfortable in a position where they have to lead and be in charge of people. While on the other hand, some people are born leaders with natural leader skills.

It is not said that the natural leader always makes the right decisions but people tend to follow and trust their actions. The opposite is a person who doesn't feel comfortable in a leading position, people around will probably question or doubt the leader who will struggle to get the crew along. These two personalities will probably choose different leadership styles.

There are just as many different theories about leadership as there are ships in on the seas. It is up to each and every individual to grow into a leading a position that suits the organization, situation but above all, the personality.

The key to become an accepted leader is to not underestimate the coworkers and work for a good attitude and knowledge. There is a reason for the founding of the saying “Knowledge is power”. The reason is that people tend to follow a wise person since it provides a sense of security and trust.

A leader can never diminish anyone, but has to have a clear attitude of what is right and what is wrong and communicate this in a clear sentence to the coworkers.

3.5.2 Workload

Some tasks a leader has to deal with are for example to share the workload, to adjust the workload after the crew and the current pressure on the situation. The master needs to distribute and allocate the task and duties onboard to the crew. It is important that it is consistently moderate workload. Also to allocate the recourses within the crew based on their knowledge and experience.

For example put an inexperienced AB on the same watch as an experienced and both of them can take advantage of it.

To optimize the workload, planning and organization is vital. Preparation and goals will help during the process.

Available time need to be in balance to the extent of the work. If too little time is given to solve a task, stress level will increase and thoroughness will be put aside. But if given too much time, it will generate laziness and boredom.

Briefing: a meeting before a job to be carried out to introduce the involved people, also to establish a plan and goals. This can be a five minutes meeting or a more massive briefing, depending on what kind of job to be carried out. This briefing may very well include toolbox talk, which is a short safety talk, and perhaps filling out a risk assessment schedule.

Debriefing might be even more important than the briefing, this is when the job will be summarized and analyzed and the crew will give and receive feedback. Safety issues and other obstacles that might have arisen during the job can be brought up for discussion.

How the feedback is received is about what attitude the person concerned chooses to obtain.

3.5.3 Decision-making

To make a decision is a far more complex process than just saying yes or no. At first we need to clarify what a decision is. A decision is when a choice has to be made, it might be more or less conscious but still somewhere in the mind you make a decision based on information or experiences (Rosenzweig, 2013).

Every decision is some sort of compromise or conflict between alternatives.

We make decisions all the time, even when we don't think about it, in our daily life and at work. It can be a simple decision for example to decide what lunch to order at the lunch bar, or which sweater to wear.

A bit harder can be to decide whether to buy a new sofa or not, suddenly you need to collect information, maybe compare different brands and materials. And finally find a balance between price and quality. In the end the decision probably feel safe and well planned.

Next level of decision-making is when other people is directly affected by the decisions you make. Other people must be taken into consideration when making the decision.

Decisions are based on our mental situational awareness and our capability to handle the information we are exposed to. Time is also crucial, how much time we have available to make the decision as well as performing the act of our decision. If the decision stands between two alternatives the consequences of both will be carefully evaluated, and at last it will either be a compromise or a definite choice.

Basically decisions are most often based on:

- Judgment
- Common sense
- Earlier experiences
- Available information

To be a master on a ship the primary task is to look after the crew and the ship. Secondarily prioritized will the cargo or the operation be. The master is alone to make decision about the crew and the ship. And this position has to answer to several instances such as the shipping company, the cargo owner and the crew. The task is to compromise to that extent that everyone is satisfied (fig 3-16).

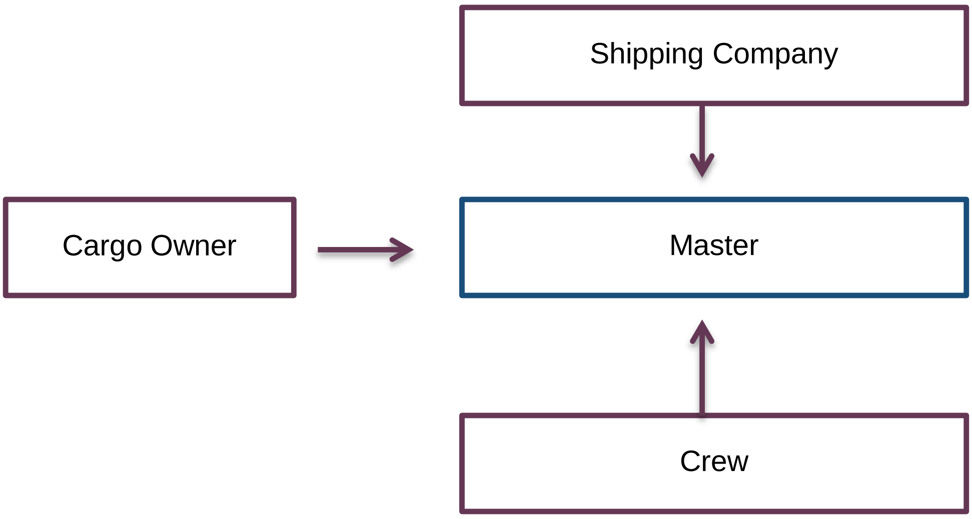


Figure 3-16 The master has to balance different interests (Ekstrand Lovisa).

The master is boss over the crew, employee under the shipping company and responsible for the cargo owners cargo. Hence this person's decision will affect a lot of people. The decision making process will therefore be a conscious act, analyzing information from the situation, based on situational awareness, how much time available and available recourses. When going through this process a consequence analysis will consequently be updated in the mind.

3.5.4 Efficiency versus thoroughness

The study of Hollnagel (2009) shows that the flow of decisions that people make during a day shows continuous series of balancing efficiency against thoroughness.

To have both is impossible, preferring efficiency and the thoroughness will suffer and vice versa.

When less time is spent on thinking and planning and more effort is put into acting, the efficiency increases. Reversed balance is when people put effort and time in planning, the thoroughness increases but time will suffer.

In a company safety issues and quality will be paramount and favored to thoroughness. Since safety is always of big concern in the shipping industry, hasty decisions about safety will and can never be defended if an accident occurs.

The area where efficiency is favored to thoroughness is when production and outputs is emphasized. Although being effective does not mean being careless and inattentive.

Naturally human try to increase the efficiency all the time, either to have more leisure time, or to move on to the next task.

Efficiency versus thoroughness means that there is always a compromise between time and effort.

3.5.5 Attitudes

When a decision is made that affects a part of, or the whole crew the attitude as it is received with is essential. Some attitudes can even be hazardous. If the leadership is weak decisions may fail and the culture onboard is unstable. This will result in crewmembers basing their acting decisions on hazardous attitudes.

Some examples of these attitudes are:

"Don't tell me…" – The person has problem with authorities and is most likely stubborn to do as he/she finds best.

"Do something quickly…" – Impulsive persons who don't stop and think. Instead of evaluating the situation they act on impulse.

"It won't happen to me…" – The immortal persons who are aware of the risks but never believe it is actually going to befall them. These persons are more likely to take risks and chances.

"I can do it…" – The macho attitude. Trying to prove that they can manage with tasks even though help is required. These persons often take unnecessary risks.

"What's the use…" – Ignorant persons who don't care what the outcome may be.

It is up to the leader in the group to do what is in his or her power to change the general attitude. Our own attitude is something we have to work with daily. In many cases the antidote to hazardous attitude is the event of an accident. To prevent this from happening the methods are to discuss the reason why the decision was made, maybe even stricter checklists and rules.

However the first step to a successful attitude onboard our vessels is to set the norms from the beginning.

To sum up the decision-making chapter:

Decisions we make are depending on our cultural background and based on information we percieve from the situation (situational awareness). In the background of our mind is a continual consequence assessment running, scanning the options and the possible outcomes. If the decision affects a lot of people, as in a leaders case, all the involved persons should be taken into consideration as well, so that no one feels diminished or disregarded. If that is the case though, the attitude against the decision will most likely be negative.

3.6 Notes

CHAPTER 4

EMERGENCY RESPONSE & CRISIS MANAGEMENT

MARITIME OPERATIONS
Aalesund University College

4. Emergency Response & Crisis Management

Figure 4-1 Rescue swimmer (AirbusHelicopters.com).

Lightweight hulls and high speeds are a bad combination if an accident would happen. The energy of a moving object increases with its speed in square, so doubling you speed increase the potential forces in an impact by four times. When operating a high speed craft it is important to know the procedures and responses if something would happen, both in relation to the vessel, fire and structural damage and how to handle media and dealing with traumatized casualties, relatives and crew.

Working with small crews makes it even more important to make the correct actions early if an accident should happen. With limited resources it is harder to correct mistakes later on. Tackling one emergency might engage the collective resources onboard, therefore a responsible officer have to make priorities and manage the crews resources well.

According to both national and international regulations a vessel is obligated to assist another unless the risks to the own vessel and crew are too great. A high speed vessel has the possibility to be fast on scene if someone would require assistants and can cover large areas when conducting search operations. Another benefit is that routes close to shore means that help from ambulance, fire department or other emergency services are closer at hand than for other vessels

This chapter will go through rules and regulations concerning emergency procedures, the organization on shore and on scene, first response procedures, and crisis management. Talk about challenges when operating with helicopters (Fig 4-1), aswell as what challenges the vessels special design and construction causes in an emergency, firefighting equipment, how they work and how to operate basic emergency equipment.

4.1 IAMSAR

The International Aeronautical and Maritime Search and Rescue Manual is a cooperation between IMO and The International Civil Aviation Organization, ICAO. It is divided into three separate volumes where volume III is required to be carried onboard according to SOLAS chap. V. Figure 4-2 below shows the three Volumes of IAMSAR (IMO, 2003).

The purpose of the IAMSAR is to assist all levels in the search and rescue organization, all the way from national organization and intergovernmental liaison and cooperation down to vessels on scene and practical guides on winching a casualty.

When conducting search and rescue operations, air and sea resources need to work together in order to make the operation as effective as possible. By having a common manual IMO and ICAO believes that the conditions for an effective cooperation is improved.

Figure 4-2 International Aronautical and Maritime Search And Rescue Manual (ChartKorea.com).

4.1.1 Volume I and II

The first volume of the IAMSAR is named «organization and management volume» and is divided into six part with different focus from national and international organization to training requirements for RCC operators. Volume I discusses the system as a whole, not actions and procedures onboard (IMO, 2008a).

Volume II is intended to be used by mission control operatives and personnel engaged in coordinating search and rescue missions and exercises. It discusses communication systems and key components as rescue coordination centers and sub-centers. A big focus lies on training and certification of shore station operators to «Develop professionally competent SAR personnel» and realistic exercises.

Volume II also stresses the importance to evaluate every case and always try to perform better the next time. Therefore accurate recordkeeping and debriefings are vital.

4.1.2 Volume III

IAMSAR Volume III is named «Mobile resources» and it is required to be carried onboard all SOLAS-vessels as a part of the vessels library (IMO, 2008b). Unlike the other two volumes Mobile Resources contains more practical information and guidance, suitable for vessels engaged in search and rescue operations. Section 1 gives the reader a basic understanding of the search and rescue organization, explained deeper in volume I and II and chapter 4.2 of this book.

IAMSAR provides flowcharts that can be used when receiving a distress by radiotelephony or Digital Selective Call, DSC. It stresses the importance that DSC distress calls are to be acknowledged by a shore station and not a Mobile Resource. Would a DSC distress go un-acknowledged it will retransmit after four minutes. In that case, acknowledge receiving the call to the vessel in distress by radiotelephony and relay the distress to a coast radio station. Await instructions from shore before acknowledging on the VHF DSC station.

Record all received messages and actions taken in the vessels logbook. Time, position and actions taken are to be written down. Would the own vessels master decide not to proceed to the casualty and assist that shall be recorded as well. Including reasons not to assist. If the vessel has previously been in contact with a Search and Rescue unit they are to be informed about the vessel cancelling its assistance. Be ready to reevaluate the decision not to assist if the conditions where to change.

Working with air resources in search operations or evacuation is a big part of IAMSAR vol. III. It provides information and checklists which may be used by the vessels crew when working with, mainly, helicopters. Before any winching from the vessels deck can start a suitable area must be agreed upon with the Helicopters captain. A helicopter require a 30 meter wide maneuvering zone with no obstacles over 3 meters over the deck. A 5 meter wide free zone or working zone are placed inside the maneuvering zone. The deck of the working zone must be clear of any obstacles and be placed on deck of the vessel. Some parts of the maneuvering zone may be placed outside of the vessels deck. Due to the small size of most High speed crafts, a large enough area suitable for winching may be hard to find. In those cases the helicopter crew can decide to use a technique called «Hi-Line» shown in Figure 4-3 and described in detail in the IAMSAR. The helicopter positions itself at the side of the vessel at low altitude and the winch wire with rescue swimmer is pulled onboard with a heaving line. Use caution and observe the helicopters instructions when conducting any operations, especially Hi-line winching (IMO, 2008b).

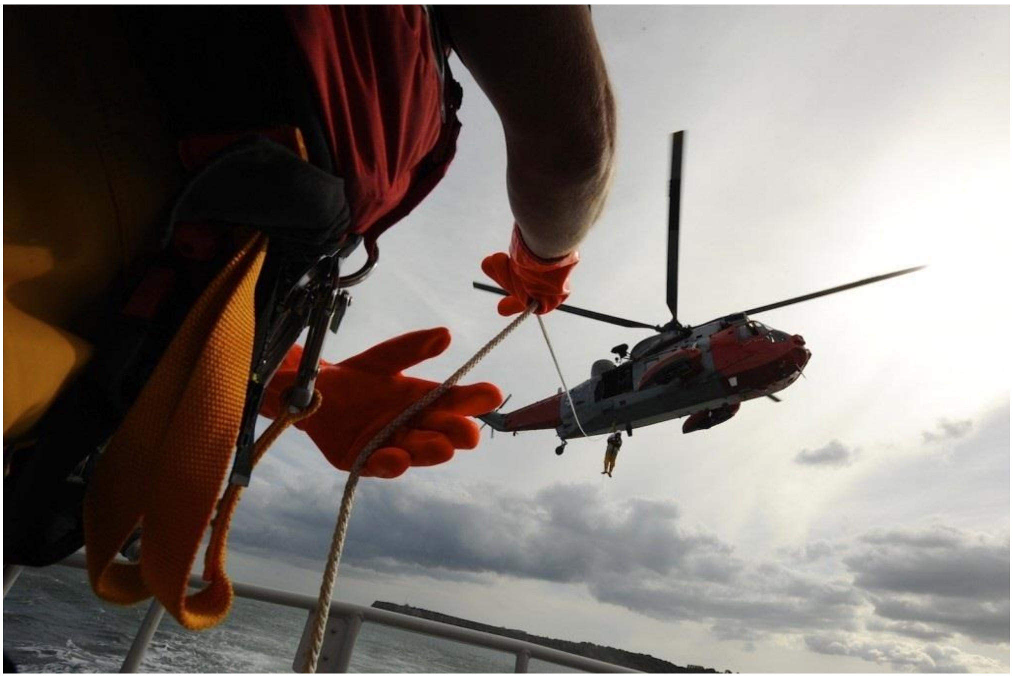


Figure 4-3 Hi-Line winching of a small craft (RHOAviation.com.au).

Another challenging operation in search and rescue is picking up survivors from the water. For any individual in the sea, an approaching vessel seems extremely large and might be frightening. Therefore approach survivors slowly and with great caution. IAMSAR provides several recommendations to assist in making recovery of survivors easier. For example using nets and pilot ladders on the vessels side for survivors to climb on. The assisting vessel can also use its own life rafts as a lift and transferring survivors from a fast rescue boat to the vessel. Use ingenuity and try different solutions during exercises to simplify and ease any recovery from the sea.

4.2 SAR organization

This part will mainly focus on the SAR organization in Norway. A more global and generic perspective is to be found in the IAMSAR Volumes I and II.

The responsibility for providing and monitor Norwegian SAR is with the ministry of justice and police which in turn has delegated to the department of civil emergency and rescue planning to manage the day-to-day operation and the two Joint Rescue Co-ordination Centers (justis- og politidepartementet, 2002).

The SAR service is divided into two areas of responsibility, displayed in Figure 4-4, named Search and Rescue Regions SRR. In 2014 there were 8605 search and rescue missions in Norway. About half, 4443 where over sea. There is a high increase in SAR activity during the summer months due to the increasing number of pleasure crafts.

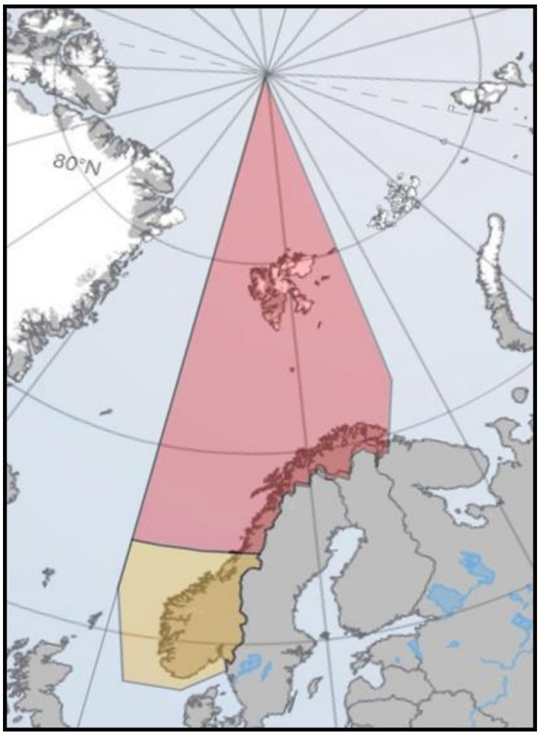


Figure 4-4 Norwegian search and rescue regions (Justis- og politidepartementet).

There are several ways of alerting a shore station about an emergency. Close to shore, where High speed crafts usually operates, VHF is the primary system used. Further out to sea, MH/HF DSC and telephony or Inmarsat are the primary system used, as the range of VHF are limited to about 35-60nm, depending on the height of antennas. The message is received by an «alerting post» which is any facility capable of receiving such signal. Such as a coast radio station or a satellite local user terminal. The message is directed to the co-ordination center responsible for the area of origin of the vessel in distress. Operators there acknowledge the alert and starts to direct resources to the distressed.

A rescue co-ordination center shall acknowledge the distress message on the same system as the message was sent. Accept distress alerts received via Cospas-Sarsat EPIRB which is a one-way satellite system only capable of receiving and relay messages. All alerts must be considered to be real until proven otherwise. The IAMSAR flow-chart for receiving a distress alert is in appendix 5

4.2.1 JRCC

A Joint Rescue Co-ordination Center (Fig 4-5), JRCC, is responsible for coordinating search and rescue over both land and sea. Norway has two Joint Rescue Co-ordinations Centers. JRCC NN in Bodø and JRCC SN in Stavanger, with a total of 48 employees in 2014 (Hovedredingssentarlen, 2014).

The reason for gathering all areas of SAR in one joint center is to maximize the usage of resources, minimize the need to priorities funding and to help providing a better overall view and management over the operations. JRCC NN has responsibility over the northern Search and rescue region and 7 Rescue Sub-Centers RSC. JRCC SN has 21 RSC in its area of responsibility. The two JRCCs 2014 common budget was about 107 million NOK.

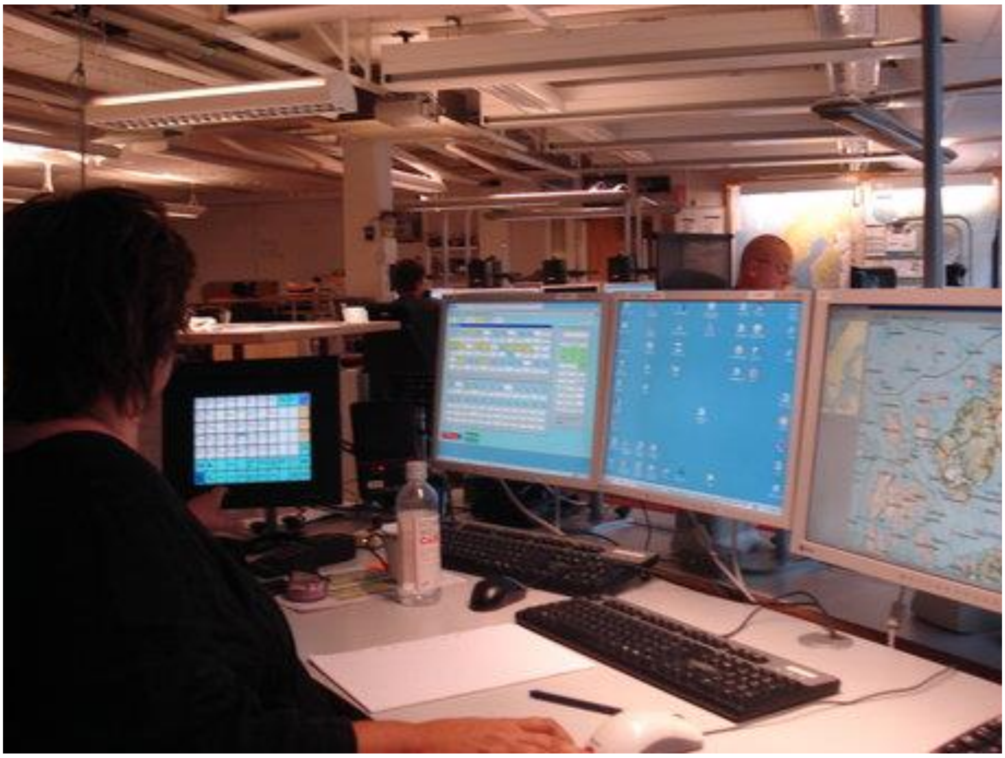


Figure 4 5 Operator at JRCC "Sweden Rescue" (Sjoraddning.se).

Each RSC has the possibility to lead a co-ordinate smaller emergencies and responsibility to set up a forward command post. The RSC is under the supervision of the chief of police in the precinct of the RSC.

4.2.2 OSC

When two or more units are engage in a search and rescue one might be appointed to co-ordinate the operation on location in the SAR area, an OSC. OSC stands for on-scene coordinator and is appointed by the Search and Rescue mission coordinator, SMC. Until the SMC has appointed an OSC, it is common practice that the first to arrive at the casualty acts as OSC. The SMC decides the amount of responsibility and authority given to the OSC, in general, the better the communication between SMC and OSC, less workload needs to be put on the OSC (IMO, 2008a).

The OSC fills a vital role in the SAR operation and has several duties. The first is to supervise and co-ordinate all SAR resources in the area to make sure the operations can proceed in an effective and safe manner. The OSC receives the SMCs Search And Rescue-plan and implements it on scene. The OSC has authority to modify the SAR-plan to better fit the conditions on location but must inform the SMC if he does so. OSC shall also send a situation report, SITREP, to SMC on a regular basis, and keep a detailed log over the events. A SITREP should contain information about weather, wind and environmental conditions in the area, search results and actions, planed or executed. A standard form for SITREPS are in IAMSAR Vol III and appendix 4. Even if nothing has changed during a prolonged operations, reports should still be sent. The OSC shall also inform about survivors picked up, on what SAR-unit they are located and request that resources be relieved or added, e.g. air lifting of casualties, called CasEvac or MedEvac.

Assuming the role as OSC is a great responsibility and if the task proves too great the OSC may and should ask to be relieved or assisted.

4.2.3 SAR-Plan

There are mainly two different types of Search and Rescue plans, national and local (sjöfartsverket, 2013). The national SAR-Plan describes various aspects of national SAR-service. It follows the same structure as the local SAR-plan but describes regions, units and communications over a national level. It defines Search and Rescue Regions, co-ordination facility's as JRCCs and the number, type and standby-time of national SAR-Units like the Norwegian Sea King in Figure 4-6.

Figure 4-6 Norwegian Sea King Search and Rescue Helicopter (Karlsen Vebjorn).

A local SAR-Plan is established for every emergency situation. It describes how the SAR-operation shall be conducted and organized. A SAR-plan follows a set format described in the IAMSAR. It starts with a description of the situation, what has happened, how many people where onboard and what type and number of survival gear the vessel was equipped with. There after a description of the search area follows, position and weather conditions. Implementation of the search and rescue including a list of available SAR-resources and the method of search, e.g. patterns and spread, or rescue. The plan conclude with information about coordination on scene, communication together with call signs and reports between OSC and SMC. Figure over four standard search patterns are in appendix 3.

The main responsibility to establish a search and rescue plan lies on the Search and rescue mission coordinator, SMC. However the situation may require that the OSC develop one on its own. As the situation change on scene the OSC also might have to modify the original plan from the SMC.

4.3 Emergency response

This part will cover some of the responses and actions taken onboard during an emergency and the aftermath. Shock, media and, in worst case, informing someone that their loved one won't be coming home.

There are levels of emergencies. Depending on the risk to human life or other vessels around. It can be divided into three steps: Distress, Urgency and Security. Each level has its own radio prefix: Mayday, Pan Pan and Securité. All repeated three times. Mayday are used when someone is in great risk or the vessel requires external assistants. It holds the highest priority in radio traffic and overrules all other traffic. Pan Pan are one step down on the emergency scale. It is used when there is no immediate danger to life and when assistance might be useful but not necessary at the moment. Securité is primary used for meteorological and navigational warnings (IMO, 2008b).

Other ways of alerting are the use of pyrotechnics and radar transponders. The operation of such equipment are discussed in part 4.4.3. One thing in common for all pyrotechnics is the color, red or orange. Red flares or rocket parachute flares and orange smoke. Other emergency signals are described in IAMSAR vol III and in appendix 6

4.3.1 Standard Operating Procedures and Checklists

A vessel and shore organization needs to have established procedures for emergencies. That is stated in IMOs «International Management Code for the Safe Operation of Ships and for Pollution Prevention», the ISM code, discussed in chapter 2.1.1. Having a checklist and procedure for every kind of emergency situation is next to impossible as every situation is different and poses special challenges and hazards. However, establishing standard operating procedures, SOP, helps in decision-making and makes a good foundation for exercises to train so called back-bone behavior, responding to arising situations on instinct.

As mentioned in chapter 3.1.3 «habits and reliable systems» it is important to have an open mind to the situation and be prepared to think outside the box. You as a crew know your vessel best. A SOP and checklist is a living document and should be subject to change. Points in a checklist can be old or no longer valid. Other points might have to be added. A checklist that is not followed is a checklist that has lost its meaning. Make sure you use the appropriate checklist during exercises to confirm its validity. Notify the company if changes needs to be made and work together with them to develop a new version.

A checklist should not be viewed as a set of instructions, rather an aid to ensure no critical actions are forgotten. The human mind has limitations and without assistance like a checklist it is easy to forget things. Forgetting critical tasks can pose increased risk for the vessel and a higher workload as the crew need to react to the situation rather than act. This is never a desirable aspect, especially in a stressful situation like an emergency.

A common reaction to stress is tunnel vision, focusing on one thing. Breaking that tunnel vision gives you better overlook over the situation but can be hard. Following a good, working checklist forces you to lift focus from the situation or paper to execute tasks in the list. Another way of ensuring that things on the list are executed is to complete it two by two, where one calls out the tasks and verify and the other does them.

4.3.2 First Response

When traveling in high speed, with passengers and a small crew it is vital to take action rapidly. A small situation might quickly escalate if nothing, or the wrong response is taken. These actions are generic and might not always be suitable to your vessel. Always know and follow procedures and checklists that are valid on your HSC. Always keep in mind the possible damages to the environment such as leaking fuel (University of Washington, 2013).

Collision

The high degree of maneuverability a high speed craft has, gives the navigator several options to avoid collision. Short stopping range and narrow turning circle is to the vessels advantage. Would a collision occur the implications can be severe. A HSC is usually made in aluminum which is lighter than steel but also softer. The damages to the vessel in a high speed collision would therefore be greater than if the vessel would be of conventional construction.

- Make sure watertight and shell doors are closed.
- Note time, position, course, speed and angle of collision in ships logbook.
- If the vessels are still in contact do not try to disengage from each other.
- Care for possible wounded.
- Contact the other vessel.
- Sound tanks, voids and compartments for water ingression.
- Contact operator, insurance company and rescue center.

Grounding

The «Sleipner» accident in 1999 shows with striking brightness the consequences of a grounding in high speed. According to the P&I club «the Swedish club» the most common cause of groundings is human error, with malfunction to steering and propulsion on second place. Other usual sources of grounding, like the one in figure 4-7, are hard weather or currents, when taking evasive maneuvers to avoid collision or due to navigational errors.

Figure 4-7 Grounding of HSC Rich Passage 1 (KitsapSun.com).

- Stabilize the vessel on the ground, do not try to re-float until the damages to the vessel has been fully inspected.
- Close all watertight compartments.
- Search the vessel for wounded and care for them.
- Sound tanks, voids and compartments for water ingression.
- Establish the location of the vessel on the ground. Sound the water depth around the vessel and changes to trim and list to determine where the vessel has struck.
- Determine the tide and range.

Unless the vessel is at immediate danger, it is advisable to first contact the owners and insurance company before requesting or accepting assistance from a salvager. The cost for salvage are related to the value of vessel and everything on board and can therefore be huge.

In case of a failure of steering or propulsion, swift action can prevent a grounding. The first action should be to slow down or stop the vessel. Then determine what level of control the crew still has. Some water jets have the possibility to back-flush the propulsion unit if the reason for failure is debris stuck in the jet pump.

Fire

A fire on board is a serious situation (Fig 4-8). The small crews on board makes your actions limited. The best response might be to keep the fire at bay and make fore closest port, rather than try to fight the fire onboard. Most high speed crafts are fitted with various types of fixed firefighting equipment like water mist systems or CO_2 in engine rooms and sprinklers in passenger areas. These systems are a great tool for combating fires and it is important that the crew knows how to operate them. The one who spots the fire should consider an early action. A small fire might be put out with a mobile fire extinguisher at an early stage.

Figure 4-8 Fire on HSC High Speed 5 (ShipwreckLog.com).

- If possible close doors and hatches to the room where the fire is.
- Sound the fire alarm.
- If applicable, start fixed firefighting equipment.
- Organize equipment and crew to fight the fire.
- Call for assistance either at sea or from shore.

Man over board

First determine when the person has gone overboard. Can you see when it happens, was it recently or has the person been missing a while. If a person been missing a while on a high speed craft it might be advisory to make sure the person has been on board in the first place or might have disembarked on a previous stop, as their voyages are relatively short compared to other vessels. If not, try to estimate where the person has fell over board and how long he or she has drifted, with respect to wind and current.

Initial actions are:

- Throw a lifebuoy in the water as close to the casualty as possible, preferably one with smoke or other pyrotechnics.
- Alert crew and, if deemed necessary, other vessels/SAR-Units.
- Start to maneuver the vessel back on its track towards the casualty. Note that fore a vessel equipped with waterjet the fastest and most effective way may be a crash-stop and turn the vessel around rather than conducting one of the standard MOB-Maneuvers, Williamson-, Andersson- or Scharnow-turn as in appendix 6.
- Note time, position, wind direction and force in the vessels logbook.
- Prepare a mean of recovery, for example a fast rescue boat or pilot ladder.

A sharp lookout is vital.

4.3.3 Crisis, Media and Next of Kin

Managing a crisis

A crisis can be divided into two kinds. The physical and mental. The physical crisis are an accident or event that could lead to an accident. The mental crisis is what follows after the physical, stress, anxiety and/or depression (Prevent arbetsmiljö och samverkan, 2015).

Every member of the vessels safe manning crew has its predetermined roll. In the event of a crisis those roles are put to the test. To be able to perform and solve the situation you as a crewmember needs to be proficient with your duties. You also need to be familiar with your vessel and the safety equipment on board. It is everyones duty to be familiar with its own roles onboard and an important job for the master to motivate the crew to have a safety mindset. A crisis reveals whether checklists and procedures are updated and valid. However, it is too late to adjust them during an ongoing event. In a good safety culture, problems and deficiencies are discovered early and corrected.

Safety culture is something that covers the whole organization, from the top management in the company to the individual crewmembers. It was first established as a concept after the Chernobyl disaster in 1986, when it was discovered that the leadership on the power plant did not pay attention to safety issues and that was a direct cause of the accident. If the top management commit to the prevention of accidents and improvement of safety routines it reflects on the organizations as a whole. In the maritime industry several of the key items regarding safety culture are covered by the ISM code, like reporting, audits and proper documentation. In spite of that, several accidents has uncovered faults in companies' safety culture and management. Especially in times of hard competition and bad market the preventive safety issues can be down prioritized. The attitude that «it won't happen to us» is the safety cultures greatest enemy. In a good safety culture, every member of the organization can report deficiencies to the management without feeling concern for reprisals. Such actions are instead encouraged and rewarded.

Everyone reacts different to an unplanned event, some get stressed, other resort to denial and some keep calm and calculating even if the world collapses around them. No matter how good you are in dealing with the situation stress reactions can arise afterwards. Mild reactions are for example, talking loud with others that was in the same situation and restlessness. More severe reactions are aggressions, arousal, apathy and depression. If stress reactions goes unrelieved it can lead to post traumatic stress disorder PTSD. Threats, violence, accidents or personal issues at home can all cause a crisis. As a small crew that are used to working together it is easier to spot stress reactions, if everyone is vigilant and knows what to look for.

One organization that is used to dealing with trauma and stressful situations is the military. Several armed forces, like the Swedish, American and Brittish use a concept called «mental first aid» which is the first actions taken by your friends and co-workers after a trauma. Dealing with someone in a personal crisis might feel intimedating and as a non-professional. It can be hard to know what to do. Small actions does a big difference. Simply be there for the person and listening can be enough. Do not degrade someones problems, like using words as «that's not too bad» or «don't worry about it». Be supportive and lend a shoulder to cry on is the best actions. After the first reactions has passed, more professional help might be needed but with proper help in the first stages conditions for a good and fast recovery are improved.

Media

Figure 4-9 Accidents tend to draw media attention (Tanketornet.worldpress.com).

Everyone has the right to contact and talk to the media, it is a vital part of the freedom of speech. However one must remember that when being interviewed or making a statement, you are viewed by the public as a professional in your role as a crewmember. Your personal opinion might also be viewed as the companies official opinion. Few are used to handling media and after, for instance, an accident the pressure from journalists to get information can be hard (Fig 4-9).

The company or operator might have a media policy or official spokesman that can assist you or give you advice. If you are interviewed, try to decide on forehand what you want to say and how you want to say it. Look at the reporter, not the camera and try to be relaxed. Here are some other basic advice.

- Reflect over why they want to interview you. Are you the victim, liable or the expert? The questions to be expected varies with the role you play.
- Never lie. If you do not wish to answer a question simply say so, the phrase «no comments» is not recommended. You do not have to argument why you do not wish to answer something, it is ones free will.
- Stick to facts and avoid speculations. If you do not know the answer to a question, say so, and if possible refer to someone who knows or ask to return when you know more. Remember to inform the one you refer to.
- Focus on the affected and never put the blame on a casualty. Try to avoid naming individuals especially if the next of kin has not been notified of the accident.
- Avoid specialist language or jargon. Use words that the public can understand and relate to. Try not to curse
- Nothing is «off the record» everything you say is a part of the interview.
- Remember that social media are also used to collect information and statements. Use it with care and constraint.
- Inform other affected parties what you have said directly after the interview has ended as the journalist are likely to cross-reference your statements. If you have said something wrong don't be afraid to say so, so it can be corrected.
- Be careful what you primise, media is likely to return after a while and if things that you have promised is not carried out they will wonder why.

Informing next of kin

In the event of a passenger or crewmembers passing or serious injury it is important to notify that one's relatives as soon as possible. Contact the company for assistance and agree on how to act.

Always notify the next of kin in person and together with the police and, if deemed necessary, welfare officer or representative for the victims religious institution. Choose a calm and secluded area, i.e. the relative's home and make sure you are prepared yourself.

Give a description of what happened and take your time to listen. The company should be prepared to offer or recommend further counselling with for example a psychiatrist if the next of kin wants that.

In case of a suspended search for survivors it is the Search and rescue mission coordinators responsibility to inform next of kin about such decision.

4.4 Equipment and Damage

4.4.1 Damage Particulars

Damage stability

A vessels transverse stability is measured in its GM which is the distance between the vertical center of gravity, G, and the metacenter, M. In static conditions and small heel angles M is a static point. As the heel increases M starts to move and therefore GM is no longer the same (Van Dokkum, 2010). Therefore at larger heel GZ is used where Z is a point in a line stretching from M to the center of the vessels buoyancy B, perpendicular to G. GZ is also called the righting lever, see figure 4-10.

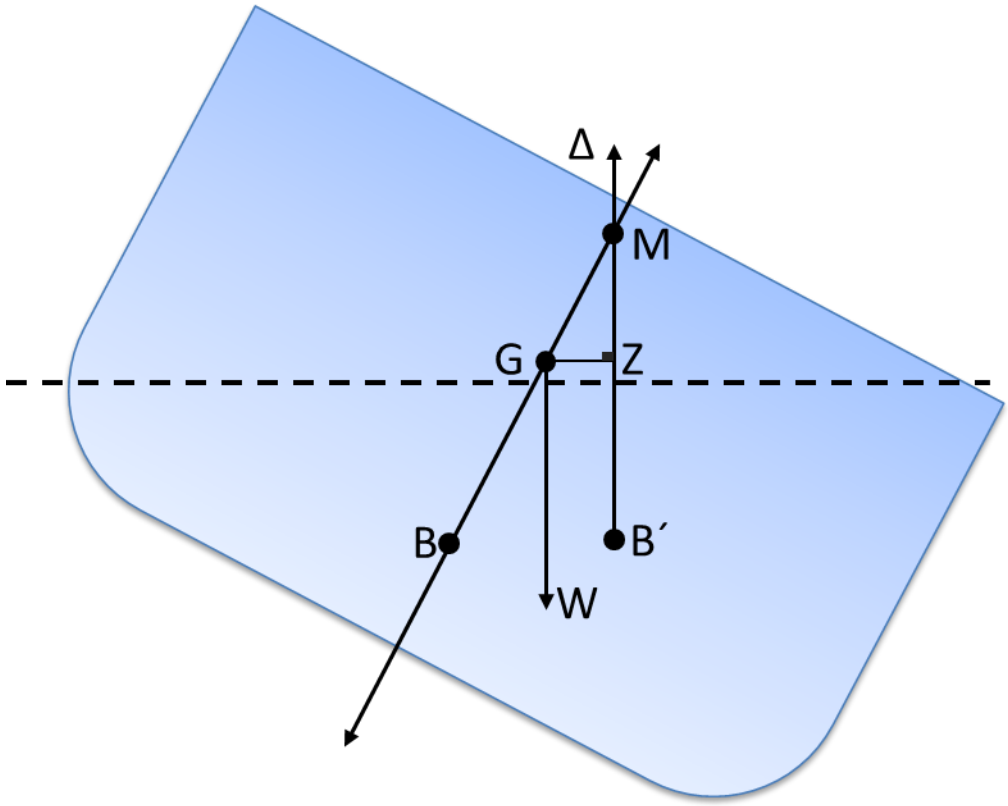


Figure 4-10 position og G, B, M and Z (ShipMedia.com).

If a compartment is damaged below the waterline, there are two ways of explaining what happens. One is that the buoyancy of that compartment is lost and therefore the vessel starts to sink. The other one is that the inflowing water adds weight and the vessels displacement increases. The end result is however the same, water will flow in until the vessel again has enough buoyancy to stop the sinking process. That state when the water level in the compartment and the outside is stabile is called equilibrium.

Damage to the vessel can be either symmetrical or asymmetrical, as displayed by the drawing in figure 4-11. A typical symmetrical damage is a punctured cargo hold in a bulk carrier or other large compartment, the water floods the compartment more or less in the vessels centerline and the vessels sinks vertically with little or no list. An asymmetrical damage is for example a damage to one of the hulls in a catamaran. The water fills only on the side that is damaged and the vessel sinks not only downwards but also with a substantial list.

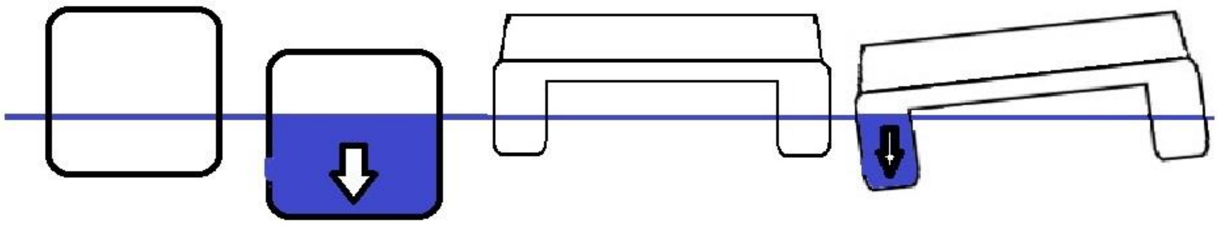


Figure 4-11 Symmetrical and asymmetrical damage (Åfeldt Jimmy).

Passenger vessels are known as «2 compartment ships» that should not be interred as a guarantee that the vessel will survive if it suffers damage to two compartments. The term simply describes that if two compartments are damaged the waterline is maximum 76mm from nearest floodable opening. It does not guarantee a sufficient righting moment to keep the ship upright to the forces exposed by wind and waves.

The Catamaran

The catamaran has a strong initial stability. The GZ-curve has a steep inclination until about 15° or where the opposing hull exits the water. Afterwards it decreases down to about 70° where the stability is lost. However openings in the hull, like windows and doors, will most likely be under water before and the risk is great that the vessel will flood through those openings and therefore not be able to right itself even if the vessel has a righting moment on paper.

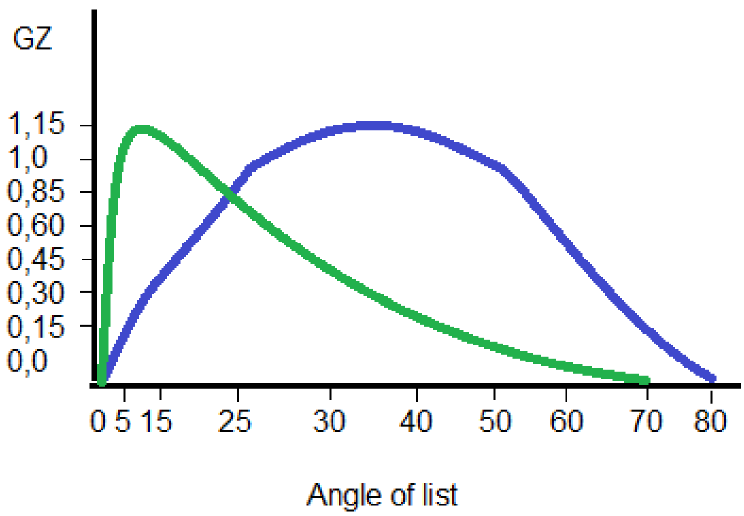


Figure 4-12 GZ-curve for a Catamaran, green, and monohull, blue (Åfeldt Jimmy).

Figure 4-12 shows the difference between a catamaran, shown with a green line, and a conventional monohull, shown with a blue line

A damage to a catamaran will in most cases be asymmetric, unless both hulls are damaged fairly equal. The result is therefore that the vessel will list. There are different challenges depending on the direction of waves. If the damage is on the windward side, the vessel may not have sufficient residual stability to cope with the forces of the waves acting on it and the vessel might capsize. Waves acting on the vessels leeward side may break over the deck, making staying there dangerous, however risk of capsizing is less.

After flooding it is important to know whether the vessel has enough stability to stay afloat. Special care needs to be taken regarding free surface moments in partly filed compartments. Keep in mind that tanks containing fuel can also pose a problem even if they are full at the time of damage. As the water is heavier than fuel the weight of the tank will increase as fuel leaks out and water in. Always consider the risks of entering a damaged compartment before any stamping, the possible benefits and whether such actions are practicable.

4.4.2 Firefighting Equipment

Apart from regular mobile firefighting equipment like hoses, nozzles and extinguishers a high speed craft is also fitted with several different fixed firefighting equipment in order to quickly detect and combat any fire. The small size of most HSC crews means that fixed firefighting equipment is a vital tool to maintain safety for passengers and the crew needs to be proficient with its operation, benefits and limitations

Detectors

Detectors can be divided into three different types: Smoke-, heat- and flame-detectors. Areas defined in the HSC Code as «Major or moderate fire hazard» as well as other areas not regularly occupied shall be fitted with smoke detectors. Flame detectors may only be used as a supplement to smoke or heat. Every detector shall have at least two sources of power and a dedicated alarm panel, it may also be used for closing ventilation and fire doors if they are not automatically operated (transportstyrelsen, 2009).

There are mainly two different kinds of smoke detectors. The Ionization detector, known from most domestic fire alarms and the photo-electric detector. In the Ionization detector, a small amount of radioactive material, usually Americium-241, in a chamber causes the air to ionize. An electrical current is passed through the ionized air. As smoke particles enter the chamber the ions attach to the smoke instead and the current is reduced or interrupted, triggering the alarm. Figure 4-13 also displays the working principle of the ionization detector.

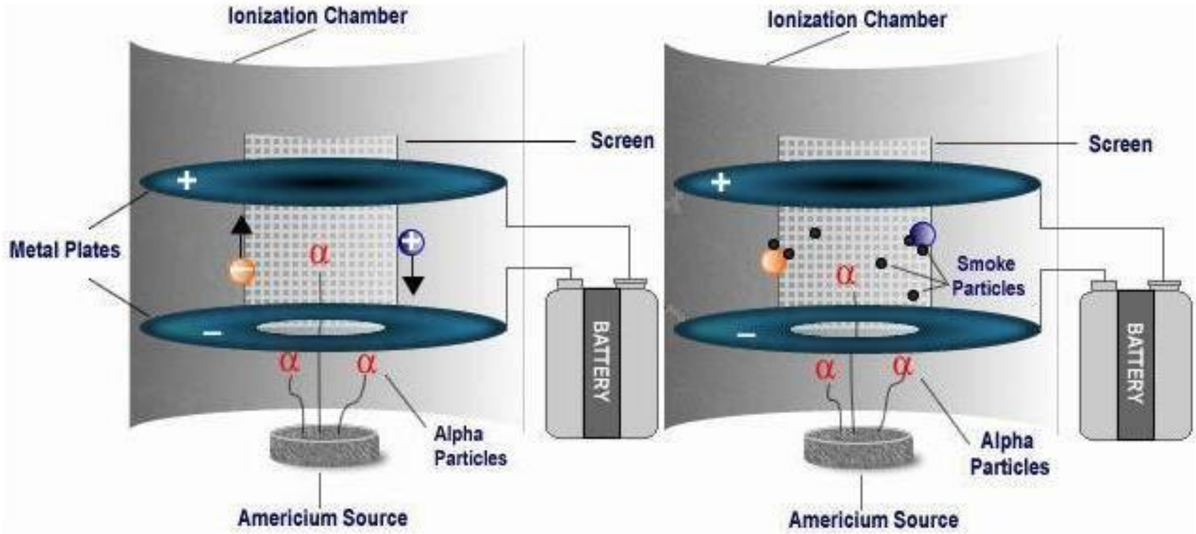


Figure 4-13 Ionization smoke detector (KNTU.ac.ir).

Figure 4-14 shows the other type that uses a focused beam of light that hits a black surface in the detector and is absorbed. As smoke enters, the light is scattered and hits a light sensitive receiver and the alarm is triggered. The size of smoke particles varies with different types of fires. A large burning fire creates rather large particles compared to a smoldering fire. A photo-electric detector works better with smaller particles and is therefore faster to react to slow burning or smoldering fires. It is not specified in the HSC code what type of detector should be used but civil organizations recommend either the use of only photo-electric or in combination with ionization detectors.

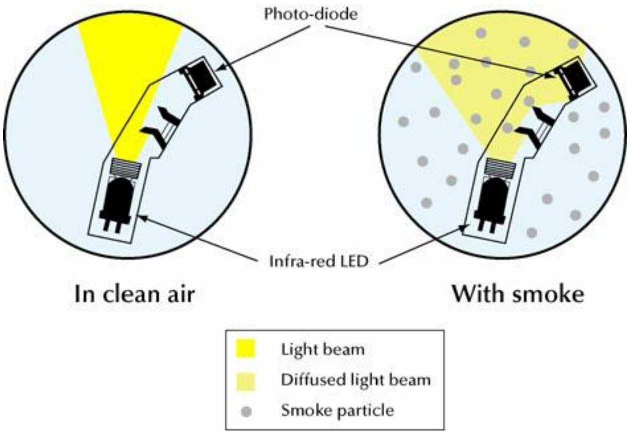


Figure 4-14 Photo-electric smoke detector (Apollo-fire.com.uk).

Even though the detectors have a different working principle they both react to particles. Therefore they have that same generic faults. Other particles such as dust, aerosols, and vapor can trigger the alarm. The ionization detector is more prone to such failures as it is more sensitive to larger particles. In areas with a lot of particles, such as the galley or showers, it might be advisable to install heat detectors instead.

Old heat detectors are usually of bi-metal type. Inside the detector is a metal plate of two different types of metal which expands different when subjected to heat. The plate therefore bends, closing a circuit and triggering the alarm. The biggest downside of a bi-metal detector is that it is a mechanical system with moving parts. It is rugged and simple but not as sensitive as the thermistor is. The thermistor detector uses an electrical resistance which changes as it is exposed to heat. As there are no physical moving parts and a continuous electrical current it is less exposed to faults in the detector itself. The rate can be determined by the variation of temperature in two thermistors, one over the other. The lower will be exposed to heat befor the upper one and the difference is measured. However it is more dependent on software and power supply than the more mechanical bi-metal detector. The bi-metal detector sense rate by another metal piece placed under the main sensor. This part reacts faster to heat than the other. As the temperature rise rapidly the lower will “catch up” the upper and the circuit is closed.

A flame detector is extremely effective in detecting liquid fires, it is therefore suitable in engine rooms or boiler rooms where flammable liquids are present. The flame detector reacts to light, namely ultra violet or infra-red, produced by the flames. Old flame detectors were prone to false alarms due to flashes from electrical sparks, direct sunlight, welding or cameras. Newer detectors combine sensors for both infra-red and ultra violet in different wavelengths to reduce the risk of false alarms. The detectors also has a limited angle of view, maximum 120°, and the detector needs to «see» the flame in order to detect it.

Extinguishing systems

The HSC-Code has demands that fixed fire extinguishing systems shall be installed in engine rooms, bond stores or other areas with high fire hazard. However it is common that such systems also is installed in passenger areas, stairways and other public places.

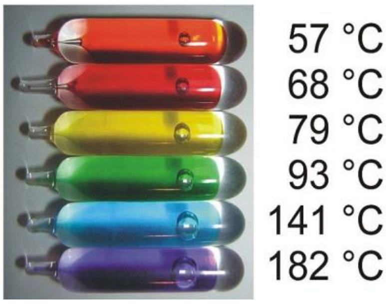


Figure 4-15 Color-code of sprinkler bulbs (Wikimedia.org).

Common in areas where people reside, for example passenger areas and accommodation, are sprinklers or water mist systems. The sprinkler is either activated manually or with heat by a glass bulb filled with an expanding fluid. As the liquid expands the bulb breaks and water

Figure 4-16 Water mist extingusher (GBDMagazine.com).

pressure in the system falls, opening an alarm valve causing water to flow. The liquid in the bulbs are color-coded, displayed in figure 4-15 above, after what temperature it breaks. In a manually operated system the pipe is «dry» and water only starts to flow as a section valve or fire pump is started.

The main drawback of a traditional sprinkler in maritime use is the large amounts of water that is flowing out. In a typical small HSC the passenger area is rather high compared to the rest of the hull and large amounts of water high over the center of gravity combined with the free surface moment can cause problems with the vessels stability. Newer systems like *Hi-Fog®* use smaller amounts of water in small droplets (Fig 4-16), like a mist, cooling the fire. Water mist systems are slightly more complex than a regular sprinkler system but very effective at extinguishing fires.

HSCs usually have unmanned machinery spaces, and a common fire extinguishing system is CO_2. The carbon dioxide gas is stored under pressure, either in racks or “batteries” as shown in figure 4-17, or in one big tank, and manually released into the burning compartment. The gas smothers and cools the fire but it will also smother any occupants left inside so it is important to be sure that any survivors are rescued before releasing the gas. Old systems used another gas, Halon, to extinguish the fire. Halon chemically interrupts the combustion process. Unlike CO_2 people can remain in the area without being killed by the gas, it is however extremely toxic to the ozone layer and was banned from use in 1994. Before using a gas extinguishing agent it is important that all openings and ventilations are closed so the gas remains inside. Keep the area closed and sealed even if the fire is extinguished to avoid it to re-ignite.

Figure 4-17Rack of preassurized CO2 (Alibaba.com).

4.4.3 Emergency Equipment

Apart from firefighting equipment, a HSC also has ha wide array of other emergency and lifesaving equipment. Pyrotechnics, rafts and various types of communication devices. What type and number of different equipment that is required to be carried on board is governed by international and national regulations, but in general a HSC is required to carry, life rafts, parachute and hand held flares, portable VHF, Search And Rescue Transponder (SART) and Emergency Position Indicating Radio Beacons (EPIRB).

Pyrotechnics

Pyrotechnics is usually stored in a canister containing various sorts of pyro, flares and smoke. Even if there is daylight, the strong light emitted from flares is still visible from great distances. Smoke is mainly used for aerial observations as the smoke tend to lie on the surface of the water and is hard to spot unless the observer is at an elevated position. Operation of the pyrotechnics varies from maker to maker so the crew needs to learn how to operate your type of pyro. However a short instruction manual is usually printed on equipment so it can be operated by an untrained individual like a passenger.

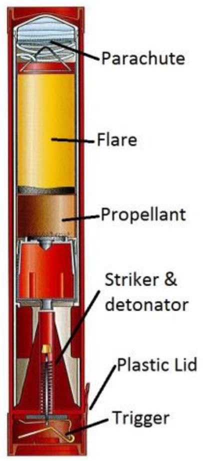


Figure 4-18 Parts of a parachute flare (Adopted from Hansson-pyrotech.se).

The parachute flare (fig 4-18) consists of a mix of chemical substances, usually Strontium, Magnesium and Potassium mixed with a binder like sawdust or charcoal attached to a parachute. It is stored in a metal lined plastic tube together with a propellant charge (black powder) and igniter. When the igniter is lit, usually by pulling a cord or depressing a trigger, the propellant drives the flare and parachute out of the tube and ignites the pyrotechnic substance. As the velocity reduces the parachute deploy and the flare slowly sinks to the surface. A Parachute flare has a burning time of about 1 minutes, depending on type and angle when being launched.

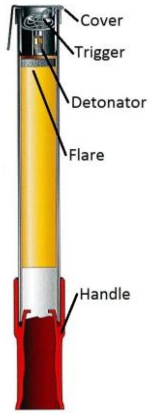


Figure 4-19 Parts of a hand held flare (Adopted from Hansson-pyrotech.se).

The hand held flare in Figure 4-19 has the same working principle as the parachute flare but the difference is that the burning compound remains in the tube as it burns. The flare burns with a high temperature and bright light, about 10 000 candela which is 74 times as high as a normal light bulb. Therefore the user should avoid looking straight into the light and keep the flame away from combustible materials like plastics in for example a raft. The hand held flare burns for about one minute as well.

Smoke signals (Fig 4-20) contain a smoke-compound of wax, Potassium chlorate, lactose and a coloring agent stored in a floating metal canister. The trigger cord is stored under a lid and when pulled it sets off a time fuse that ignites the smoke-compound after a few seconds. When the smoke signal is lit it is extremely hard to extinguish until all compound has burned up after about 3 minutes. Some find the smoke irritating to throat an eyes so it is advised to throw the smoke downwind.

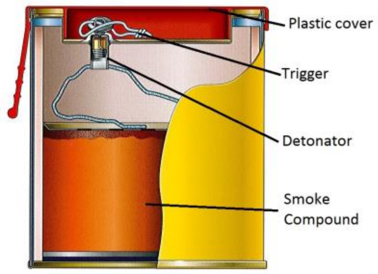


Figure 4-20 Parts of a smoke signa (Adopted from Hanson-pyrotech.se).

Rafts

A rubber life raft is stored in a plastic container, visible in Figure 4-21, on deck. The container is attached to a hydrostatic release mechanism which cuts the lashings to the container if the vessel would sink. When pulling a cord the raft is inflated by compressed air stored in tubes under the raft. The force from the inflation breaks open the container and the raft is released.

Figure 4-21 Raft Packed inside container (Wikimedia.org).

The raft is equipped with survival gear, pyrotechnics, food and water. The underside of the raft has ropes attached to aid in righting the raft should it end up upside-down. It also has a sea-anchor which should be deployed to stabilize the raft in rough seas and floodable compartments on the underside to prevent capsizing.

The raft can either be launched via a davit as in figure 4-22 below, or by throwing it over board. If the raft is launched by davit the raft is connected to a off-load release hook through a small

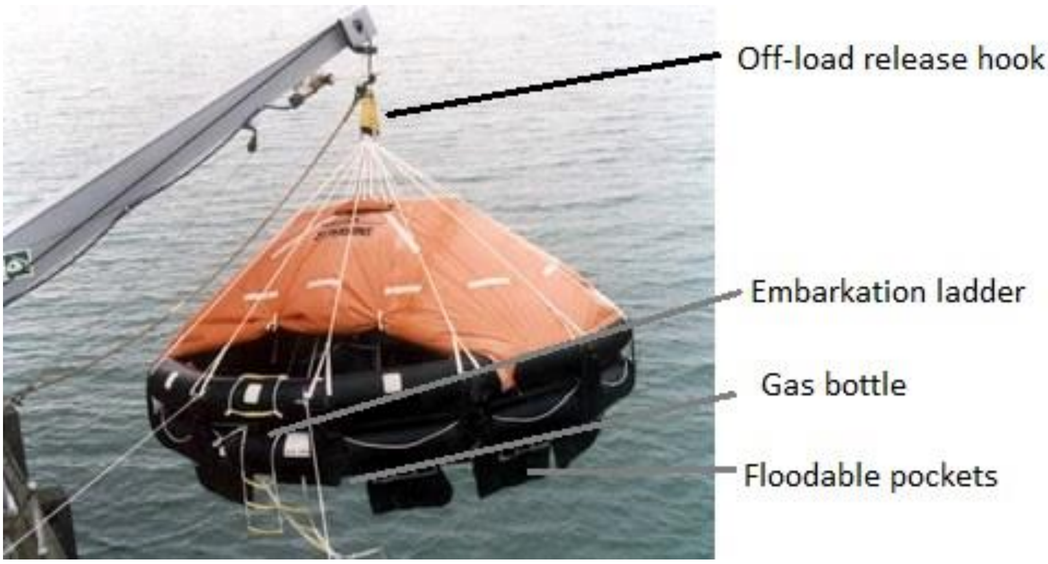


Figure 4-22 Davit-launched liferaft (Avalonrafts.com).

hatch in the canister. The hook is designed to release the raft as the load on the hook is lost when the raft hits the water surface. Several accidents during exercises as occurred with that type of hook and it is important to know how your type is operated.

The life raft needs to be serviced annually. In the service the raft is unpacked, inflated and checked for leaks and damage. All equipment in the raft is inspected and, if expired, it is replaced. After the raft is checked, cleaned and repaired it is deflated and repacked. The container is remarked with new expire date and the service is documented before the raft can be reinstalled on board.

Communication

The HSC has at least three different types of emergency signaling and communication devices. For direct two-way communication there is the Portable VHF and for homing and position indication there is the Search And Rescue Transponder and Emergency Position Indicating Radio Beacon.

Figure 4-23 Jotron Portable VHF (Wikimedia.org).

Figure 4-23 displays a portable VHF that is required to be carried on board. It shall have at least channel 16 and one extra channel. The battery should last for 8 hours. Passenger vessels, which most of HSCs are, shall also carry a special aeronautical VHF. They communicate on 121.5 and 123.1 MHz which is the air traffics emergency channels. SAR aircraft also has the possibility to home on the 121.5 MHz frequency. High or low effect can usually be selected, 2 and 5 W is standard. High effect gives better range and signal strength but consumes more battery.

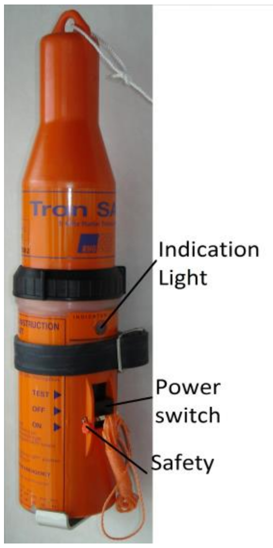


Figure 4-24 Jotron Search And Rescue Transponder (Wikimedia.org).

The SART (Fig 4-24) responds to the signal from a 3 cm radar and transmits a response signal which the radar displays as 12 dots just behind the SART and stretching away. As the radar comes closer to the SART, the dots are stretched into a wedge and finally as the radar is close, circles. The range of the SART is dependent on the height of the radar and transponder, but typically it can be seen at about 5 nm. According to IMOs performance standards the battery should last for 96 h standby-time and 8 h of transmission. When the SART receives a signal from a radar it will give an audible and visual indication.

When an EPIRB are activated they transmit a signal on 406 MHz to satellites. The COSPAS/SARSAT system consists of equipment fixed on board 6 geostationary, GEOSAR, and 5 dedicated low altitude polar orbiting satellites; LEOSAR. The LEOSAR satellites calculates the position of the beacon by Doppler effect. As the satellite moves towards the beacon, the frequency appear to increase until it passes the beacon. The frequency then appear to reduce as the satellite moves away. Figure 4-25 shows a Jotron® Eprib and its basic parts

Figure 4-25 Jotron Emergency Position Indication Radio Beacon (Wikimedia.org).

The system cannot calculate on what side of the satellite the beacon is located so the first pass will give two possible positions. Therefore another pass is required. Now the earth will have turned slightly and the false positions will be different than the first. The processed data is downloaded to one of 41 Local User Terminals, LUT, and forwarded to a rescue coordination center. A resolved position is provided after a maximum of 60 minutes. The GEOSAR cannot calculate the position as it does not move relative to the earth. Its purpose is to provide early notice and to serve as a complement to the LEOSAR satellites. Some beacons have an internal position receiver and sends it with the emergency signal to the GEOSAR satellites. That provides a very fast and accurate position fix. The EPIRB also transmit a homing signal on 121.5 MHz the battery lasts for at least 96 hours.

There are EPIRB beacons approved by IMO which transmit on VHF channel 70 instead of 406 MHz. These are allowed on vessels that only sails within VHF coverage, called area A1. All countries however does not approve its use and there is currently no manufacturer that produces such beacons. In 2010 the use of an AIS SART was approved by IMO. In difference to the normal SART the AIS SART sends it position once every minute on AIS making it visible on nearby vessels ECDIS, radar or other displays connected to the AIS receiver.

Figure 4-26 shows a hydrostatic release, also visible in figure 4-25. It is fitted to most Rafts and EPIRBs and its purpouse is to release the lashings of the equipment at a set preassure or deapth. The lashings are drawn through the mechanism wich containd a spring-loaded knife held in place by a pin connected to a membrane. When water preassure increeses the membrane is being depressed and releasing the knife which cuts away the lashings. It is important that the mechanism is installed correctly, so that it cuts the correct line and that no other lashings remain, holding the equipment in place as the vessel sinks.WHne installed on rafts the inflation painter is attached to the red "week link" seen below in figure 4-26. As the raft floats to the surface the painter is stretched out and inflates the raft. The buoyancy of the inflated raft then brakes the week link and it is then free from the vessel and can float to the surface.

Figure 4-26 Hydrostatic Release Unit (Wikimedia.org).

4.5 Notes

CHAPTER 5

APPENDIX

MARITIME
OPERATIONS
Aalesund University College

5. Appendix

5.1 Appendix 1: Foreskrift om kvalikasjoner og sertifikater for sjøfolk

§ 65.Krav om sikkerhetskurs og kvalifikasjonsbevis for sjøfolk på hurtiggående fartøy

(1) Skipsfører, overstyrmenn og vakthavende offiserer på hurtiggående fartøy skal ha gjennomført og bestått godkjent kurs for navigatører på hurtiggående fartøy dokumentert ved gyldig kvalifikasjonsbevis for navigatører på hurtiggående fartøy. Andre sjøfolk som har tjenestested på bro under fart skal ha gjennomført og bestått godkjent kurs i operasjon av hurtiggående fartøy dokumentert ved gyldig kvalifikasjonsbevis for brobesetning på hurtiggående fartøy. Assessor godkjent for hurtiggående fartøy skal evaluere kompetansenivået hos dekksoffiserer. Evalueringen skal skje ved fartøysspesifikk og farvannsspesifikk utsjekk fastsatt av rederiet.

(2) Kvalifikasjonsbevis for navigatører på hurtiggående fartøy og kvalifikasjonsbevis for brobesetning på hurtiggående fartøy er gyldig i fem år fra utstedelsesdato. Fornyelse av kvalifikasjonsbeviset krever at innehaver i løpet av de siste seks måneder før gyldighetstiden utløper gjennomfører og består godkjent oppdateringskurs.

(3) Innehaver av kvalifikasjonsbevis som nevnt i annet ledd skal i perioden 24 til 30 måneder etter utstedelses- eller fornyelsesdato gjennomføre og bestå godkjent oppdateringskurs eller gjennomføre trening om bord på skipet under instruksjon fra instruktør fra godkjent opplæringssted og vurdering av rederiets assessor godkjent for hurtiggående fartøy.

(4) På hurtiggående passasjerskip skal alle sjøfolk minst ha gjennomført og bestått grunnleggende sikkerhetskurs som nevnt i § 9.

(5) Dekksoffiserer som etter tidligere forskrift om kvalifikasjoner for sjøfolk har fått utstedt sertifikat med adgang til å føre fartøy med hastighet opp til 25 knop kan fortsatt føre slike fartøy.

0 Endret ved forskrift 27 juni 2013 nr. 803 (i kraft 1 juli 2013).

§ 66.Tilleggskrav til skipsfører og dekksoffiserer på hurtiggående fartøy

(1) Skipsfører og dekksoffiserer på hurtiggående passasjerskip med bruttotonnasje under 50 skal minst ha kompetansesertifikat dekksoffiser klasse 5. Skipsfører skal ha førerrettigheter hvorav minst seks måneders fartstid som ansvarshavende vaktoffiser på bro på hurtiggående fartøy. Disse seks måneders fartstid kan erstattes av minst to måneder godkjent systematisk opplæring.

(2) Skipsfører og dekksoffiserer på hurtiggående fartøy med bruttotonnasje 50 opp til 500 skal minst ha kompetansesertifikat dekksoffiser klasse 4. Skipsfører skal ha førerrettigheter hvorav minst seks måneder som ansvarshavende vaktoffiser på bro på hurtiggående fartøy.

(3) Skipsfører og dekksoffiserer på hurtiggående fartøy med bruttotonnasje 500 opp til 3000 skal minst ha kompetansesertifikat dekksoffiser klasse 3. Skipsfører skal ha førerrettigheter hvorav minst seks måneders fartstid som ansvarshavende vaktoffiser på bro på hurtiggående fartøy.

(4) Skipsfører på hurtiggående fartøy med bruttotonnasje 3000 eller mer skal i tillegg til kompetansesertifikat dekksoffiser klasse 1 ha minst seks måneders fartstid som ansvarshavende vaktoffiser på bro på hurtiggående fartøy.

0 Endret ved forskrift 27 juni 2013 nr. 803 (i kraft 1 juli 2013).

5.2 Appendix 2: Forskrift om bygging mv av hurtiggående fartøy

§ 36.*Operasjonskrav*

(1) Bestemmelsene om operasjonskrav i kodens kapittel 18, gjelder også for eksisterende hurtiggående passasjerfartøy.

(2) Den dokumentasjon som kreves for operasjonskontroll etter kodens kapittel 18 nr. 18.1 og den fartøydokumentasjon som kreves etter kodens kapittel 18 nr. 18.2, skal være forfattet på norsk og oppbevares om bord.

(3) Rederiets system for opplæring og bedømmelse av besetningens fartøyspesifikke kompetansenivå krevd i kodens kapittel 18.3 skal minst tilfredsstille følgende kriterier:

a) Assessor

Rederiet skal utpeke en koordinerende assessor som er kvalifisert i henhold til kvalifikasjonsforskriftens § 9-3 (4).

b) Opplæring

Rederiets opplæringsprogram skal spesifisere opplæringens varighet og innhold, slik at kandidaten, i tillegg til å tilegne seg kunnskap, har opparbeidet praktiske ferdigheter til å fylle sine oppgaver så vel i normalsituasjon som i nødsituasjon før tiltredelse i stilling om bord. Relevante deler av opplæringen skal foregå når fartøyet er underveis slik at kandidaten blir kjent med alle aktuelle havner og hele operasjonsområdet under dag- og nattseilas med aktuelt fartøy.

c) Kompetanse

Rederiet skal forvisse seg om at enhver besetningsmedlem innehar de her spesifiserte kompetansenivå før vedkommende tiltrer i stilling.

d) Utsjekk

Bedømmelse av kompetansenivå skal bestå av en praktisk og en skriftlig del. Kandidaten skal også ved praktisk bruk vise tilfredsstillende ferdigheter i bruk av instrumenter, utstyr og tekniske hjelpemidler som inngår i arbeidsoppgavene.

Relevante deler av utsjekken skal foregå når fartøyet er underveis og bestå av minst én ankomst og én avgang i alle aktuelle havner og seilas i hele operasjonsområdet under dag- og nattseilas med aktuelt fartøy.

Den fartøysrelaterte utsjekk skal bedømmes av sertifisert assessor jf kvalifikasjonsforskriftens § 9-3 (4). Den fartøysrelaterte opplæring skal minst tilfredsstille fartøyets operasjons-, opplærings-, vedlikeholds- og servicemanual.

A= LedelsesnivåE5:I 16F9E5:I15	***Ta komplekse strategiske beslutninger på selvstendig grunnlag***	***Brobesetning***		
B= Operere	***Bruke prosesser, komponenter og systemer på selvstendig grunnlag.***			
C= Forstå	***Forstå hensikt, bruk og effekt av prosesser, systemer og komponenter.***			
		Fører og Navigatør	***Maskinist***	***Øvrig besetning***
.1	Kunnskap om alle framdrifts- og kontrollsystemer om bord, herunder kommunikasjons- og navigasjonsutstyr, styringssystemer, elektriske, hydrauliske og pneumatiske systemer og lense- og brannpumper.	A	B	C
.2	Feilmodus for kontroll-, styrings- og framdriftssystemene og korrekt reaksjon på slike feil.	A	B	C
.3	Fartøyets manøvreringsegenskaper og operasjonsbegrensninger.	A	B	C
.4	Brokommunikasjon- og navigasjonsprosedyrer.	A	C	C
.5	Intakt stabilitet og skadestabilitet og fartøyets overlevelsesevne i skadetilstand.	A	B	C
.6	Plassering og bruk av fartøyets redningsredskaper, herunder utstyr i redningsfarkostene.	A	B	B
.7	Plassering og bruk av rømningsveier i fartøyet og evakuering av passasjerene.	A	B	B
.8	Plassering og bruk av brannbeskyttelses- og brannoppdagelsesredskaper og -systemer i tilfelle brann om bord.	A	B	B
.9	Plassering og bruk av skadekontrollredskaper og -systemer, herunder betjening av vanntette dører og lensepumper.	A	B	C
.10	Sikringssystemer for stuing av last og kjøretøyer.	A	B	C
.11	Metoder for kontroll og kommunikasjon med passasjerer i en nødssituasjon.	A	B	B
.12	Alle elementer i opplæringshåndboken. Jf. kodens punkt 18.2.3.	A	B	B
.13	Havner, ruter og spesielle forhold som vedrører operasjon og evakuering av fartøyet. Jf. kodens punkt 18.2.2 Rutehåndbok.	A	B	C
.14	Operasjonsbegrensinger og grunnlag for operasjonstillatelsen. Jf. kodens punkt 18.1.3	A	A	C
.15	Passasjerhåndtering, passasjerkomfort og informasjon til passasjerene, inkludert bruk av PA anlegg under normaloperasjon.	A	B	B
.16	Rederiets politikk og prosedyrer for passasjerbehandling i samsvar med STCW-kodens regel V3 (V2) sett i sammenheng med kodens punkt 18.2.3.24.	A	B	B
.17	Rederiets politikk og prosedyrer for sikkerhet (Security).	A	B	B
.18	Rederiets praksis for å sikre et godt arbeidsmiljø (HMS).	A	B	B

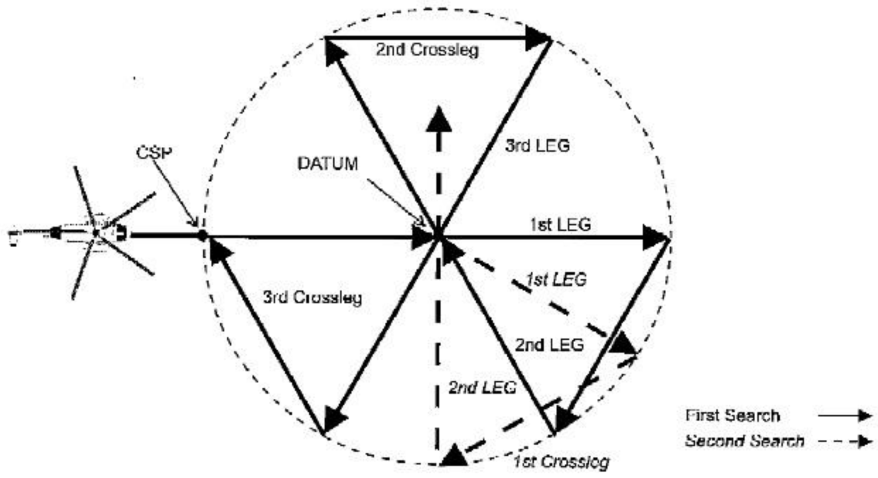
e) Dokumentasjon av utsjekk

Alle besetningsmedlemmer skal ha bestått og dokumentert utsjekk før de tiltrer i tjeneste om bord på et fartøy, eller i et nytt operasjonsområde. Ny utsjekk skal gjennomføres før tiltredelse etter opphold i tjenesten på et fartøy eller i en rute på over 6 måneder.

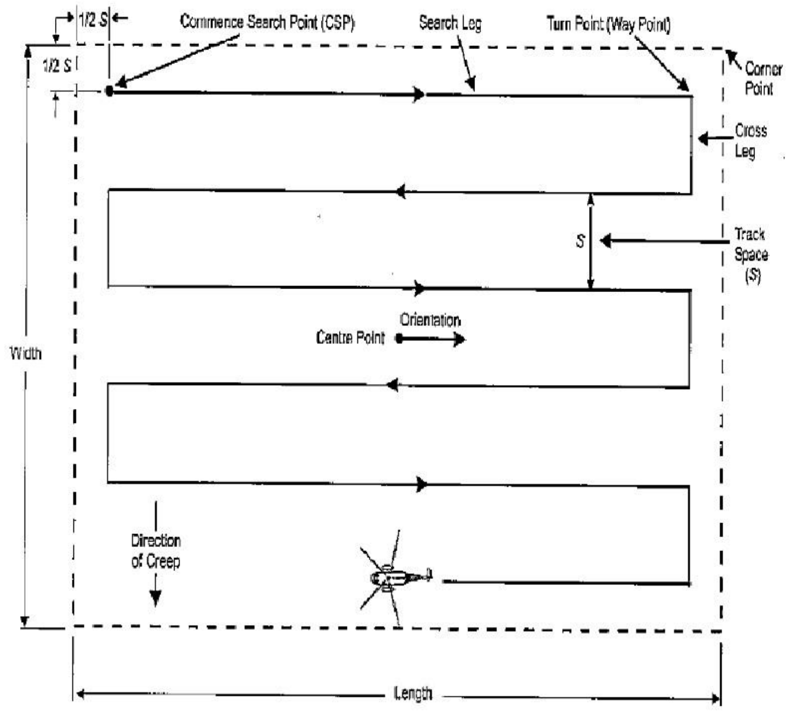
0 Endret ved forskrifter 22 des 2000 nr. 1575 (i kraft 1 jan 2001, tidligere § 27), 4 juni 2002 nr. 618 (tidligere § 30), 18 okt 2004 nr. 1377 (i kraft 1 jan 2005).

5.3 Appendix 3: Standard search patterns

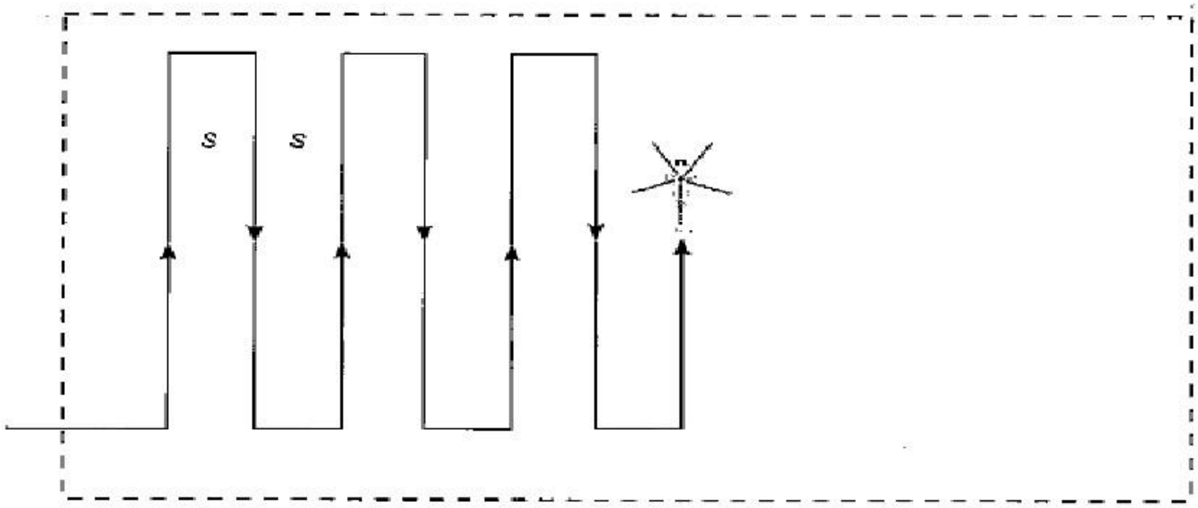
Sector Search



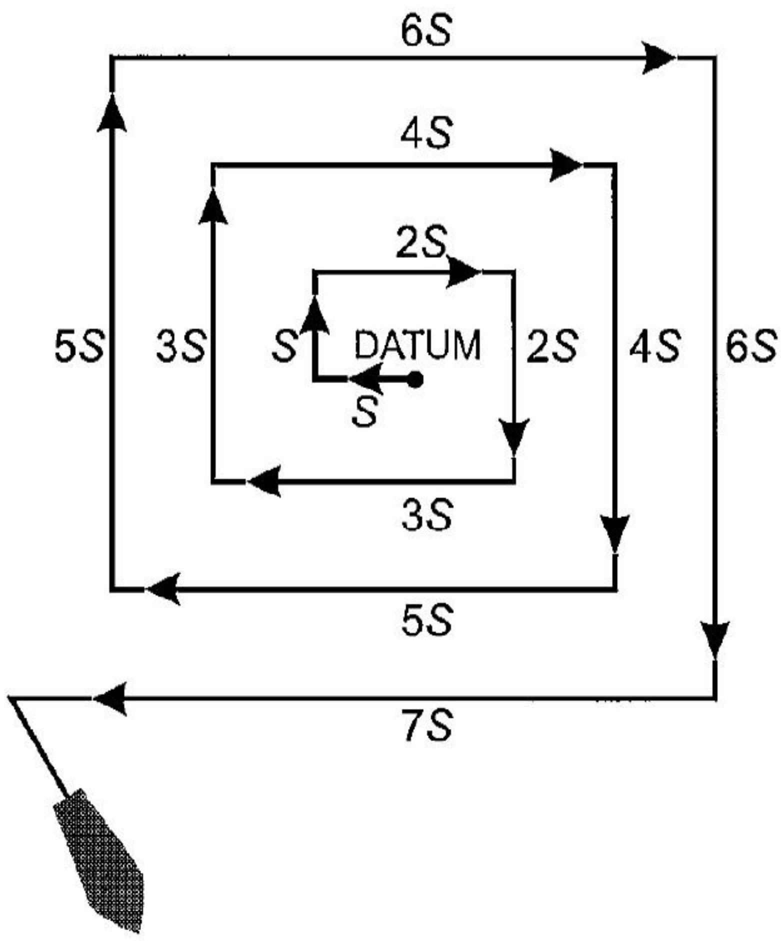
Parallel serach



Creeping line



Expanding square search



(IMO, 2008a p121-127)

5.4 Appendix 4: Format For SITREP

Short form – To pass urgent essential details when requesting assistance, or to provide the earliest notice of casualty, the following information should be provided:

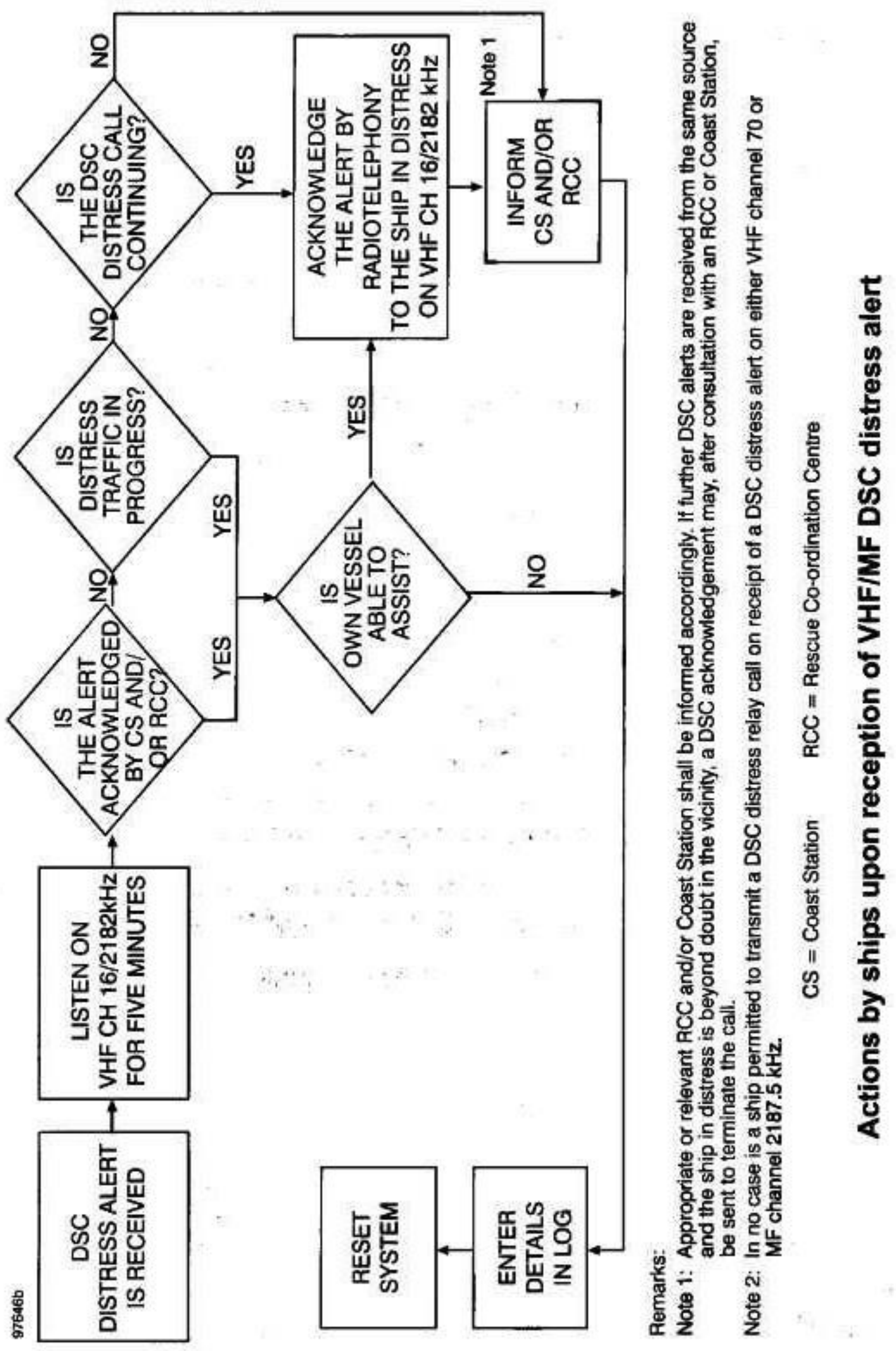
TRANSMISSION	(Distress/urgency)
DATE AND TIME	(UTC or Local Date Time Group)
FROM:	(Originating RCC)
TO:	
SAR SITREP (NUMBER)	(To indicate nature of message and completeness of sequence of SITREPs concerning the casualty)
A. IDENTITY OF CASUALTY	(Name/call sign, flag State)
B. POSITION	(Latitude/longitude)
C. SITUATION	(Type of message, e.g., distress/urgency; date/time; nature of distress/urgency, e.g., fire, collision, medico)
D. NUMBER OF PERSONS	
E. ASSISTANCE REQUIRED	
F. CO-ORDINATING RCC	

Full form – To pass amplifying or updating information during SAR operations, the following additional sections should be used as necessary:

G. DESCRIPTION OF CASUALTY	(Physical description, owner/charterer, cargo carried, passage from/to, life-saving equipment carried)
H. WEATHER ON SCENE	(Wind, sea/swell state, air/sea temperature, visibility, cloud cover/ceiling, barometric pressure)
J. INITIAL ACTIONS TAKEN	(By casualty and RCC)
K. SEARCH AREA	(As planned by RCC)
L. CO-ORDINATING INSTRUCTIONS	(OSC designated, units participating, communications)
M. FUTURE PLANS	
N. ADDITIONAL INFORMATION	(Include time SAR operation terminated)

(IMO, 2008a p264-265)

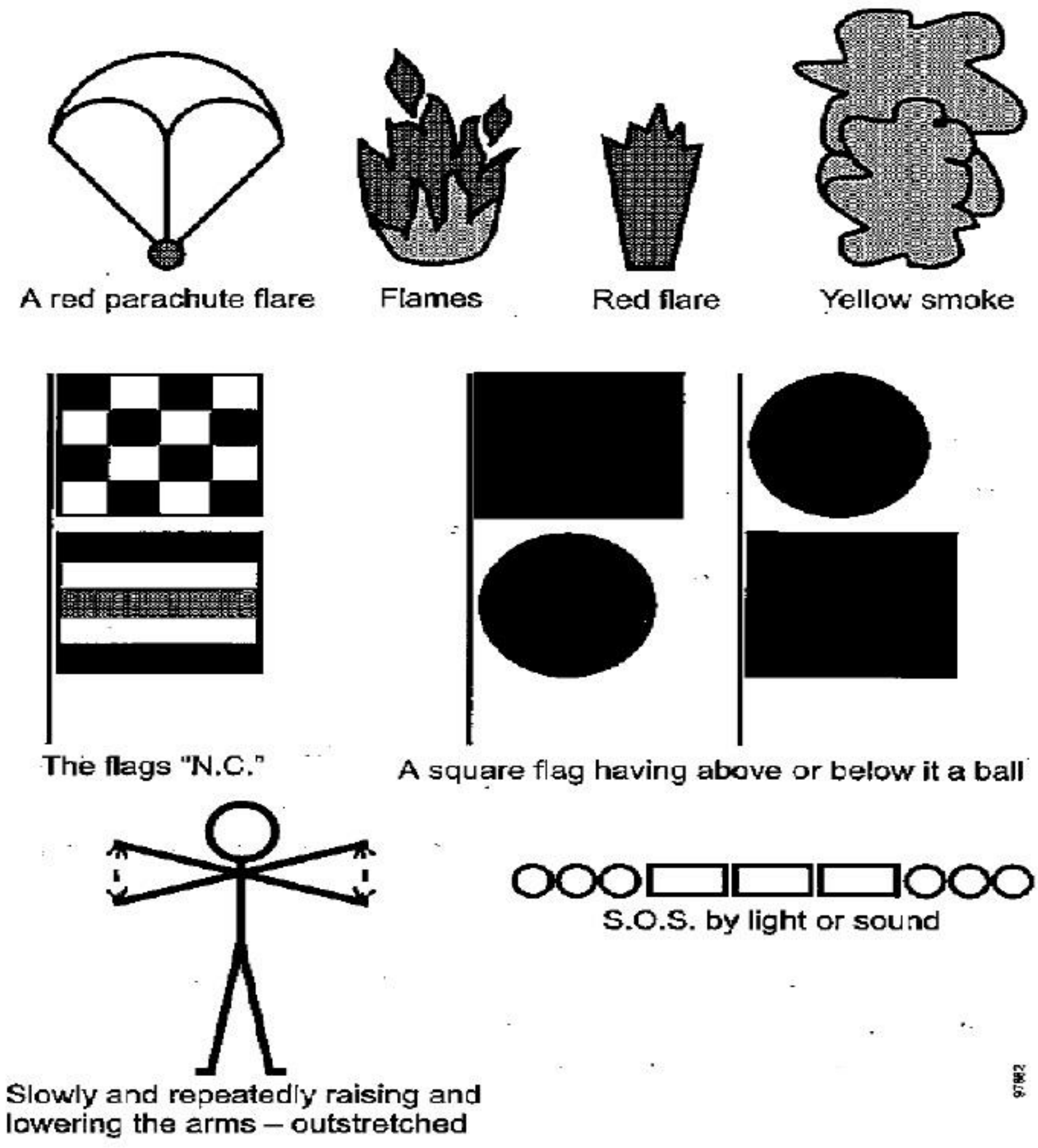
5.5 Appendix 5: Flowchart when recieving DSC Alert



(IMO, 2008b p31)

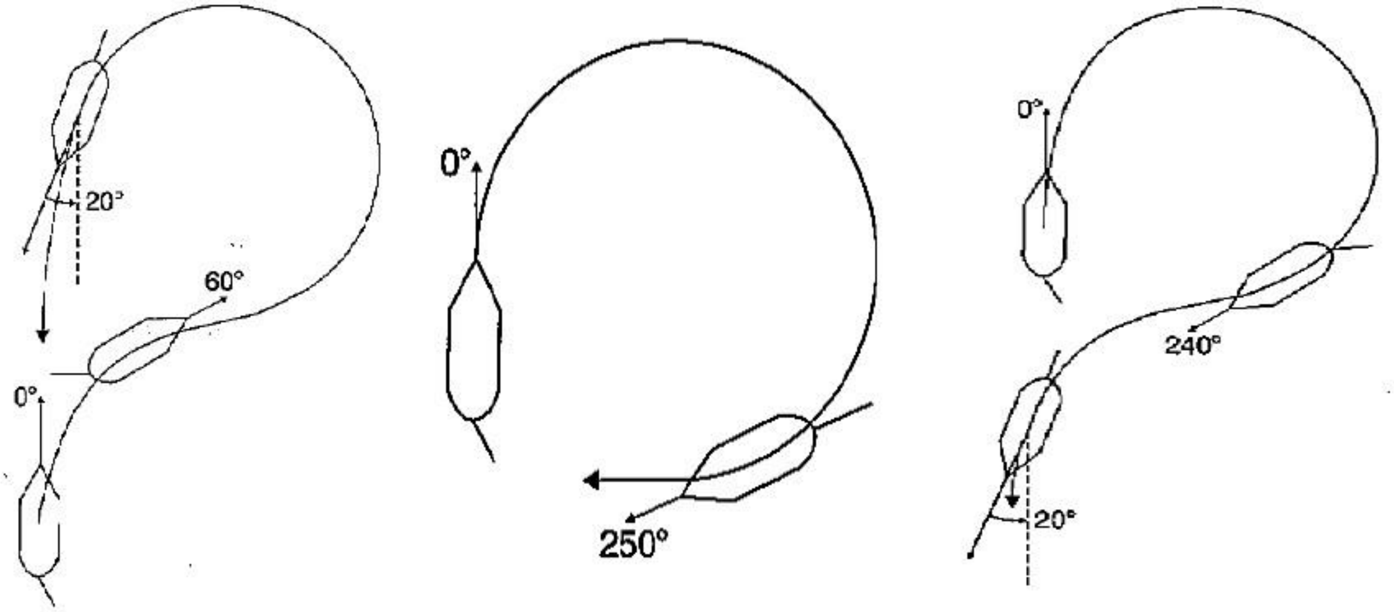
5.6 Appendix 6: Emergency signals and MOB maneuvers

These are emergency signals from vessels in distress listed in the IAMSAR



(IMO, 2008b p152)

Maneuvers for MOB situations listed in the IAMSAR



Williamson Turn:
Give hard over rudder to the side of the MOB to swing the vessels stern away. When the vessel is about 60º of course shift rudder. Keep hard over until vessel is aproximately 20º from opposite course, then steer the vessel back on its track.

The Wiliamson turn puts the vessel back on its original track ahead of initial position and is therefore ideal when the crew observes the casualty falling and takes action early.

Anderson Turn:
Give hard over rudder as in the Williamson turn but let the vessel du a 250º turn before easing the rudder and slowing down the turn.

This maneuver will not bring the vessel back on a parallel track adn is not suited when searching for a casualty. However it returns the vessel to the initial position faster than the Wiliamson turn and is ideal as a fast response and when the casualty is continously in view.

Scharnow Turn:
Give hard over and let the vessel turn 240º then shift rudder. When the vessel is about 20º from opposite course ease rudder and steer the vessel back on its track.

This is a faster way of returning to the vessels original track than the Williamson turn. However the vessel return behind the original position and should only be used when someone is missing and presumed to have fallen over board earlier and the vessel shall search its track.

(IMO, 2008b p160-161)

CHAPTER 6

LIST OF FIGURES & REFERENCES

MARITIME
OPERATIONS
Aalesund University College

6. List of figures and references

6.1 List of figures

6.1.1 Chapter 1

6.1.2 Chapter 2

Figure 2-9 Adopted from Weber Reto (2015b) Chalmers university of technology

Figure 2-10 Adopted from Wikimedia Commons (n.d.) https://commons.wikimedia.org/wiki/File:WaterJet_Forward,Back,Side,Turn.PNG 2015-11-05

Figure 2-11 Projectcheck (2010) A checklist for checklists http://www.projectcheck.org/checklist-for-checklists.html 2015-11-05

Figure 2-12 Åfeldt Jimmy (2015c)

Figure 2-13 Adopted from Wikimedia Commons (n.d.) https://commons.wikimedia.org/wiki/File:WaterJet_Forward,Back,Side,Turn.PNG 2015-11-05

Figure 2-14 Åfeldt Jimmy (2015d)

6.1.3 Chapter 3

Figure 3-1 North Seattle Community Collage (n.d.) http://facweb.northseattle.edu/bholt/PhilosophyScience.html 2015-11-05

Figure 3-2 National institute of standards of technology (2010) http://www.nist.gov/el/isd/ks/images/pridesitaware_1.gif 2015-11-05

Figure 3-3 Adopted from Psygrammer (2011) www.psygrammer.com 2015-11-05

Figure 3-4 Geograph (2011). http://www.geograph.org.uk/photo/2647015 2015-11-05

Figure 3-5 Ekstarnd Lovisa (2015a)

Figure 3-6 Ekstrand Lovisa (2015b)

Figure 3-7 Andersson Daniel (2015a)

Figure 3-8 Wikimedia Commons (2015a) https://upload.wikimedia.org/wikipedia/commons/thumb/a/a2/US_Navy_080911-N-1635S-001_Quartermaster_3rd_Class_Christopher_Bridges_describes_his_job_to_Ultimate_Fighting_Championship_%28UFC%29_fighter_Rich_Franklin_on_the_bridge_of_the_Nimitz-class_aircraft_carrier_USS_Ronald_Reagan_%28CVN_76.jpg/1200px-thumbnail.jpg 2015-10-28

Figure 3-9 Andersson Daniel (2015b)

Figure 3-10 Adopted from Ok akademi (n.d.) http://www.okakademi.se/sites/default/files/imagecache/Huvudbild/wysiwyg_imageupload/6/firo2.jpg 2015-11-04

Figure 3-11 WHO (n.d.) http://www.who.int/hac/techguidance/hbp/hbp_wh2.gif 2015-11-04

Figure 3-12 Wikimedia Commons (n.d.) https://upload.wikimedia.org/wikipedia/commons/d/d9/Tennis_shake_hands_after_match.jpg 2015-10-28

Figure 3-13 Andersson Daniel (2015c)

Figure 3-14 Train HR (n.d.) http://www.trainhr.com/images/keywords/emotionalIntelligence.jpg 2015-10-28

Figure 3-15 Ekstrand Lovisa (2015d)

Figure 3-16 Ekstarnd Lovisa (2015e)

6.1.4 Chapter 4

Figure 4-1 Airbus Helicopters (2015) http://www.airbushelicopters.com/w1/jrotor/79/iso_album/rotor79uk_1612_page_09_image_0001_600x600.jpg 2015-10-19

Figure 4-2 Korea Ocean Development Company co. Ltd. (2015) http://www.chartkorea.com/download/mail/20100614/iamsarM.jpg 2015-10-19

Figure 4-3 RHO aviation training services (2012)

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Figure 4-4 Justitis- og politidepartementet (2002) https://www.regjeringen.no/globalassets/upload/kilde/jd/bro/2003/0005/ddd/pdfv/183865-infohefte_engelsk.pdf 2015-10-20

Figure 4-5 Svenska Sjöräddningssällskapet (2015) http://www.sjoraddning.se/media/cache/74/74c8fceface90f870e14b6513fbd576e.jpg 2015-10-19

Figure 4-6 Vebjorn Karlsen (n.d.) http://vebjornkarlsen.no/onewebstatic/6f917266d9-Sea-King%20Redningsmann%20pa%CC%8A%20vei%20ut.jpg 2015-10-20

Figure 4-7 The Kitsap Sun (2014)
http://mediaassets.kitsapsun.com/photo/2014/05/31/0/0129_KSLO_Beached1_5532258_ver1.0_640_480.JPG 2015-10-19

Figure 4-8 Shipwreck Log (2015)
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Figure 4-9 Tanketornet (2013)
https://tanketornet.files.wordpress.com/2013/11/media-page-cameras_630x2501.jpg 2015-10-20

Figure 4-10 Ship media (2010)
http://www.shippipedia.com/wp-content/uploads/2010/10/stability-2.png 2015-10-20

Figure 4-11 Åfeldt Jimmy (2015d)

Figure 4-12 Åfeldt Jimmy (2015e)

Figure 4-13 K.N. Tooshi Universety of technology
http://saba.kntu.ac.ir/eecd/ecourses/instrumentation/projects/reports/smoke%20detector/images/ion%20chamber.jpg 2015-10-20

Figure 4-14 apollo fire detectors ltd. (2014)
http://www.apollo-fire.co.uk/media/753726/optical.jpg 2015-10-20

Figure 4-15 Wikimedia Commons (n.d.)
https://upload.wikimedia.org/wikipedia/commons/4/47/Sprinkler_ampuller_temp.jpg 2015-10-20

Figure 4-16 Green building and design magazine (2012)
http://gbdmagazine.com/wp-content/uploads/2012/10/HI-FOG_sprinkler_discharge_3_1.jpg 2015-10-20

Figure 4-17 alibaba.com (n.d)
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Figure 4-18 Adopted from Nammo LLIAB AB (2015a)
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Figure 4-19 Adopted from Nammo LLIAB AB (2015b)
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Figure 4-20 Adopted from Nammo LLIAB AB (2015c)
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Figure 4-21 Wikimedia Commons (n.d.) https://upload.wikimedia.org/wikipedia/commons/1/14/Life_raft_open,_reddingsvlot.jpg 2015-10-20

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Figure 4-23 Wikimedia Commons (n.d.) https://upload.wikimedia.org/wikipedia/commons/f/f7/Handheld_Maritime_VHF.jpg 2015-10-20

Figure 4-25 Wikimedia Commons (n.d.) https://upload.wikimedia.org/wikipedia/commons/2/2b/SART_radar_transponder.jpg 2015-10-20

Figure 4-25 Wikimedia Commons (n.d.) https://upload.wikimedia.org/wikipedia/commons/4/4f/EPIRB@.png 2015-10-20

Figure 4-26 Wikimedia Commons (2013b) https://upload.wikimedia.org/wikipedia/commons/3/36/IMO_9185554_STAD_AMSTERDAM_%2809%29_Hammar_Hydrostatic_release_unit_H20_R.JPGList of refferences

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6.2.5 Appendix

Appendix 1 Naerings og fiskeridepartementet (2011) *föreskrift om kvalifikations og certifikat för sjöfolk* FOR-2011-12-22-1523. oslo: Naerings og fiskeridepartementet.

Appendix 2 Naerings og fiskeridepartementet (1998) *föreskrift om byggning m.v. av hurtiggående fartöy.* FOR-1998-01-05-6 oslo: naerings og fiskeridepartementet.

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Appendix 4 IMO (2008a) International Aeronautical and Maritime Search And Rescue Manual vol 2
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Appendix 5 IMO (2008b) International Aeronautical and Maritime Search And Rescue Manual Vol 3
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Appendix 6 IMO (2008b) International Aeronautical and Maritime Search And Rescue Manual Vol 3

London: IMO ISBN 92-801-4171-6

6.3 About

This course compendium is made as bachelor thesis by:

- Daniel Andersson
- Christopher Stadelman
- Lovisa Ekstrand

  And
- Jimmy Åfeldt

At Ålesund University Collage during the autumn semester of 2015.

The authors were in Ålesund in the Erasmus exchange program and study navigation at Chalmers University of science, Göteborg - Sweden.

The authors would like to thank the following for their contribution to this compendium:

- Tron Resnes for tutoring and guidance.
- Norled AS and the crew of HSC "Ekspressen" for letting us observe their work, take part in their routines and take pictures.
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- Caroline Sandelin for assistance with graphics and layout.

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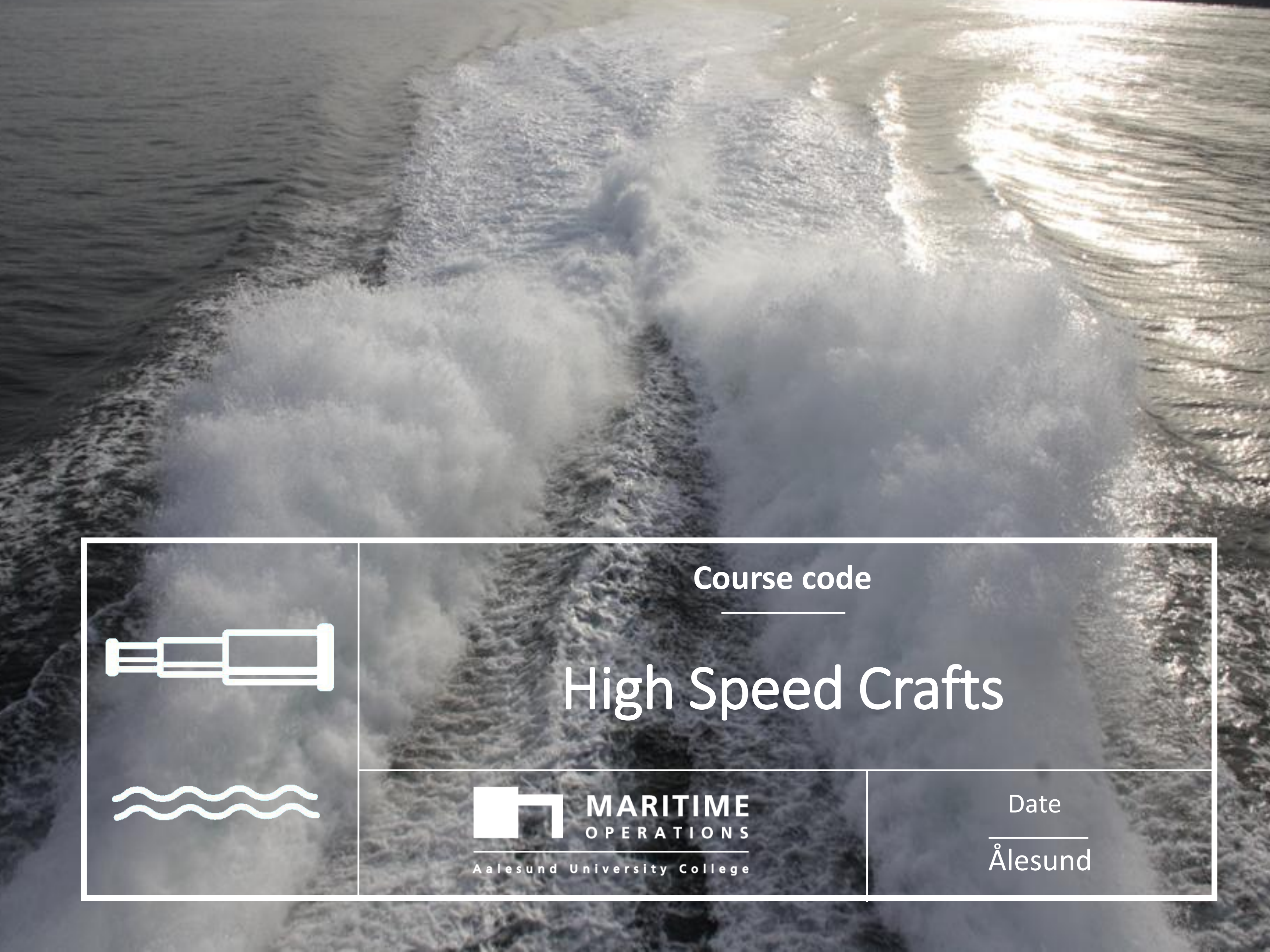

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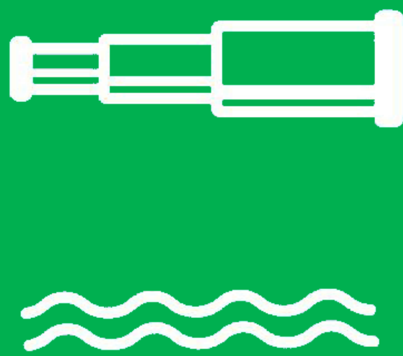
Velkommen til kurs!

Nyttig info



Part 1

Introduction

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Time schedule

Day 1	Day 2	Day 3	Day 4	Day 5
8-12 Introduction **13-17** Technique, Watchkeeping Introduction BRM/ERM	**8-12** BRM **13-17** Simulator	**8-10** BRM **10-17** Simulator	**8-10** SAR & Emergency procedures **10-17** Simulator	**8-12** BRM Crisis management **13-17** Repetition Test

Learning objectives

HSC
After the course, the participant shall be able to demonstrate the competence given in the STCW convention part A (chapter 2 and 3) and the Norwegian Maritime Directory instruction regarding qualification and certificate of seagoing personnel, FOR-2011-12-22-1523, § 65.

BRM
After the course, the participant shall be able to conduct safe watch keeping and practice good leadership on the bridge.

ERM
The participant shall have competence to assess and maintain the seaworthiness of the vessel.

Introduction

- It all began in 1960s
- Hydrofoil vessels
- H/F Vingtor
- No HSC training requirements

Introduction

- In 1971 the Westamaran was launched
- Higher passenger capacity
- Could sail in much more adverse weather
- Still no HSC training requirements

Introduction

- M/S Sea Cat accident in 1991
- HSC training became a requirement
- Deck officers should attend a HSC course and train onboard

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Introduction

- Braathens Safe in cooperation with the NMD
- First ever HSC course in 1992
- Converted aviation experience into BRM

Introduction

- The Sleipner accident 1999, new requirements for HSC training
- Onboard training replaced by simulator training
- All onboard personnel (engineers and deck)

Why do I need HSC training?

- High speeds = high risks
- National and international regulations

Why do I need HSC training?

National regulations

- All crew working on vessels with cargo and/or passenger certificate capable of reaching 20 knots or more

International regulations

- HSC code chapter 17
- Uses an formula to decide if the vessel is an HSC

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Part 2

Rules & Technical Characteristics

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Rules And Regulations

This Part:

- International regulations
- National regulations
- Definition of a HSC

International Maritime Organisation
IMO

- **171 member States**
- **Headquartered in London**
- **United Nations agencies who work with**

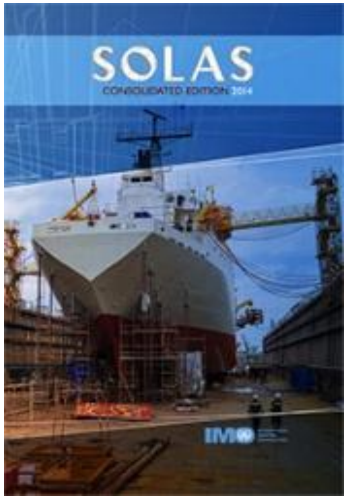
"Safety and Security of shipping and prevention of marine pollution by ships"

International regulations

SOLAS

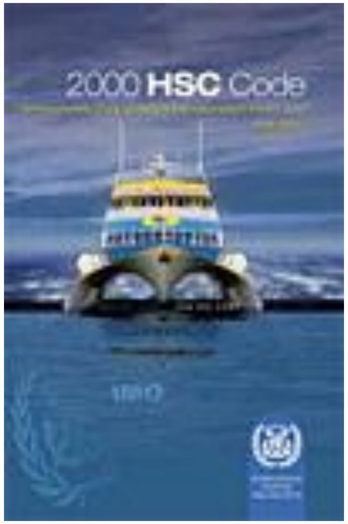
CHAPTER X

- Safety measures for high-speed craft.
- Special rules for high speed craft.
- Detailed rules for those vessels can be found in the HSC Code (High Speed Craft Code).



International regulations

HSC-Code



- International Code of Safety for High-Speed Craft 2000

Requirements for

- Construction
- Equipment
- Operational

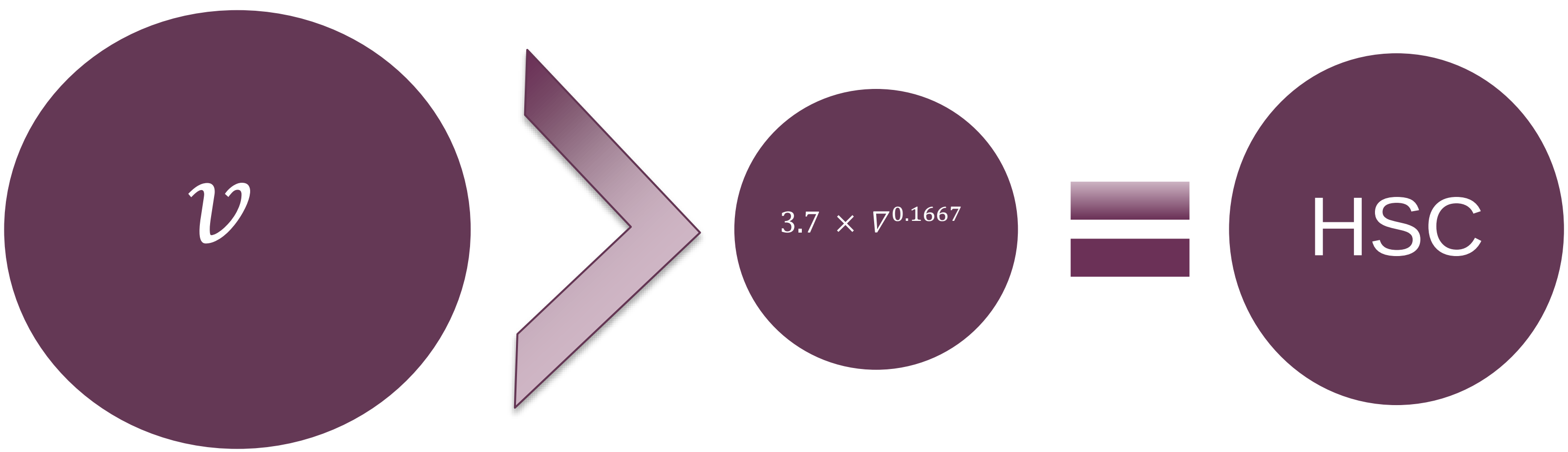
The definition of a HSC according to the HSC-Code

Mathematical formula to classify

$$v = 3.7 \times \nabla^{0.1667}$$

$$\nabla = maximum\ displacement\ (m^3)$$

$$v = service\ speed\ at\ maximum\ displacement\ (m/s)$$



International regulations

STCW

International standards of

-Training

-Certification

-Watchkeeping

Manila amendments

BRM + ERM

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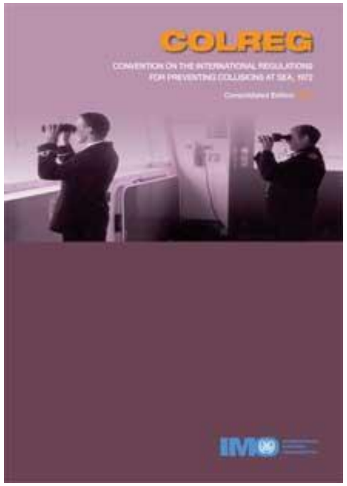
International regulations

COLREG

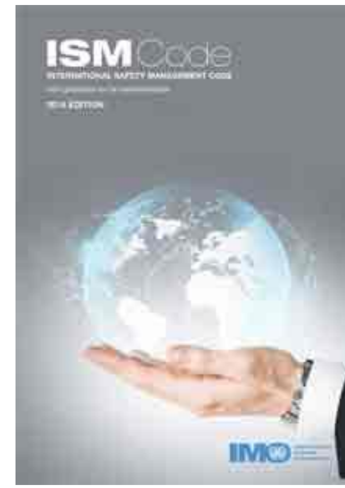
- International Regulations for Preventing Collisions at Sea 1972



International regulations

ISM-Code

- Company
- SMS
- Designated person



Purpose of the Code

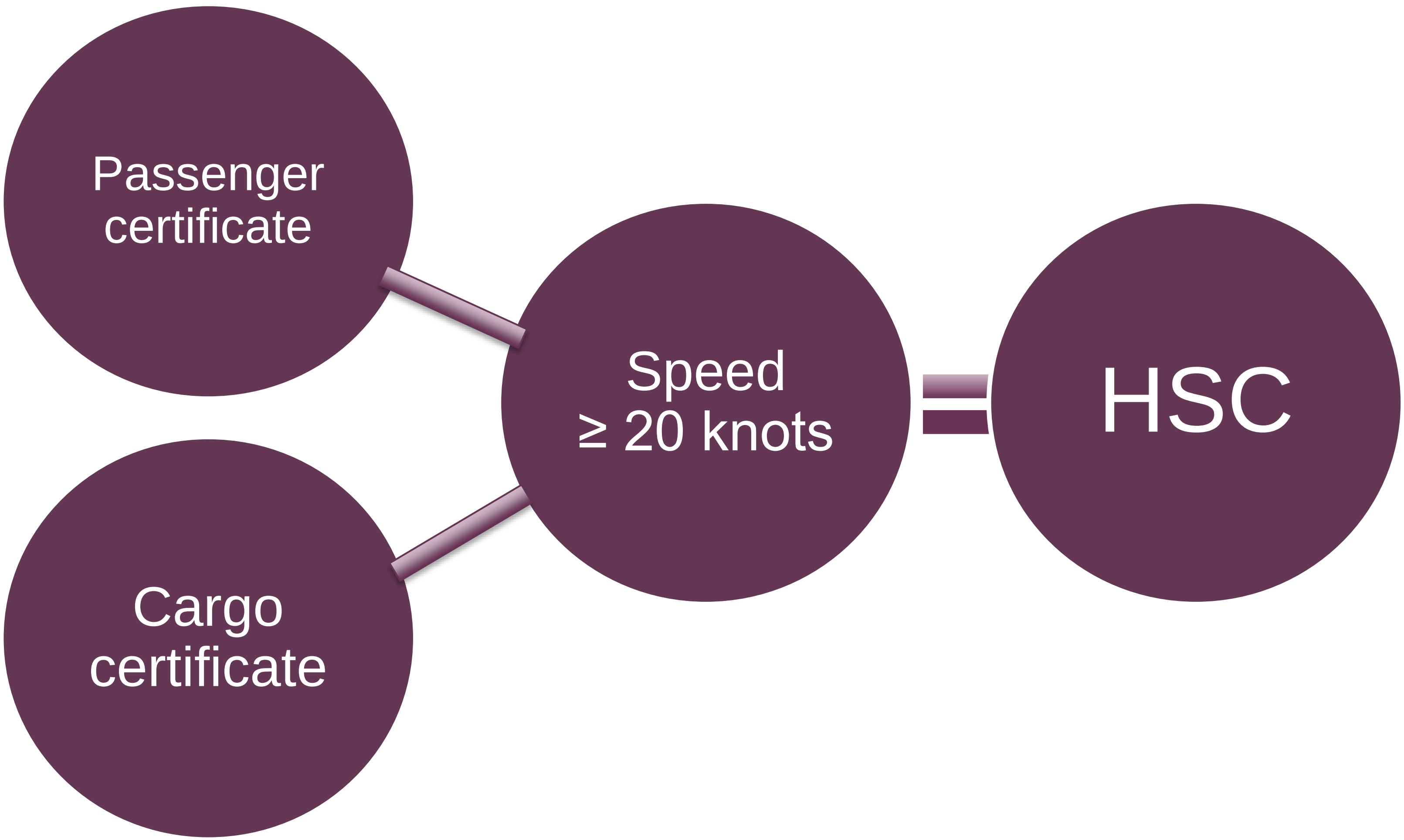
§ 1.2.1
"The objectives of the Code are to ensure safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular to the marine environment and to property

National regulations

In Norway must HSC comply with Norwegian Maritime Authoritys regulations, such as the following:

- FOR-2011-12-22-1523 Foreskrift om kvalikasjoner og sertifikater for sjøfolk
- FOR-2009-06-18-666 Foreskrift om bemanning av norske skip
- FOR-1999-04-27-537 Foreskrift om vakthold på passasjer- og lasreskip
- FOR-1998-01-05-6 Forskrift om bygging mv av hurtiggående fartøy

Norwegian way to classify



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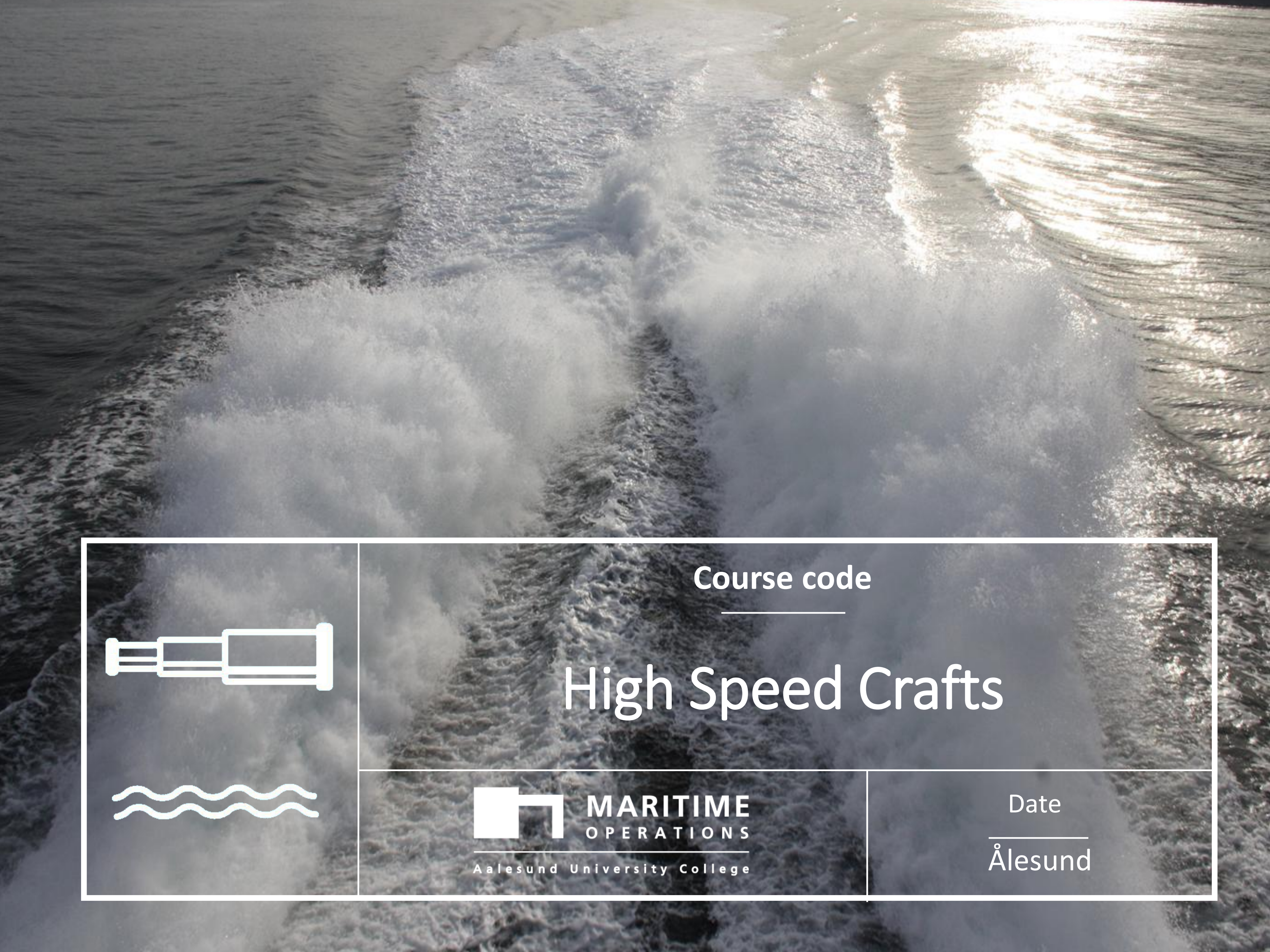
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Part 2

Rules & Technical Characteristics

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Technical characteristics

This Part:

- Hull, rudder and orientation
- Machine and propulsion
- Maneuvering
- Navigations aid

Different types of HSC

Monohull

Catamaran

Hydrofoil

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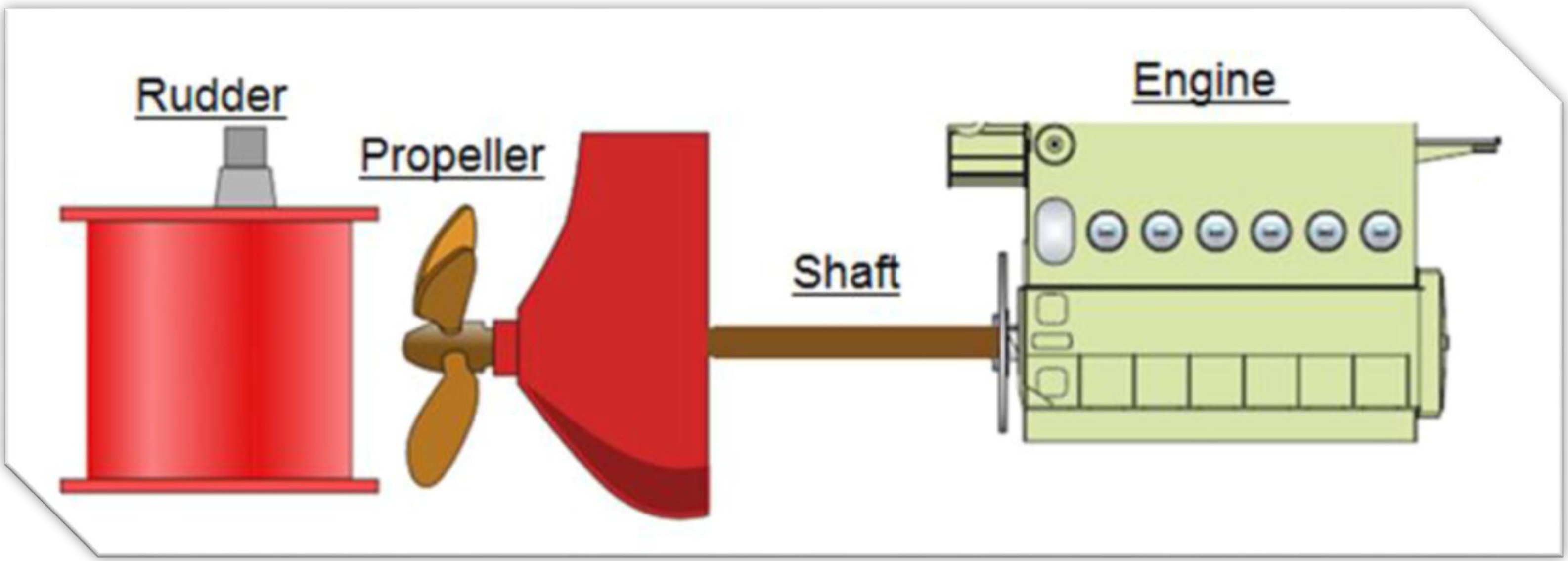
Machine and propulsion

Conventional propulsion

- **Fixed pitch propeller**
- **Controllable pitch propeller**

Machine and propulsion

Conventional propulsion set up



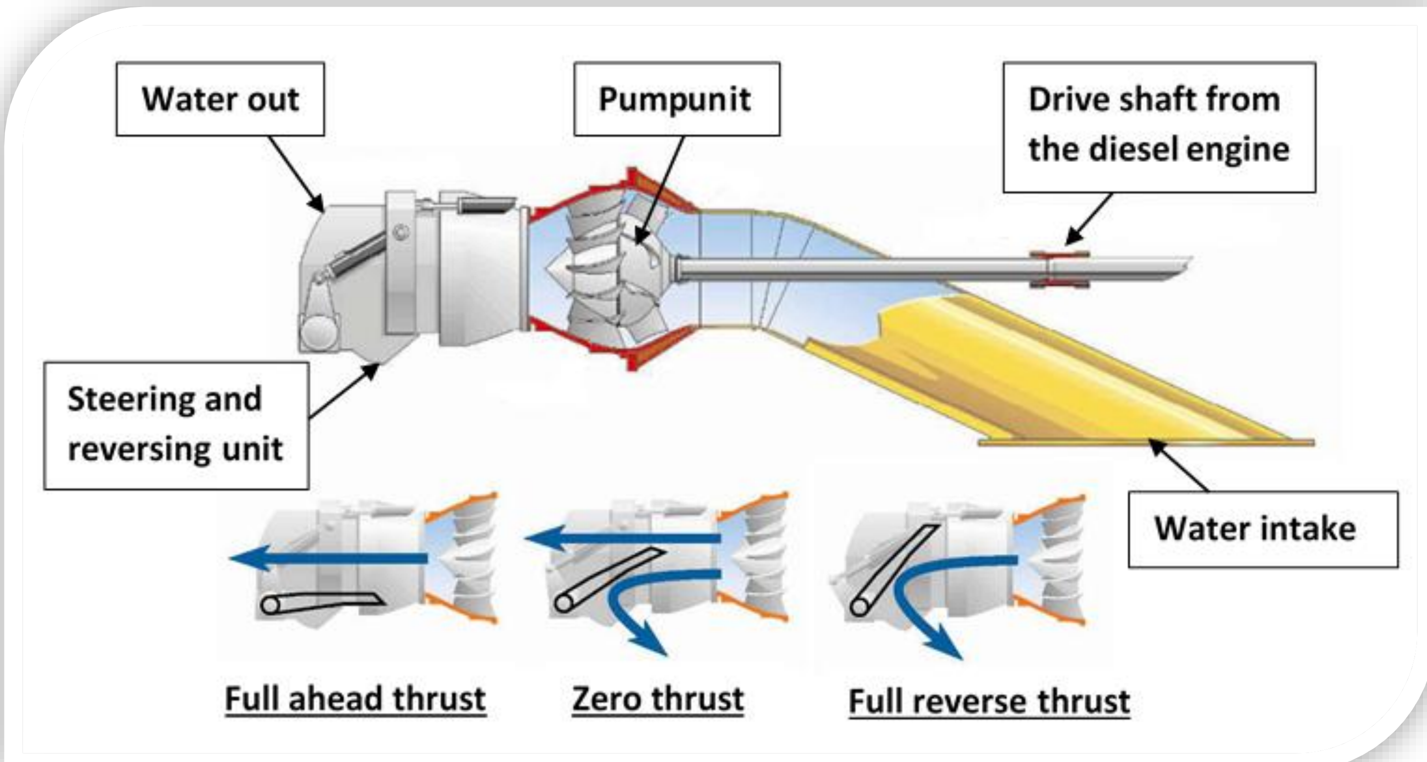
Machine and propulsion

Water jet

- Protected propulsion
- Good maneuverability
- Shallow draft design
- Smooth engine load
- Less vibration

Machine and propulsion

Water jet parts



Maneuvering

Water jet set up

- Two units results in excellent maneuvering capacity

Maneuvering

Large forces

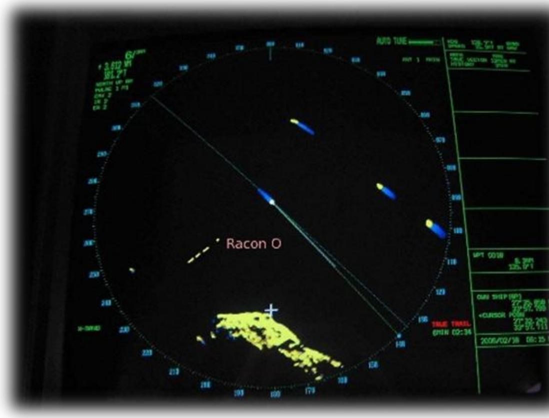
- High Speed
- Crash stop

Low draft + Large superstructures =

Risk for drift!

Navigations aid

RADAR



- X-band 9GHz
- ≥ 500 GT or ≥ 450 pers
  Needs a second radar
- ARPA
- Adequate communication between the radar observer

Navigations aid

ECDIS

- Updated electronic charts on board for entire voyage
- Safety depth and contour setting
- Loss of primary positioning information alarm

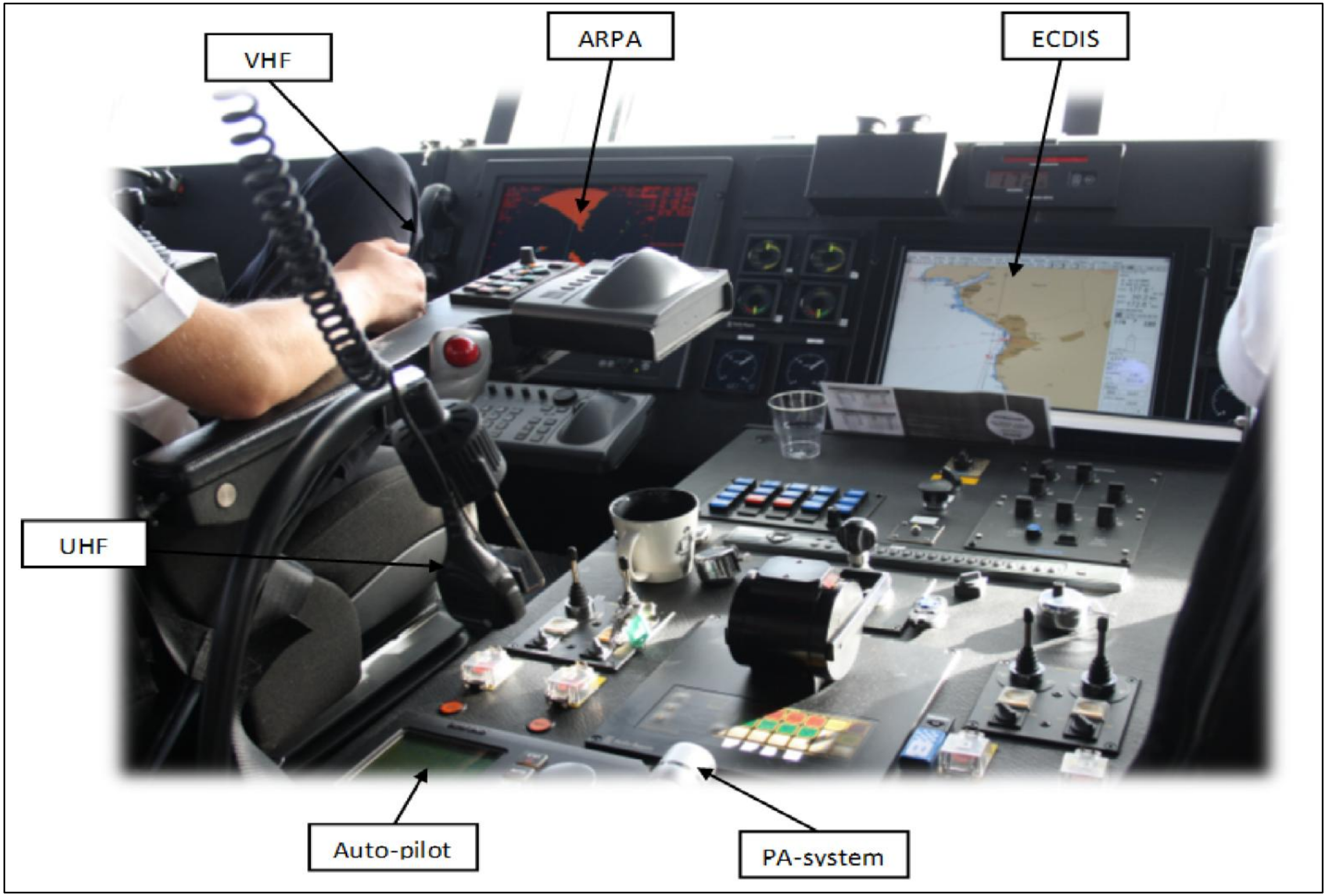
Navigations aid

AIS

<u>Bridge procedures</u>

- Check own ship data accuracy
- Procedures for update of voyage and nav-data
- Decisions based solely on AIS data

Navigations aid



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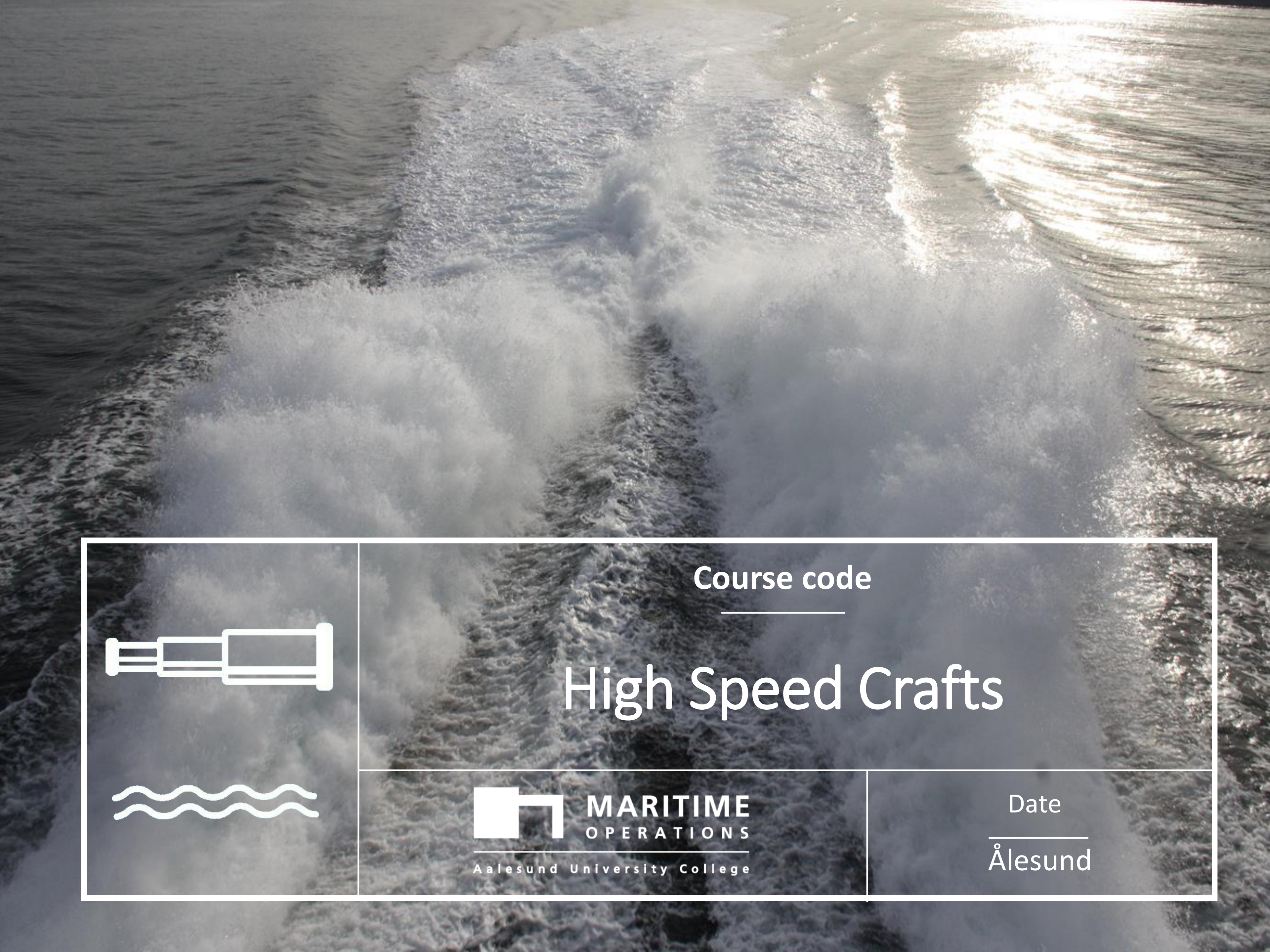

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Part 2

Rules & Technical Characteristics

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Safe watchkeeping

This Part:

- Watch keeping in generally
- Checklists
- Roles and responsibilities
- Communications
- Bridge watch
- Engine watch

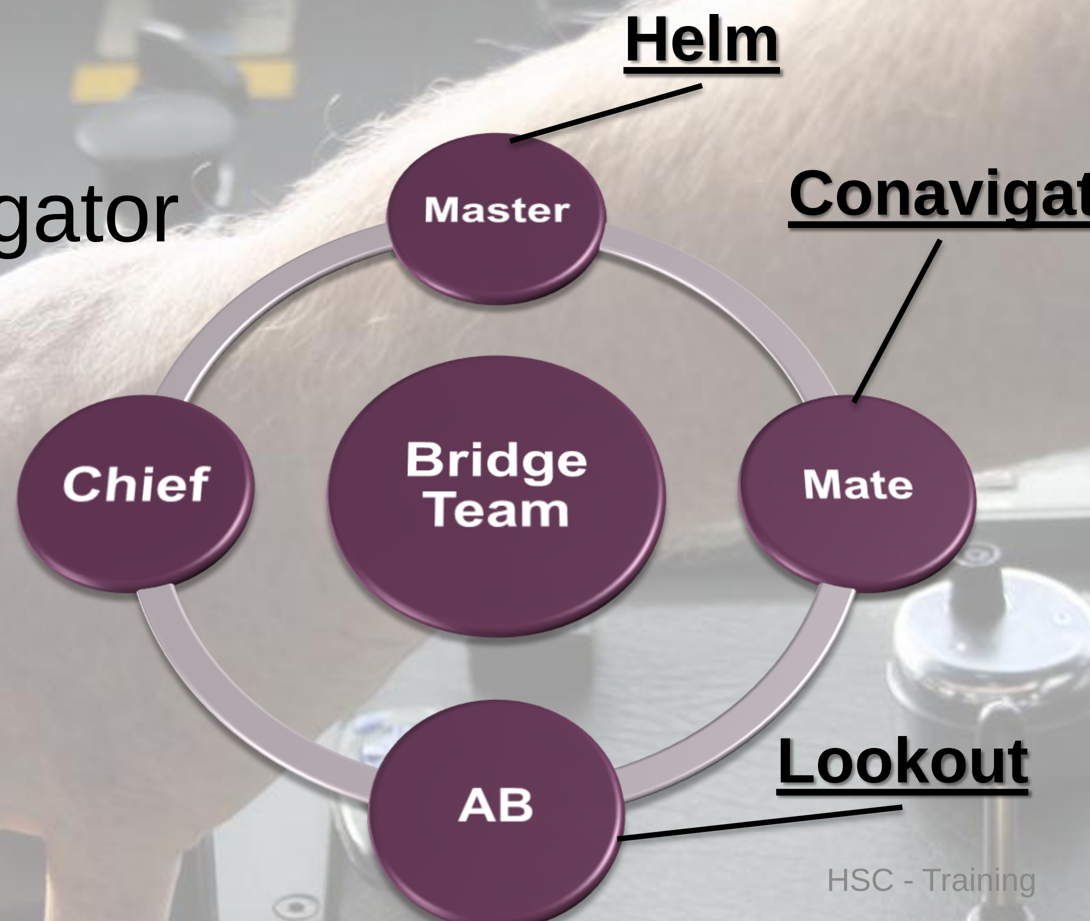
Watchkeeping in general

- The bridge should never be left unmanned
- Weather conditions and visibility
- Navigational hazards
- Decision-making
- The OOW may not hand over the watch to the relieving officer if there is reason to suspect that the relieving officer is not fit to perform their duties.

Watchkeeping in generally

Bridge team organization

- Safe manning
- Navigator-Conavigator



Checklists

A checklist is a type of **informational** job aid used to **reduce workload** and **prevent stress** by compensating for potential limits of human **memory** and **attention**.

A CHECKLIST FOR CHECKLISTS

Development → Drafting → Validation

Development

- ❑ Do you have clear, concise objectives for your checklist?

Is each item:

- ❑ A critical safety step and in great danger of being missed?
- ❑ Not adequately checked by other mechanisms?
- ❑ Actionable, with a specific response required for each item?
- ❑ Designed to be read aloud as a verbal check?
- ❑ One that can be affected by the use of a checklist?

Have you considered:

- ❑ Adding items that will improve communication among team members?
- ❑ Involving all members of the team in the checklist creation process?

Drafting

Does the Checklist:

- ❑ Utilize natural breaks in workflow (pause points)?
- ❑ Use simple sentence structure and basic language?
- ❑ Have a title that reflects its objectives?
- ❑ Have a simple, uncluttered, and logical format?
- ❑ Fit on one page?
- ❑ Minimize the use of color?

Is the font:

- ❑ Sans serif?
- ❑ Upper and lower case text?
- ❑ Large enough to be read easily?
- ❑ Dark on a light background?

- ❑ Are there fewer than 10 items per pause point?

- ❑ Is the date of creation (or revision) clearly marked?

Validation

Have you:

- ❑ Trialed the checklist with front line users (either in a real or simulated situation)?
- ❑ Modified the checklist in response to repeated trials?

Does the checklist:

- ❑ Fit the flow of work?
- ❑ Detect errors at a time when they can still be corrected?

- ❑ Can the checklist be completed in a reasonably brief period of time?

- ❑ Have you made plans for future review and revision of the checklist?

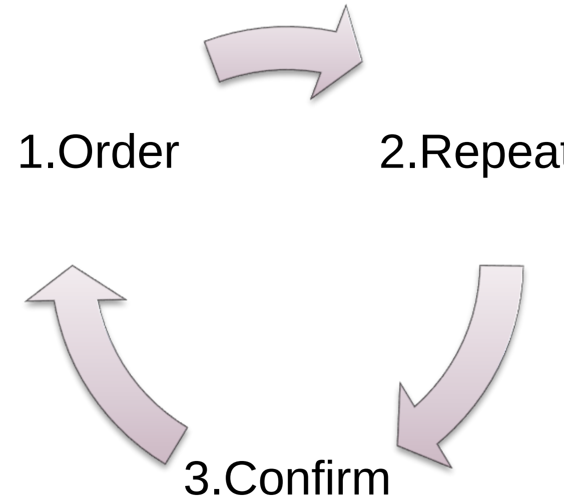
Roles and responsibilities

OOW Duties

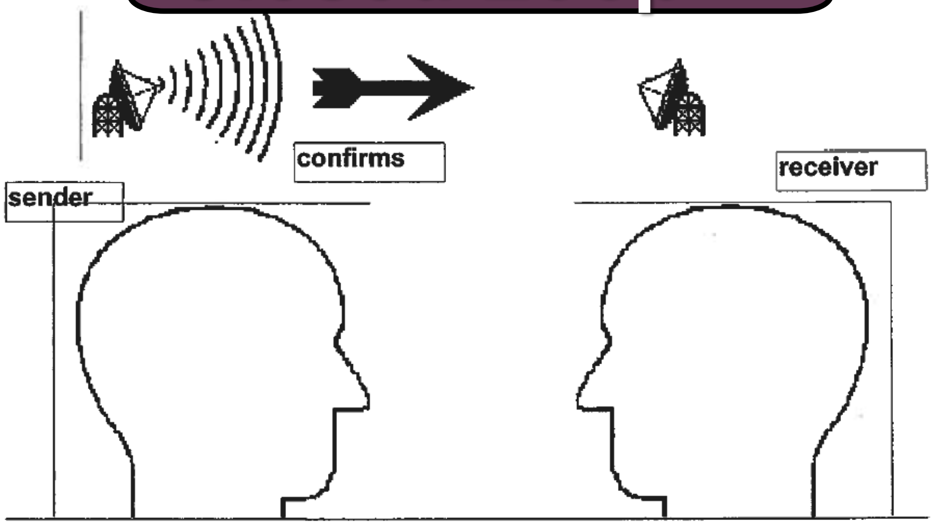
- Watchkeeping
- Navigation
- Radiocommunication

The OOW is the master´s representative and responsible at all times for the safe navigation of the ship and for complying with the COLREG

Communications



Closed Loop



The sender sends an message, the receiver acknowledges it by repeating the key parts back to the sender, and then the sender confirms the acknowledgements
(MRM Student's Workbook)

Bridge watch

- Preparation of a passage plan
- Collision prevention
- Operate radio
- Lookout

Bridge watch

VTS

- Information service
- Navigation assistance service
- Traffic organization service

Bridge watch

VTS

Communication messages that are frequently used in VTS:

- INFORMATION
- WARNING
- ANSWER
- ADVICE
- REQUEST
- QUESTION
- INTENTION
- INSTRUCTION

Engine watch

Duties

- Maintenance
- Operation and testing of all machinery
- Bunkering
- Inspection

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Part 3

BRM/ERM

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Bridge Resource Management

- Bridge RM, Crew RM, Engine RM
  - It is all about distributing resources

A **tool** to keep up with the development and globalization in the shipping industry

Topics

- Situational Awareness
- Culture & Communication
- Human Error
- Group Dynamics
- Leadership and Decision Making

Bridge Resource Management

- Applicable to all kind of vessels
- How we choose to apply it is individual
  - but inevitable
- Abstract subject with concrete actions

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BRM/ERM

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Topics

- **Situational Awareness**
- Culture & Communication
- Human Error
- Group Dynamics
- Leadership & Decision Making

Situational Awareness

”Perception of the elements in the surroundings in a volume of time and space, understanding of their meaning and prediction of their status in a near future. ” – Mica Endsley 1988

SA = improving our safe navigation

- Situational Awareness in everything we do
- Individual assessment

- Being aware of situational awareness = SA

- No conscious act

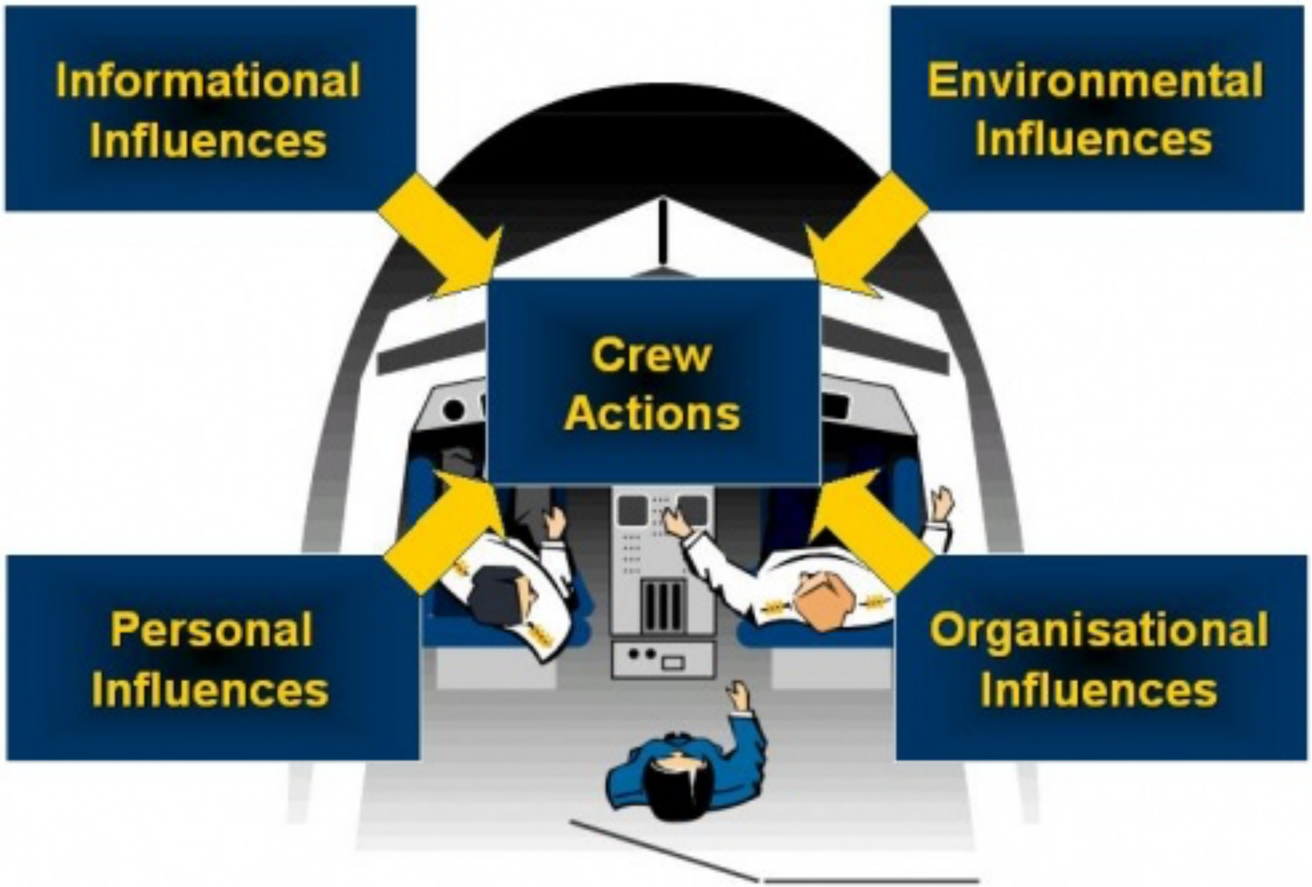
3 LEVELS

- Perception
- Comprehension
- Projection

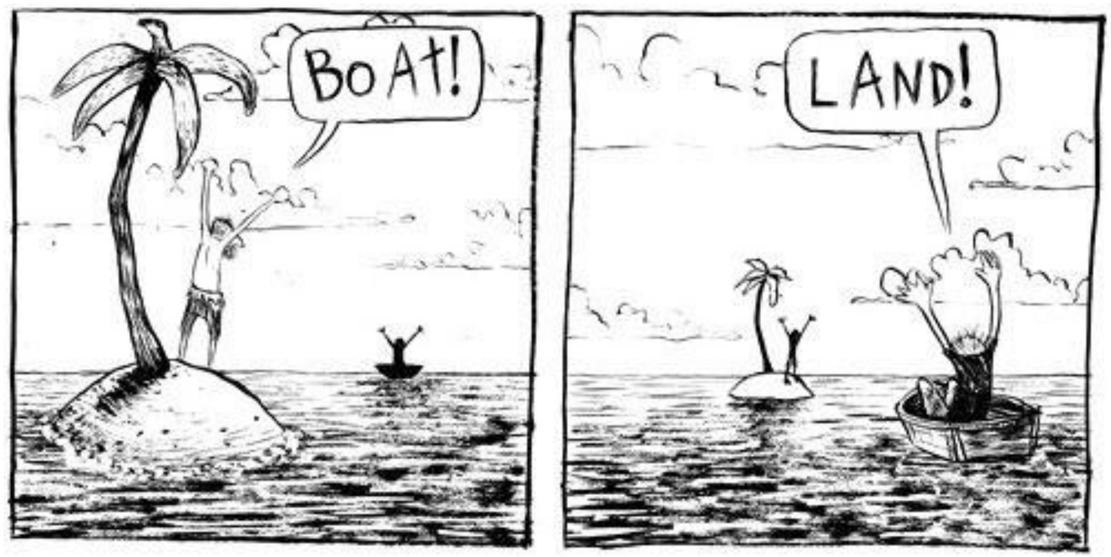
LEVEL 1: PERCEPTION

- All avaliable information
  - -Focus
  - -Alertness
- Only perception – no interpretation

- GPS
- ECDIS
- RADIO
- CONVERSATIONS
- VISUAL
- RADAR
- SMELLS
- ETC.


Informational Influences
Environmental Influences
Crew Actions
Personal Influences
Organisational Influences

LEVEL 2 : Comprehension



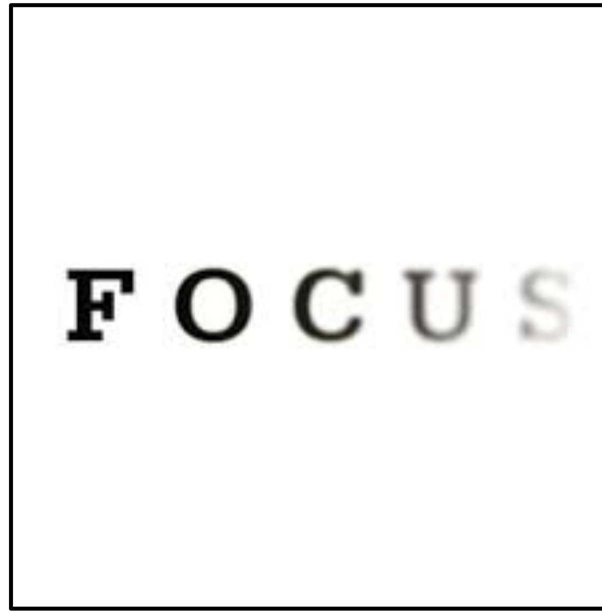
- Evaluation
- Mental model
- Individual comprehension

Level 3: PROJECTION

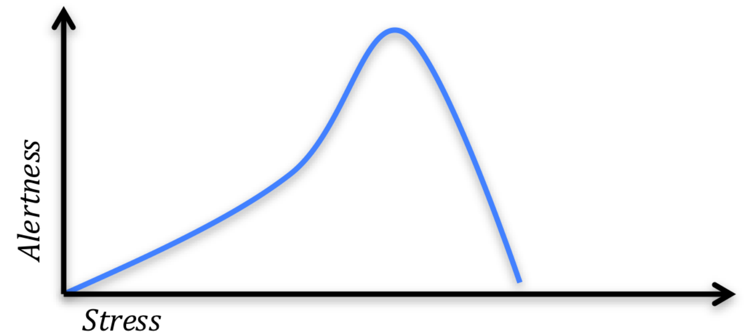
- A chance to predict the development of the situation
- Aviod close situations
- Decision- making

Distractions

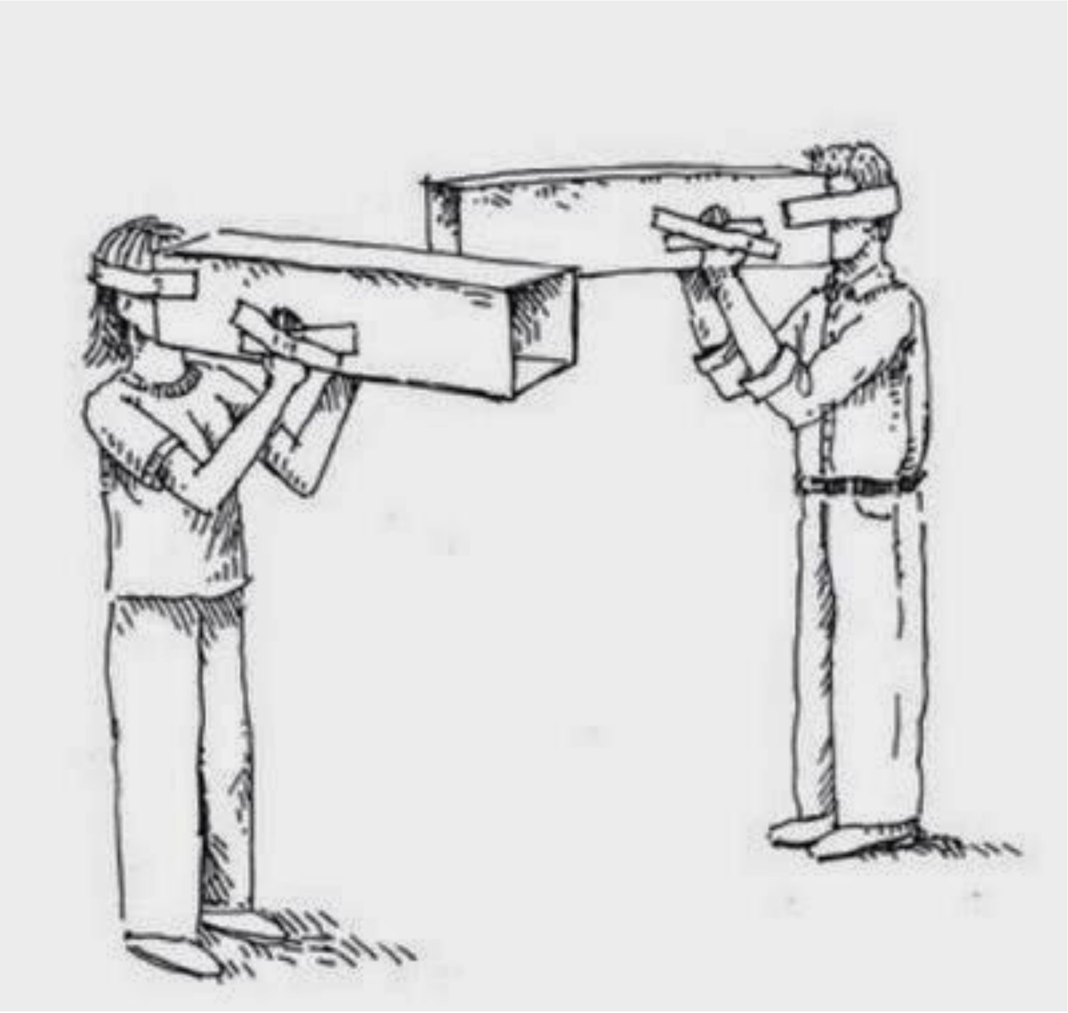
- Stress
- Fatigue
- Habits
- Reliable Systems
- Information Volume



Stress



- Stress vs Arousal
- Little stress for a long period of time = a lot of stress for a short period of time
  - Just as dangeruous
  - Health issues
  - Concentration
  - Level 1: Perception



Fatigue

- Daily shape
- Chronic state
- Wathckeeping
- Interruption

Affects:

- Concentration
- Alertness
- Patience
- Judgement
- Critical thinking

Habits

- Strong habits = good
- TOO strong habits = dangerous
- Unable to change and see other perspectives / solutions.


...AND THAT IS WHY WE LIFT ON THREE...
COMMUNICATION
©DOLIGHAN.
dolighan.com

Reliable systems

- Reliability and dependency of technology
- Cross checking sources
- Awareness of systems weaknesses

Information volume

- How much information are we able to handle?
  - Screens clammes with information
  - Filtering out irrelevant information
  - Noises
    - Alarms
    - Radio
    - Conversations

Information volume

- Experience generates:
  - + Filtering more effectively
  - + Higher Situational Awareness

  - Reduced vigilance
  - Too strong expectations = misinterprets situation

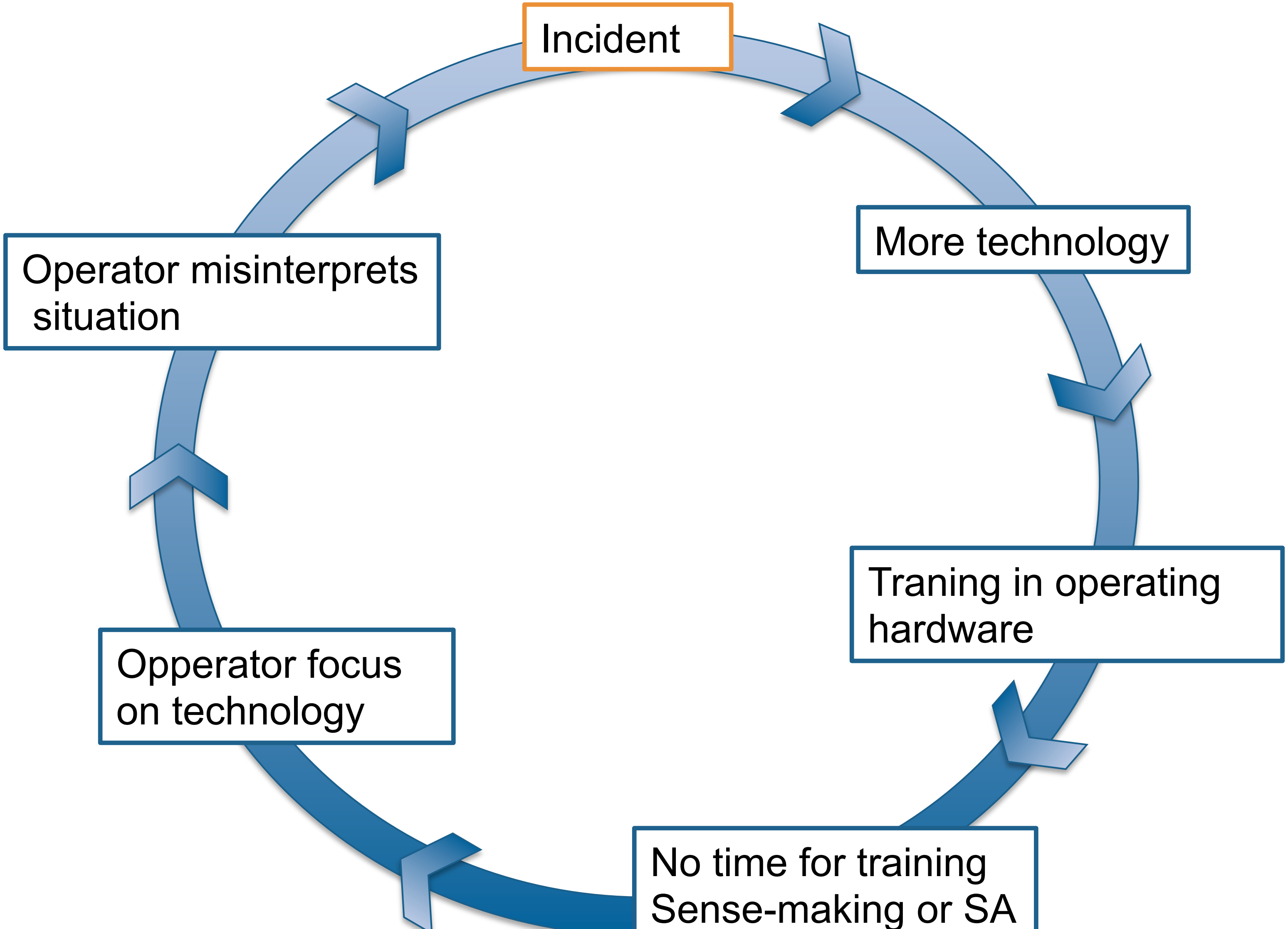
Handling distractions

- Stop and Think!!
- Distractions engaging the whole crew
- Losing focus
- Continuously create an overview

Handling distractions

- People awareness
  - Look after each other!
  - Work as a team

- Fix the real probelms, not only temporary solutions


Incident
More technology
Traning in operating hardware
No time for training Sense-making or SA
Opperator focus on technology
Operator misinterprets situation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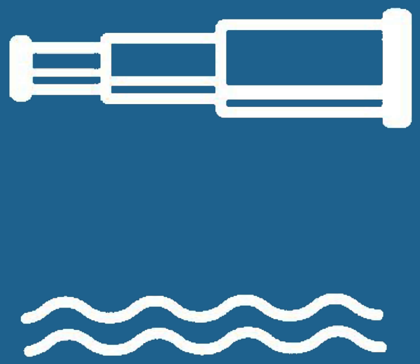

Part 3

BRM/ERM

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Topics

- Situational Awareness
- **Culture & Communication**
- Human Error
- Group Dynamics
- Leadership & Decision Making

Culture

”The arts and other manifestations of human intellectual achievement regarded collectively.”

(Oxford Dictionaries, 2015)

Culture

- Excists because of comparisons
- Dynamic cultural diversities
- Globalization

Culture

- No defined borders
- Small nouances
- Affinity to a group

Culture

- Language
- Religion
- Traditions
- Behavior
- Etc.

❖ Acceptance

❖ Understanding

❖ Open mind

Culture

- Four dimensions
  - – 1. Power Distance
  - – 2. Individualism versus Collectivism
  - – 3. Masculanity versus Femininity
  - – 4. Uncertanity Avoidance

Communication

- *"Human communication is the process of influencing a human receiver to create thought and action that is consistent with, and responsive to, the sender's purpose." – MCA, 2010*

Communication

… or:

Encoding signals from a transmitter through a medium.

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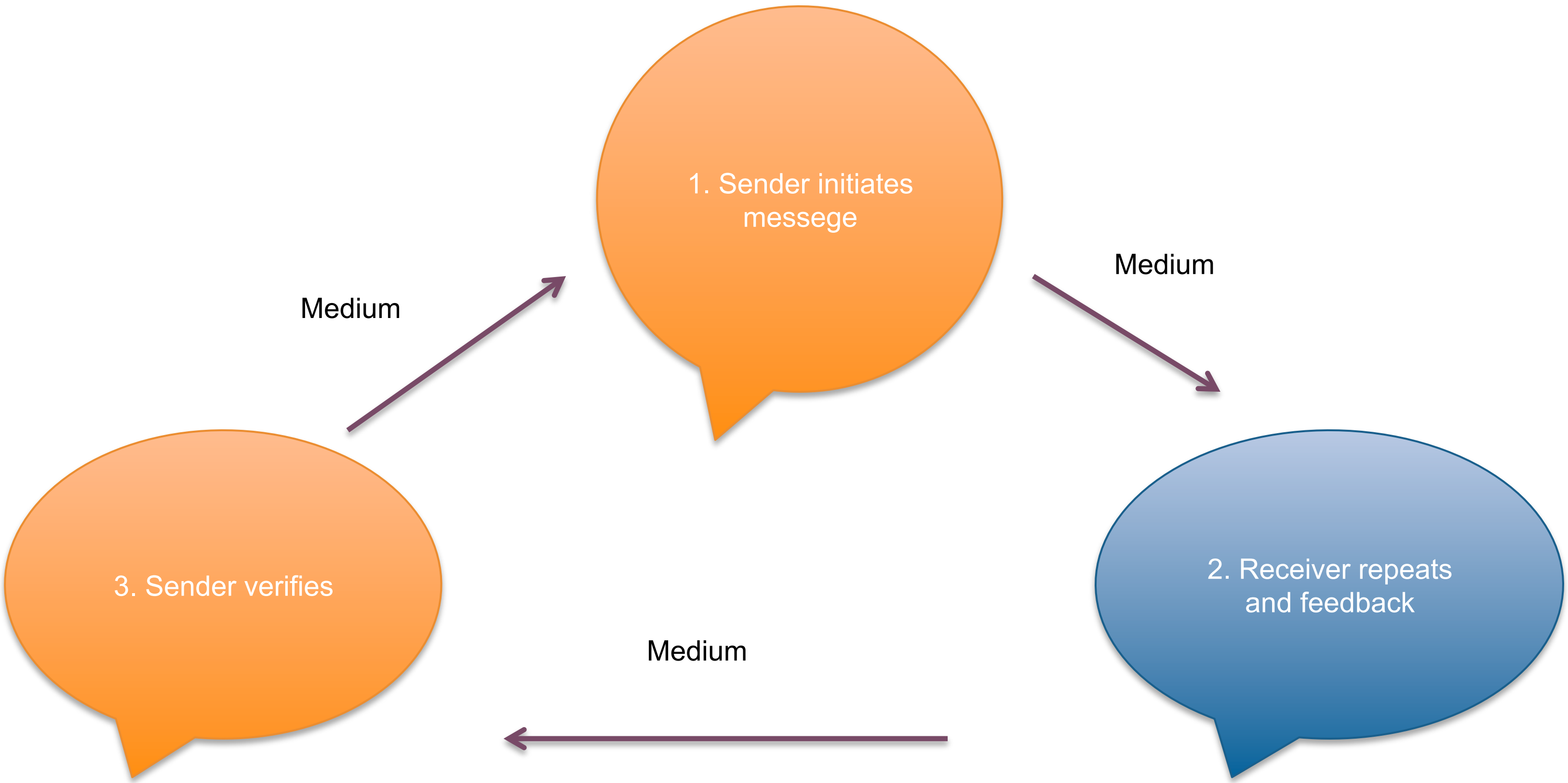
Communication

- Minimize loss of information
- Minimize misunderstandings

- 80% body language
- 20% speech

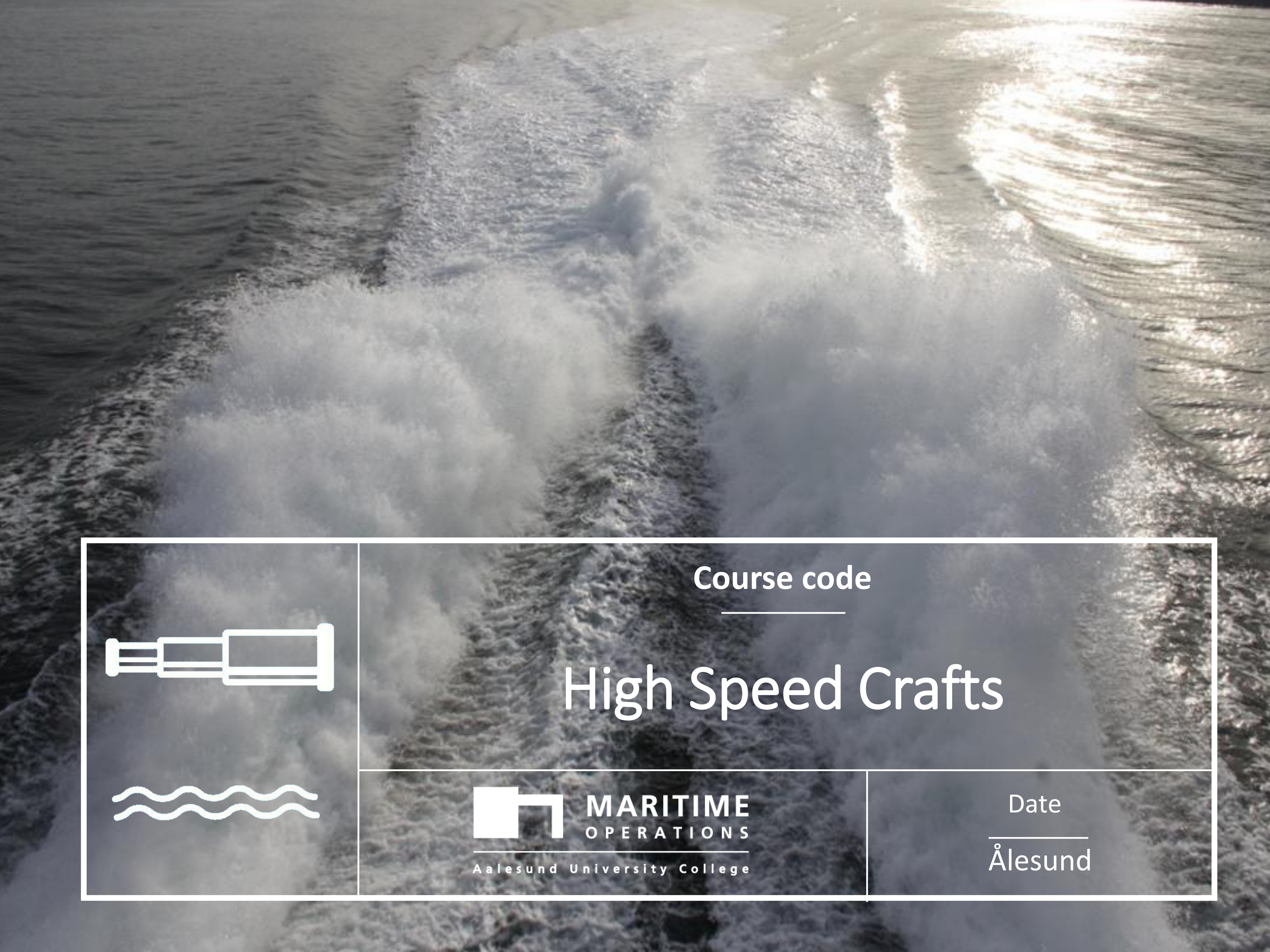
Communication



Communication

Measures to be taken to prevent communication failures:

- Lack of skills and knowledge.
- Lack of social skills, cultural knowledge and team skills.
- Lack of time.



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Part 3

BRM/ERM

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Topics

- Situational Awareness
- Culture & Communication
- **Human Errors**
- Group Dynamics
- Leadership & Decision Making

Human Error

- What is Human Error?
- What influences it?
- Fatigue and rest periods
- Briefing and de-briefing

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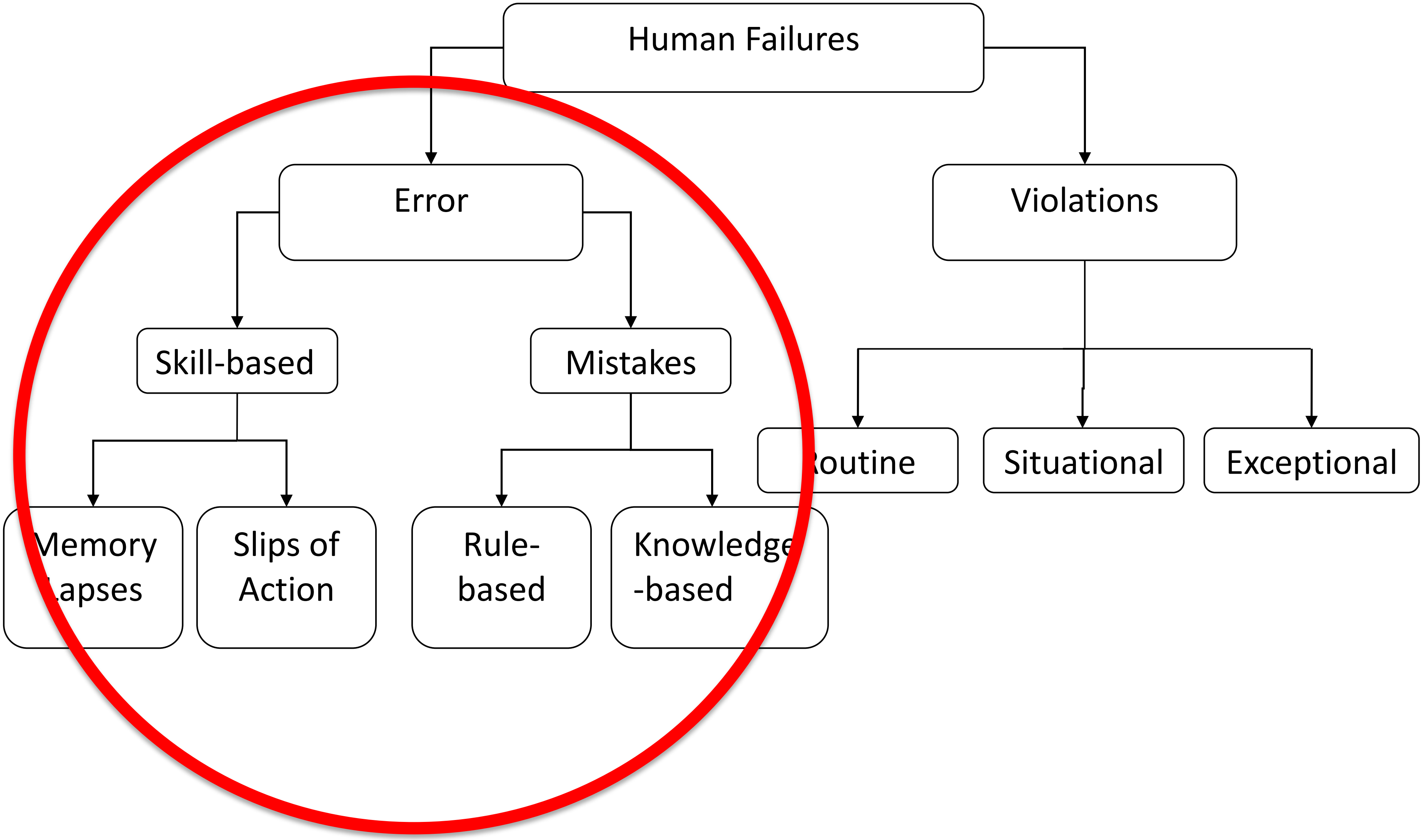
What is Human Error?

- ”the failure of a planned action to achieve the desired outcome”
- Several types of errors


Human Failures
Error
Violations
Skill-based
Mistakes
Routine
Situational
Exceptional
Memory Lapses
Slips of Action
Rule-based
Knowledge-based

Skill-based errors

Why?	What types?	How to prevent it?
• Occurs during routine work • More common for persons with experience	• Memory Lapse • Slip of action	• Cross-checking, fatigue management • Reduce distractions, human-centered design

Mistakes

Mistakes

Why?	What types?	How to prevent it?
• Good planning, wrong approach • Inexperience / lack of knowledge	• Rule-based mistakes • Knowledge based mistakes	• Standard operating procedures, guidelines • Regular drills, training, experience sharing

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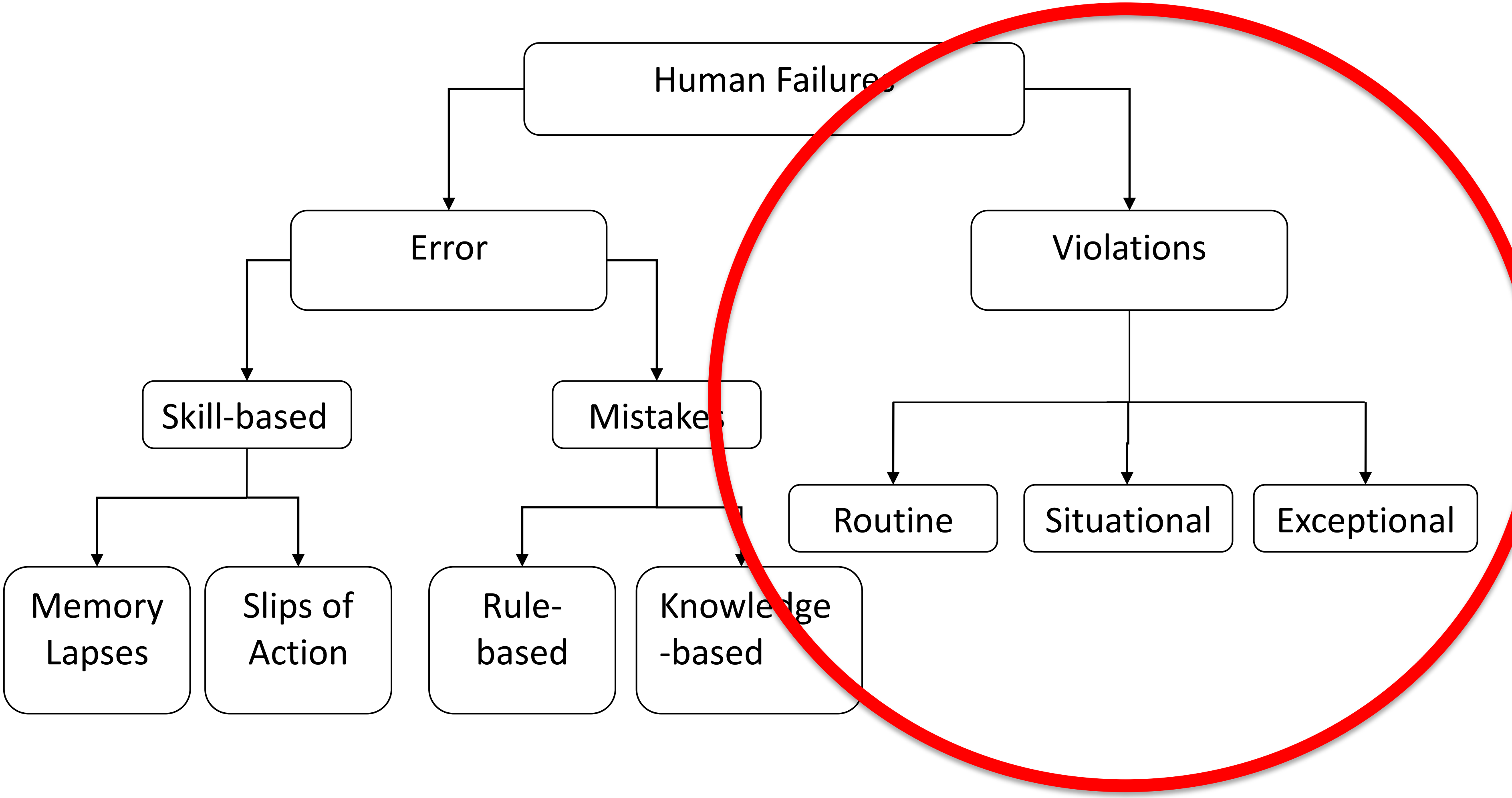
Human Failures
Error
Violations
Skill-based
Mistakes
Memory Lapses
Slips of Action
Rule-based
Knowledge-based
Routine
Situational
Exceptional

No safety, smoking first?

Violations

Why?	What types?	How to prevent it?
• Deliberate deviations from rules & regulations • Shortcuts to save time and effort • Often done with the organizations best in mind	• Routine – ”It’s normal to not follow the rules” • Situational – ”The situation requires it” • Exceptional – ”Following the rule won’t help me”	• Improve routines, should be no need to take shortcuts • Safety culture

What influences the Human Error?

- Size of the crew
- New technology
- Organizational
- Fatigue

Size of the crew

- Small crews, less redundancy and more responsibilites
- Is it practical possible?

"Sorry but we are shorthanded today . . ."

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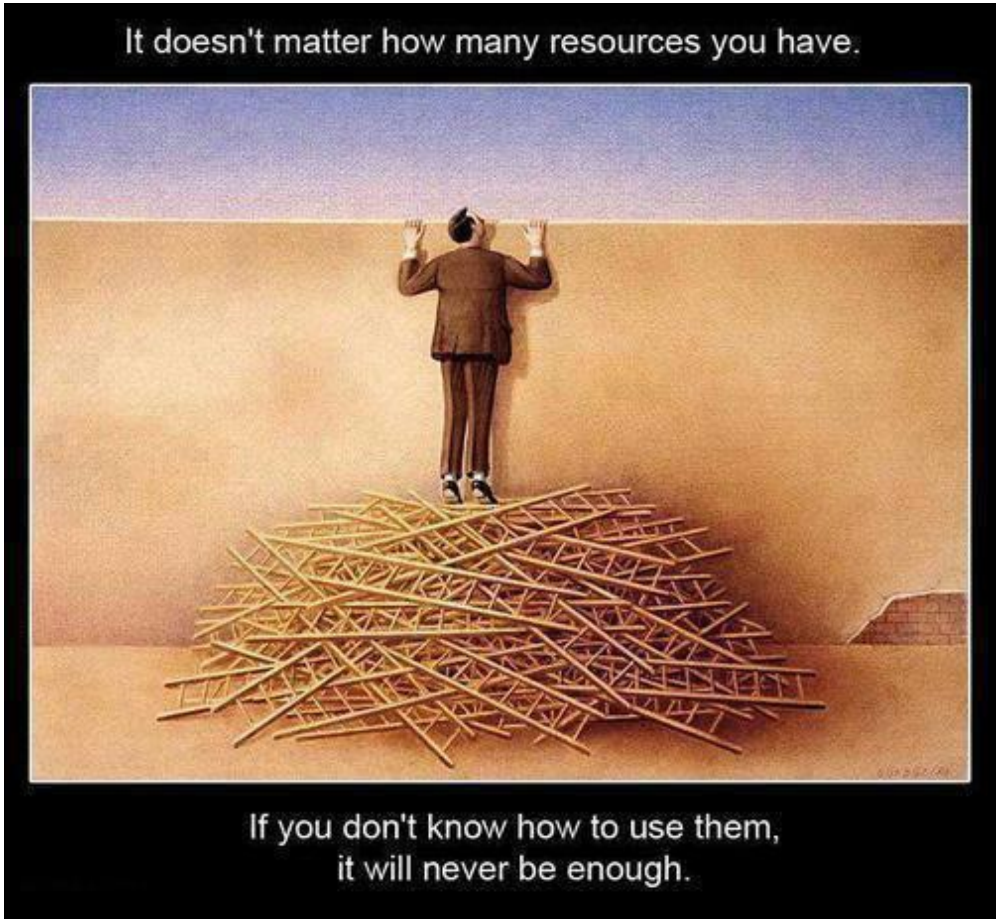
New technology



- More technology, more safety?
- Alarms?

Organizational

- Company policys
- Bad rule compliancy leaks down to the crew

Fatigue and rest periods

- What causes fatigue?
- How do you prevent it?

Workload

- How much is too much?
- External demands and experience
- Varies over the period of work
- Boredom is also a safety risk

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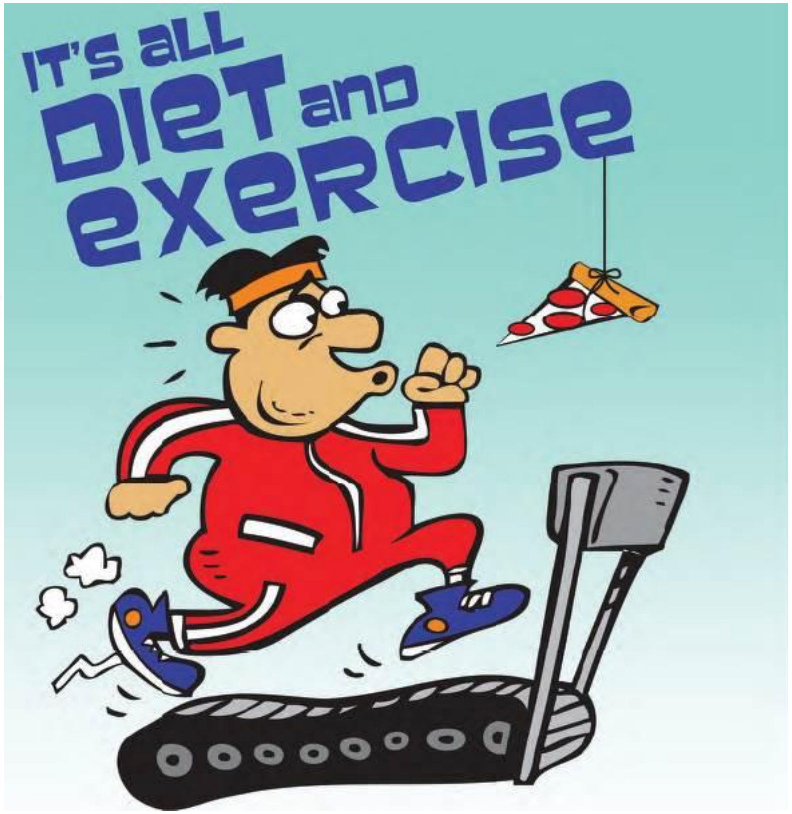
Sleep

- Enough time and good quality
- Sleep debt

Diet and exercise

- Food has a major impact on fatigue
- Carbohydrates increases sleepiness
- Protein increases alertness
- People who stay fit have a longer endurance



How to prevent fatigue?

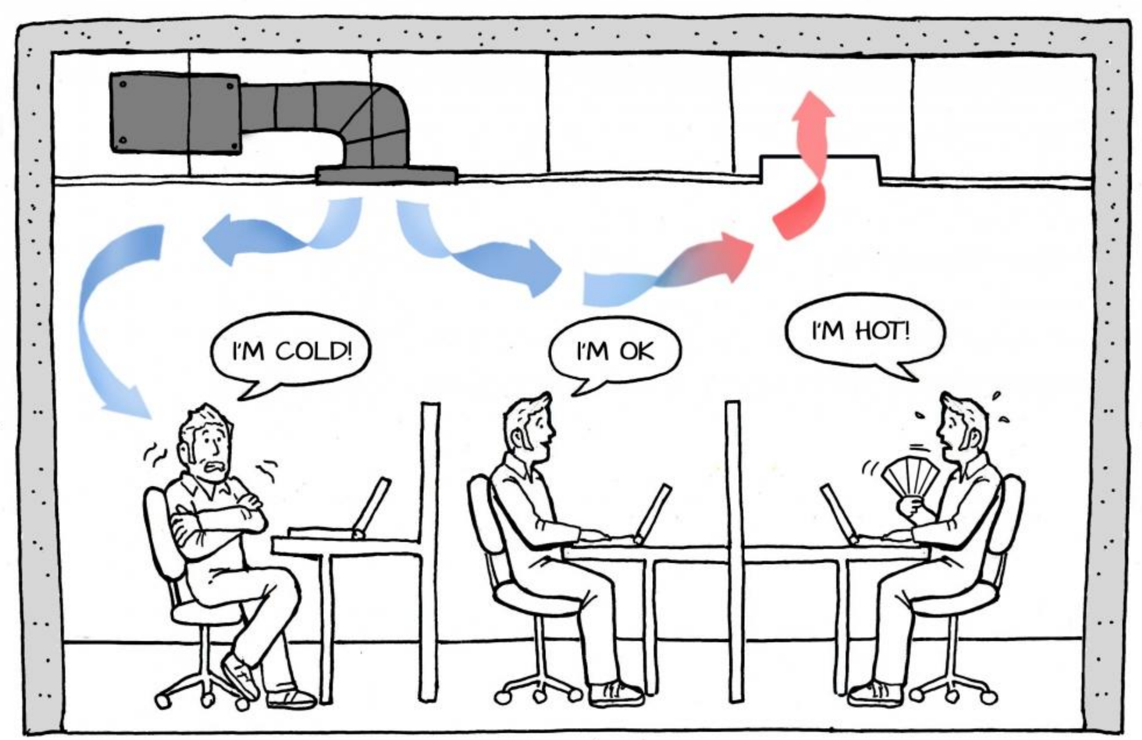
Design

Organizational management

Fatigue Management Plan

Design

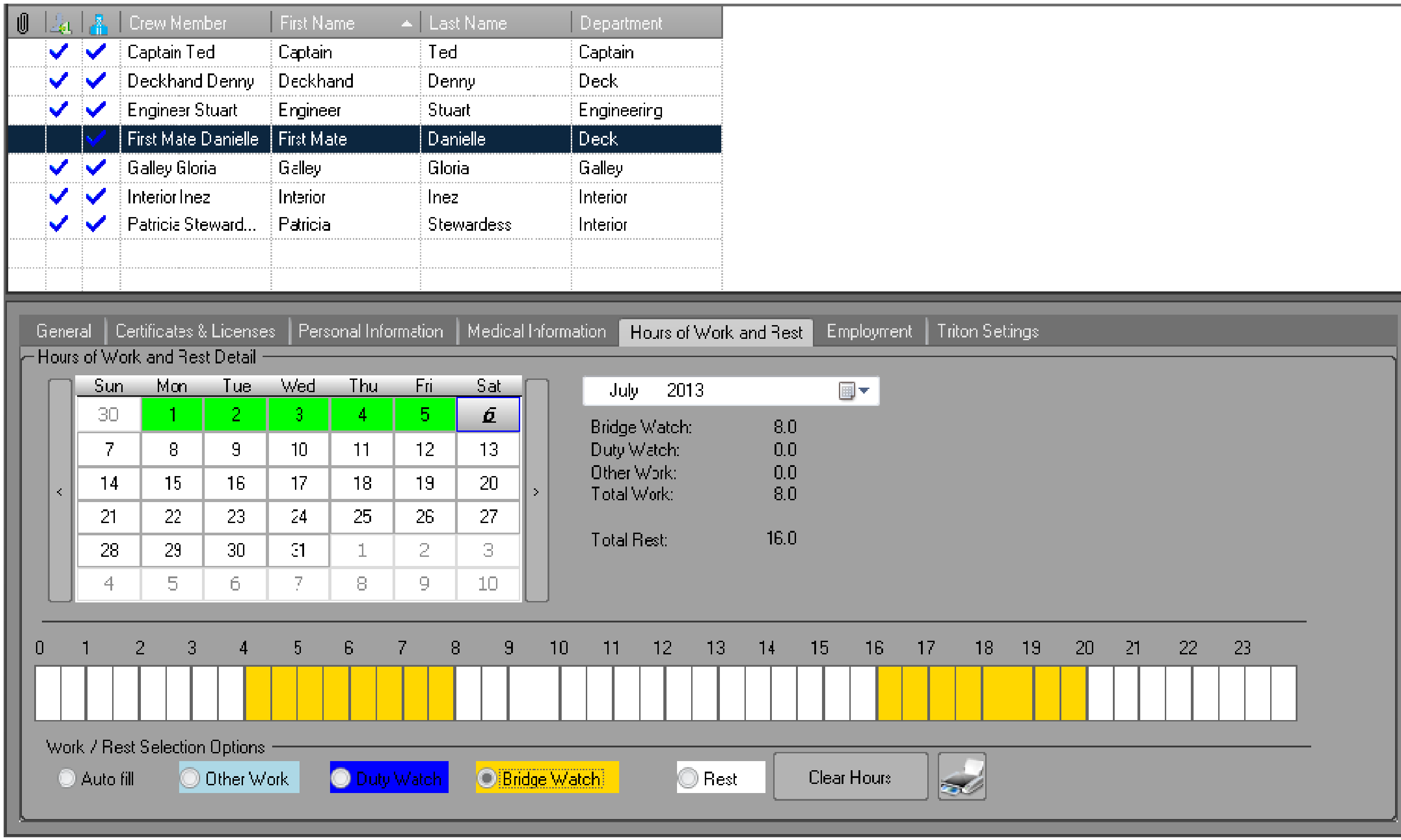
- Noise – high levels and low levels
- Vibrations – changes heart function
- Ventilation – temperature and quality of air



Operational

- Fatigue needs to be taken serious
- Follow the rest / work rules
- Work/rest journal
- Fatigue Management Plan

Electronic work/rest journal



“EC Directive 1999/95/EC mandates ILO convention 180, article 5:

1. The limits on hours of work and rest shall be as follows:
   (a) maximum hours of work shall not exceed:
   (i) 14 hours in any 24-hour period; and
   (ii) 72 hours in any seven-day period;
   OR
   (b) minimum hours of rest shall not be less than:
   (i) 10 hours in any 24-hour period; and
   (ii) 77 hours in any seven-day period.
2. Hours of rest may be divided into no more than two periods, one of which shall be at least six hours in length, and the interval between consecutive periods of rest shall not exceed 14 hours.”

Fatigue Management Plan

Ship owner/ manager

Forms the policys and rules. Makes it possible for the crew to follow the rules

The Master

Ensures policys and rules are followed. Dynamically monitors the crews well being

The seafarer

Uses rest periods for rest, with good quality sleep. Fills out the journal correctly

Briefing and debriefing

- All group activities should start with a briefing, and end with a debriefing
- Improves the perfomance
- Important to follow good practice

Good practice

- Briefings require some organization
- Good practice is using checklists
- Should be limited to the most relevant information
- Three leading words
  - Clear
  - Concise
  - Factual

Adapt to the situation

- The style and details should be based on the situation

- Accidents shall be followed by a initial briefing, and when more information is available new briefings should be given

Shift change

- Master gives details of the trip
- How many passengers are expected, and how many are on board, which route the vessel is on
- Check that all crew members are familiar with operations on the vessel, understands their role and are fit for duty
- The Master could give a ”what if” situation for the crew to discuss. What if a passenger falls overboard, or becomes sick?

Debriefings after special events

- After the situation has cleared up, people generally feel a need to talk about whats happened
- Informal briefings is good, but a formal shall be commenced as soon as possible with all involved parties

Routine debriefings

- Debriefings are not only for special events, such as accidents
- During the last trip of the shift, or when waiting for the releivers a casual debrief could be done
- Example questions:
  - Did everything go as expected?
  - Why did it, or why didn't ?
  - Is there anything we need to do different next time?
  - Questions?

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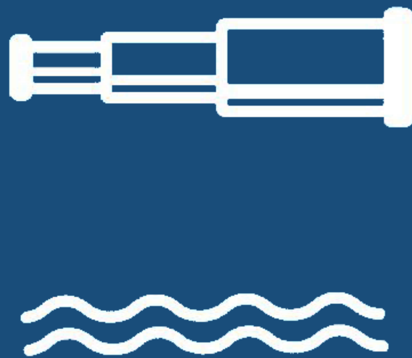

Part 3

BRM/ERM

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Topics

- Situational Awareness
- Culture & Communication
- Human Error
- **Group Dynamics**
- Leadership & Decision Making

Group dynamics

- Team building (FIRO)
- Conflict management
- Values, attitudes and norms
- Emotional intelligence

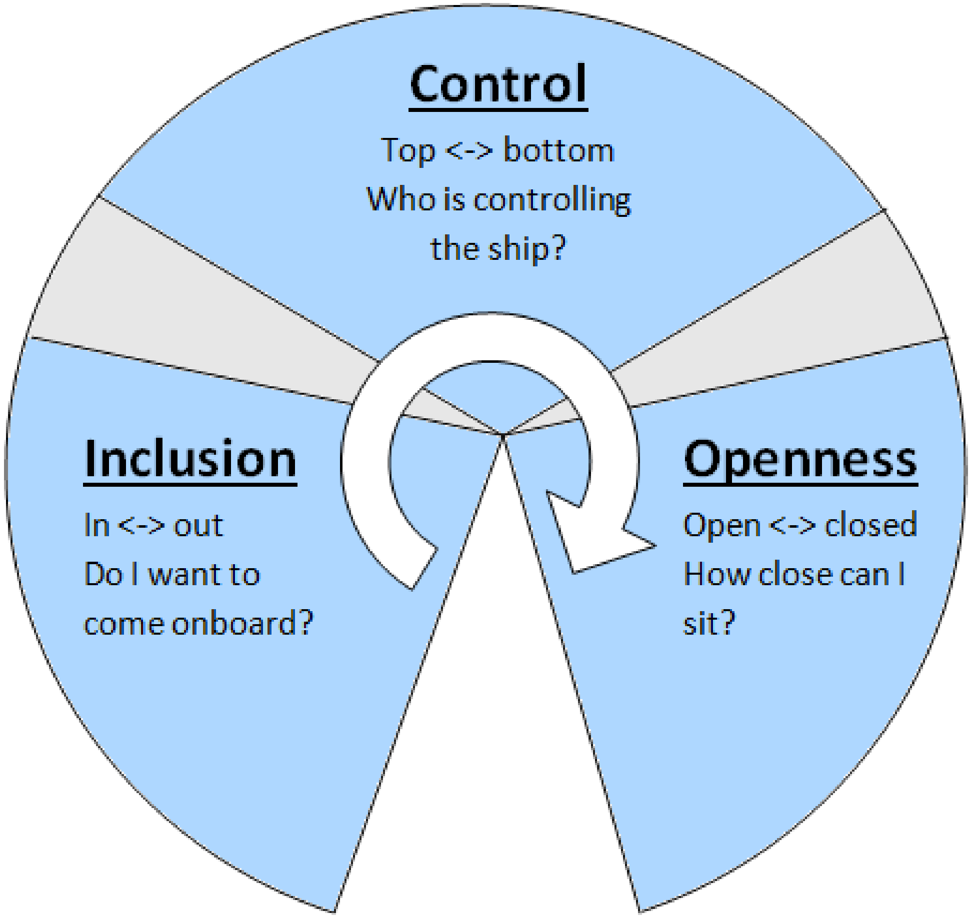
Team building (FIRO)

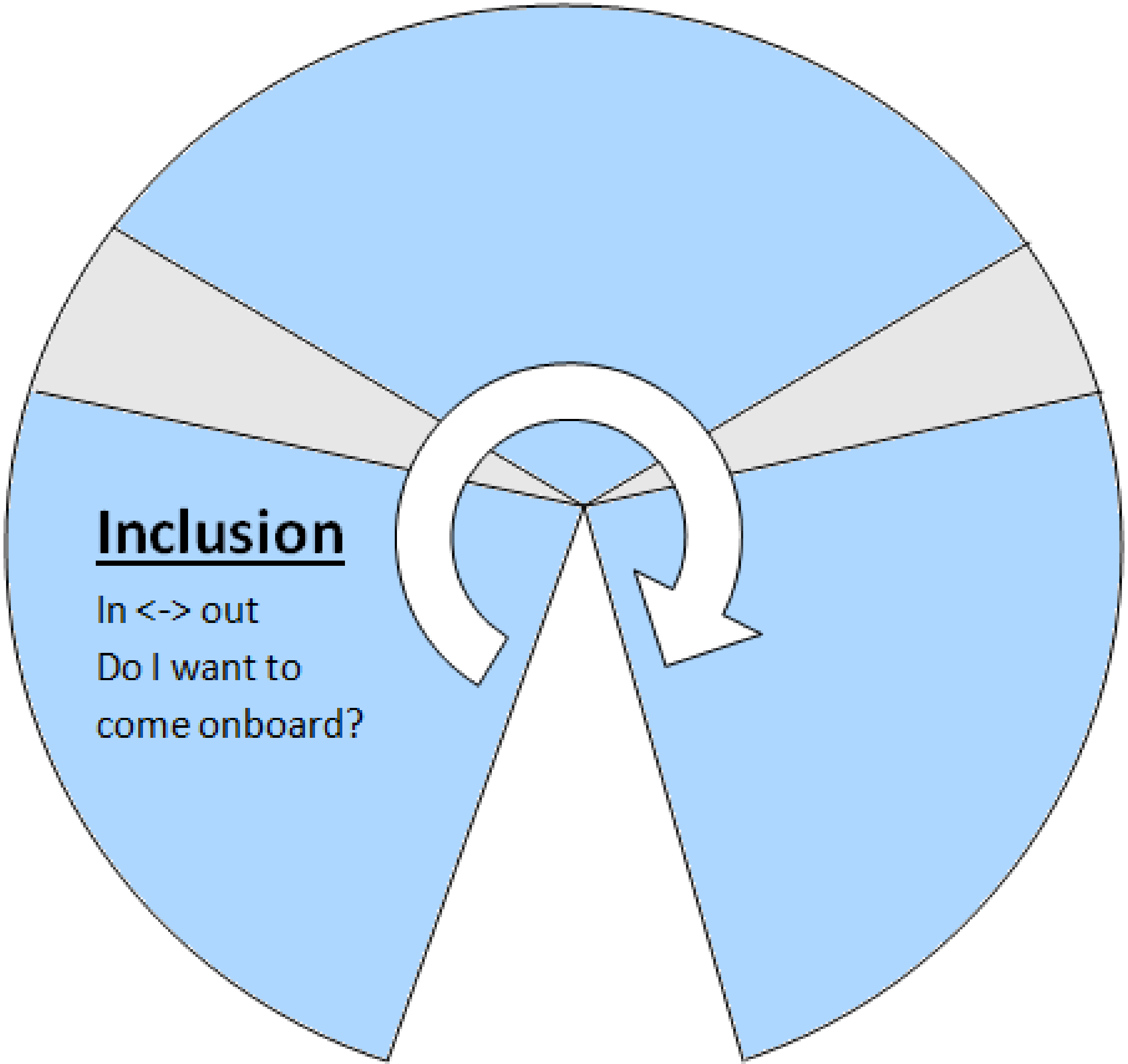
- Fundamental Interpersonal Relations Orientation

Everyone wants to feel:	Significant	Competent	Likeable
These are expressed through:	Behavior	Feelings	Self-concept
What we want to achieve in a group:	Inclusion	Control	Openness

FIRO

- Inclusion phase
- Control phase
- Openness phase




Inclusion
In <-> out
Do I want to
come onboard?

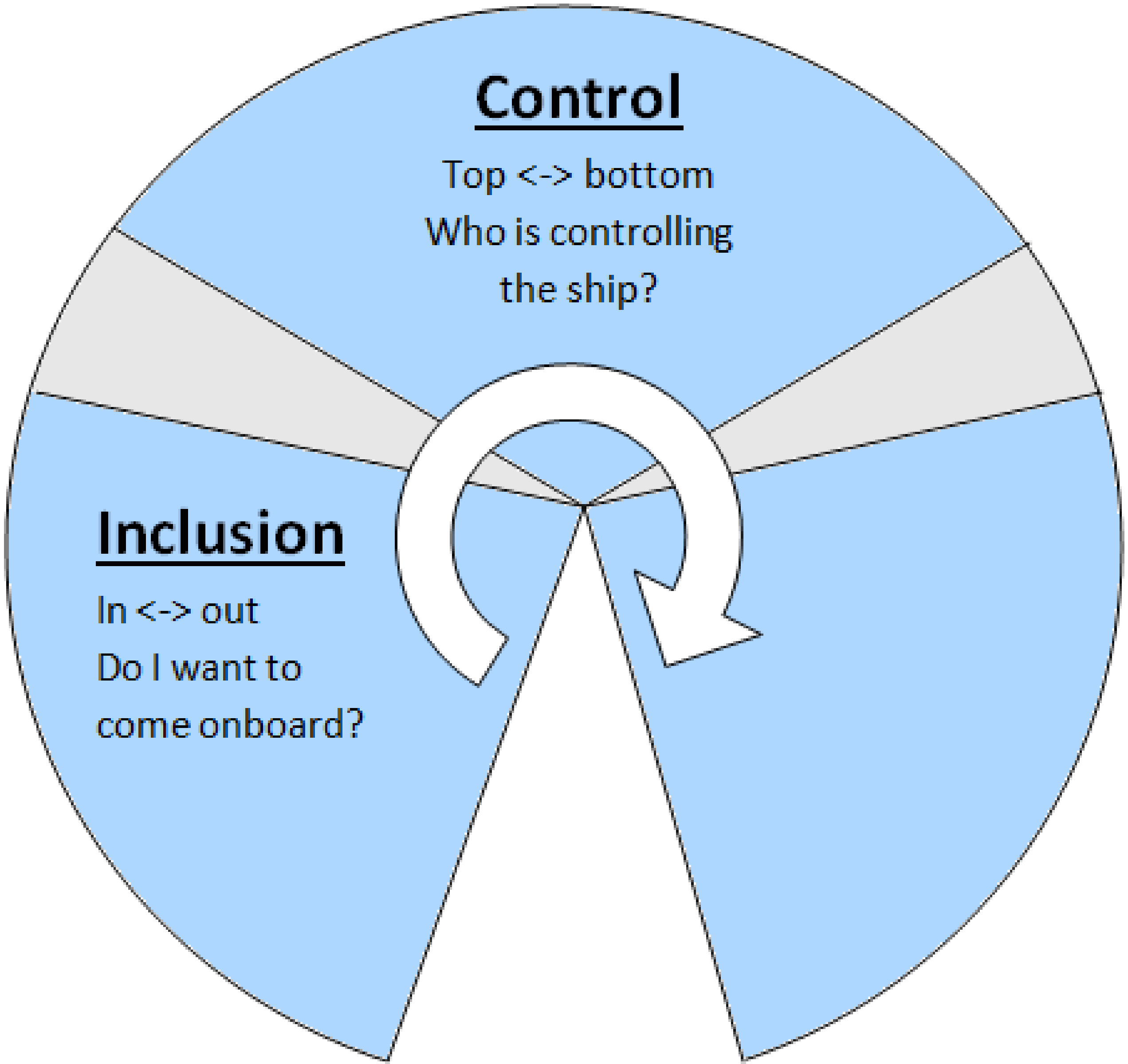
Inclusion phase

Focus of the group: Membership (in or out)
Interactions between persons: Socializing
Self-examining questions: Am I accepted?
Do I accept the others?

Important questions: Do I fit in this group?
Who are the other members?
Do I want to be here?
Can I be here?

Inclusion phase

- Much interaction, persons try to get to know eachother
- Conflicts are actively avoided, polite attitude
- Energy is spent on membership questions


Control
Top <-> bottom
Who is controlling
the ship?
Inclusion
In <-> out
Do I want to
come onboard?

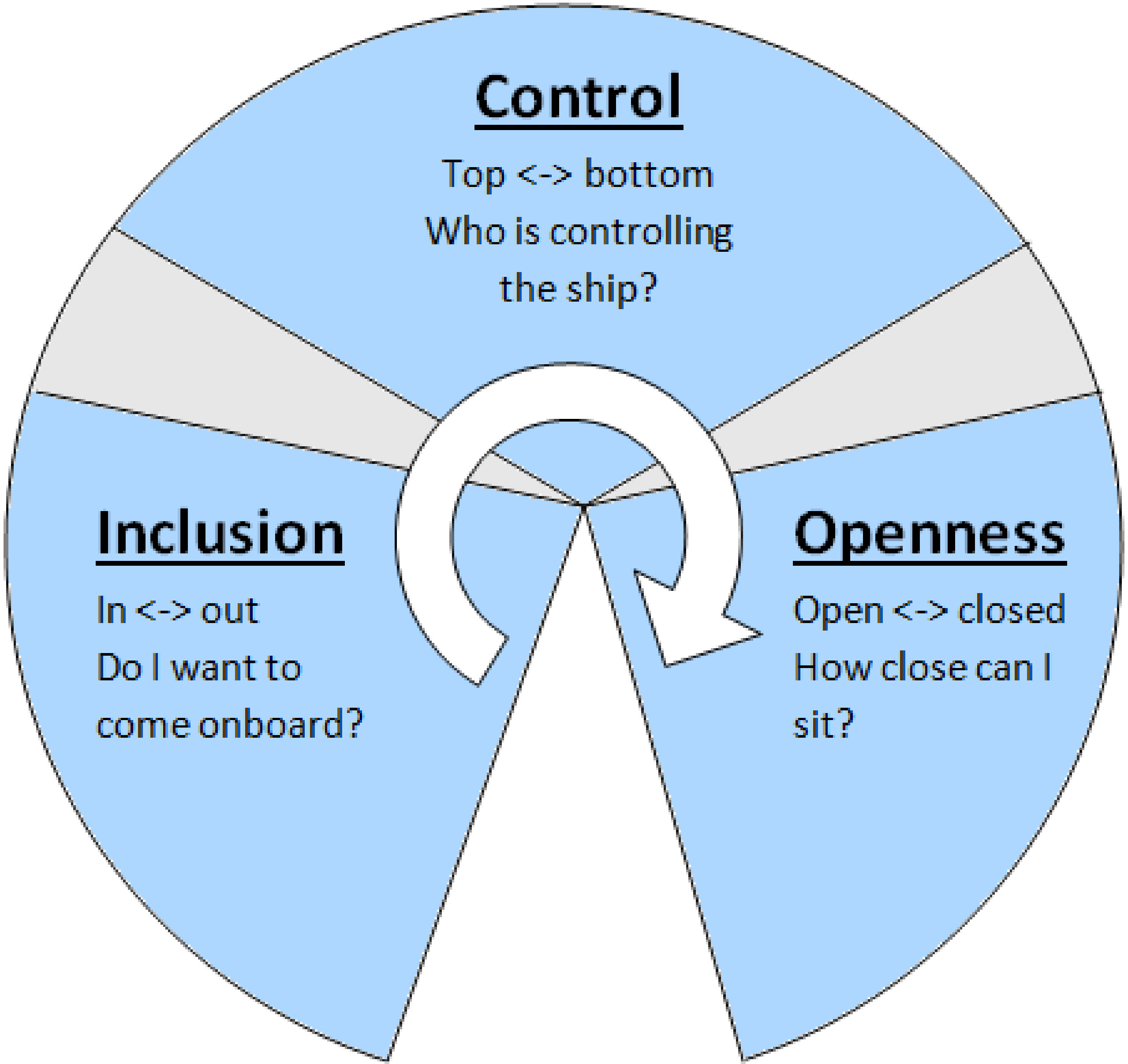
Control phase

Focus of the group: Confrontation
Interactions between persons: Independency
Self-examining questions: Am I competent enough? Are the others competent enough?

Important questions: Who are the leader(s)?
How much influence do they have?
How big responsibilities are I given?
Am I strong enough to make myself heard?

Control phase

- The most demanding phase
- About 60% of the time is spent here
- Confrontations
- Energy is focused on leadership


Control
Top <-> bottom
Who is controlling the ship?
Inclusion
In <-> out
Do I want to come onboard?
Openness
Open <-> closed
How close can I sit?

Openness phase

Focus of the group: Relations
Interactions between persons: Co-operation
Self-examining questions: Am I liked?
Do I like the others?

Important questions: How close can I come?
How strong emotions can I show?
Are the group members loyal towards me and the group?
How open I be?

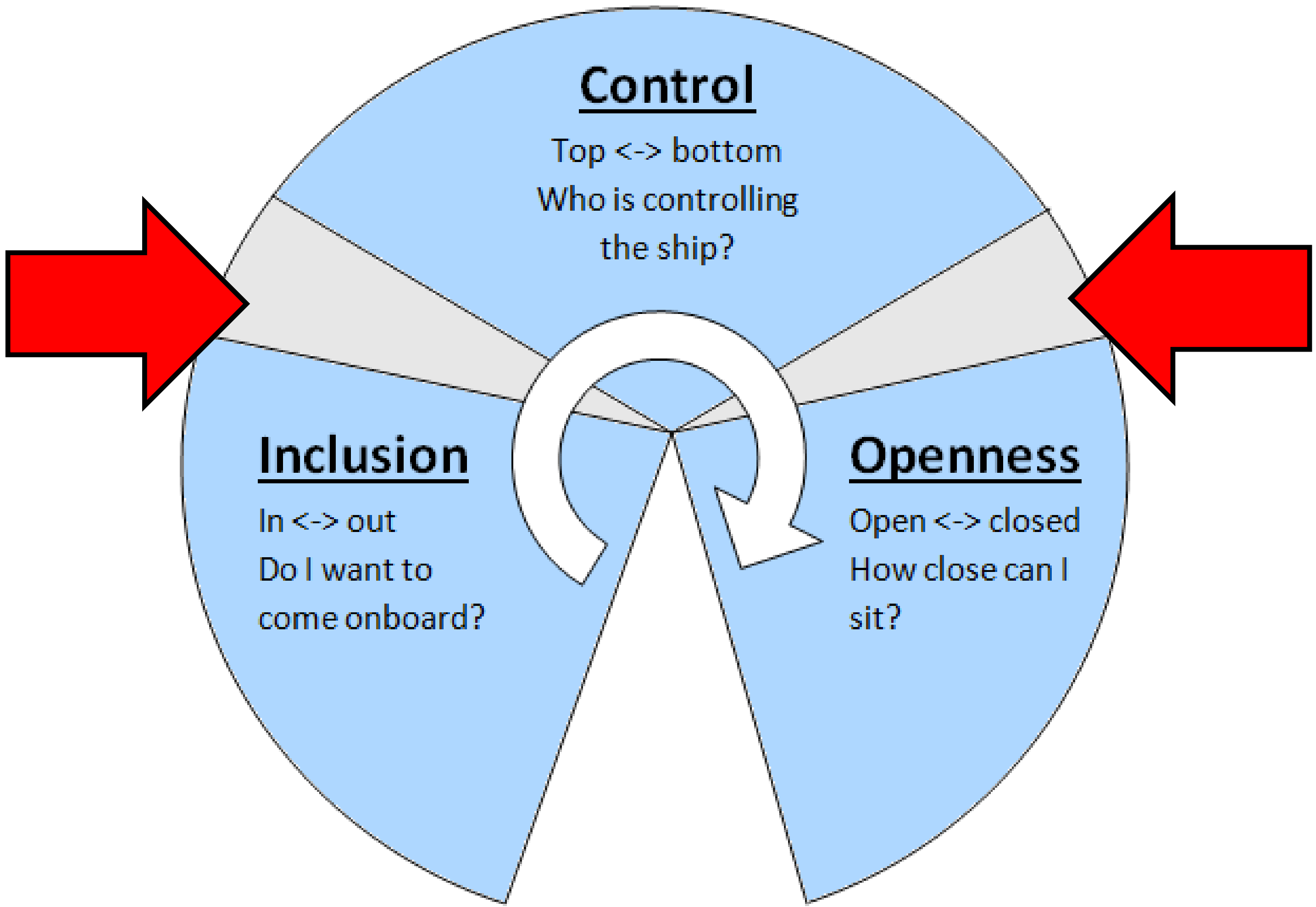
Openness phase

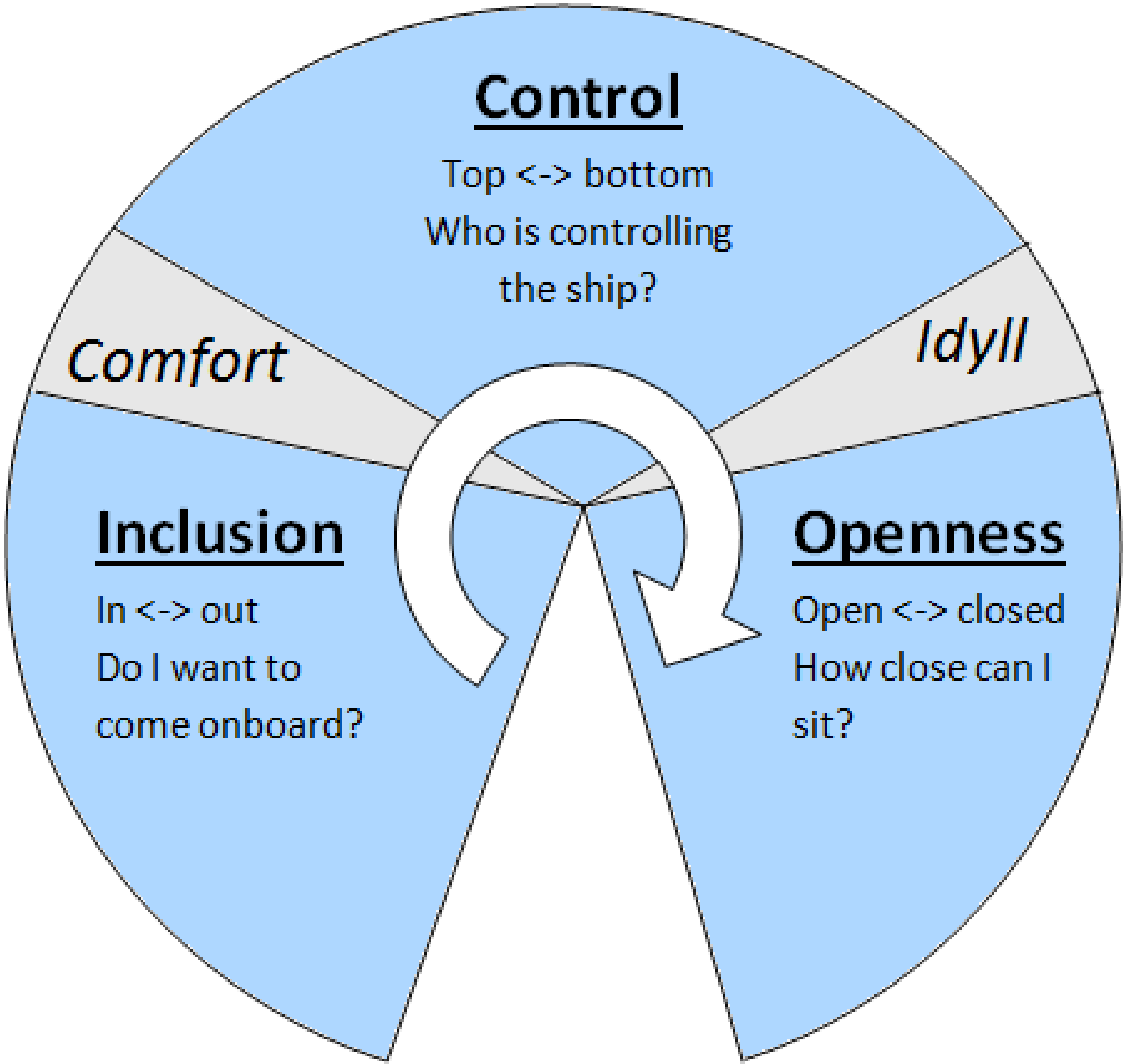
- The group is finally functional
- Conflicts are dealt with immediately
- A feeling of satisfaction and trust
- You start to wonder how close you can be

Conclusion

- Team building is very complex
- A method for ”group a” is not sure to work for ”group b”
- Not all groups fulfill the FIRO circle
- May take days, weeks, months or even years

What happens between phases?




Control
Top <-> bottom
Who is controlling
the ship?
Comfort
Idyll
Inclusion
In <-> out
Do I want to
come onboard?
Openness
Open <-> closed
How close can I
sit?

Comfort phase

- Between the inclusion and the control phase
- Everyone is accepted in the group
- Any conflicts are actively avoided

- A group feeling is starting to grow
- Members actively show their engagement

Idyll phase

- Between the control and the openness phase
- Very similar to the comfort phase
- No conflicts occur
- Is often entered after an intensive conflict

- Group identity is formed
- Members begin to understand their roles
- Energy is used to preserve the feeling of idyll

Conflict management

- How to prevent conflicts on your vessel?
- How do you solve conflicts?

Preventing conflicts

Policys

Social rules

Code of conduct

Solving conflicts

- A balance between opposing views of a situation
- Conflicts does not always have to be something bad
- Escalated conflicts may lead to problems

1 – Determine what type of conflict

- Lose-win
- Win-win
- Lose-lose

- ”If I cant win, I want the opposition to lose aswell”

2 – Co-operate about the conflict

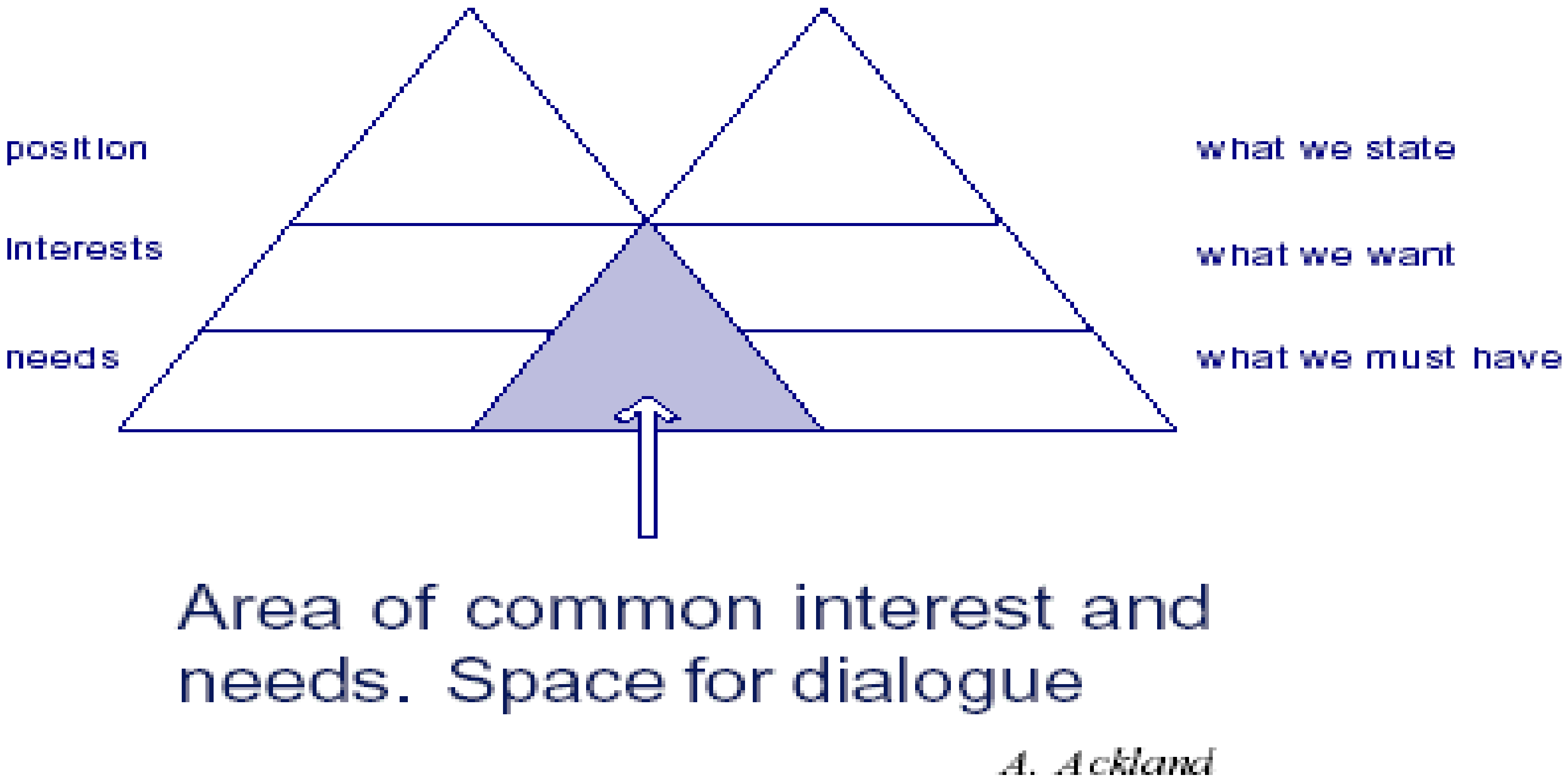
- Everybody wants to co-operate, or don’t they?
- Co-operation is based on:
  - Good communication
  - Respect
  - Helpfulness
- These values tend to be forgotten in conflicts
- Conflict is not a battle, but a mutual problem

3 – Separate positions and interests

- Positions is what you say you want to have
- Interest is what you actually need
- This is the main problem with conflicts

- “The orange method”

3 – Separate positions and interests



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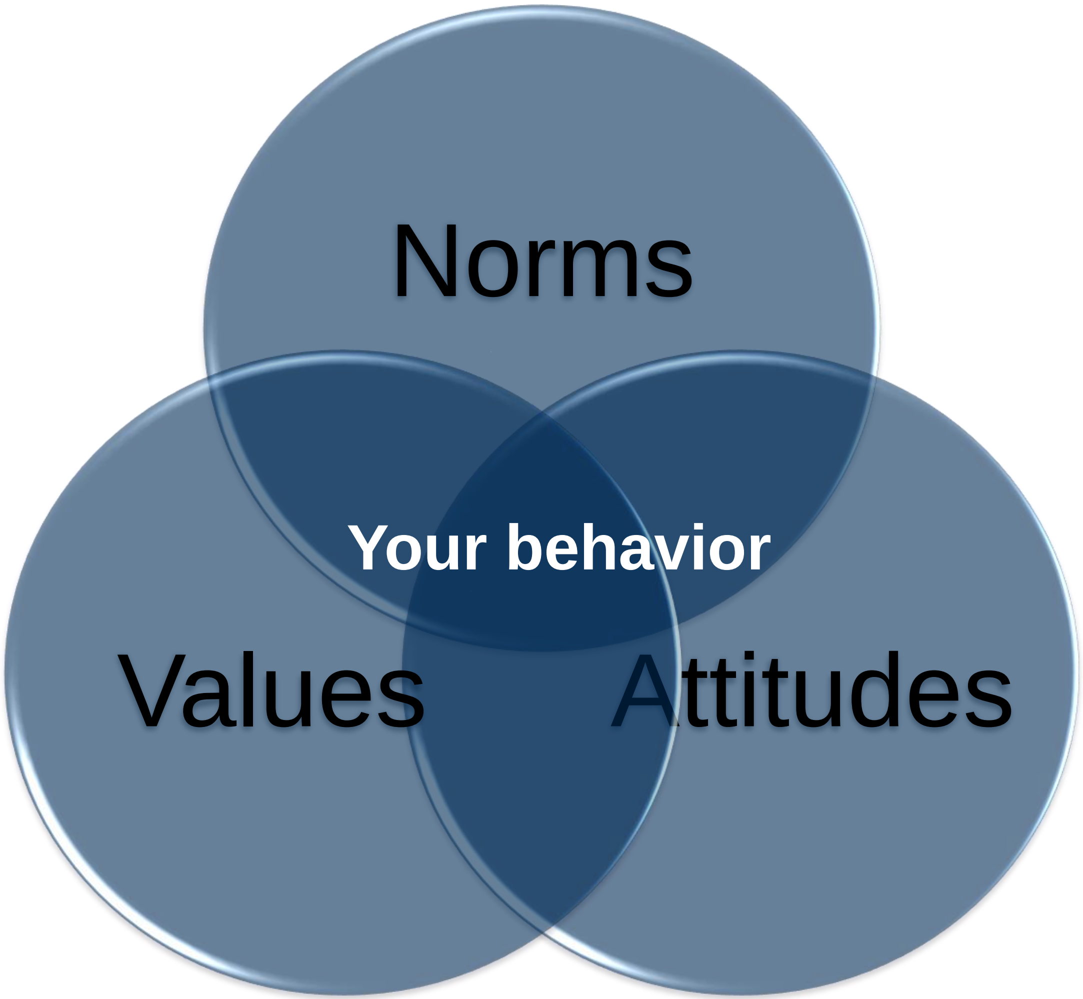
4 – Turn your opponent into your partner

- The interests are essential
- Positions is only an idea of how to fulfill the interest

- Be flexible with your position, and be firm with your interest
- Make your opponent your partner in finding a solution, instead of increasing the distance

Norms, attitudes and values



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Norms

- ”Rules” of how to behave, think and feel in specific situations
- Increases the affinity and co-operation
- Norms may have to be broken to develop the group

Norms

- The system of norms requires some kind of punishment for breaches
- More aggravated breaches may lead to jail time
- Less aggravated breaches are also punished

- What do you do when someone cuts the line?

Norms

- Norms are passed on to us during our childhood
- Both consciously and unconsciously
- Your norms will be passed on to new generations

Attitudes

- General approach to something or someone
- Strong beliefs, connected to your feelings

- You can have an attitude towards people, groups, organizations, objects, situations, events

Attitudes

- The learning method is very similar to norms
- **Expressing your conception about a thing**
  - The group will encourage or correct you
- **Social copying**
  - You copy the attitudes of persons with high influence on you
- **The classic way**
  - You connect situations and objects/activities to each other

Values

- Closely related to attitudes and norms
- Example
  - Equal rights for all persons
  - Everyone should be treated with respect

- By standing up for your values you become more liable as a person

Values

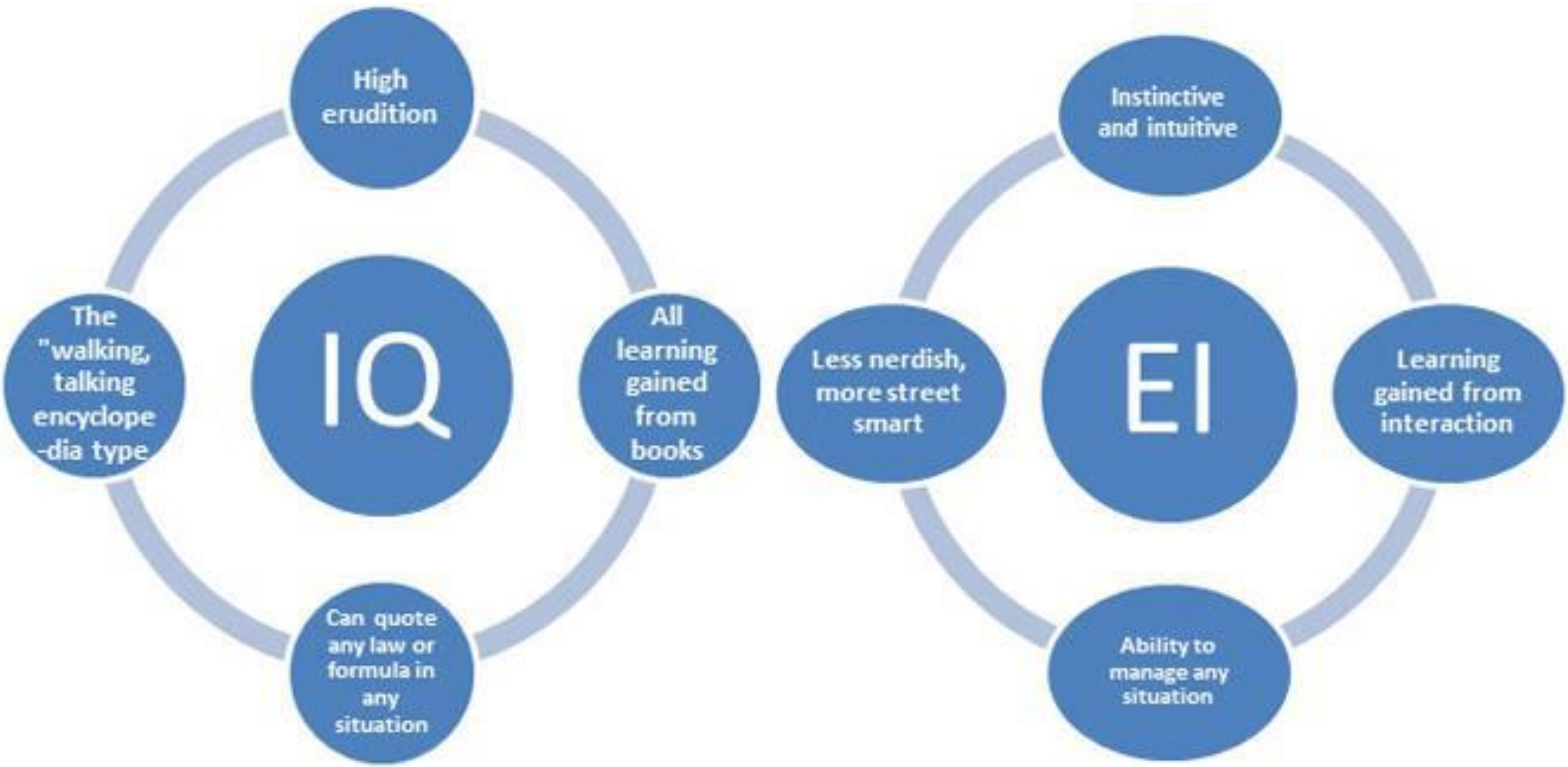
- Positive and negative values

- **Negative**
  - Persons who says one thing, but does the opposite. Does not gain respect from the group
- **Positive**
  - Persons who live as they learn. Listens to group members, gains their trust and respect.

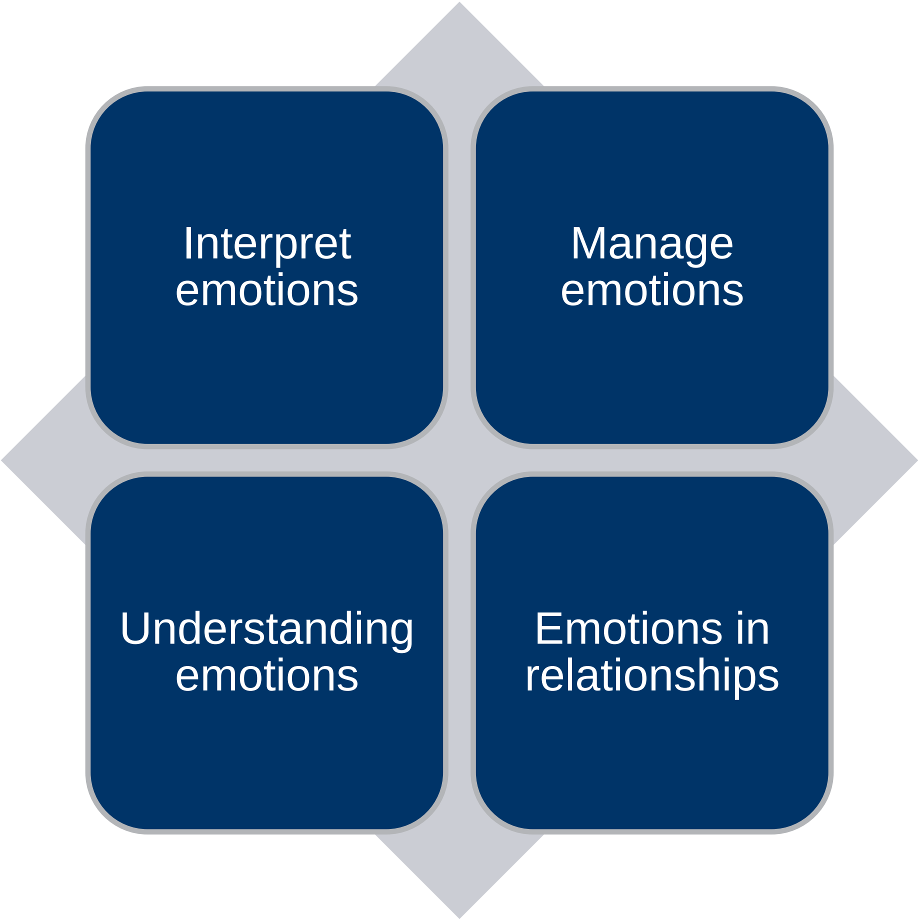
Emotional intelligence

- Intelligence (IQ) helps you learn navigation
- Emotional Intelligence (EI / EQ) helps you manage stress, emotions and situations onboard

Emotional intelligence



Emotional Intelligence



Emotional Intelligence

- Why is it important?
- Emotions are the brains strongest signal
- We make decisions with emotions

- EI is to the heart, what IQ is to the brain

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Topics

- Situational Awareness
- Culture & Communication
- Human Error
- Group Dynamics
- **Leadership and Decision Making**

Influencing others:

- Thinking
- Attitude
- Behavior

Leader vs. Boss

- Distrubution of power

- One need not exclude the other
  - Situational based

- Hierarchy +/-

Leader vs Boss

To much leader:

- Long vision without shorter goals and budget
- No rules or structure
- Inspired coworkers not using any control systems.

Consequenses: The Organization with no or a little control, deadlines will not be held and the budget fails.

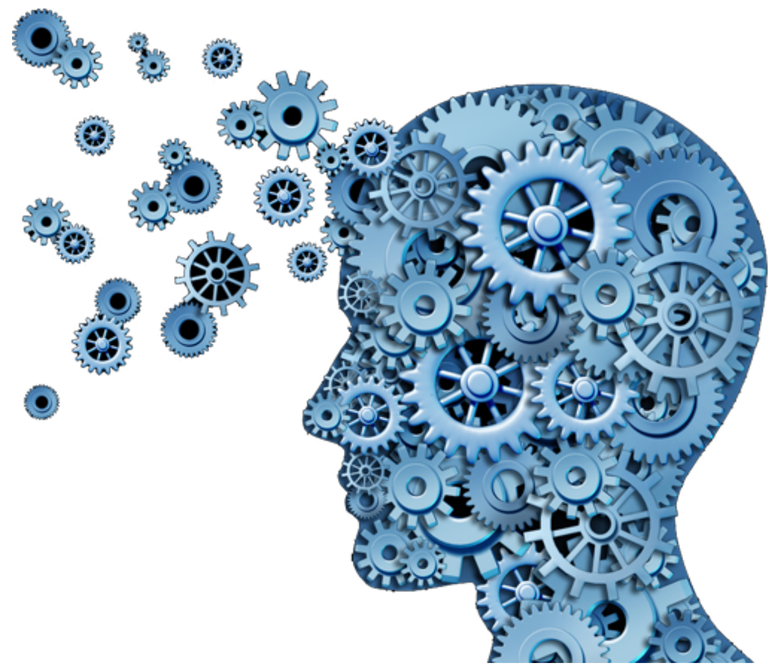
To much boss:

- Hirarchy
- Impersonal
- Focus on controlling
- Uninspired coworkers

Consequences: The organization will be rigid and non innovative. Changes will be hard.

Leadership

- Organizational leadership
- Social leadership



- Personality
- ”Knowledge is power”

Leadership

- Distribute workload
- Distribute competence
  - Discover and make use of the competence within the group.
- Briefing
- Debrief

Decision Making

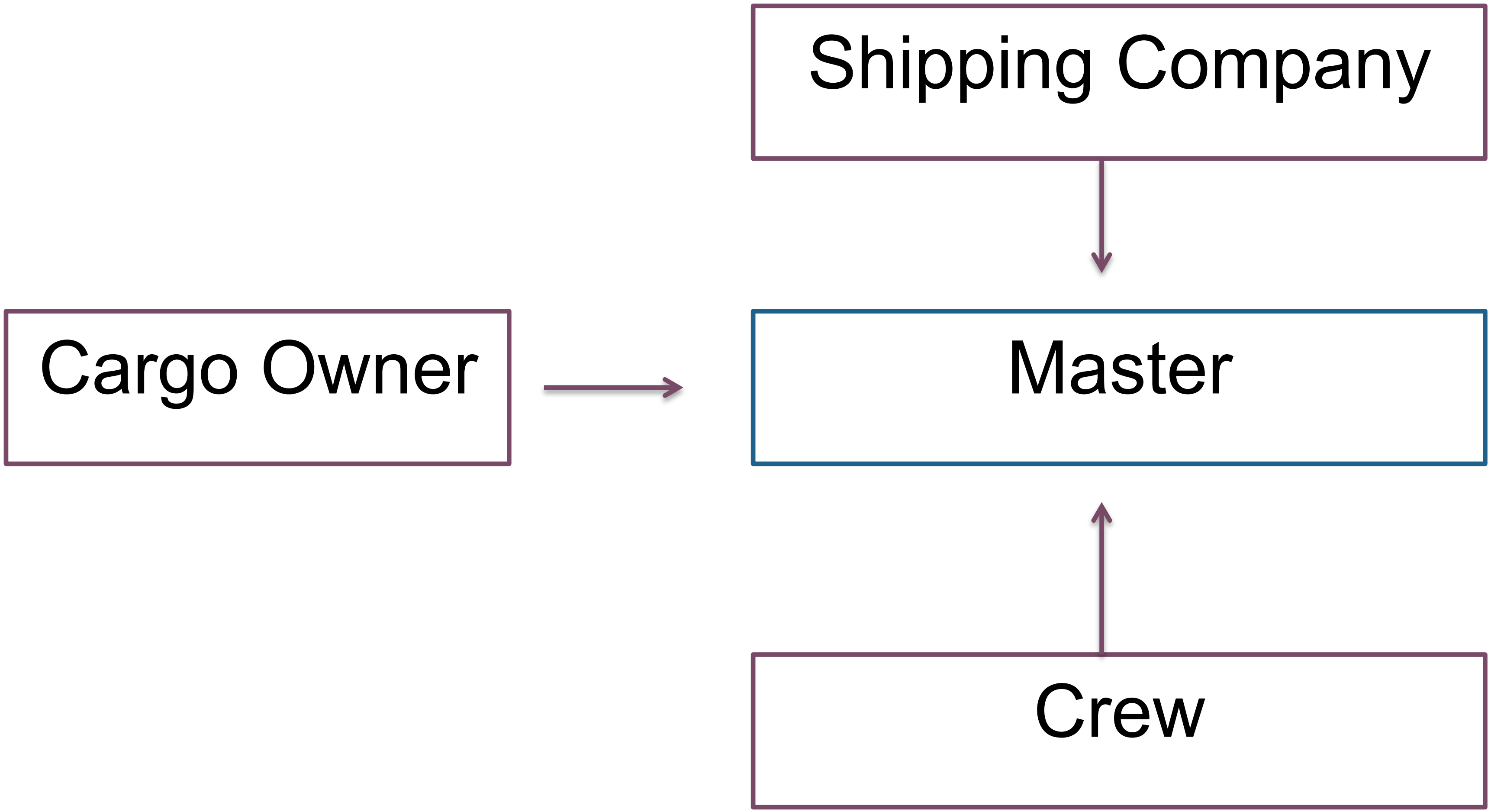
- Compromize
  - Alternatives
  - Information-based

- The outcome of a decision
  - Evalutation
  - Consequence analysis

Decision Making

- Judgment
- Common sense
- Earlier experiences
- Available information

Decision Making



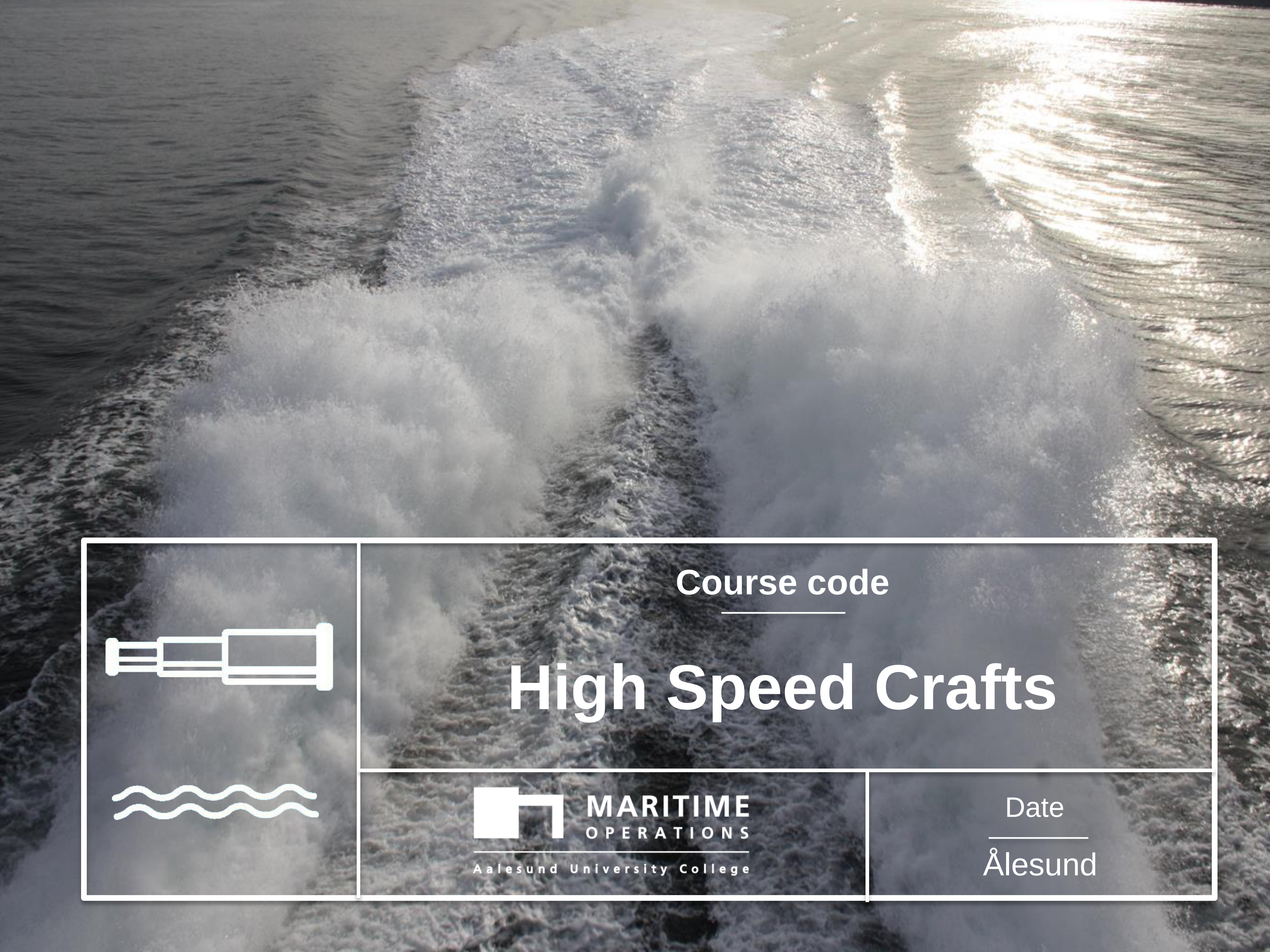
Decision Making

- Efficiency versus Thoroughness

= conflict between time and effort.

Decision Making

- Attitudes:
  - “Don’t tell me…” - The Arrogant
  - “Do something quickly…” – The Impulsive
  - “It won’t happen to me…” – The immortal
  - “I can do it…” – The macho
  - “What’s the use…” – The Ignorant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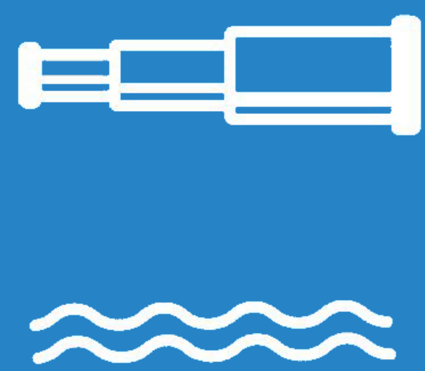

Part 4

Emergency response & crisis management

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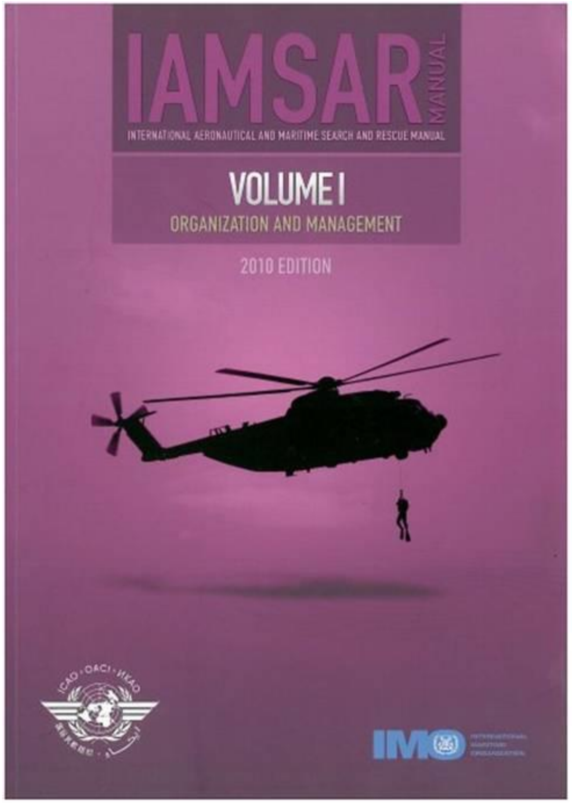
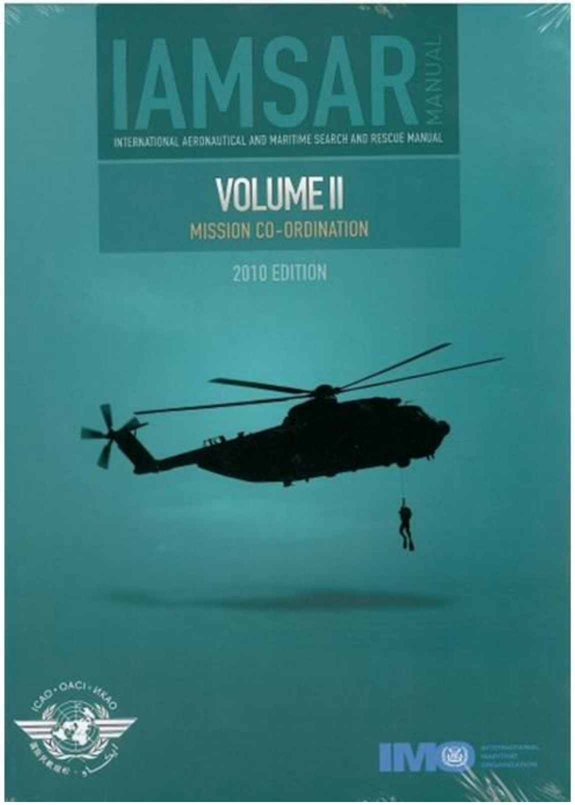
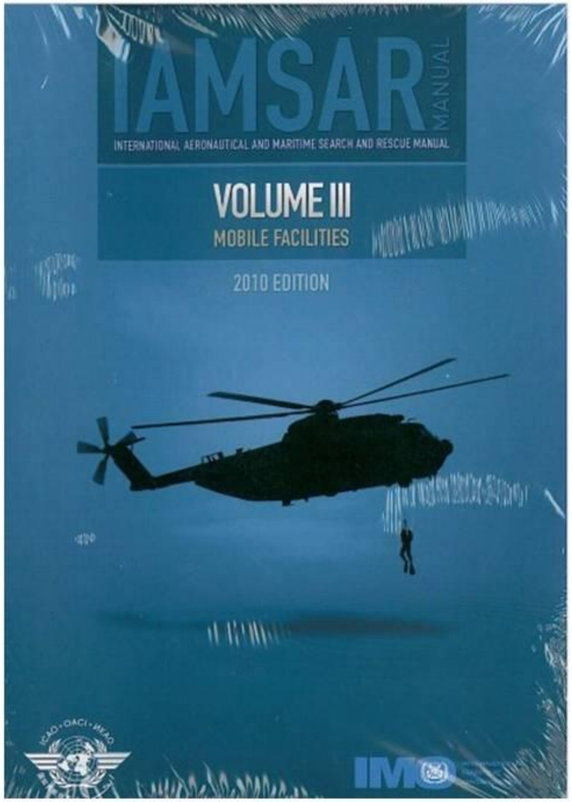
IAMSAR


IAMSAR MANUAL
INTERNATIONAL AERONAUTICAL AND MARITIME SEARCH AND RESCUE MANUAL
VOLUME I
ORGANIZATION AND MANAGEMENT
2010 EDITION


IAMSAR MANUAL
INTERNATIONAL AERONAUTICAL AND MARITIME SEARCH AND RESCUE MANUAL
VOLUME II
MISSION CO-ORDINATION
2010 EDITION


IAMSAR MANUAL
INTERNATIONAL AERONAUTICAL AND MARITIME SEARCH AND RESCUE MANUAL
VOLUME III
MOBILE FACILITIES
2010 EDITION

This part:

- Emergency signaling (GMDSS)
- IAMSAR vol 1&2
- IAMSAR vol 3
- Helicopters

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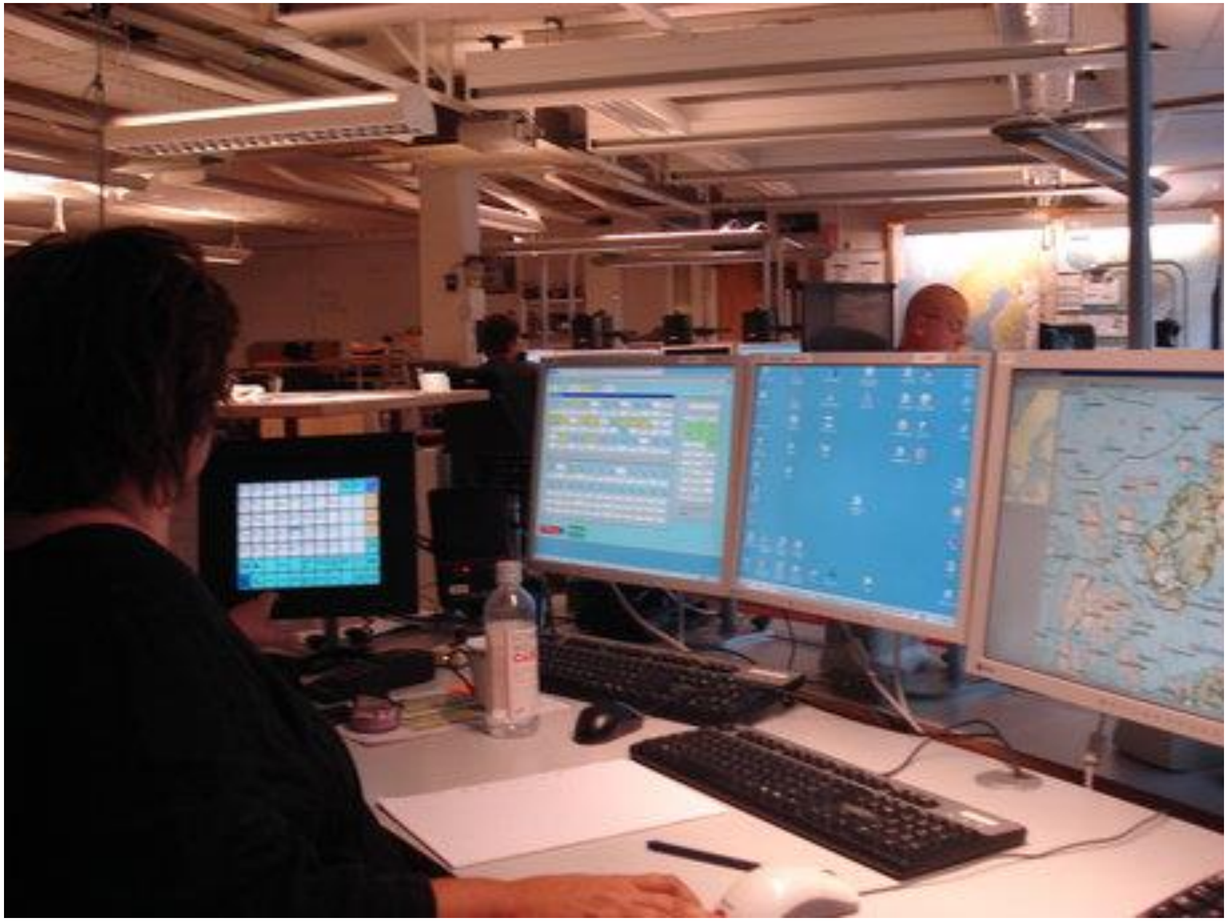
Quick repetition of emergency signals

- May Day x3
- Pan Pan x3
- Sequrité x3
- VHF ch 16
- VHF DSC ch 70

Followed by:

- This is
- Shipname x3
- Callsign x3
- (MMSI nr.)
- (May day)
- Message



Other signals:

- Flag N C
- Ball & square
- Red stars
- Gun fire
- Flames
- Waving arms
- SOS
- Smoke
- Flares

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IAMSAR - 1998

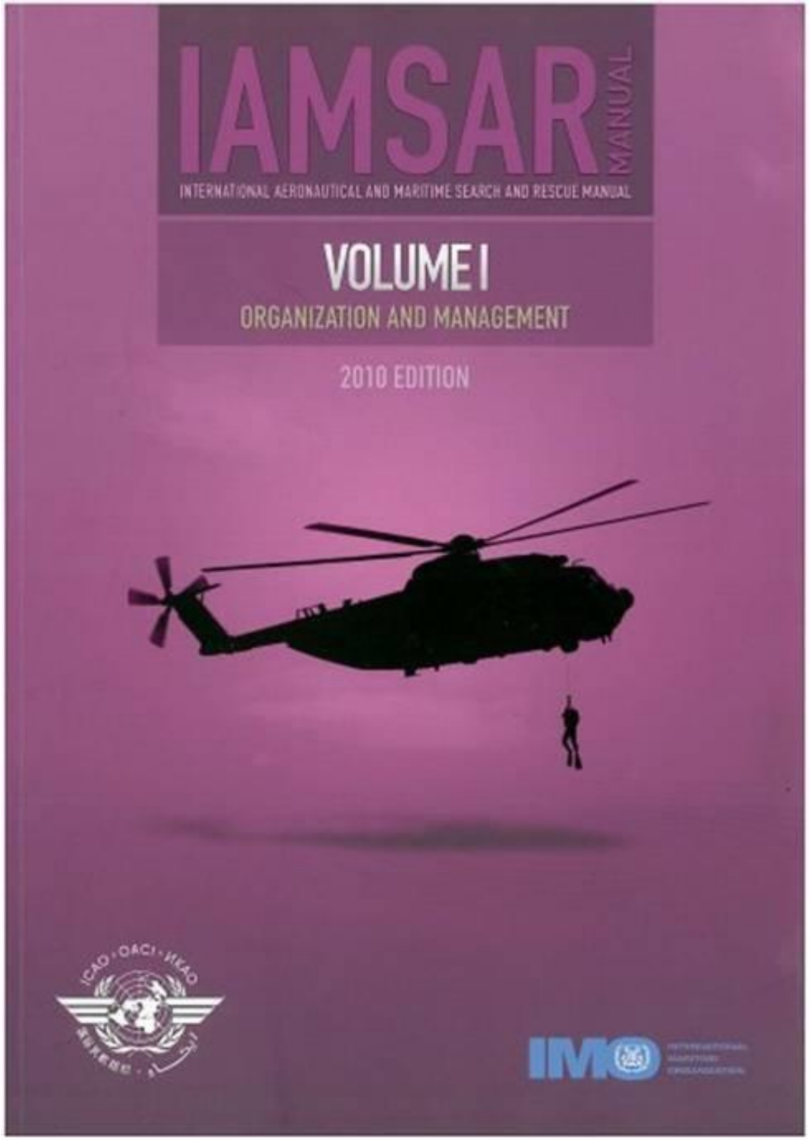
- International Aeronautical & Maritime Search And Rescue – Manual
- Same for air and sea
- ”Designed to harmonize aeronautical and maritime search and rescue:

I. Organization
II. Procedures
III. Equipment”

- 3 volumes

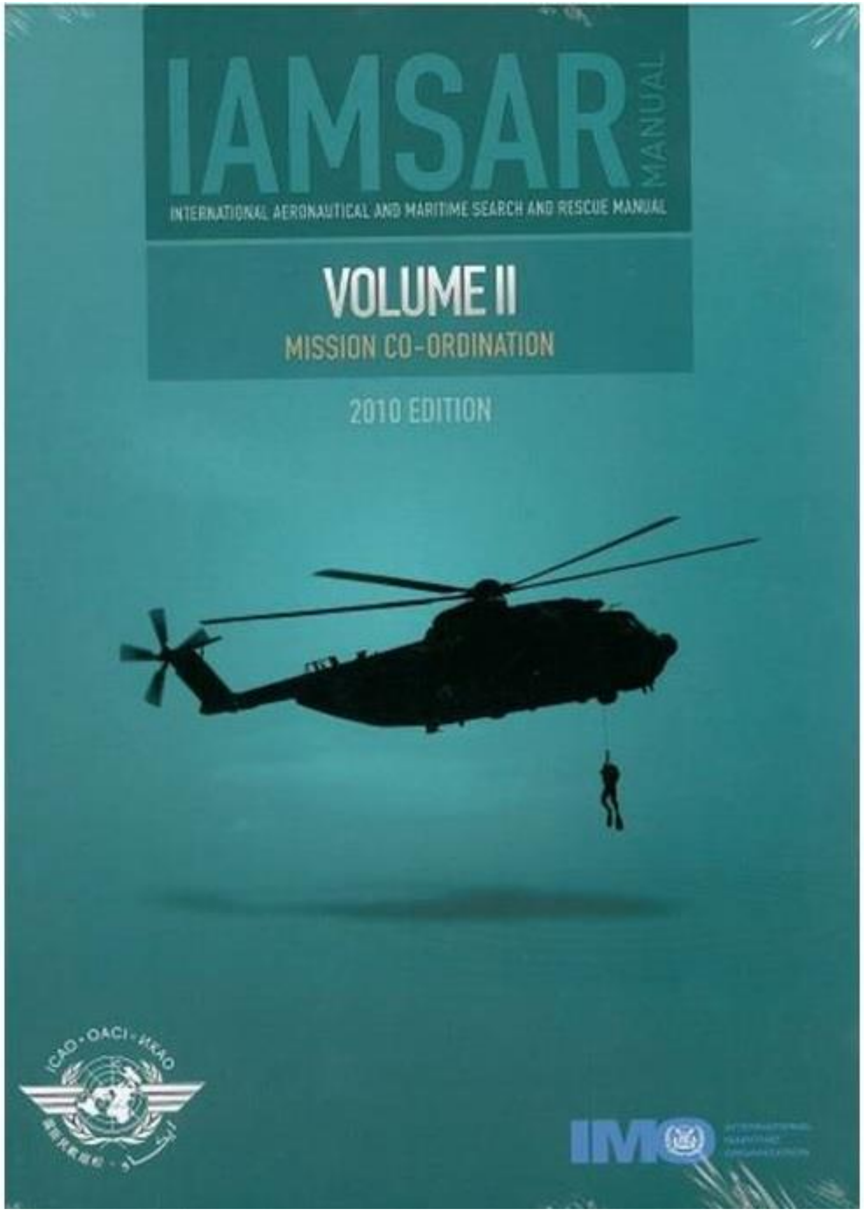
IAMSAR Volume 1

- ”Organization & Management”
- Global perspective
- Focused on the organization of SAR-service
- National and international co-operation



IAMSAR Volume 2

- Mission ”co-ordination”
- For personell in RCC
- Planning for SAR-missions
  and exersices



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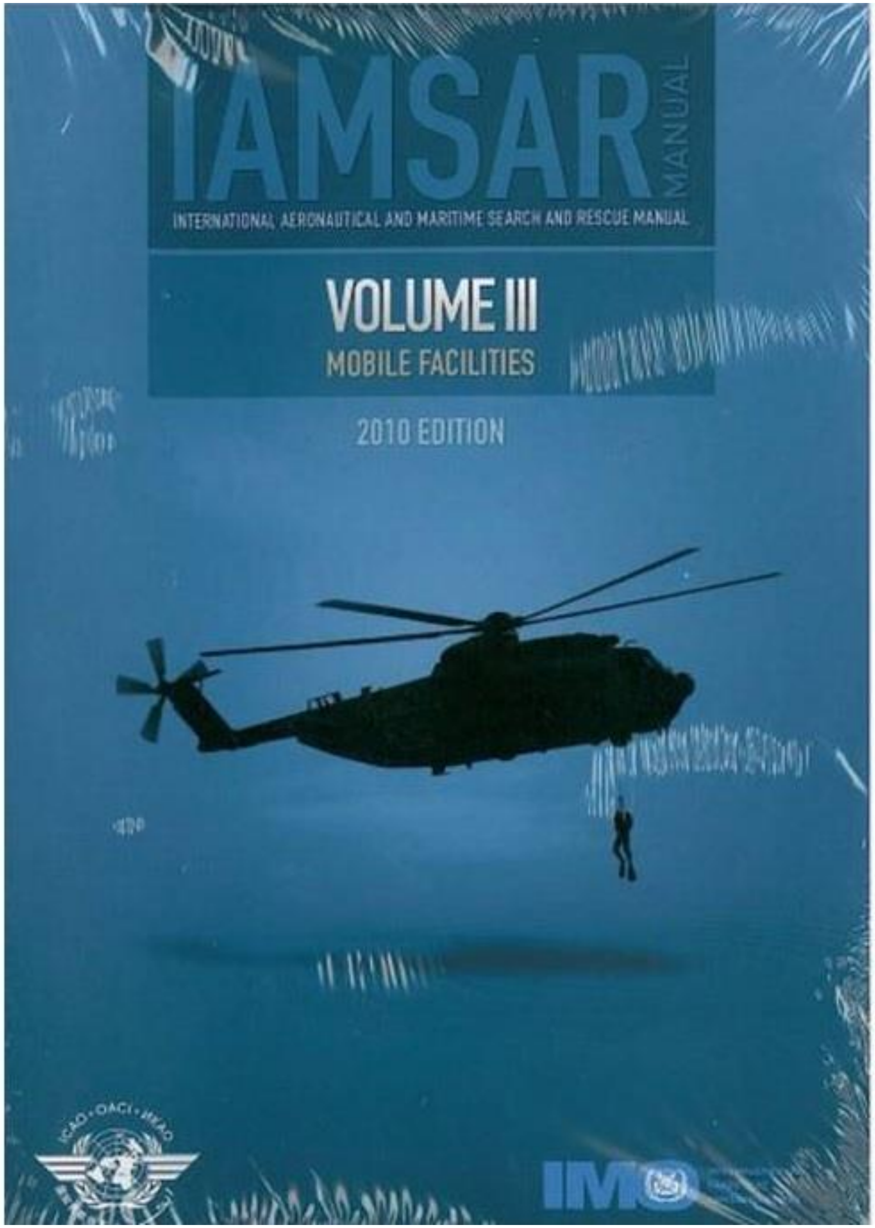
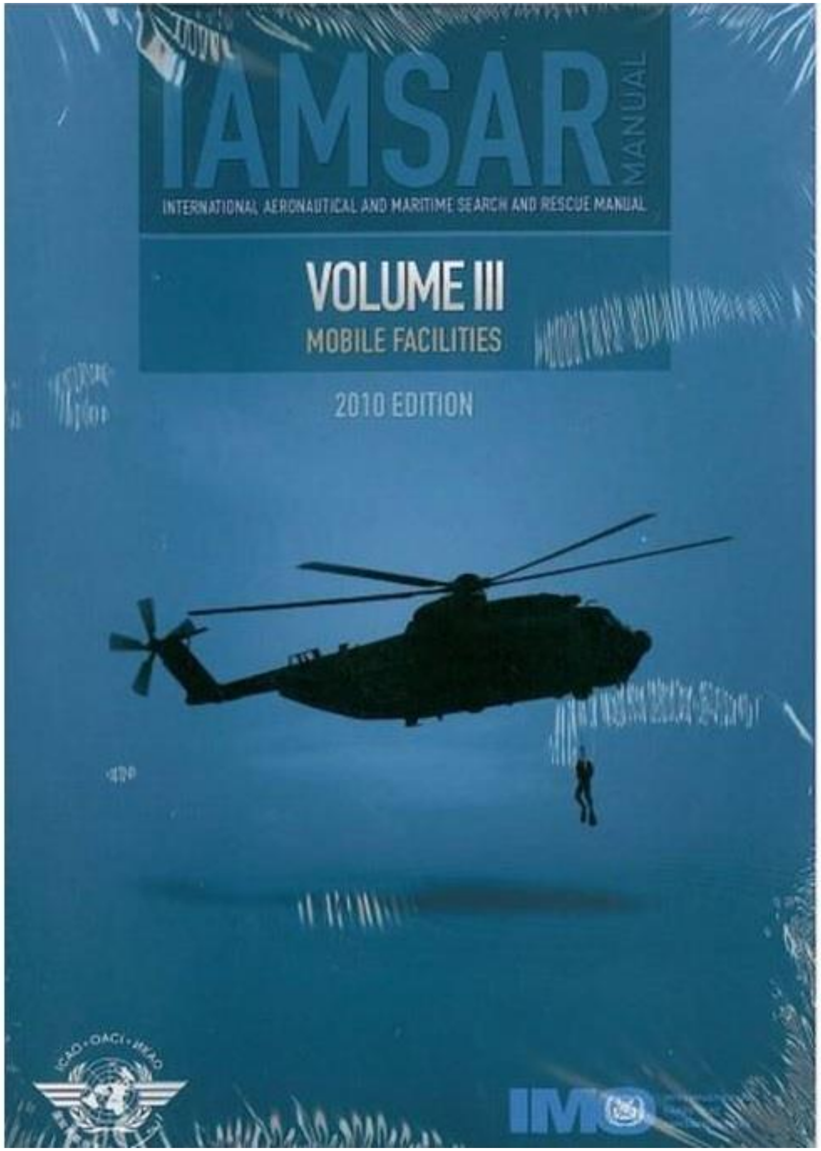
IAMSAR Volume 3

- ”Mobile Facilities”
- To be carried onboard
- Same for ships and aircrafts



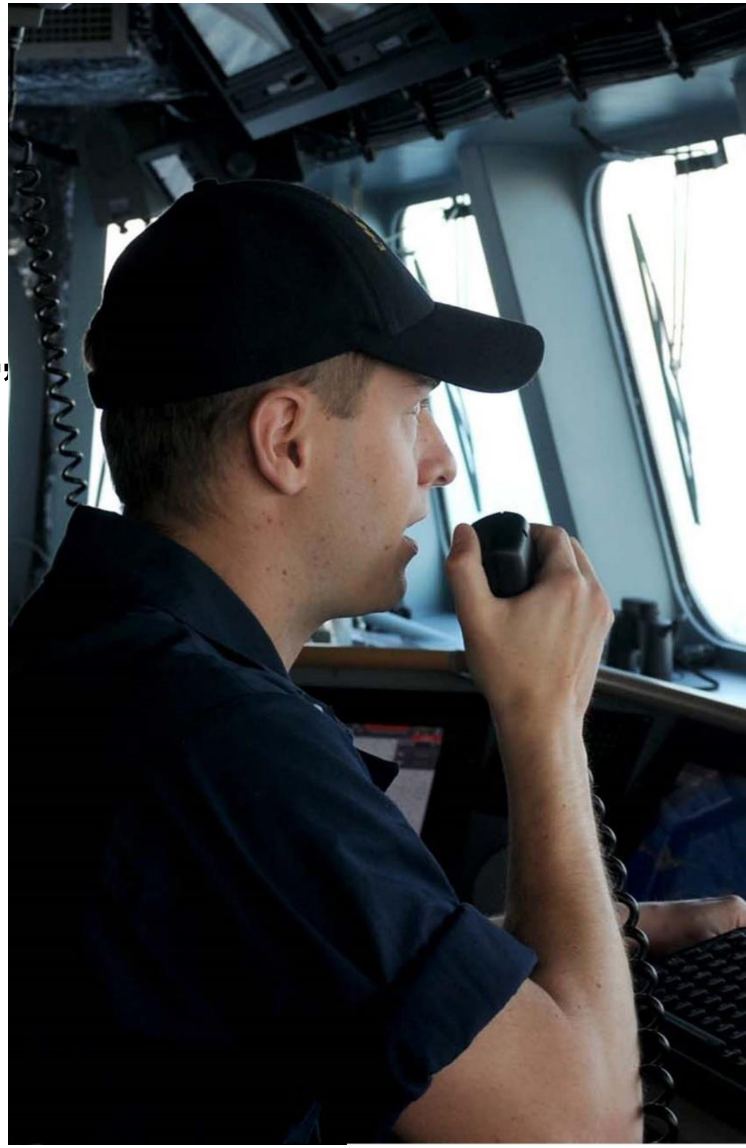
IAMSAR Volume 3

- Search and rescue organization
- Resources
- Guidelines for OSC
- First response onboard
- Search patterns
- Helicopters



OSC

- On-Scene Coordinator
- Rescue center’s ”eyes & ears”
- Organize & Co-ordinate units
- Implement or modify searchplan
- Send sit-reps



Helicopters

Helicopters

- Cover large areas
- Around the clock standby
- MEDEVAC/CASEVAC

I. MEDical EVACuation – medical care onboard

II. CASualy EVACuation – only transport

- Trained & experienced crew

Working & maneuvering zones

Hi-Line

Helicopters

- Maintain contact with heli.
- Follow instructions
- Fire fighting equip. ready
- Restricted maneuverability

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Part 4

Emergency response & crisis management

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Search And Rescue

This part:

- SAR organization
- JRCC
- Redningsselskapet
- Search patterns

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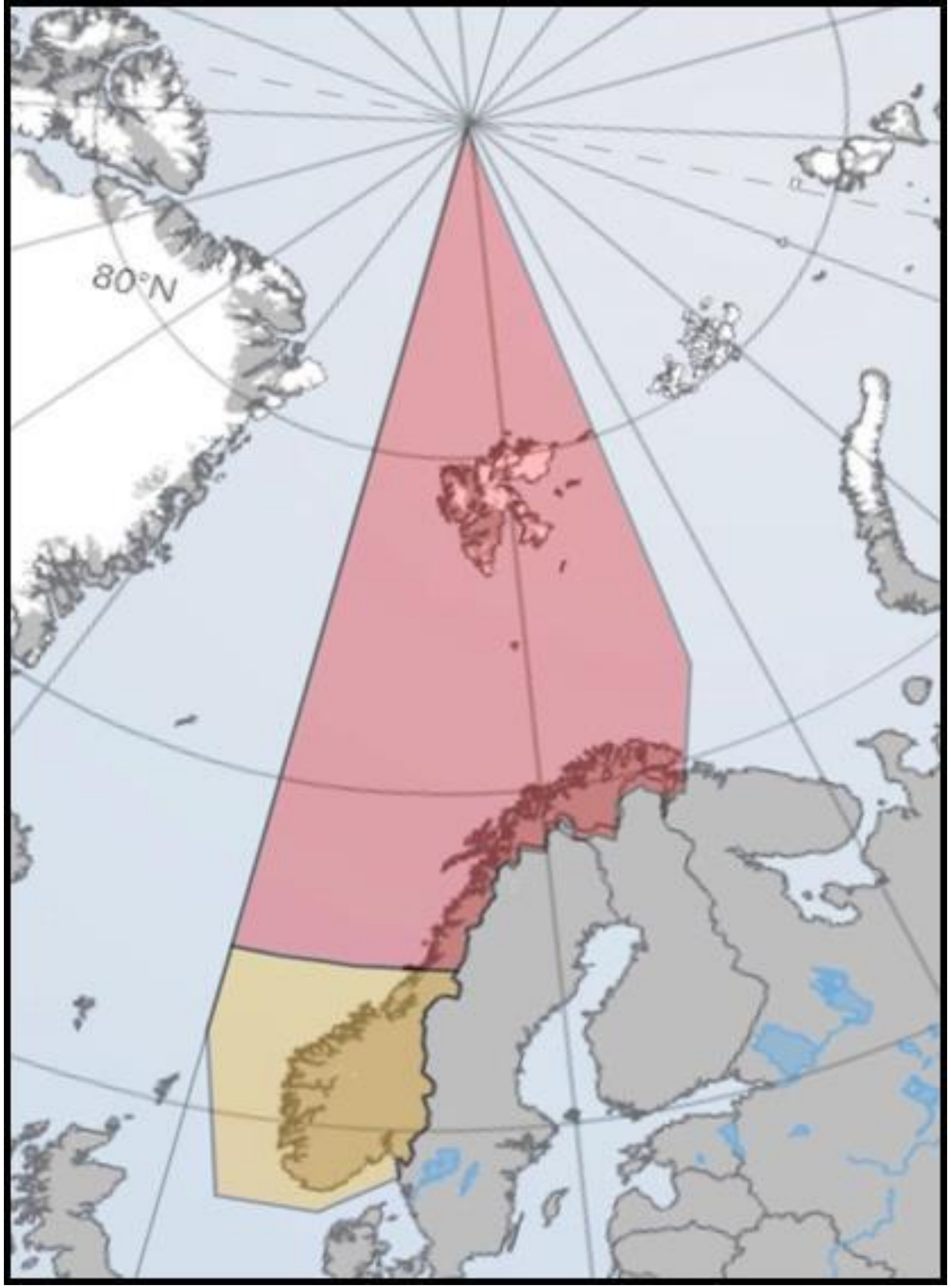
Organization

- Justis- og politidepartementet
- Two Search and rescue regions SRR
- Two joint rescue coordination centers JRCC
- JRCC-NN in Bodø
- JRCC-SN in Stavanger
- Several Rescue sub centers RSC



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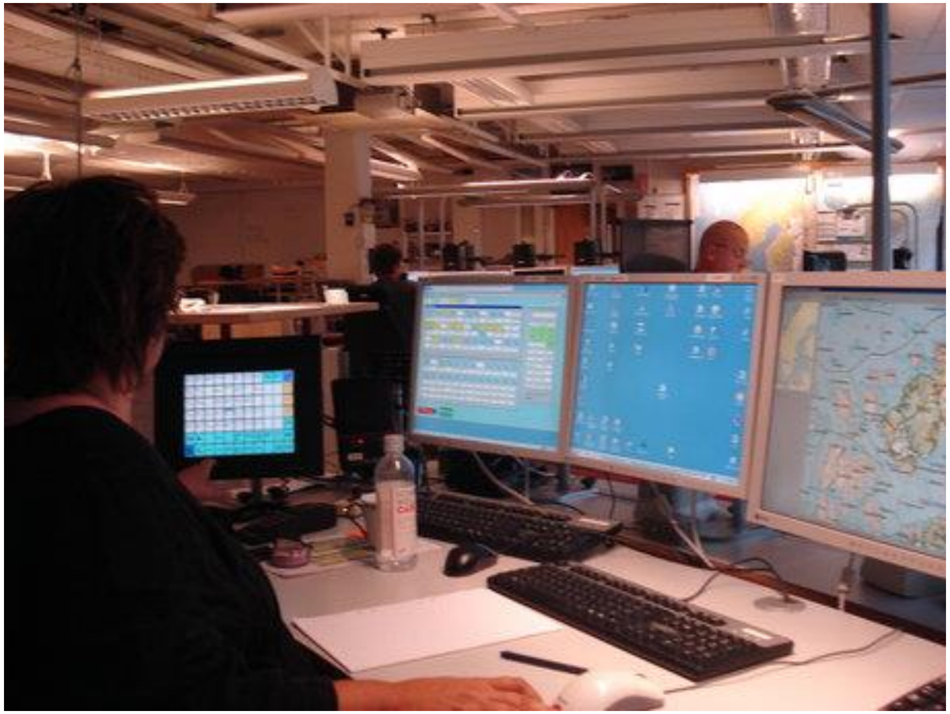
Organization

- An emergency is received by:
  - Coast radio station
  - Local User Terminal
  - Relay
- Forwarded to Responsible JRCC
- JRCC alerts and directs SAR units
- Appoints On Scene Coordinator OSC

JRCC

- Chief of police is head of JRCC
- Around the clock manning
- Land, sea and air rescue
- Handles about 8500 missions a year



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SAR-plan

- National – covers organization, number, type and standby times of SAR units
- Local – for a how a specific mission shall be conducted, where to search and how
  - To be provided by JRCC
  - OSC might have to establish a temporary before JRCC is ready
  - Consult IAMSAR Vol III

Redningsselskapet

- Voluntary association
- 1200 rescue operators
- 50 vessels
- Some employed but most are civilians
- Nationwide coverage
- Usually first on site

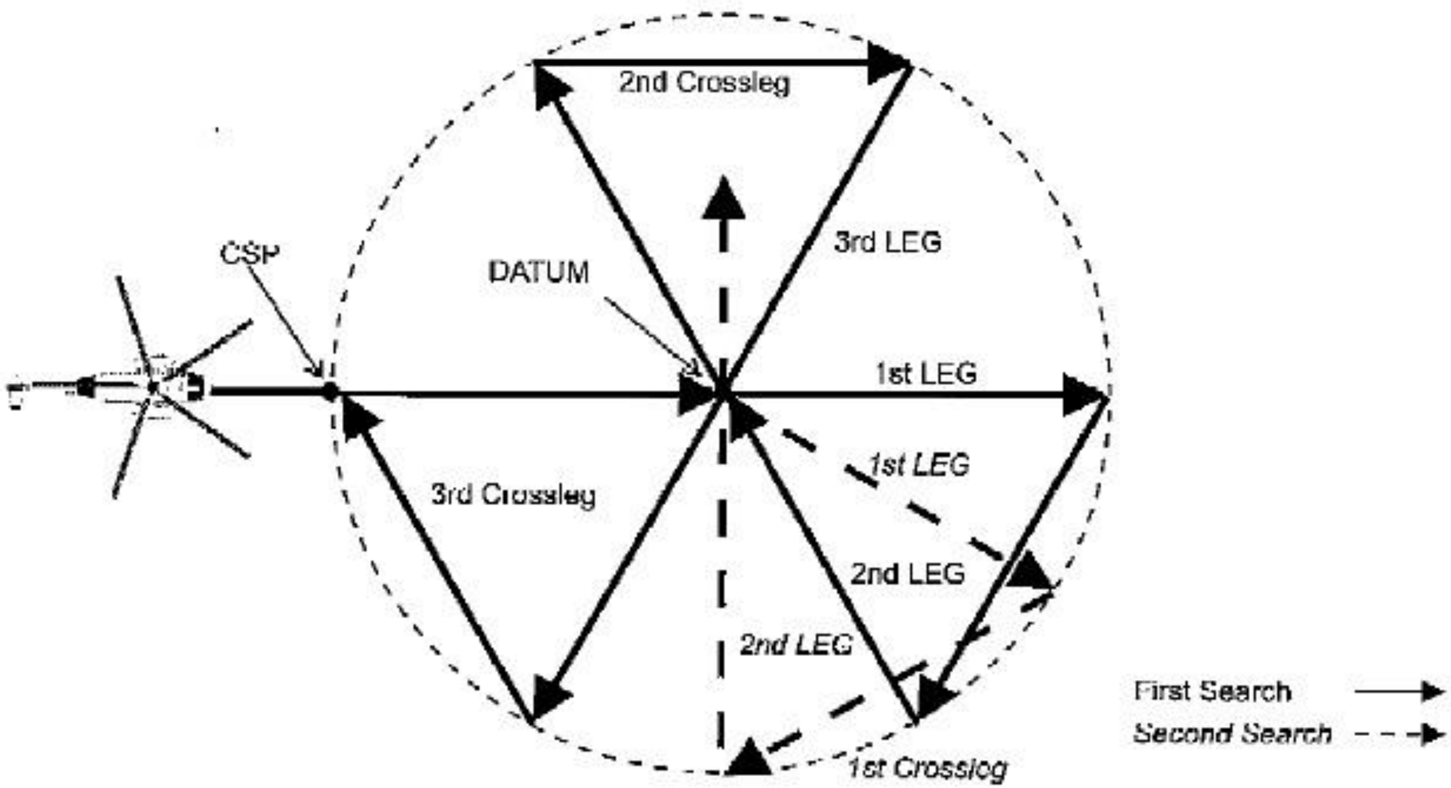
Search patterns

- Decided by JRCC or OSC
- Depending on:
  - Accuracy of last known position
  - Time since alerting
  - Weather conditions
  - Speed of crafts
  - Area of operations

Datum

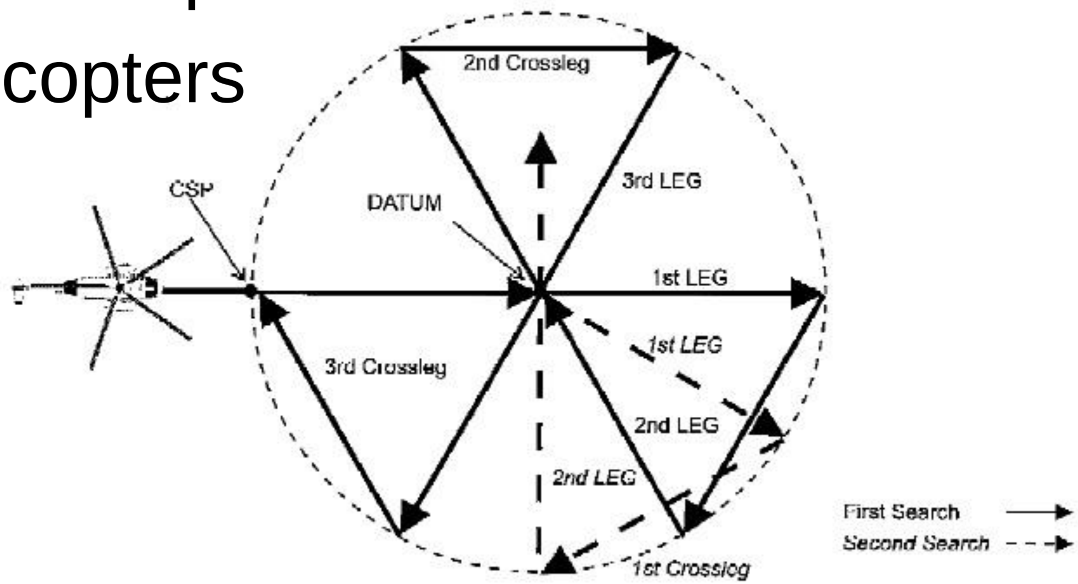
- “last known position” or:
- “probable position”
- Subject to change after findings or after receiving new information

Sector search



Sector search

- Passes through datum several times
- Covers smaller area but more thorough
- Used when datum is probable
- Suitable for helicopters



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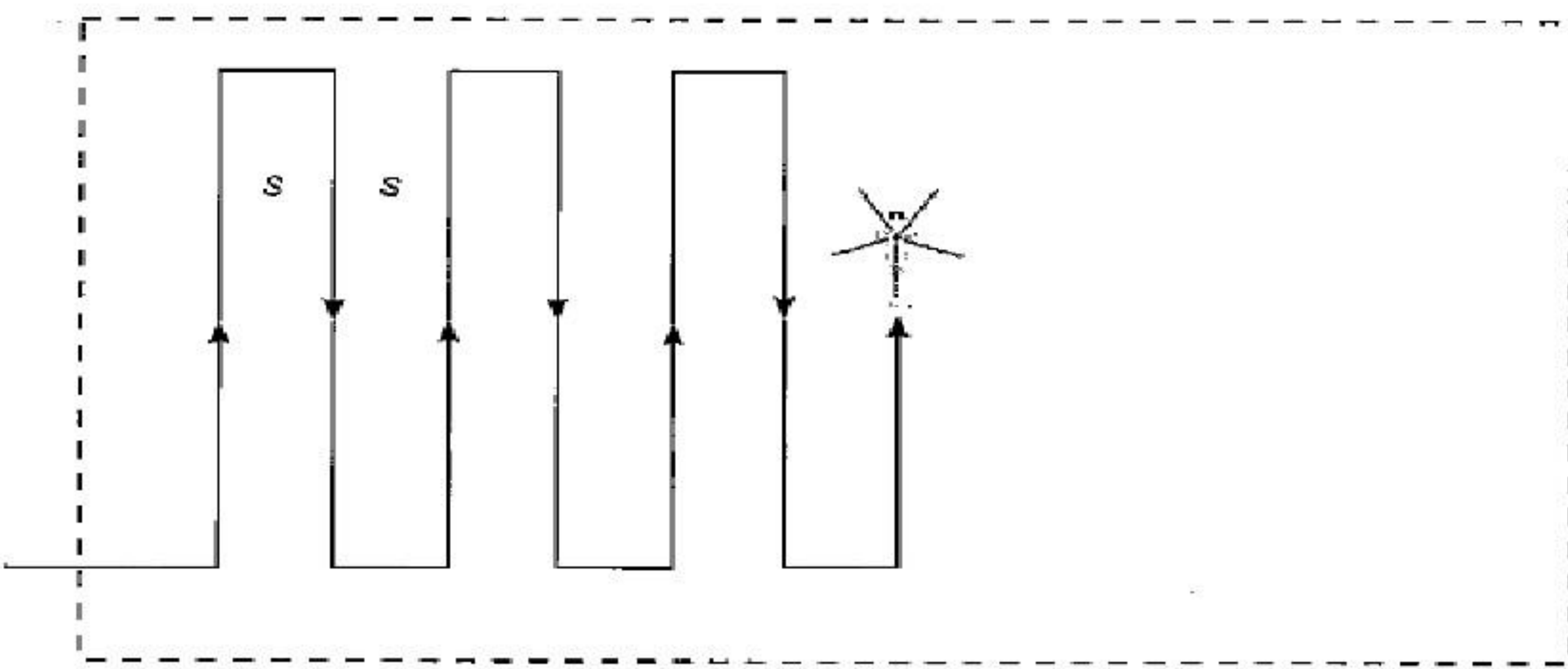
Creeping line



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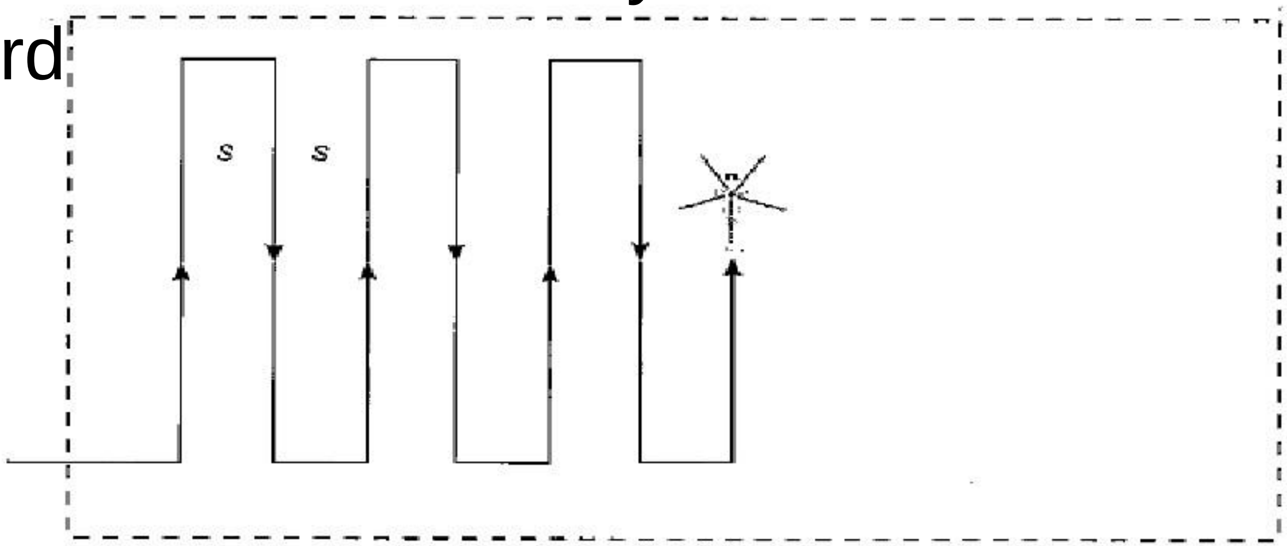
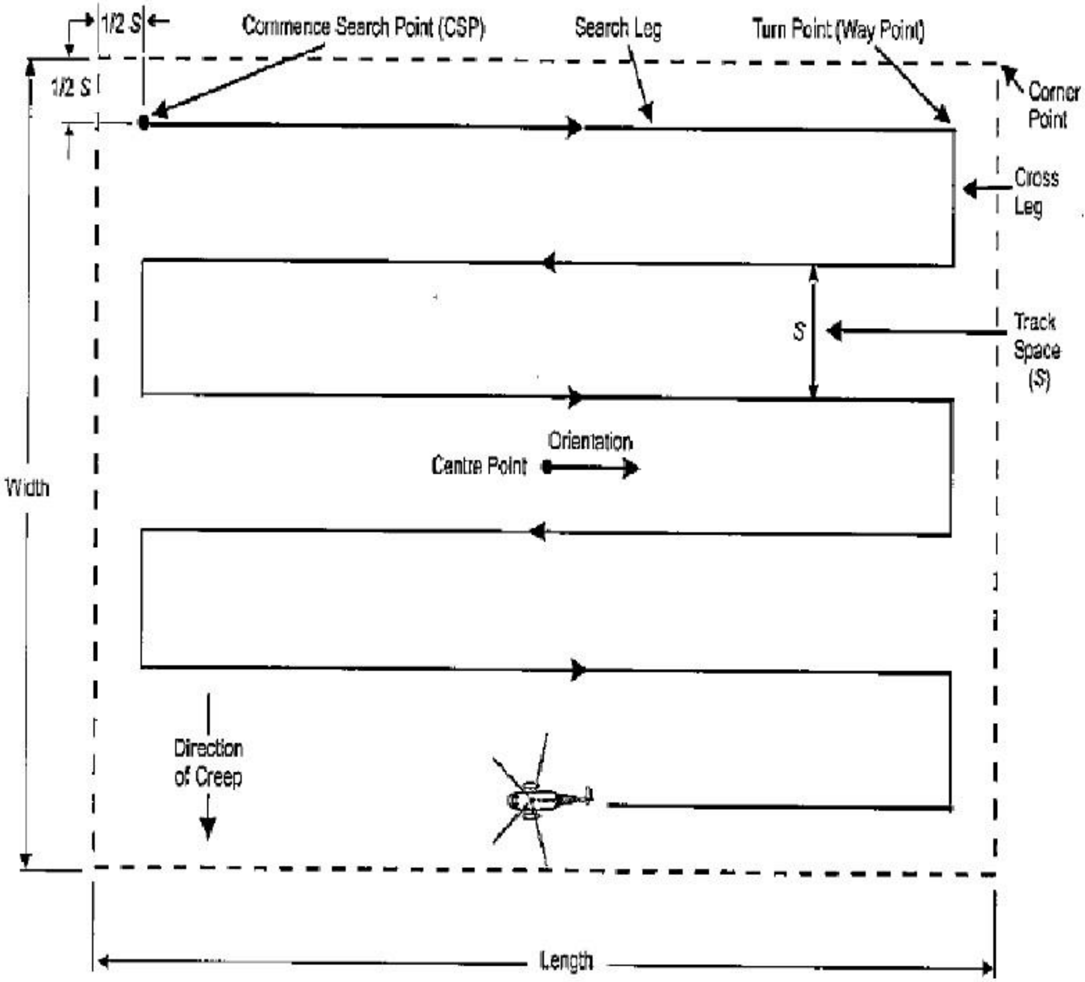
Creeping line

- Narrow stretched pattern
- Starting at datum and expanding towards direction of drift
- Perfect when area is restricted by land, for example a fjord

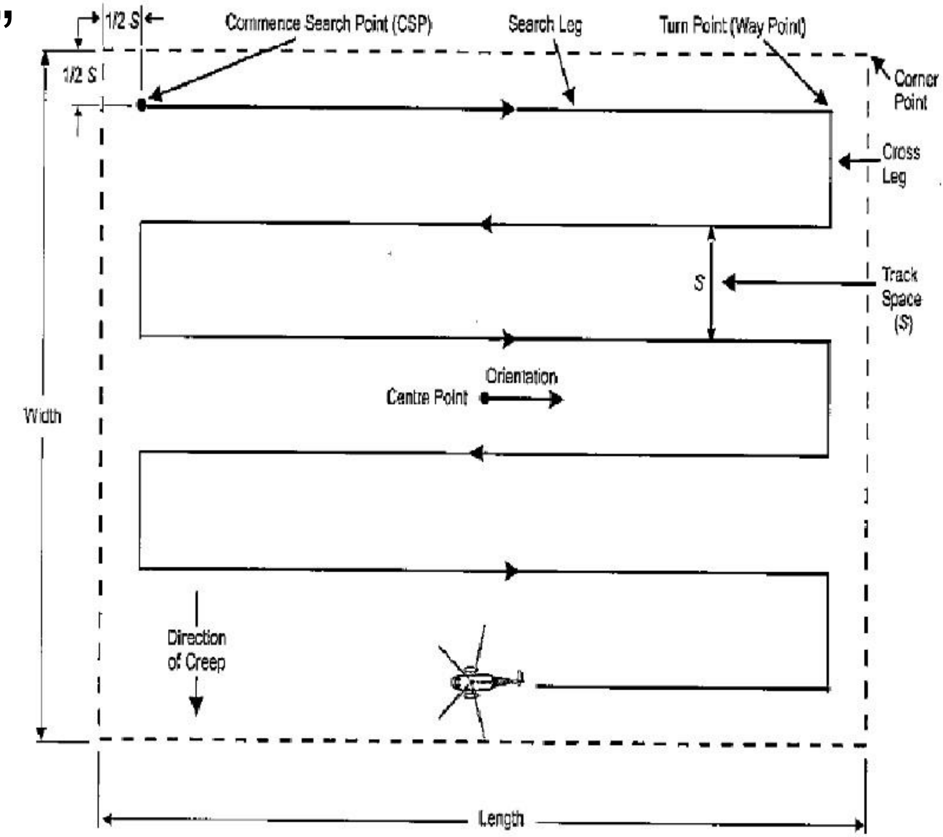


Parallel search



Parallel search

- Standard “box area”
- Similar to creeping line
- More suited for open sea



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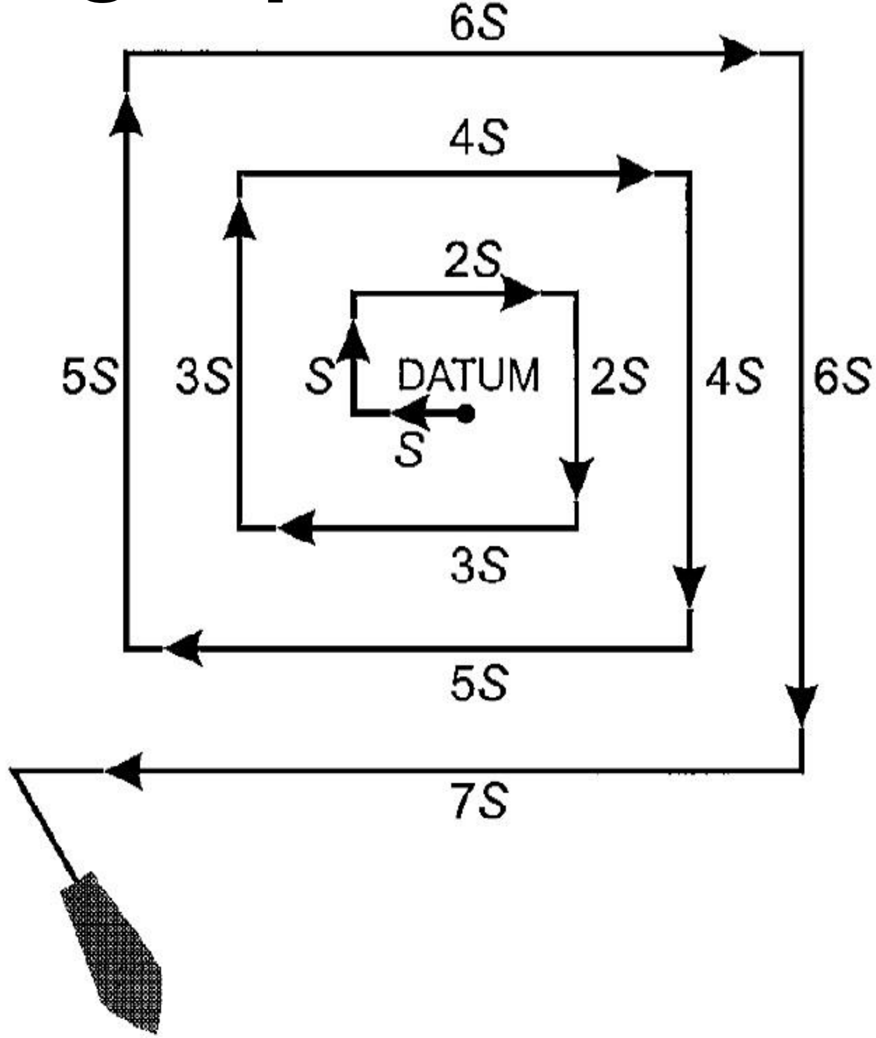
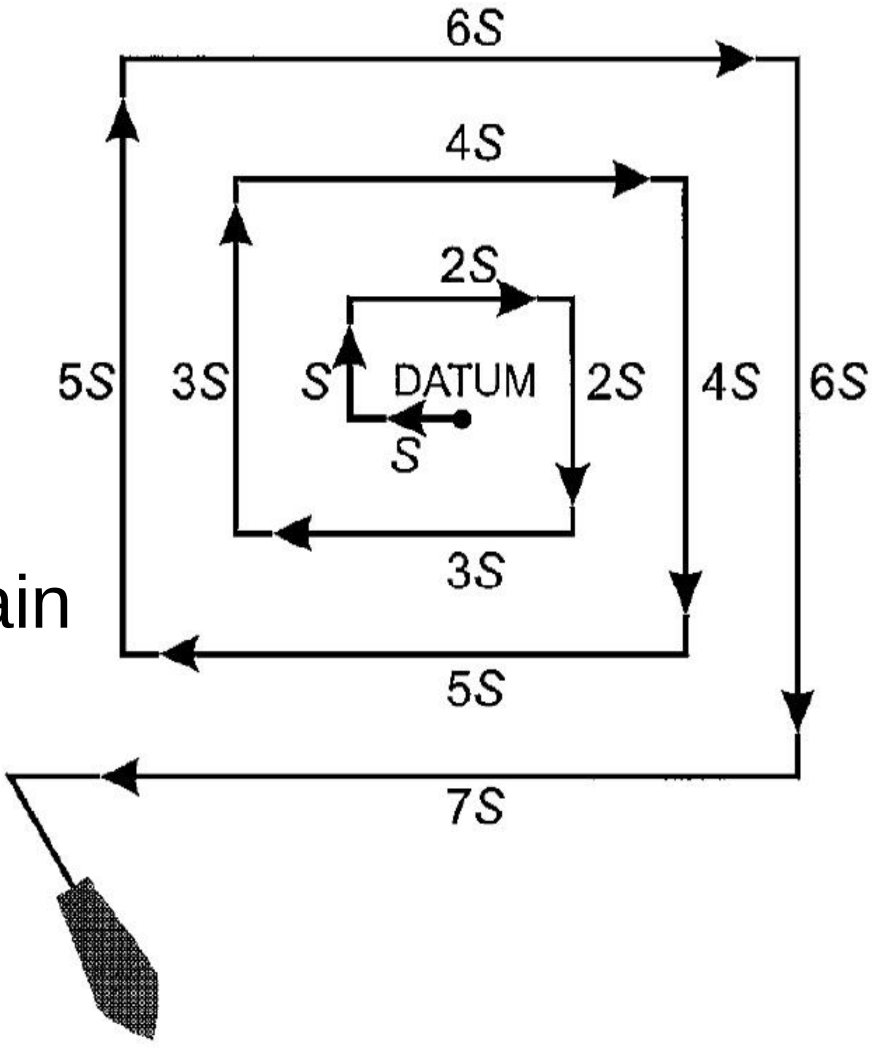
Expanding square



Expanding square

- Starts at datum and working the way out
- Slow but meticulous
- Ideal when direction of drift is small or uncertain



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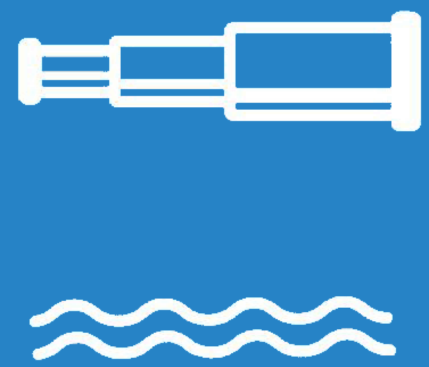

Part 4

Emergency response & crisis management

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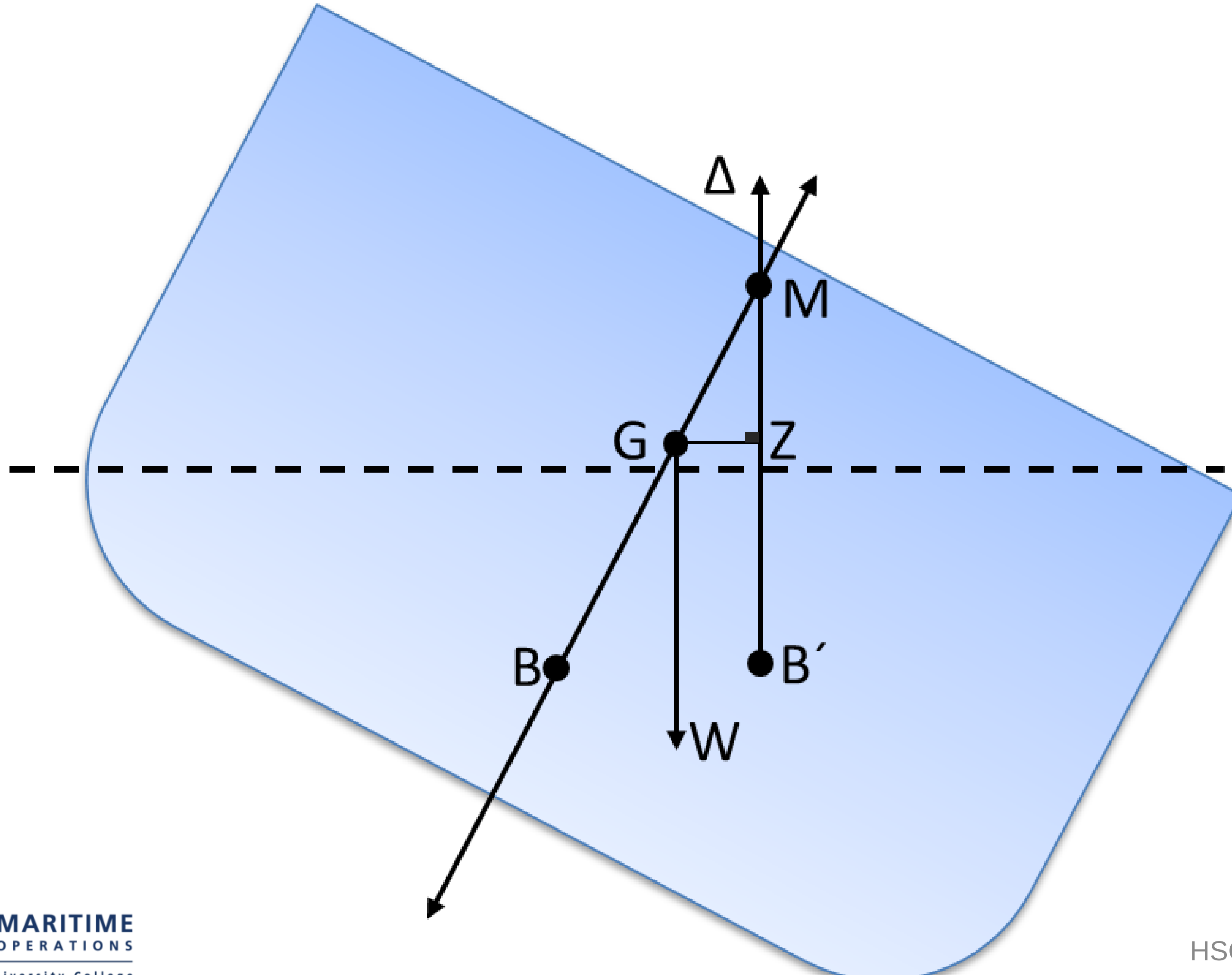
Damage

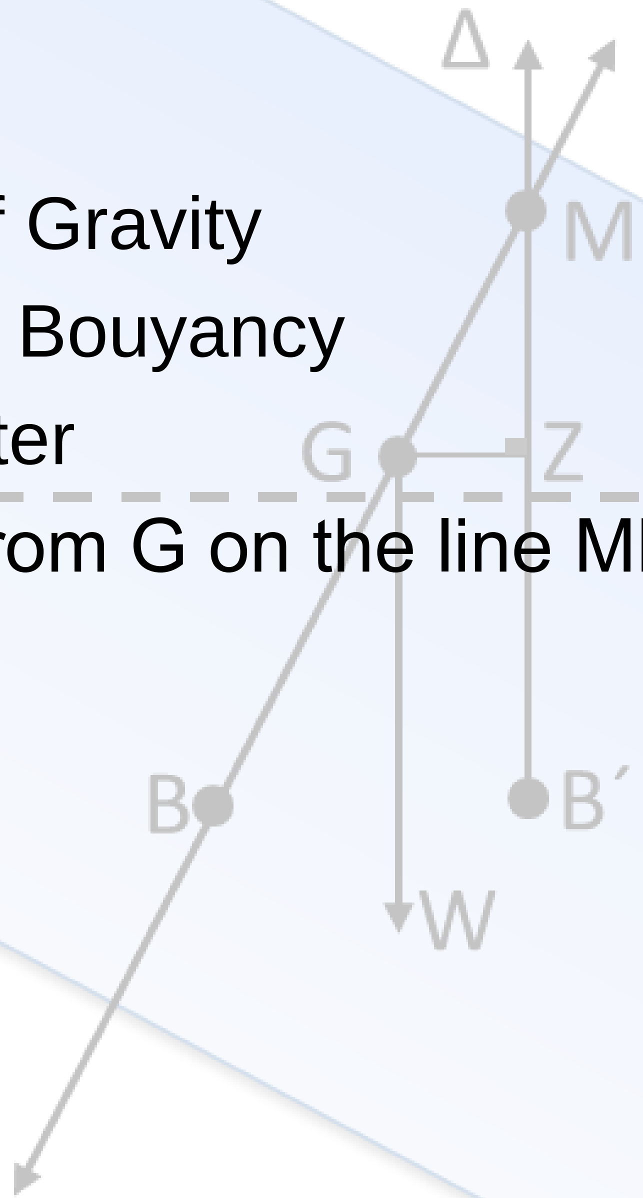
This Part:

- Repetition of stability
- Damage stability
- Special features of the catamaran

Stability

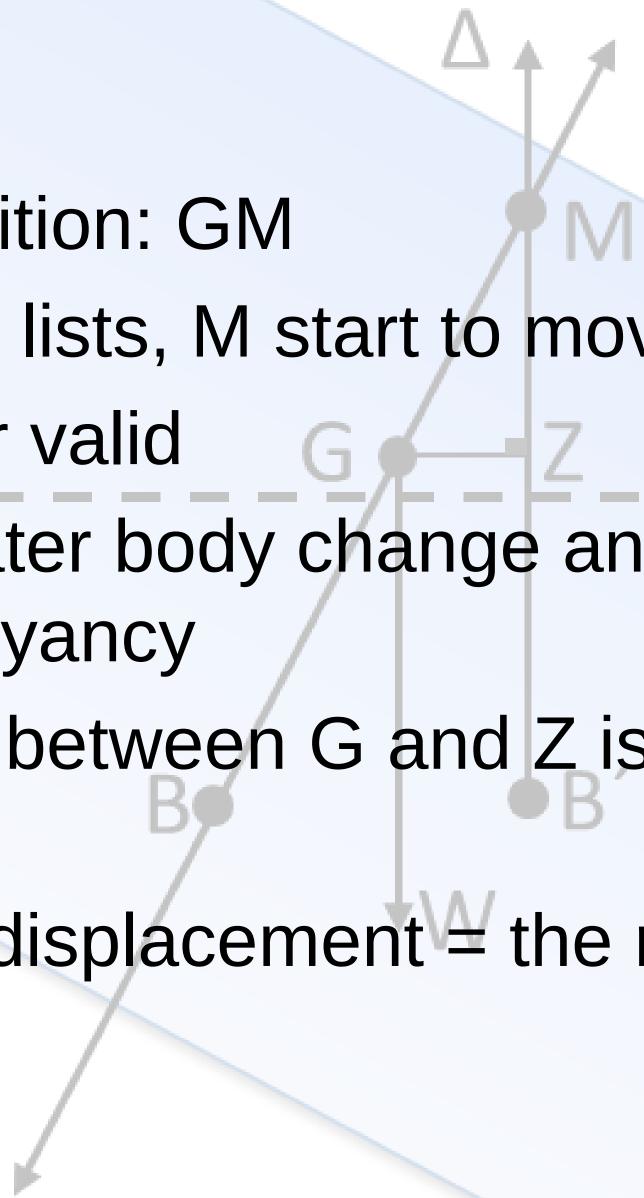


- G – Center of Gravity
- B – Center of Bouyancy
- M – Metacenter
- Z – Angular from G on the line MB’



Stability

- In static condition: GM
- As the vessel lists, M start to move
- GM no longer valid
- The Underwater body change and therefore the center of Bouyancy
- The distance between G and Z is the righting lever
- Multiply with displacement = the righting force



Stability

- As B and M Moves GZ will increese
- At one point GZ will reach the maximum value and decrease
- The righting lever will continue to decrease until the stability is lost
- That angle tells the vessels ”stability width”
- Windows and hull openings means that the vessel will not be able to right itself even of it has stability ”left”

Damage Stability

- When the hull is damaged below the water line there are two ways to describe what happens:
- Boyancy is lost, or:
- Weight (water) is added
- Result the same, vessel sinks until ”equlibrium”
- Damage can be symetrical or asymetrical

Damage stability

- As water fills the compartment:
  - G moves downwards
  - Free surface moment increase
  - Thus forcing G upwards again
- Tanks filled with fuel:
  - Water heavier forcing fuel out ”added weight”
  - If tank surface is above equlibrium it will empty creating free surface moment

Catamaran

- High initial stability
- Peak at 15-20 degr.
- Heavy reduction when one hull exits the water
- Passanger areas relatively high compared to G

Damage to a catamaran

- ”duble hulls, double safety”
- Damage will most likely be asymetrical
- Narrow hulls gives less free surface effect
- Several closed longitudonal compartments
- Large open areas for passangers

HSC ”SEA SMOTH” after a collision

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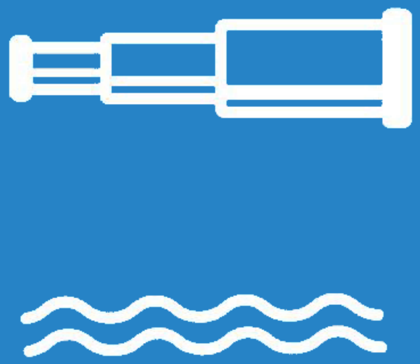

Part 4

Emergency response & crisis management

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Emergencies

This Part:

- Man over board
- Collision
- Grounding
- Fire
- Media
- Crisis
- Safety culture

Man over Board

- Life buoy
- Notify Bridge
- Mark position
- Maneuver
  - Crash-stop
  - Williamson turn
- Pick up
- How hard can it be?

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Man over board

- When did the casualty fall?
- Was he/she even onboard?
- Darkness, fog, snow/rain
- Call for assistance?
- Survivability in cold water?
- How to pick up?

Tideros

- 16 sep 2012 near Molde, passenger fell overboard
- Fast to return, only 2 min
- Recovery took 10 min
- Engineer had to jump in the water to help
- No FRB only Rescue davit

Collision

- Close compartments
- Do not try to reverse until the situation is under control
- Inform passengers
- Establish contact with other vessel
- Contact company and authorities

Gotlandia II and Gotland

Gotlandia II and Gotland

- 23/7 2009 Nynäshamn
- The ferry Gotland collides with HSC Gotlandia II in thick fog
- The crew on Gotlandia II lost orientation in the thick fog and accidently turned in front of Gotland
- 33 passengers injured…


DESTINATION GOTLAND

Grounding

- Make sure all compartments are closed
- Do not try to drive off the ground until the situation is under full control
- Contact authorities
- Sound tanks and voids
- Determine the tide and range

Rich Passage 1

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Rich Passage 1

- In the night of January 29th 2009
- The master of HSC Rich Passage 1 misinterprets the lights leading in to Port Townsend Washington USA
- In about 24 knots the vessel comes to a halt on a sandy beach
- No one onboard was injured!

Fire

- Notify the bridge or sound alarm
- Determine if you can extinguish the fire yourself
- If not: evacuate and close the area
- Start fixed fire fighting equipment if installed
- Call for assistance if necessary

High Speed 5, Piraeus, Greece

Media

- Right to talk to media – freedom of speech
- Journalists are professionals
- Nothing is “off the record”
- Talk to the reporter, not the camera
- Your personal opinion might be viewed as the companies
- It is a good idea to inform the company about what you have said

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Media Tips:

- Think about what you want to say before you talk, a short paus is not a bad thing
- Do not lie
- If you don't want to answer a question: say so, do not use the phrase "no comments"
- Use language that everyone can understand
- If you accidently say something wrong, contact the reporter and correct it
- Stick to facts and don't speculate if you don't know
- Be careful what you promise

Crisis

- Physical crisis
  - Accident or event that could lead to accident
- Mental crisis
  - Stress, anxiety, depression etc.

Physical crisis

- Hard to prepare for
- “Train as you fight – fight as you train”
- Be proficient with equipment and routines
  - Confidence and a sense of “I know what I’m doing” helps in handling the situation
- “Take 2” stop and think the situation over a short time before acting

Mental crisis

- Different from person to person
- Talking loud and restless – light stress reaction
- Apathy – severe stress reaction
- “Mental first aid” talk to a person and let them ventilate
- Untreated might lead to PTSD – Post Traumatic Stress Disorder

Safety culture

- First mentioned after the Chernobyl accident
- Means that the entire organization “thinks safety”
- Every ones responsibility

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Next of kin

- Police's job to inform
- Having a college (you!) with is often appreciated
- Take time, don't rush
- Religion!
- Company should be willing to offer professional counselling

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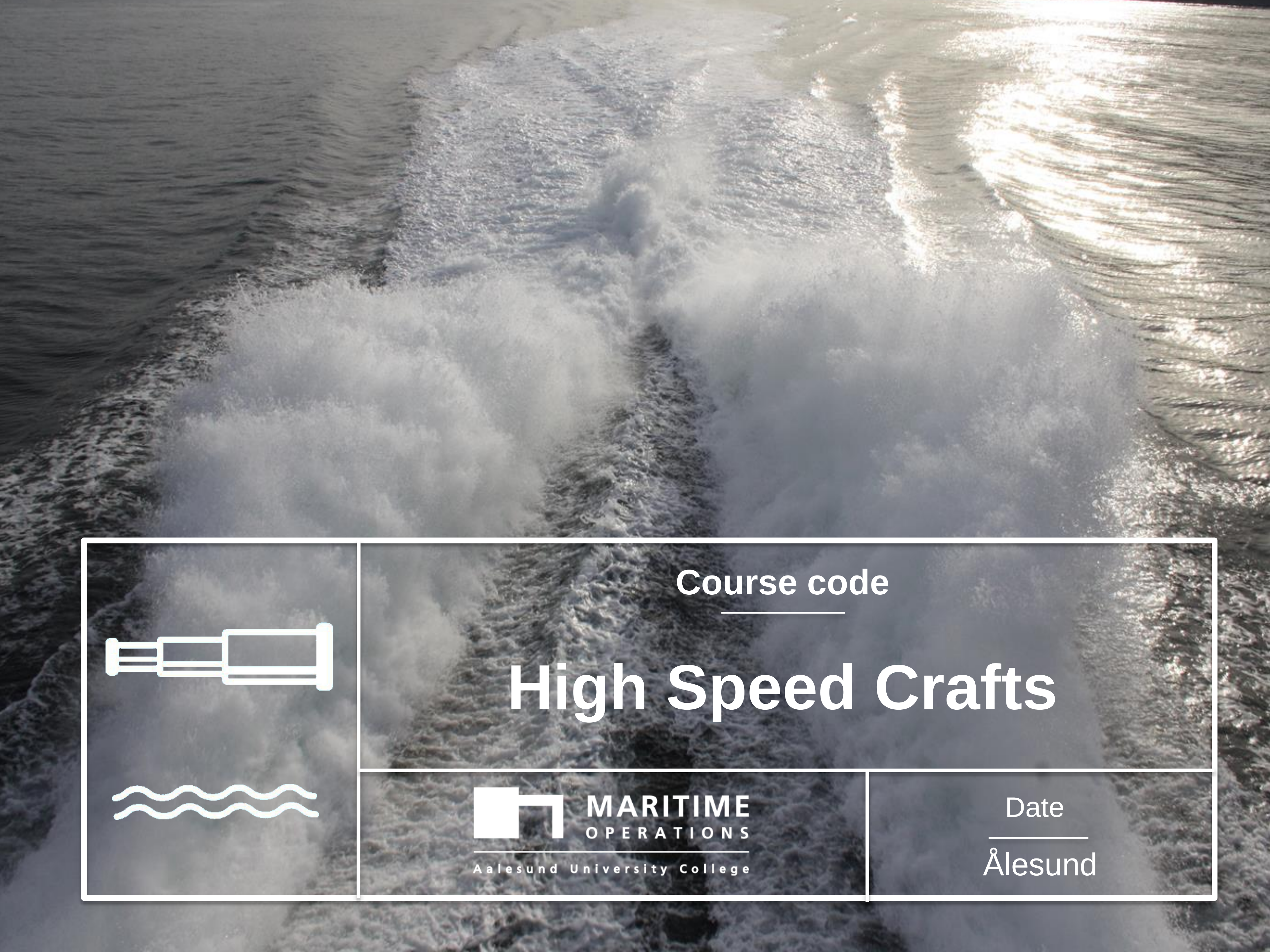
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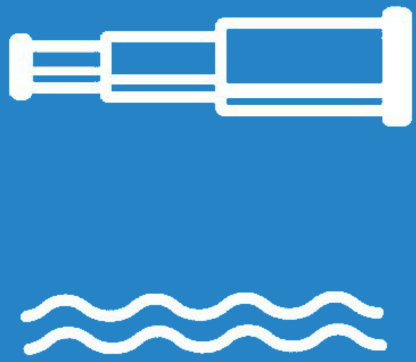

Part 4

Emergency response & crisis management

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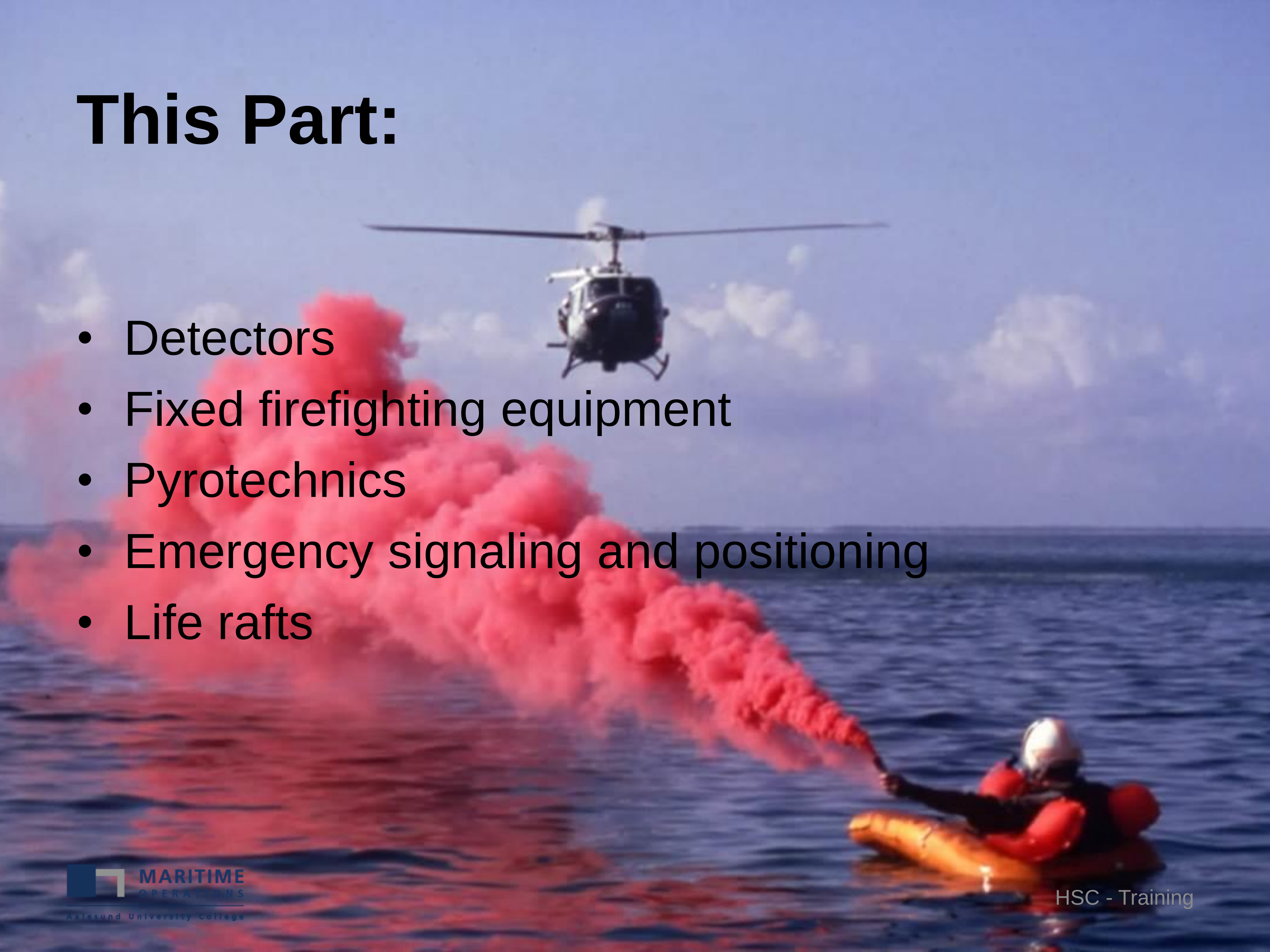
Emergency equipment



This Part:

- Detectors
- Fixed firefighting equipment
- Pyrotechnics
- Emergency signaling and positioning
- Life rafts

Ionizing smoke detector

- Radioactive material (americium-241)
- Alpha-particles ionize the air
- Electrical current
- Smoke particles distrupst Current
- + low power needed
- + long lasting
- - Not good for smoldering fires

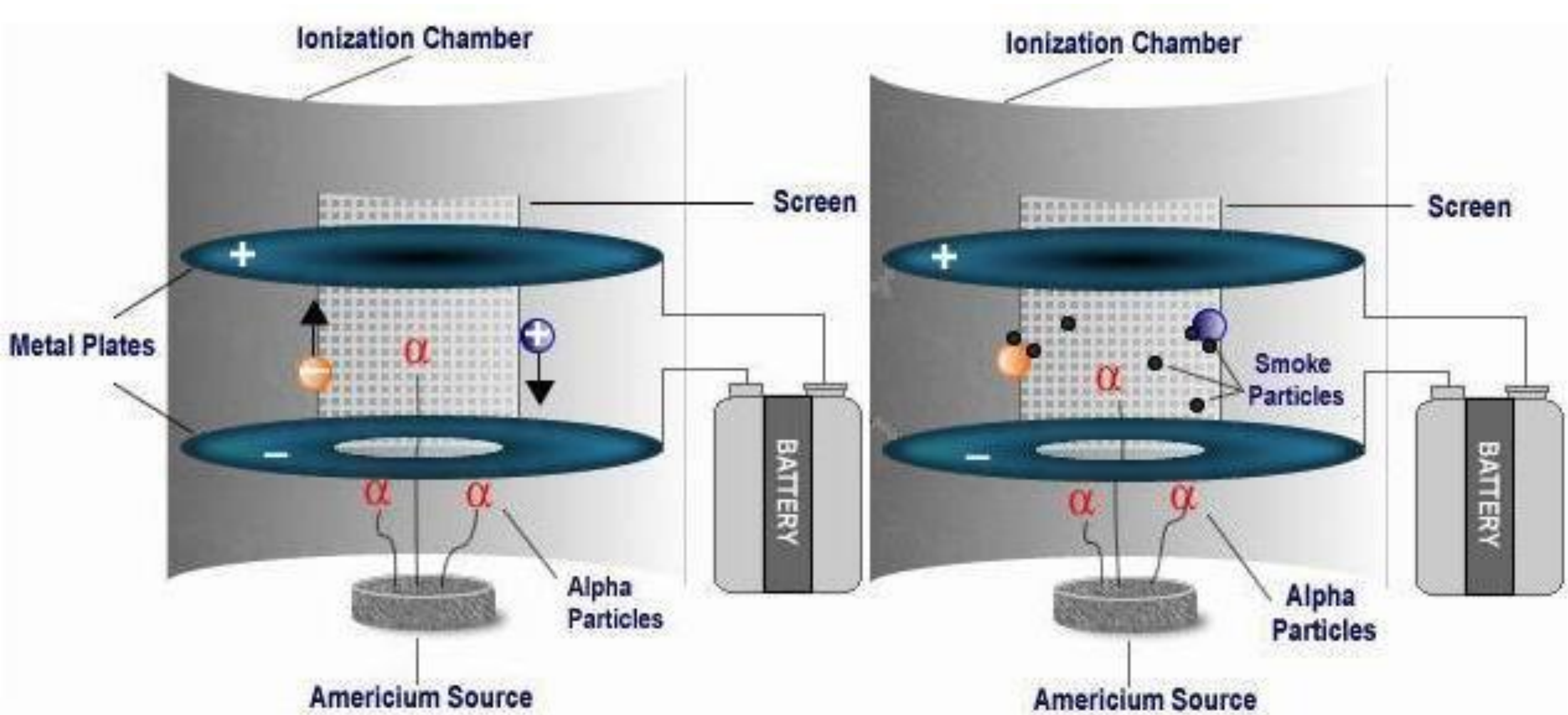

Ionization Chamber
Screen
Metal Plates
+
−
α
BATTERY
Alpha Particles
Americium Source
Ionization Chamber
Screen
Smoke Particles
+
−
α
BATTERY
Alpha Particles
Americium Source

Photo-electric smoke detector

- Focused light beam
- Offset reciever
- Smoke disrupts light
- Hits reciever
- + sensitive to small particles
- - more complex

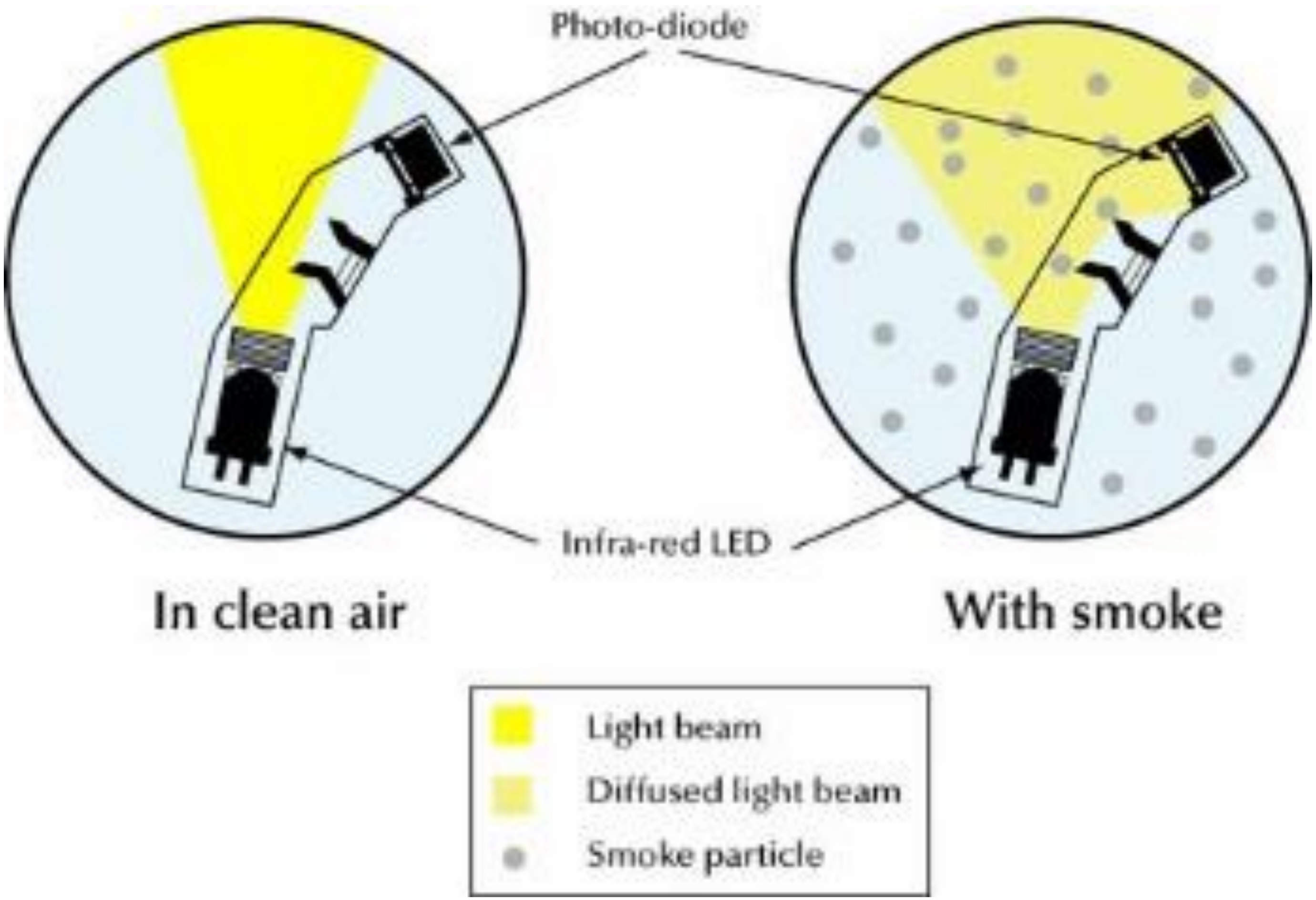


Photo-diode
Infra-red LED
In clean air
With smoke
Light beam
Diffused light beam
Smoke particle

Heat detectors

- Bi-metal

I. Two types of metal

II. Bends and close a circuit

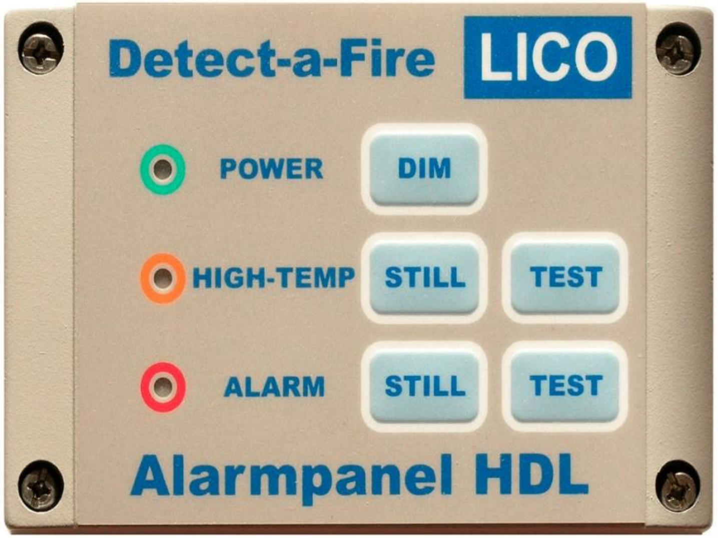
- Thermistor

I. Newer type

II. Resistance change with heat

III. Limits can be set

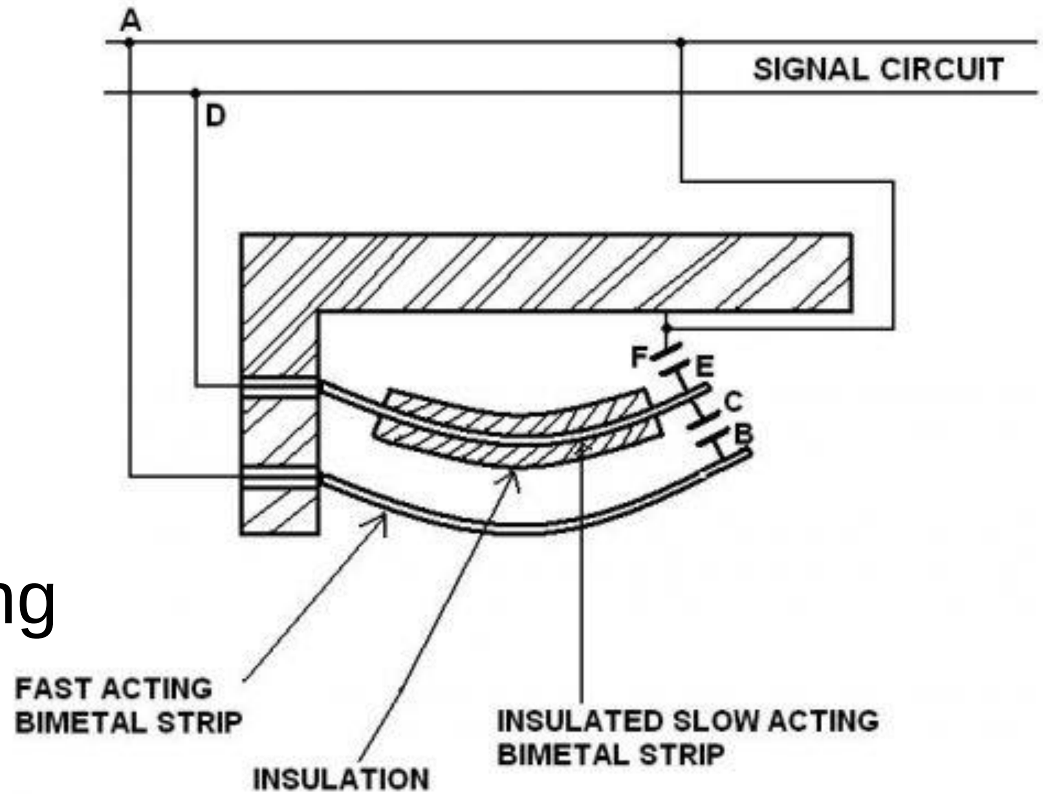
- Rate of rise – Both types



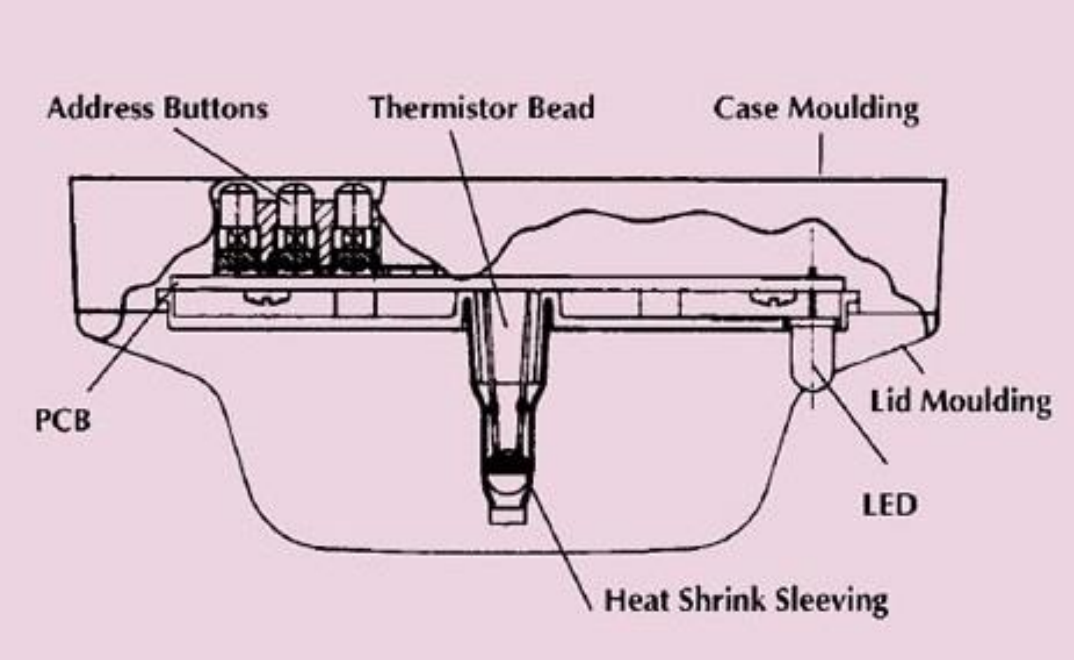
Bimetal type

- Old type
- Mechanical
- Less sensitive
- Rate of rise:

I. One fast responding
II. One slow
III. High rate = B to C
IV. Slow rate / temperature = E to F



Thermistor



- Newer type
- Resistance change
  with temp
- Rate of rise –

I. 2 thermistors placed over eachother
II. The lower will be exposed to heat before the upper

- Digital system, each detector sends adress

Flame detector

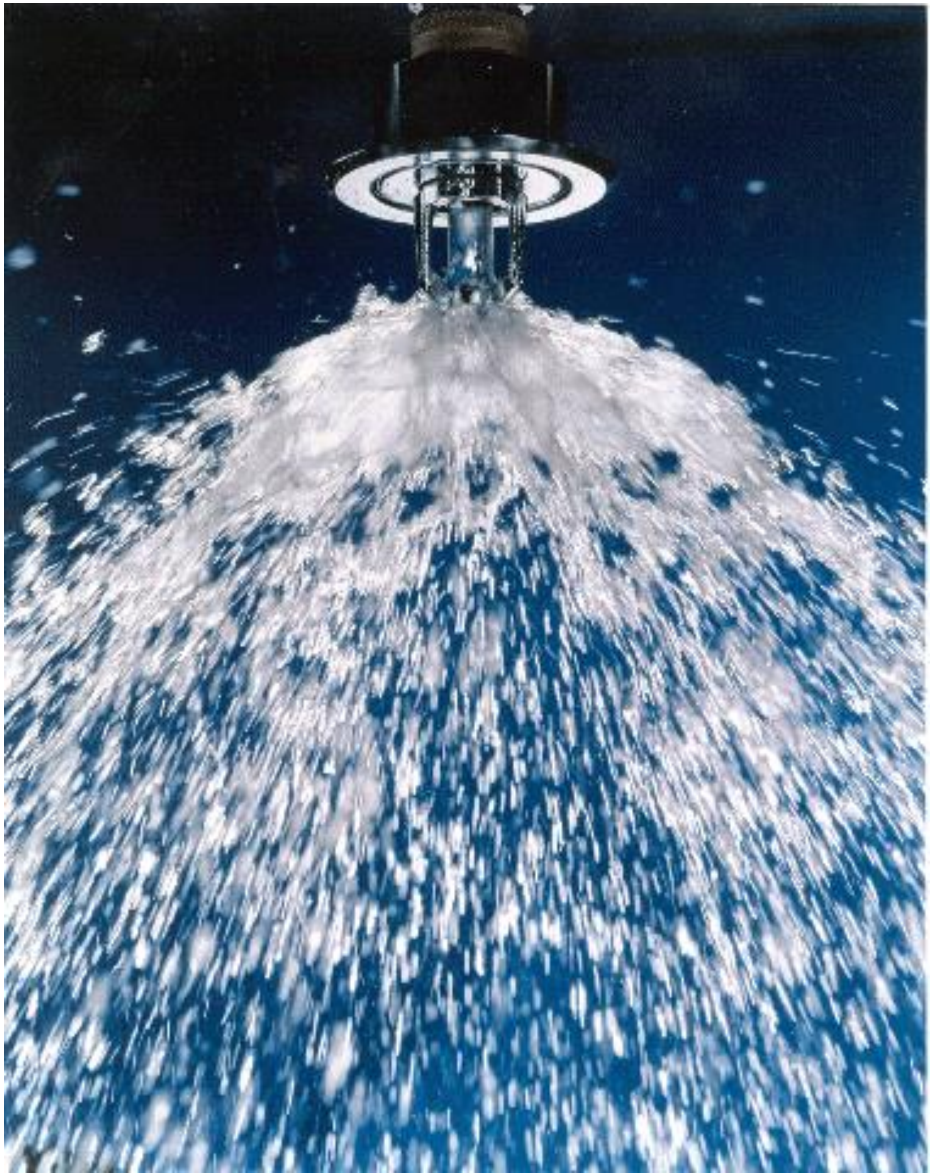
- Sense different wavelengths
- Ultra-violet and/or Infra-red
- Only allowed as a supplement
- + good for quick fires (fuel)
- - needs to ”see” the fire
- - many false alarms (better with new types)

Sprinkler systems

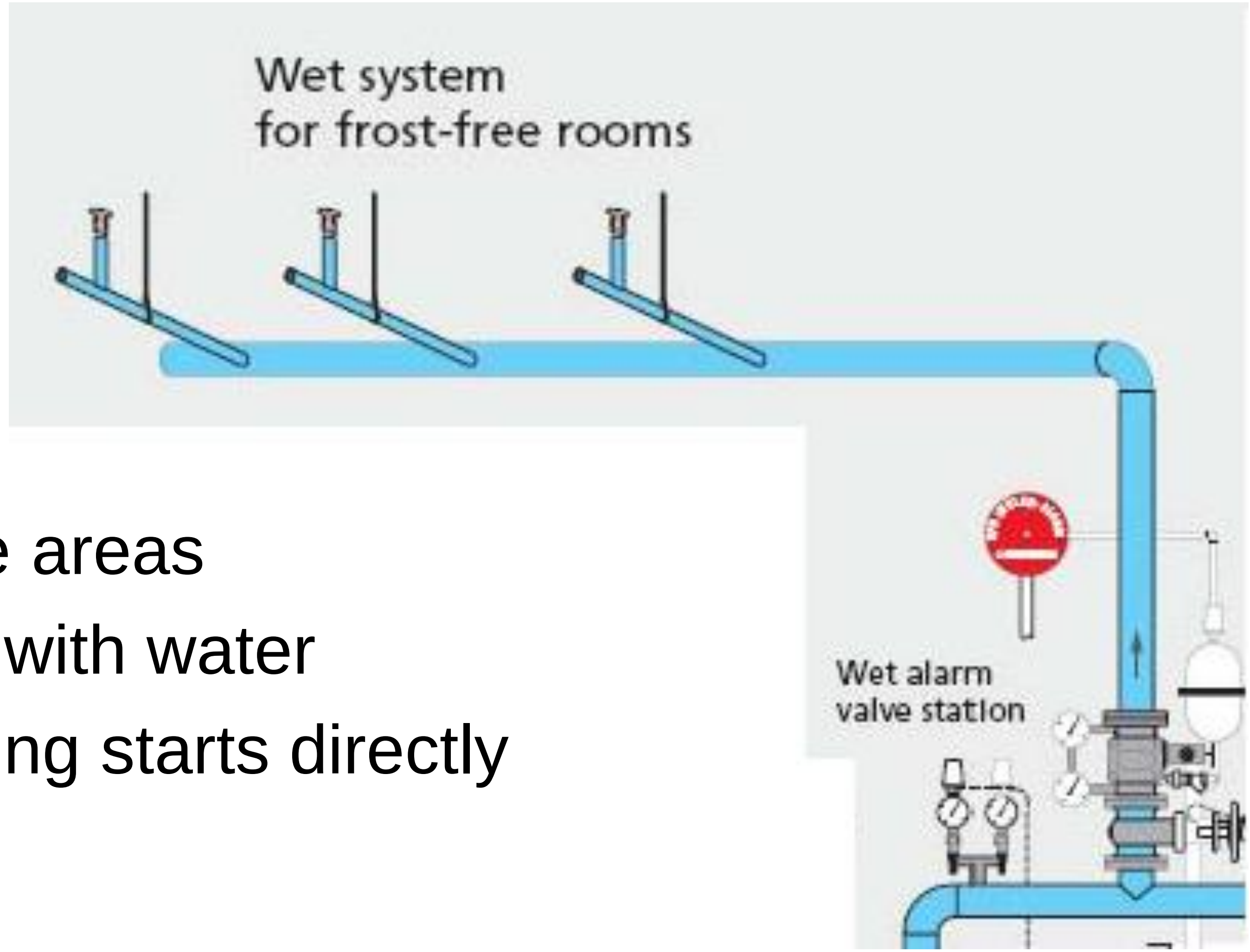
- Auto or manual
- ”wet pipe”
- ”dry pipe”
- Bulb that breakes when it reaches a set temp.
- Large amounts of water
- Closed with section-valve or stoping the pump

Sprinkler

- Free surface –
  Stabillity issues
- Galleys
- Bond stores
- Toilets/bathroom
- Also common in
  passenger areas

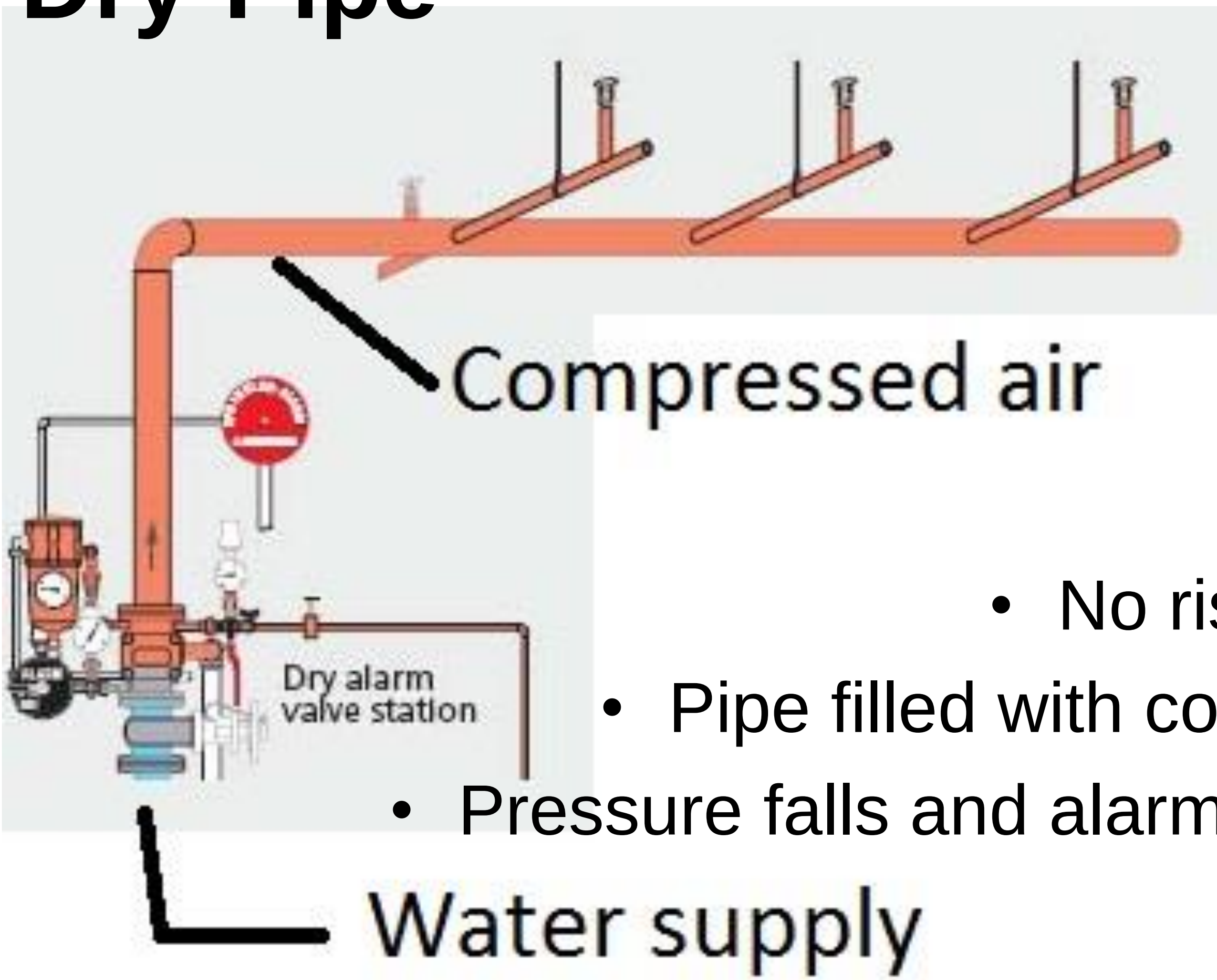


Wet-Pipe



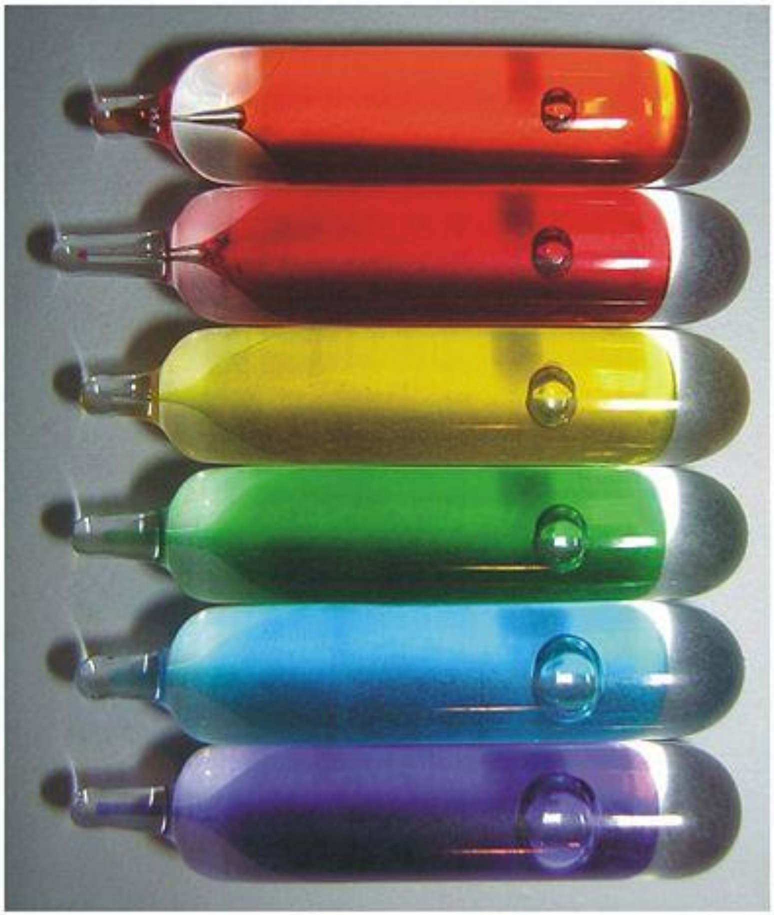
- Temperate areas
- Pipe filled with water
- Extingushing starts directly

Dry-Pipe



- No risk of freezing
- Pipe filled with compressed air
- Pressure falls and alarm-valve opens

Color of bulb shows what temperature it will brake!



57 °C

68 °C

79 °C

93 °C

141 °C

182 °C

Water mist

- Fine water particles
- High pressure through a nozzle
- Cools the fire
- + Effective
- + Less amounts of water

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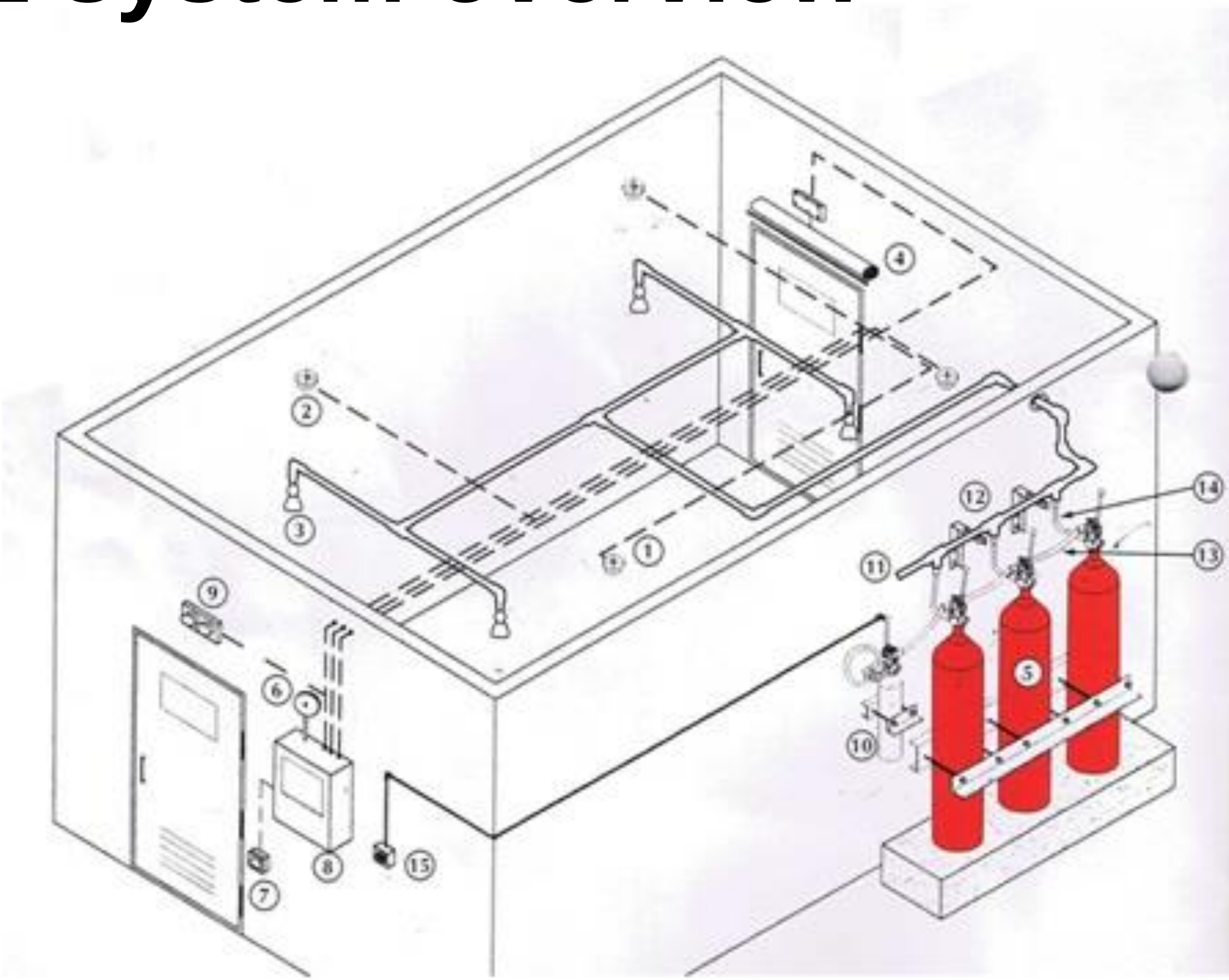
Water mist system in engine room

Carbon Dioxide

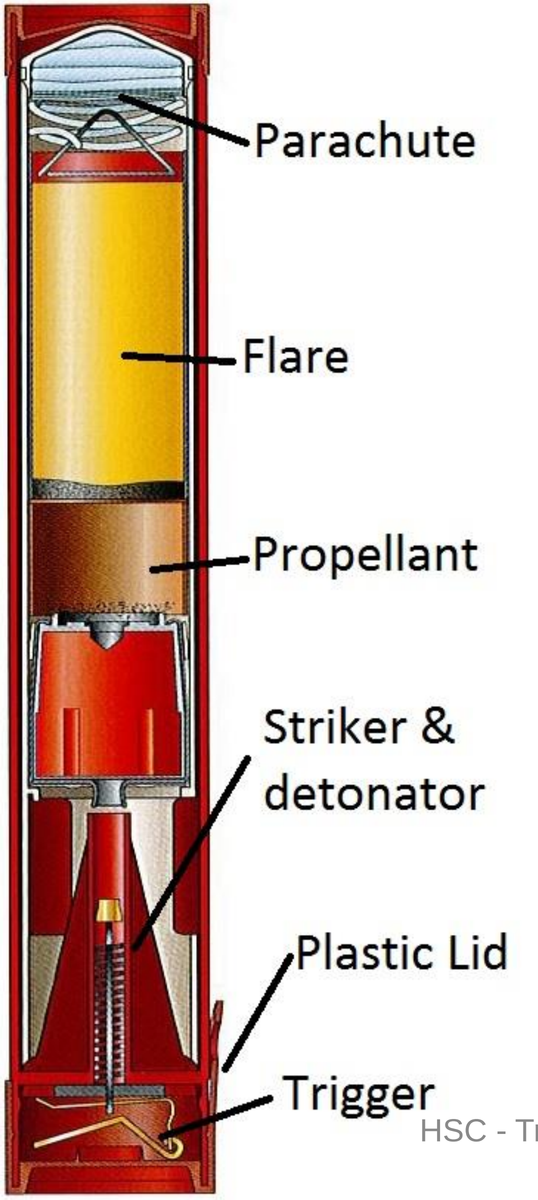
- Common in engine rooms
- Cools and smothers the fire
- CO-2 stored in bottles
- Released manually
- Area needs to be cleared and sealed

CO2 system overview



Parachute (Rocket) Flare

- Strontium, Magnesium
  and Potassium
- Propelled with Black powder
- Fired with string or trigger
- Burnes for about 1 min



Instruction (Ikaros)

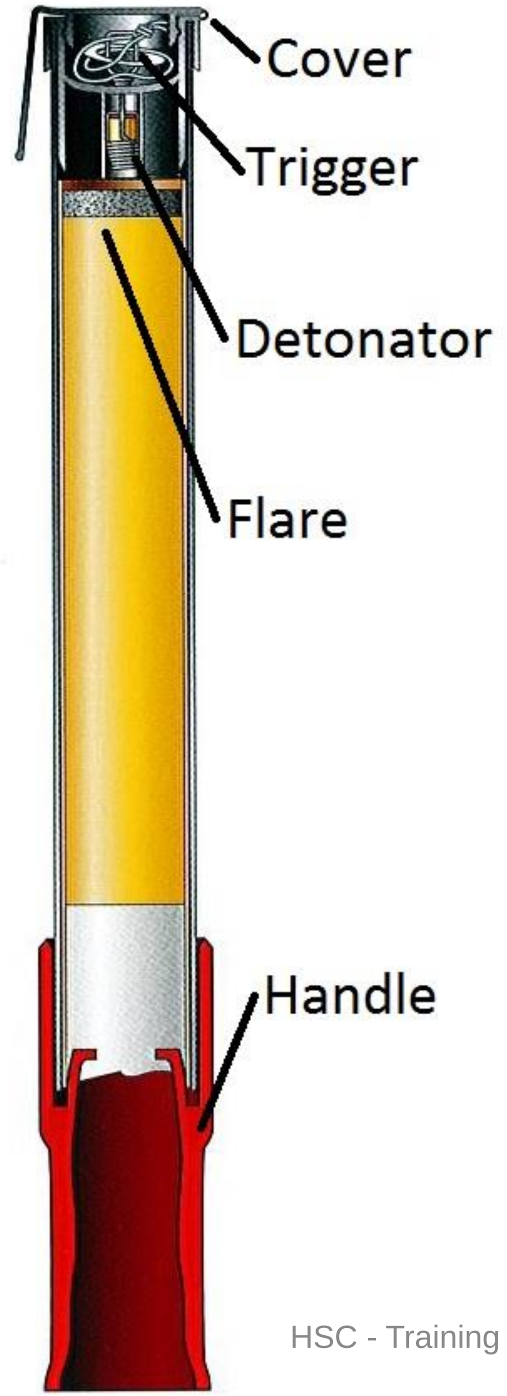
Remove bottom lid.

Trigger falls down.

Squeeze trigger against outer casing.

Hand held Flare

- Similar content as Parachute
- High temperature
- strong light (74 times a lightbulb)
- Keep away from combustibles
- Burns 1 min



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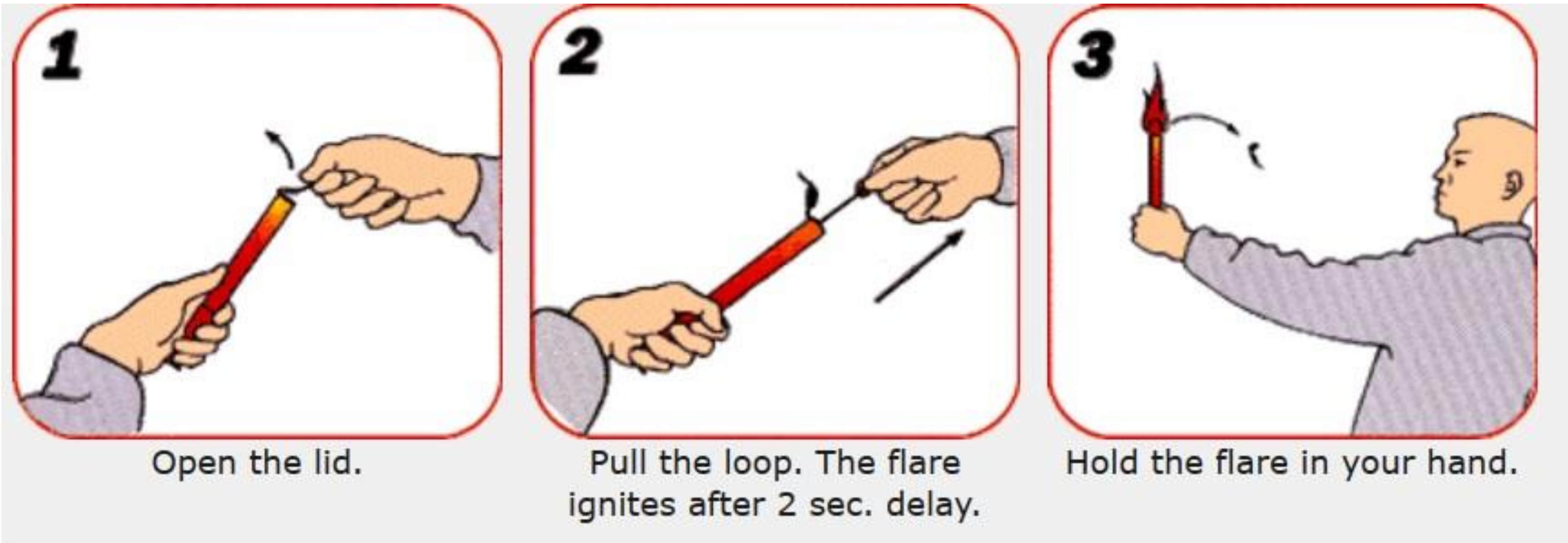
Instruction (Ikaros)

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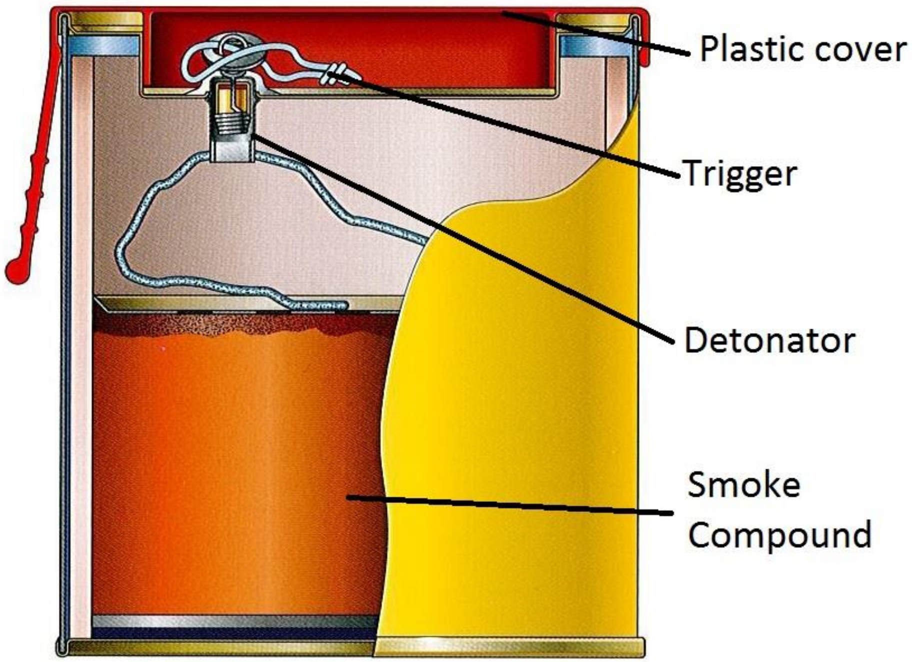
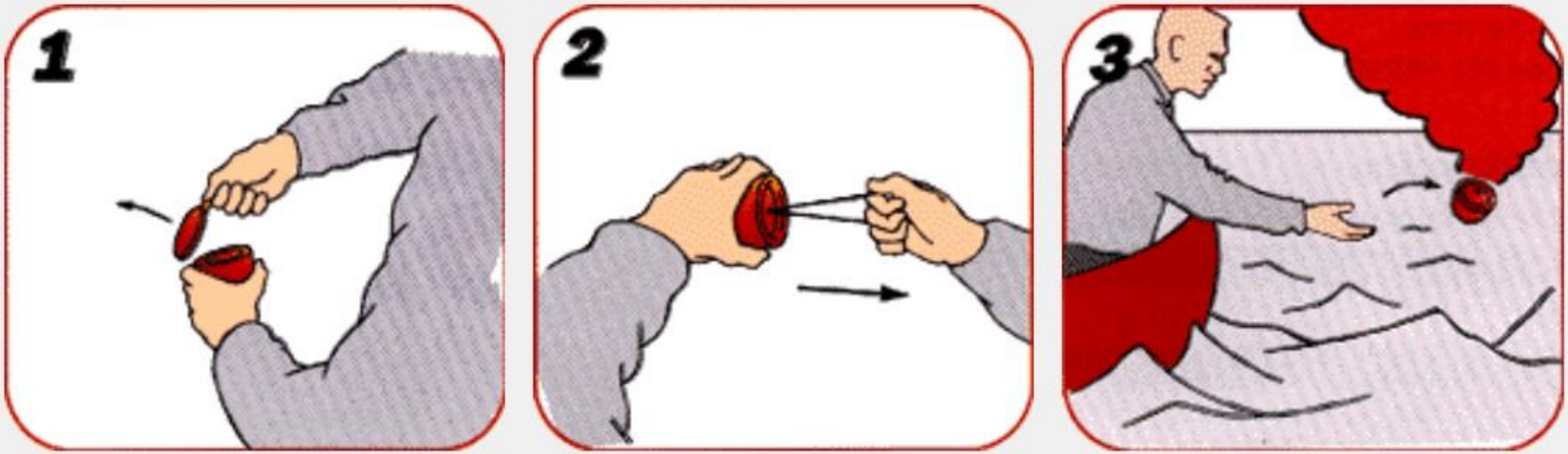
HSC- Training

Smoke signal

- Bouyant
- Also hand held
- Used for spotting by air
- Smoke compund
- Wax, lactose,
  potassium, color
- May be irritating
- Smokes about 3 min



Instruction (Ikaros)



Remove the lid. Pull the loop. Throw the signal into the water.

Portable VHF

- 8 hrs battery
- Ch 16 + 1
- Low effect = Limited range
- Special aeronautical VHF
- 121.5 & 123.1 MHz

Search and rescue transponder

- 96 hrs stand-by &
  8 hrs transmition
- Responds to 3 cm radar
- Sends signal displayed
  as 12 dots
- Dots stretch as radar
  comes closer
- New type with AIS - 2010

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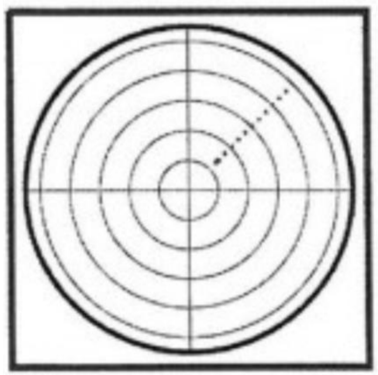
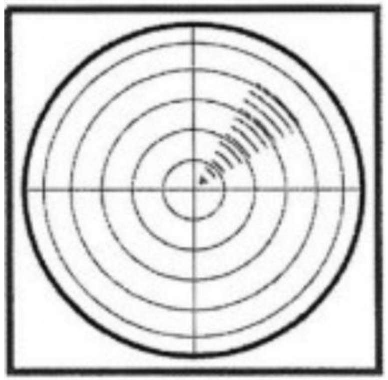
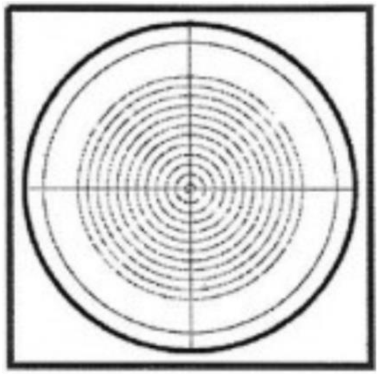
SART on radar



SART displayed at long range, approximately 2nm



SART at approximately 1nm, dots beginning to stretch



Here the SART is close, about 0,2nm. Dots are now rings around the display

Emergency position indicating radio beacon

- 96 hrs battery
- 406 + 121.5 MHz
- Signal picked up by COSPAS/SARSAT
- LEOSAR calculates pos by doppler

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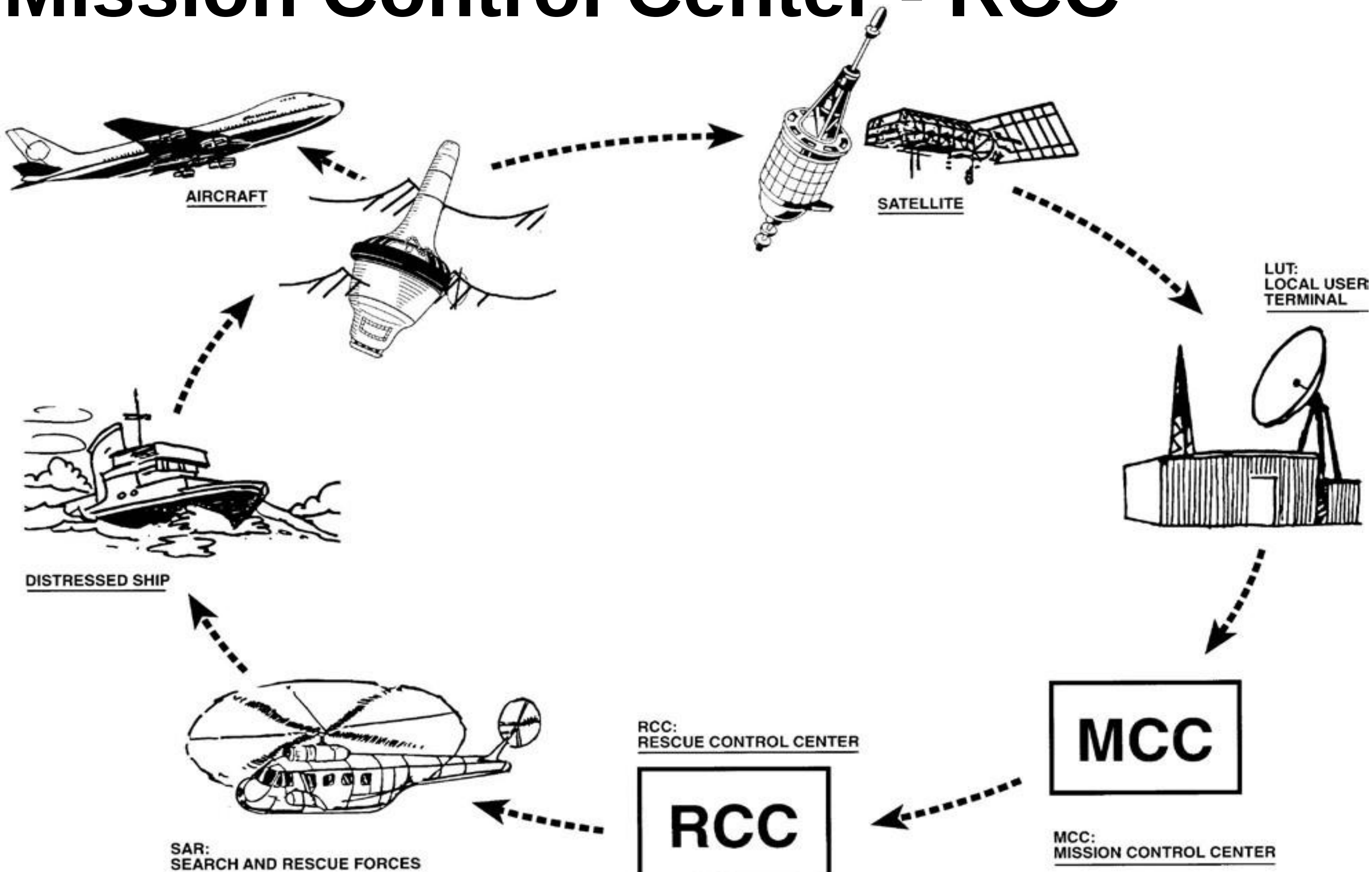
Satellite - Local User Terminal - Mission Control Center - RCC



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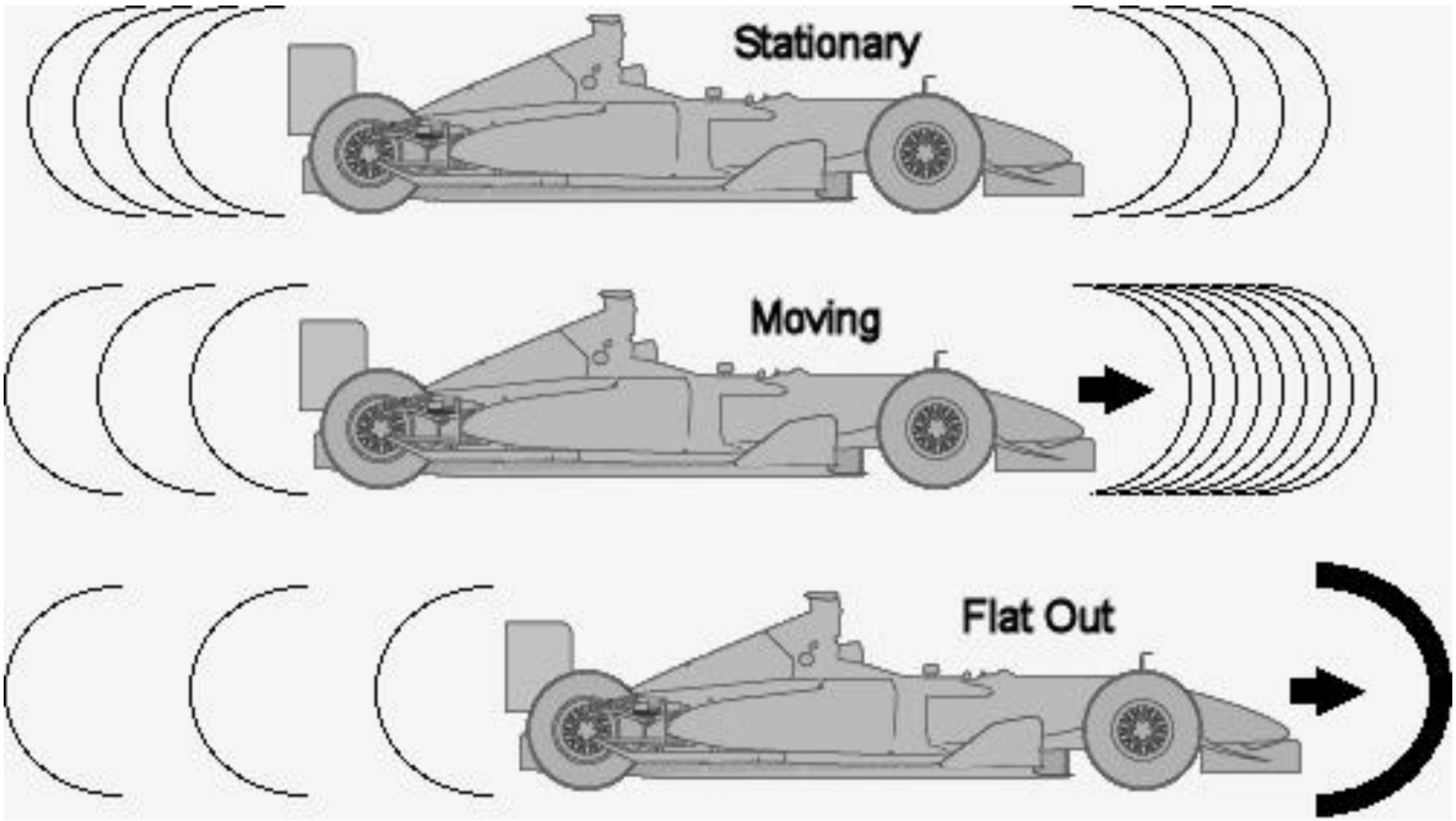
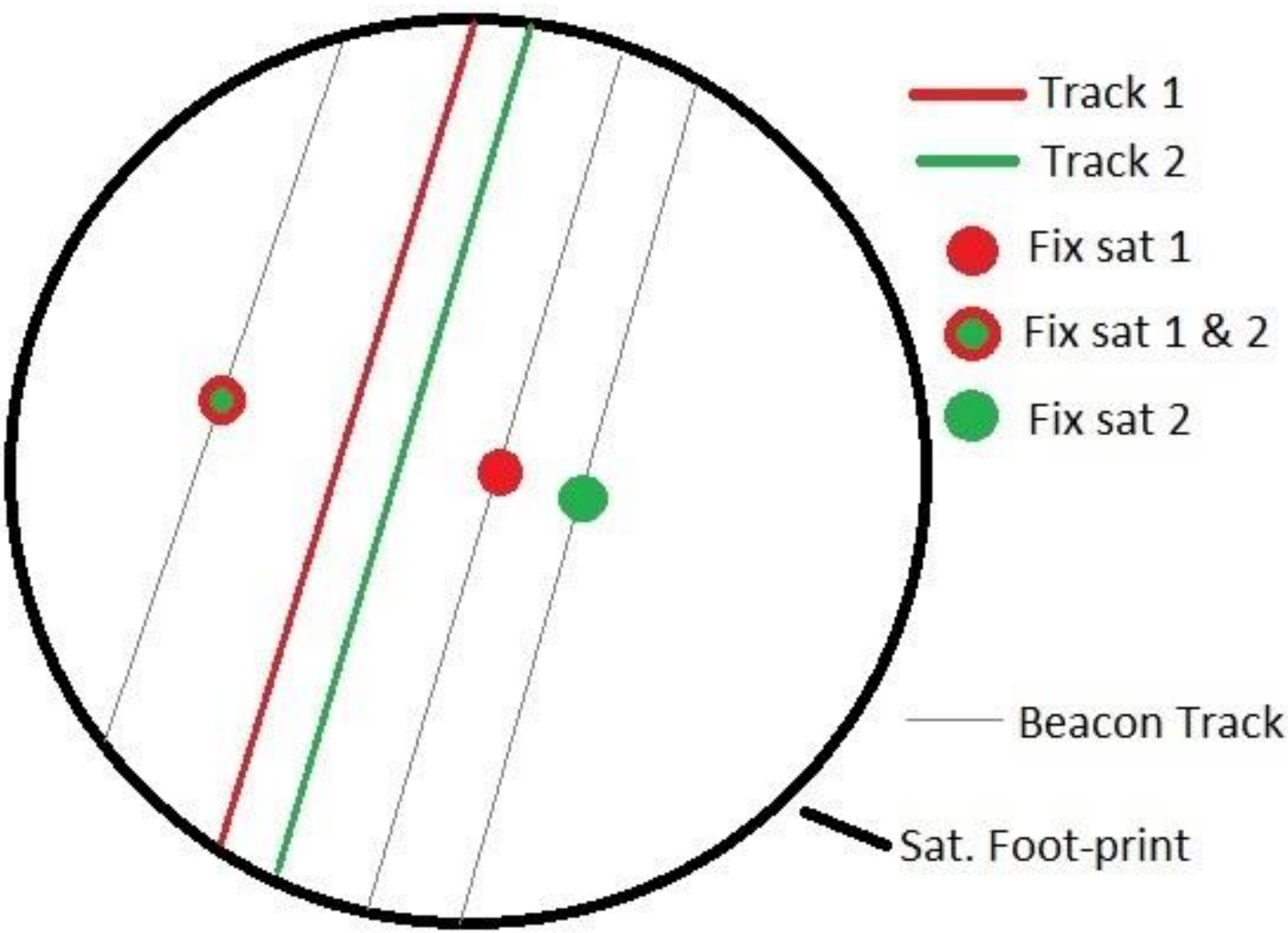
How Doppler Works:



How Doppler Works:

- The sound you hear when a car passes by
- One sound when it approaches you
- One when it passes
- And one when it moves away
- This is because the frequency of the sound is “pushed together” and “dragged apart”

LEOSAR Sat.



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LEOSAR Sat.

- The first pass (red) calculates 2 positions, one on each side
- When the second satellite pass (green) the earth will have turned slightly and the footprint will be different
- The second pass also calculates two positions but one will be in the same position as one of the two calculated by satellite one
- This is the correct or “resolved” position

Life rafts

- Davit or Throw over board
- Compressed gas (CO-2)
- Packed with gear
- Service anually

”If you ain’t kit, you ain’t fit”

- Heaving line
- Knife
- Bailer
- Sponge
- Sea Anchor
- Paddles
- Tin-opener
- First-aid kit
- Whistle
- Pyro
- Torch
- Radar reflector
- Signalling mirror
- Lifesaving signals
- Fishing tackle
- Food
- Water
- Cup
- Sea-sickness pills
- Survival instr.
- Raft instr.
- Repair kit
- Pump
- Plugs


Clamseal

Service:

- Unpack
- Inflate
- Inspect
- Replace
- Pressure test
- Repair
- Clean
- Repack
- Document

Hydrostatic release mechanism

- Spring loaded
  Knife
- Cuts lashings
  On set depth
- Rafts & EPIRBs

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maritime.hials.no

List of figures – Lecture slides

Part 1

Introduction

Part 2

Rules And Regulations

Slide 3: https://en.wikipedia.org/wiki/High-speed_Sea_Service#/media/File:Stena_Explorer_leaving_Holyhead.jpg (download 2015-11-02)

Slide 4: http://www.imo.org/EN/Pages/Default.aspx (download 2015-11-02)

Slide 5: http://www.imo.org/en/Publications/Pages/Home.aspx (download 2015-11-02)

Slide 6: http://www.imo.org/en/Publications/Pages/Home.aspx (download 2015-11-02)

Slide 8: http://www.imo.org/en/Publications/Pages/Home.aspx (download 2015-11-04)

Slide 9: http://www.imo.org/en/Publications/Pages/Home.aspx (download 2015-11-04)

Slide 10: http://www.imo.org/en/Publications/Pages/Home.aspx (download 2015-11-04)

Slide 10: https://pingpong.chalmers.se/courseId/3275/node.do?id=1611527&ts=1385369741808&u=-1540467894 (download 2015-11-04)

Technical characteristics

Slide 1: Åfeldt Jimmy 2015

Slide 3: https://en.wikipedia.org/wiki/High-speed_Sea_Service#/media/File:Stena_Explorer_leaving_Holyhead.jpg (download 2015-11-02)

Slide 4: https://upload.wikimedia.org/wikipedia/commons/5/57/Monohull_High_speed_craft_Selinunte_Jet_entering_the_Harbour_of_Reggio_Calabria_-_Italy_-_5_May_2009.jpg (download 2015-11-06)

Slide 4: https://commons.wikimedia.org/wiki/File:Hsc_tarifa_jet.jpg (download 2015-11-06)

Slide 4: https://en.wikipedia.org/wiki/Hydrofoil#/media/File:Hydrofoil_near_Piraeus.JPG (download 2015-11-06)

Slide 6: Adopted from Weber Reto (2015a) Chalmers university of technology

Slide 7: Åfeldt Jimmy 2015

Slide 8: Adopted from Weber Reto (2015b) Chalmers university of technology

Slide 9: Adopted from Weber Reto (2015) Chalmers university of technology

Slide 11: https://commons.wikimedia.org/wiki/File:Radar_Racon_O.jpg (download 2015-11-07)

Slide 12: http://www.transas.com/Onboard-equipment/Marine/NavigationSystems (download 2015-11-07)

Slide 13: http://www.radioscanner.ru/uploader/2007/saab.jpg (download 2015-11-07)

Slide 14: Åfeldt Jimmy (2015c)

Safe watchkeeping

Slide 1: Åfeldt Jimmy 2015

Slide 3: https://en.wikipedia.org/wiki/High-speed_Sea_Service#/media/File:Stena_Explorer_leaving_Holyhead.jpg (download 2015-11-02)

Slide 4: Åfeldt Jimmy 2015

Slide 5: Åfeldt Jimmy 2015

Slide 6: http://www.lolwithme.org/?p=867 (download 2015-11-03)

Slide 7: http://www.projectcheck.org/checklist-for-checklists.html 2015-11-05

Slide 8: Åfeldt Jimmy 2015

Slide 9: https://pingpong.chalmers.se/courseId/1864/node.do?id=1286232&ts=1366610070115&u=-1540467894 (download 2015-11-03)

Slide 11: http://www.sjofartsverket.se/pages/41659/vts.jpg (download 2015-11-09)

Slide 13: Åfeldt Jimmy 2015

Part 3

Situational Awareness

Slide 5: Haram, H. K. (21 10 2014). *Ship to Norway.* Ship to Norway: http://www.shiptonorway.no/Home?tag=Shortsea+Snapshot, 09 11 2015

Slide 6: Arkart, B. (09 01 2015). *Situational Awareness for Preppers.* American Preppers Network: http://americanpreppersnetwork.com/2015/01/situational-awareness-preppers.html, 09 11 2015

Slide 8: http://www.skybrary.aero/index.php/Situational_Awareness_(OGHFA_BN), 09 11 2015

Slide 9: http://www.kleefeldoncomics.com/2011/09/land-boat-im-saved.html, 09 11 2015

Slide 13: Gasaway, R. (06 07 2012). *Situational Awareness Matters!* http://www.samatters.com/explaining-tunnel-vision/, 02 11 2015

Slide 16: Gasaway, R. (04 10 2013). *Situational Awareness Matters!* http://www.samatters.com/19-ways-communications-barriers-can-impact-situational-awareness/, 03 11 2015

Slide 18: http://threehourtransformation.com/news/information-overload-north-shore-business-magazine/

Culture and Communication

Slide 6: Mcintyre, C. 13 10 2011, http://www.celebratingcolor.com/tag/from-mixing-mud-to-mastery/, 12 11 2015

Slide 4: Osburn, D. K. (20 05 2014). *Linked in*. https://www.linkedin.com/pulse/20140520031518-206311565-information-overload, 03 11 2015

Slide 7: Tenner, E. (12 12 2011). *The Atlantic.* Hämtat från http://www.theatlantic.com/health/archive/2011/12/is-the-expansion-of-knowledge-endangering-genius/249735/, 09 11 2015

Slide 13: https://plus.google.com/102267315673589747821/posts, 13 11 2015

Human Error

Slide 4: http://i.dailymail.co.uk/i/pix/2012/04/17/article-2131104-128636AB000005DC-287_468x286.jpg 2015-11-16

Slide 8: http://www.setonblog.com/wp-content/uploads/2010/09/sotp-huge-white-misspelled-freshly-painted-stop-sign-on-road-anon1-288x300.jpg 2015-11-16

Slide 11: https://shipnorway-public.sharepoint.com/pictures/Shortsea_Snapshot_No_safety_smoking_first.png 2015-11-16

Slide 14: http://2.bp.blogspot.com/-udxrMCSPzPw/T0XkK-FRlqI/AAAAAAAAAF0/iAzSdjjNH-0/s320/Understaffed.JPG 2015-11-16

Slide 15: http://1.bp.blogspot.com/-P6KZi8zICeo/UfyNZ3B5SLI/AAAAAAAAAEjY/lezRJl82XXQ/s1600/utilizing+resources+-+juggaar.com.jpg 2015-11-16

Slide 17: http://33.media.tumblr.com/tumblr_m3np9zEqiH1qllea0.jpg 2015-11-16

Slide 18: https://accountingprofessor.files.wordpress.com/2013/01/buried-in-work.jpg?w=500 2015-11-16

Slide 19: http://ak-hdl.buzzfed.com/static/2015-01/27/17/enhanced/webdr01/enhanced-9769-1422396025-20.jpg 2015-11-16

Slide 20: http://abilitymagazine.com/images/diet-exercise-humor.jpg 2015-11-16

Slide 22: http://facilityexecutive.com/wp-content/uploads/2014/03/too_hot_too_cold_-_revised.jpg 2015-11-16

Slide 24: http://cdn2.hubspot.net/hub/230326/file-224834076-png/images/work_and_rest_time_1.png?t=1442601678228&width=601&height=356 2015-11-16

Slide 27: http://static.bbci.co.uk/schoolradio/images/ic/qe//width/960/schoolradio/history/ww2/cropped_960x540/pic27_briefing.jpg 2015-11-16

Slide 29: https://photos.travelblog.org/Photos/55137/455636/f/4499575-Launching-the-Rescue-Boat-0.jpg 2015-11-16

Group Dynamics

Slide 23: http://www.hrmtoday.com/wp-content/uploads/2012/05/Tightrope.jpg 2015-11-16

Slide 27: http://www.who.int/hac/techguidance/hbp/hbp_wh2.gif 2015-11-16

Slide 30: https://gameofroles.files.wordpress.com/2011/11/screen-shot-2011-11-05-at-11-05-56-pm.png 2015-11-16

Slide 32: https://upload.wikimedia.org/wikipedia/commons/d/d9/Tennis_shake_hands_after_match.jpg 2015-11-16

Slide 35: http://www.suncorp.com.au/sites/default/files/suncorp/careers/images/suncorp_values.gif 2015-11-16

Slide 38: http://www.trainhr.com/images/keywords/emotionalIntelligence.jpg 2015-11-16

Leadership and Decision Making

Slide 4: Osburn, D. K. (20 05 2014). *Linked in*. https://www.linkedin.com/pulse/20140520031518-206311565-information-overload, 03 11 2015

Slide 7: Tenner, E. (12 12 2011). *The Atlantic.* Hämtat från http://www.theatlantic.com/health/archive/2011/12/is-the-expansion-of-knowledge-endangering-genius/249735/, 09 11 2015

Slide 13: https://plus.google.com/102267315673589747821/posts, 13 11 2015

Part 4

IAMSAR

Slide 1: Åfeldt Jimmy (2015)

Slide 3: Busherport (2014.) http://bushehrport.pmo.ir/pso_content/media/image/2014/05/34557_orig.jpg 2015-10-22

Slide 4: Defence images (2013) https://c1.staticflickr.com/9/8380/8675799486_faa2094766_b.jpg 2015-10-26

Slide 5: Marine insight (2011) http://www.marineinsight.com/wp-content/uploads/2011/08/5103220.jpg 2015-10-22

Slide 6: Svenska Sjöräddningssällskapet (2015) http://www.sjoraddning.se/media/cache/74/74c8fceface90f870e14b6513fbd576e.jpg 2015-10-19

Slide 7: Sea scout skippers locker (2012) https://skipperslocker.files.wordpress.com/2012/02/marine-distress-signals.gif 2015-10-22

Slide 8: Wikipedia (2015) https://upload.wikimedia.org/wikipedia/commons/thumb/8/82/Flag_of_the_International_Maritime_Organization.svg/2000px-Flag_of_the_International_Maritime_Organization.svg.png 2015-10-26

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Slide 9: Busherport (2014.)
http://bushehrport.pmo.ir/pso_content/media/image/2014/05/34557_orig.jpg 2015-10-22

Slide 10: Busherport (2014.)
http://bushehrport.pmo.ir/pso_content/media/image/2014/05/34557_orig.jpg 2015-10-22

Slide 11: Busherport (2014.)
http://bushehrport.pmo.ir/pso_content/media/image/2014/05/34557_orig.jpg 2015-10-22

Slide 12: Busherport (2014.)
http://bushehrport.pmo.ir/pso_content/media/image/2014/05/34557_orig.jpg 2015-10-22

Slide 13: Wikimedia commons (2010)
https://upload.wikimedia.org/wikipedia/commons/4/48/US_Navy_100402-N-7653W-060_Lt._j.g._Justin_Guernsey_communicates_on_the_ship's_VHF_radio_while_standing_watch_on_the_bridge_of_the_littoral_combat_ship_USS_Independence_%28LCS_2%29.jpg 2015-10-26

Slide 14: Wapster (2011)
https://c2.staticflickr.com/6/5263/5612905815_93a02da83d_b.jpg 2015-10-26

Slide 15: Birchall Eugene (2012)
http://s0.geograph.org.uk/geophotos/03/28/33/3283355_26b095ee.jpg 2015-10-26

Slide 16: Wikimedia commons (2009)
https://upload.wikimedia.org/wikipedia/commons/thumb/6/66/Katamaran_Fridolin_von_oben.JPG/1024px-Katamaran_Fridolin_von_oben.JPG 2015-10-26

Slide 17: RHO aviation training services (2012)
http://rhoaviation.com.au/wp-content/uploads/2012/08/HiLine1.jpg 2015-10-20

Slide 18: Defence images (2013)
https://c1.staticflickr.com/9/8380/8675799486_faa2094766_b.jpg 2015-10-26

Search And Rescue

Slide 1: Åfeldt Jimmy (2015)

Slide 3: Airbus Helicopters (2015)
http://www.airbushelicopters.com/w1/jrotor/79/iso_album/rotor79uk_1612_page_09_image_0001_600x600.jpg 2015-10-19

Slide 4: IMO (n.d.)
http://www.imo.org/en/OurWork/Safety/RadioCommunicationsAndSearchAndRescue/Search

AndRescue/PublishingImages/USCGhelicopterhoisting050826-C-2023P-523.JPG 2015-11-03

Slide 5: Vebjorn Karlsen (n.d.)
http://vebjornkarlsen.no/onewebstatic/6f917266d9-Sea-King%20Redningsmann%20pa%CC%8A%20vei%20ut.jpg 2015-10-20

Slide 6: Justitis- og politidepartementet (2002)
https://www.regjeringen.no/globalassets/upload/kilde/jd/bro/2003/0005/ddd/pdfv/183865-infohefte_engelsk.pdf 2015-10-20

Slide 7: Vebjorn Karlsen (n.d.)
http://vebjornkarlsen.no/onewebstatic/6f917266d9-Sea-King%20Redningsmann%20pa%CC%8A%20vei%20ut.jpg 2015-10-20

Slide 8: Svenska Sjöräddningssällskapet (2015)
http://www.sjoraddning.se/media/cache/74/74c8fceface90f870e14b6513fbd576e.jpg 2015-10-19

Slide 10: Redningsselskapet (2013)
http://d20tdhwx2i89n1.cloudfront.net/image/upload/yfkpcvbkvikyv4nbedf0.jpg 2015-11-03

Slide 12: Wikimedia Commons (2009)
https://upload.wikimedia.org/wikipedia/commons/6/6a/Estonia_ferry2.jpg 2015-11-03

Slide 13 – 20: IMO (2008) International Aeronautical and Maritime Search And Rescue Manual vol 2
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Damage

Slide 1: Åfeldt Jimmy (2015)

Slide 3: Sveriges Radio (2009)
http://sverigesradio.se/sida/images/86/653352_1200_798.jpg?preset=article-auto-height 2015-10-27

Slide 4: New York Times (2011)
http://graphics8.nytimes.com/images/2011/05/10/automobiles/wheels-iwate/wheels-iwate-blog480.jpg 2015-10-29

Slide 5 – 8: Ship media (2010)
http://www.shippipedia.com/wp-content/uploads/2010/10/stability-2.png 2015-10-20

Slide 9 – 10: Maritimo 48 (2012)
https://maritimo48.files.wordpress.com/2012/10/114140929_sea_smoot_342231b.jpg 2015-10-27

Slide 14: Maritimo 48 (2012)
https://maritimo48.files.wordpress.com/2012/10/114136777_sea_smoot_342229b.jpg 2015-10-27

Emergencies

Slide 1: Åfeldt Jimmy (2015)

Slide 3: Cherry mortages (2014)
http://www.cherrymortgages.com/sustainable_zero_carbon_housing/sustainable_housing_pictures/tsunami-boat-house-japan-catamaran-concrete-buildings.jpg 2015-10-29

Slide 4: Mattson Magnus (n.d.)
http://www.magnusmattsson.com/wp-content/gallery/this-is-my-life/magnus-02.jpg 2015-10-29

Slide 5: DIY.org (2015)
https://d3tixod1wp885b.cloudfront.net/c9/9ab8f63c1fb3286276cbacc0b6a86e/man-overboard-signals.jpg 2015-10-29

Slide 6: O'Bryans Law (2015)
http://obryanlaw.net/wp-content/uploads/2015/03/shutterstock_26658748.jpg 2015-10-29

Slide 7: Wikimedia Commons (2005)
https://upload.wikimedia.org/wikipedia/commons/2/25/US_Navy_050613-N-6482W-044_Rigid_Hull_Inflatable_Boat_crew_members_assist_search_and_rescue_swimmer,_Electronics_Technician_3rd_Class_Thomas_Mayes,_lift_Lt.j.g._Daniel_Proulx_during_a_man_overboard.jpg 2015-10-29

Slide 8: Maritimo 48 (2012)
https://maritimo48.files.wordpress.com/2012/10/114136777_sea_smoot_342229b.jpg 2015-10-27

Slide 9: Lashi (2009)
http://3.bp.blogspot.com/_p5QJ-DWb-k0/Smn3FX2aHlI/AAAAAAAAAX4/1JKgUfc9JUY/s1600-h/3210130437.jpg 2015-10-29

Slide 11: Sveriegs radio (2011)
http://sverigesradio.se/sida/images/103/1526520_1200_675.jpg?preset=article 2015-10-29

Slide 13: The Kitsap Sun (2014)
http://mediaassets.kitsapsun.com/photo/2014/05/31/0/0129_KSLO_Beached1_5532258_ver1.0_640_480.JPG 2015-10-19

Slide 15: Surgent Jim (2009)
http://threesheetsnw.com/blog/2013/01/ferry-runs-aground-near-port-townsend/#lightbox/0/ 20015-11-03

Slide 17: Shipwreck Log (2015)
http://www.shipwrecklog.com/log/wp-content/uploads/2015/03/Highspeed-5-2.jpg 2015-10-20

Slide 18 – 19: Glenlands (2013)
http://glenlands.com/wp-content/uploads/2013/07/TV-Camera.jpg 2015-11-03

Slide 20: Veterans sleep (2013)
http://www.veteranssleep.pitt.edu/wp-content/uploads/2013/11/ptsd-e1383860925532.jpg 2015-11-03

Slide 21: Costa, Carlos Victor (2013)
http://carlosvictorcosta.com/wp-content/uploads/2013/10/Crisis_Reputacion_Online_Formacion.jpg 2015-11-03

Slide 23: Behind closed doors (2014)
http://www.bcd-urbex.com/wp-content/uploads/2014/04/chernobyl-cover-1320x660.jpg?5fa9cc 2015-11-03

Slide 24: Radio Haugaland (2014)
http://radioh.no/wp-content/uploads/2014/09/politiet.jpg 2015-11-03

Emergency equipment

Slide 1: Åfeldt Jimmy (2015)

Slide 3: Maritime journal (2015)
http://www.maritimejournal.com/__data/assets/image/0008/1025486/Pains-Wessex-red-smoke-flares.jpg 2015-10-20

Slide 4: Seabreeze.com.au (2013)
http://www.seabreeze.com.au/img/photos/stand_up_paddle/7885374.jpg 2015-10-20

Slide 5, 7: Anthony Lee (2013)
https://anthonyleefineart.files.wordpress.com/2013/04/smoke1.jpg 2015-10-21

Slide 6: K.N. Tooshi Universety of technology
http://saba.kntu.ac.ir/eecd/ecourses/instrumentation/projects/reports/smoke%20detector/images/ion%20chamber.jpg 2015-10-20

Slide 8: Apollo fire detectors ltd. (2014)
http://www.apollo-fire.co.uk/media/753726/optical.jpg 2015-10-20

Slide 9: Direct Industry (u.a.)
http://img.directindustry.com/images_di/photo-g/heat-detector-analog-marine-applications-57861-2429439.jpg 2015-10-21

Slide 10: Marine engineering online (2014)
http://marineengineeringonline.com/wordpress/wp-content/uploads/2014/05/bimetallic_fire_detectors.jpg 2015-10-21

Slide 11: Safelinks (2015)
http://www.safelincs.co.uk/shopimages/products/high/Heat-Detector-Drawing.jpg 2015-10-21

Slide 12: Grovely.com (2015)
http://www.groveley.com/products/flame-detection/fds301-visual-flame-detector 2015-10-21

Slide 13: Wikipedia (u.d.)
https://upload.wikimedia.org/wikipedia/commons/7/76/Fire_sprinkler_roof_mount_side_view.jpg 2015-10-20

Slide 14: Firecode.com (2013)
http://firecode.com/wp-content/uploads/2013/01/Fire-Protection-A-Business-Guide-Photo-by-triadresponsegroup-11.bmp 2015-10-21

Slide 15: Enggcyclopedia (2007a)
http://www.enggcyclopedia.com/wp-content/uploads/2011/11/Typical-layout-for-dry-and-wet-type-sprinkler-systems.png 2015-10-21

Slide 16: Enggcyclopedia (2007b)
http://www.enggcyclopedia.com/wp-content/uploads/2011/11/Typical-layout-for-dry-and-wet-type-sprinkler-systems.png 2015-10-21

Slide 17: Wikipedia (u.d.)
https://upload.wikimedia.org/wikipedia/commons/4/47/Sprinkler_ampuller_temp.jpg 2015-10-20

Slide 18: Green building and design magazine (2012)
http://gbdmagazine.com/wp-content/uploads/2012/10/HI-FOG_sprinkler_discharge_3_1.jpg 2015-10-20

Slide 19: Marine insight (2015)
http://www.marineinsight.com/wp-content/uploads/2015/03/water-mist-over-generator.png 2015-10-20

Slide 20: Alibaba.com (u.d)
http://i00.i.aliimg.com/photo/v10/60153670186/CO2_fire_fighting_System.jpg 2015-10-20

Slide 21: Kumpulan Protection (2010)
http://www.kumpulanprotection.com/catalog/images/CO2_System.jpg 2015-10-21

Slide 22: Nammo LLIAB AB (2015a)
http://www.hansson-pyrotech.se/rockets/ 2015-10-19

Slide 23: Nammo LLIAB AB (2015)
http://www.hansson-pyrotech.se/rockets/instructions/ 2015-10-20

Slide 24: Sailing Amélie (2014)
http://4.bp.blogspot.com/-GgEhW2i0kIw/VBRSRIbMtsI/AAAAAAAACsE/WwwydW7PQcw/s1600/Screen%2BShot%2B2014-09-12%2Bat%2B7.45.06%2BPM.png 2015-10-20

Slide 25: Nammo LLIAB AB (2015b)
http://www.hansson-pyrotech.se/handheld-signals/ 2015-10-19

Slide 26: Nammo LLIAB AB (2015
http://www.hansson-pyrotech.se/handheld-signals/instructions/ 2015-10-20

Slide 27: Marine insight (2011)
http://4.bp.blogspot.com/_nSRnZEam3No/TLOL2DwaJ0I/AAAAAAAABbo/TaPvlFq3gS8/s1600/Red+Hand+Flare+1.gif 2015-10-20

Slide 28: Nammo LLIAB AB (2015c)
http://www.hansson-pyrotech.se/buoyant-smoke/ 2015-10-19

Slide 29: Nammo LLIAB AB (2015)
http://www.hansson-pyrotech.se/buoyant-smoke/instructions/ 2015-10-20

Slide 30: Boat foundation US (2008)
http://www.boatus.org/images/findings/flares/smoke-pws.jpg 2015-10-20

Slide 31: Jotron (2015c) User manual Tron TR20 GMDSS
http://www.jotron.com/ai_files/users_manual_tron_tr20_gmdss_817730.pdf 2015-10-19

Slide 32: Jotron (2015a) User manual Tron SART20
http://www.jotron.com/ai_files/user_manual_tron_sart20_893596.pdf 2015-10-19

Slide 33: N.C.I. Rosall Point (2013)
http://www.ncirossallpoint.co.uk/wp-content/uploads/2015/01/sart.png 2015-10-21

Slide 34: Jotron (2015b) User manual Tron20s MkII
http://www.jotron.com/ai_files/um_tron_40s_mkii_vj_944386.pdf 2015-10-19

Slide 35: N.C.I. Rosall Piont (2015)
http://www.ncirossallpoint.co.uk/wp-content/uploads/2015/01/epirb.jpg 2015-10-21

Slide 36 – 37: Thinklink (2009)
http://www.dcs.shef.ac.uk/~mark/blog/blog_files/photos/silverstone/2009/doppler.jpg 2015-10-21

Slide 38: Åfeldt Jimmy (2015)

Slide 40: Canadian Airforce (2014)
http://www.rcaf-arc.forces.gc.ca/en/article-template-standard.page?doc=jumping-into-training-on-canada-s-west-coast/hwn8upgk 2015-10-21

Slide 42: Life raft survival equpipment (2015)
http://lrse.com/images/D/ultra-lite-iso-emergencyequipment-pack-biggest.jpg 2015-10-21

Slide 43: Liferafts and survival (2011)
http://www.rcaf-arc.forces.gc.ca/en/article-template-standard.page?doc=jumping-into-training-on-canada-s-west-coast/hwn8upgk 2015-10-21

Slide 44: Fondriest (2015)
http://www.fondriest.com/media/catalog/product/cache/1/image/9df78eab33525d08d6e5fb8d27136e95/4/0/40189XL.jpg 2015-10-21

ÅLESUND UNIVERSITY COLLEGE

HSC Training Exercises – Instructor Manual

Instructor Manual

HSC Training Instructors Manual		
Title HSC Training Exercises – Instructors Manual	Revision **A**	Date 2015-11-09

Revision	Date	Author	Description
A	**2015-11-09**	**HSC**	**Preliminary**

INTRODUCTION

This booklet contains instructions for the simulator exercises in the HSC Training Course held at Aalesund University College.
These are mean to be used by the instructor for preparing, execution and evaluation of the HSC simulator exercises.

This booklet shall not be distributed.

In the following parts of this booklet, each simulator exercise will be explained along with crucial information and material. Each chapter holds an exercise with its objectives being explained using the following structure:

- Exercise Description – Picture (of the exercise area and initial set up)
- Exercise Description – Story
- Exercise Description – Details with training objectives

ROLES

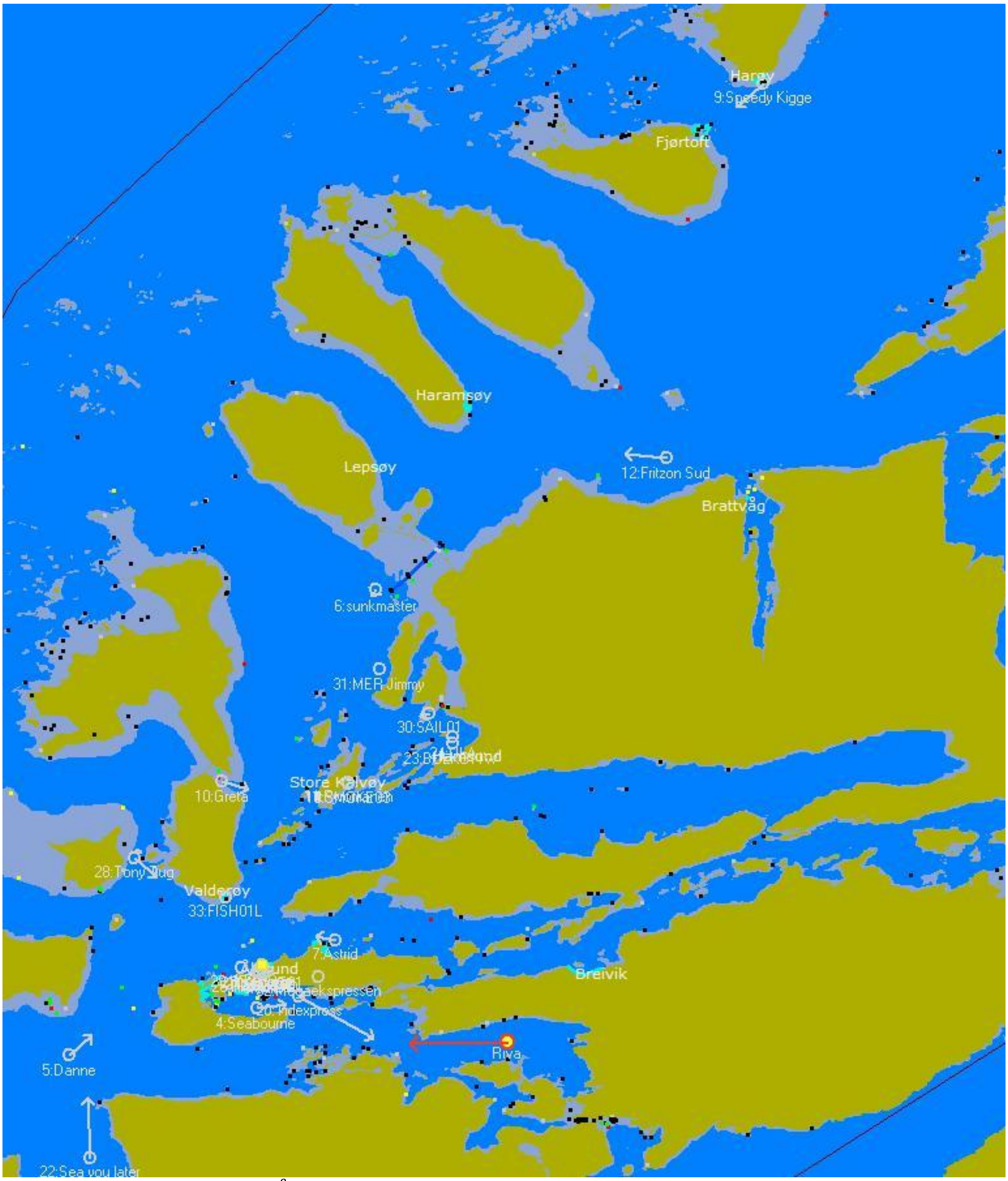
BRM Instructor: The BRM instructor delivers classroom lectures

Simulator Instructor: The Simulator Instructor operates the simulator exercises

VESSEL INFORMATION

Name: Riva Model Name: FERRY22	Vessel picture 
POB:	Draught: 1.2 m
LOA: 35.5 m	Breadth: 9.6 m
Telephone, bridge: 61429	Telephone, company: 61471

EXERCISE 1 - FAMILIARIZATION



Riva starting south east of Ålesund, northbound for Haramsøya

PURPOSE

For the participant to be get familiar with the bridge and the navigation equipment.

STORY

This is the simulator familiarization exercise. The HSC “Riva” starts north of Humla island, in Åsefjorden (south east of Ålesund). The vessel is en route to Austnes, Haramsøya, and will pass through the Kalvøysundet, between Kalvøya and Lyngholmen.

Throughout the exercise, there will be light traffic conditions and the crew shouldn’t have to make any severe collision avoidance actions.
The cruise ship “Seabourne” is departing from Ålesund, along with an HSC ferry which sails for the island south of Ålesund.
After rounding Hessa island, there’s a slight increase in traffic. A container feeder, a tug, fishing vessels and a pilot boat is in the area.

Since this is the first simulator exercise, the focus is not on creating stressful situations for the participants but to let them familiarize with the bridge equipment. They should get to know the ECDIS (scaling up/down and browsing), RADAR and ARPA functions, maneuvering levers and switching from autopilot to manual. The binocular function and the communication systems (VHF, UHF and PA) should also be remembered.

The only situation that is planned for this exercise occurs as the vessel approaches the Kalvøysundet. Thick smoke rises from a house by the port on Kalvøya. If the crew doesn’t notice this, the AB should report this to the bridge. Closely after the smoke has begun, a small pleasure craft leaves the island in high speed.
Did the bridge notice it, or did the AB report it? Does the crew report this to any authorities?

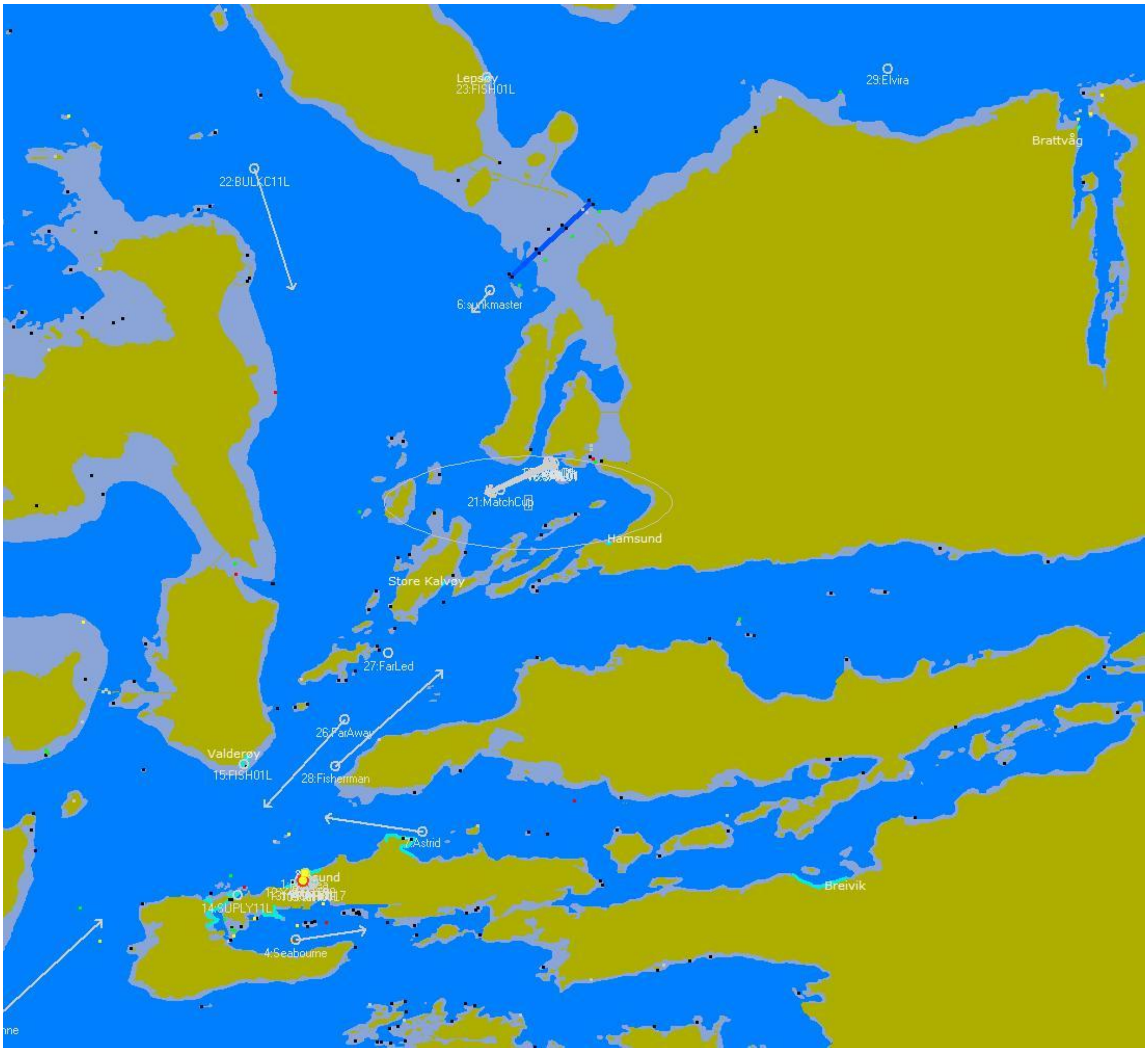
After passing Kalvøysundet, there are a few vessels in the area, but will not impede the passage of the vessel. The exercise can be either be ended by Lepsoyrevet, or in Austnes, depending on whether the whole bridge team has been familiarized.

The role of the instructor is to act as VTS and control the surrounding vessels.

EXERCISE 1 DETAILS

<table>
<tr><td colspan="2">Exercise file: EX 1 Familiarization</td><td colspan="2">Level: Operational
Module: HSC</td></tr>
<tr><td colspan="2">Ship model: FERRY22
Bridge: Herøy</td><td colspan="2">Voyage data:
From: Åsefjorden
To: Austnes, Haramsøya</td></tr>
<tr><td>Area:
Nor_Aalesund_Molde_Lepsoybro</td><td>Crew Herøy:
Captain, deck officer, AB and Engineer
POB: 40</td><td>Date: N/A
Time: N/A
Time in sim: 45 mins</td><td>Day/Night:
Day</td></tr>
<tr><td colspan="2">Initial data Herøy:
Position: N62.27.254 E006.18.097
Course: 270
Speed: 0 kt</td><td colspan="2">Environmental data:
Visibility: Good (Fog 70%)
Wind: 4 kts, west
Current: Chart
Seastate: Wind waves</td></tr>
<tr><td colspan="4">Learning Objectives:
• Simulator familiarization
• Passage planning
• VTS communication
• Application of the International Regulations for Preventing Collisions at Sea</td></tr>
<tr><td colspan="4">Based on “Emneplan hurtigbåt inkludert BRM og ERM, FOR-2011-12-22-1523, § 65”</td></tr>
<tr><td colspan="4">Tasks:
• Simulator familiarization
• Switch from manual maneuvering mode to autopilot
• Use of RADAR
• Use of ECDIS
• Use of communication equipment</td></tr>
<tr><td colspan="4">Instructor notes:
• The instructor must make sure that all participants are familiarized.
• Do they report the smoke from the house?</td></tr>
</table>

EXERCISE 2 – “ÅLESUND MATCH CUP”



Riva starts in Ålesund Port, heading north for Molde

PURPOSE

To make the participants react over how easy it is to be speed blinded and miss a target. Also, the addition of weather and it’s limitation on the safe navigation. The participants will face situation with decision making and will have to evaluate the situation and its details.

STORY

The HSC “Riva” starts in Ålesund harbor and is on its scheduled route to Ålesund – Molde - Nyhavna and will pass through Kalvøysundet. As in the preceding exercise, no planned close quarter situations are planned and the traffic is only to create a livelier environment. The weather is rainy with fog banks and reduced sight. After leaving Ålesund, and before entering Kalvøysundet, “Ålesund VTS” announces a sekurité message, saying that there’s a sailing competition in the area west of Håstein light house. Does the crew make a note of this, mentally or in paper? Do they discuss that it may become a problem for them?

When the vessel has passed through Kalvøysundet, they enter thick fog. In this fog patch there's a large number of sailing vessels, with low radar reflection. There will be one race leader vessel in the area, with AIS. Will the crew reflect on COLREG rule 6 "safe speed"? Will they post the AB as look out?

Onboard is a teacher with a group of kids, on their way back to Molde after a field trip in Ålesund. Just before Lepsøyrevet the AB reports to the bridge that a terrified teacher says she is missing one of her kids. She says that she and the kids joined the vessel at Ålesund. What does the crew do? Do they assume it's a MOB situation? Do they commence a search onboard? Will they make the AB count the passengers onboard and verify the number with the passenger manifest? If they don't think the child is onboard, do they contact the terminal in Ålesund?
See what actions the crew takes.
If crew members are sent down to search the vessel, they should come down to the instructor area and stay for 5-10 minutes. If no crew members are sent down, the AB will report after ~10 minutes that the child is found hiding in the engine room.

During the search period, a passenger onboard explains to the AB that he's a doctor and needs to urgently get to Nyhavna, to get to an appointment. He asks if it's possible for the vessel to go to Nyhavna before Molde. Which is more important, 20 kids or one doctor?
As time goes, after about 10-15 minutes the kid is found and the vessel continues its route.

After the decision is made the exercise can be stopped.

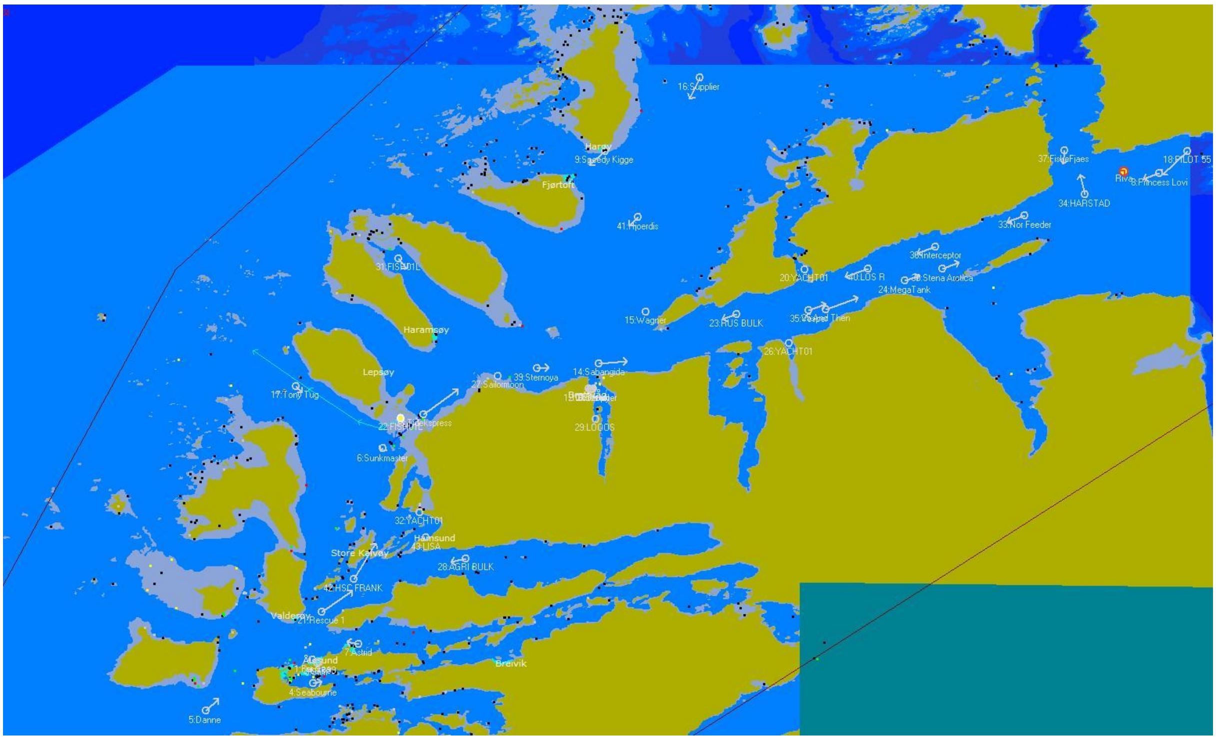
The instructor acts as:

- Ålesund VTS
- Other vessels in the area
- Ålesund passenger terminal representant
- Doctor
- Teacher

EXERCISE 2 – DETAILS

<table>
<tr><td colspan="2">Exercise file: EX2 Aalesund Match Cup</td><td colspan="2">Level: Operational
Module: HSC</td></tr>
<tr><td colspan="2">Ship model: FERRY22
Bridge: Herøy</td><td colspan="2">Voyage data:
From: Ålesund
To: Molde</td></tr>
<tr><td>Area:
Nor_Aalesund_Molde_Lepsoybro</td><td>Crew Herøy:
Captain, deck officer, AB and Engineer
POB: 50</td><td>Date: N/A
Time: N/A
Time in sim: 60min</td><td>Day/Night:
Day</td></tr>
<tr><td colspan="2">Initial data Herøy:
Position: N62.28.462 E006.09.058
Course: 325
Speed: 0 kt</td><td colspan="2">Environmental data:
Visibility: Slightly reduced (50% fog&cloud)
Wind: 8 knots, east
Current: Chart
Seastate: Wind waves (0.6m)</td></tr>
<tr><td colspan="4">Learning Objectives:
• COLREG Rule 6 “Safe speed”
• Situational Awareness
• Communication
• Decision Making
• (MOB / SAR)</td></tr>
<tr><td colspan="4">Based on “Emneplan hurtigbåt inkludert BRM og ERM, FOR-2011-12-22-1523, § 65”</td></tr>
<tr><td colspan="4">Tasks:
• Plan the voyage from Ålesund to Molde through Kalvøysundet
• Sail from Ålesund to Molde through Kalvøysundet</td></tr>
<tr><td colspan="4">Instructor notes:
• Announce Sekurité message on VHF ch. 16 regarding sailing competition
• What actions does the crew make based on the sailing competition?
• Act as the teacher, remember to keep crew members down in instructors area when they’re “searching”
• Which action does the crew make regarding doctor versus children?</td></tr>
</table>

EXERCISE 3 – "GERMANY 3 – NORWAY 0"



Riva is outbound from Molde, heading south for Ålesund

PURPOSE

The participants will be given a stressful situation, to enhance the crisis management, situation awareness, safe navigation and shed a light on safety onboard but also involve the engine room personnel. Also, stress the importance of keeping a log of events during extraordinary situations.

STORY

The HSC "Riva" starts southwest of Molde, bound for Ålesund. Medium traffic conditions in the area and its night time.

The national football team of Norway has during the evening met Germany in a world cup qualifying match and lost 3-0. A slightly intoxicated group of Norwegian supporters from Ålesund has been watching the game at a pub in Molde, and are now onboard the vessel heading home. After some time the AB reports to that the supporters are getting loud and disturbing the peace onboard. Does the bridge crew use the PA system and try to calm down the supporters? Lock the bridge?

A few moments later the supporters start to harass a German backpacker, and threaten him with a knife. The AB in the passengers area starts to panic, and calls the bridge and asks if he should bring the German to safety on the bridge. Whether or not the bridge accepts it, the AB brings the German up to the bridge. On the bridge, he starts to ask an endless number of questions about everything on the bridge and starts to touch panels and levers. What measures does the crew take, and in which order? Do they lock the bridge door? Contact police? Do they continue to Ålesund or divert to a closer port? Do they send a crew member down to resolve the situation? If they decide to contact police, the police should tell them to continue to Ålesund.

If the crew chooses to divert to Brattvåg, or any other port of their choice, they will have engine problems as they approach the port. If the crew continues to Ålesund without stopping, they will have engine problems as they are passing through Lepsøyrevet. The engine larm should sound. The starboard engine has some technical problem, and the crew is left with the port engine. Does the engineer go down from the bridge to the engine room and risk becoming stabbed?

Will the crew keep some sort of log of events? As the vessel arrives at a port, the "police" will be present and request a detailed line of event from the captain.

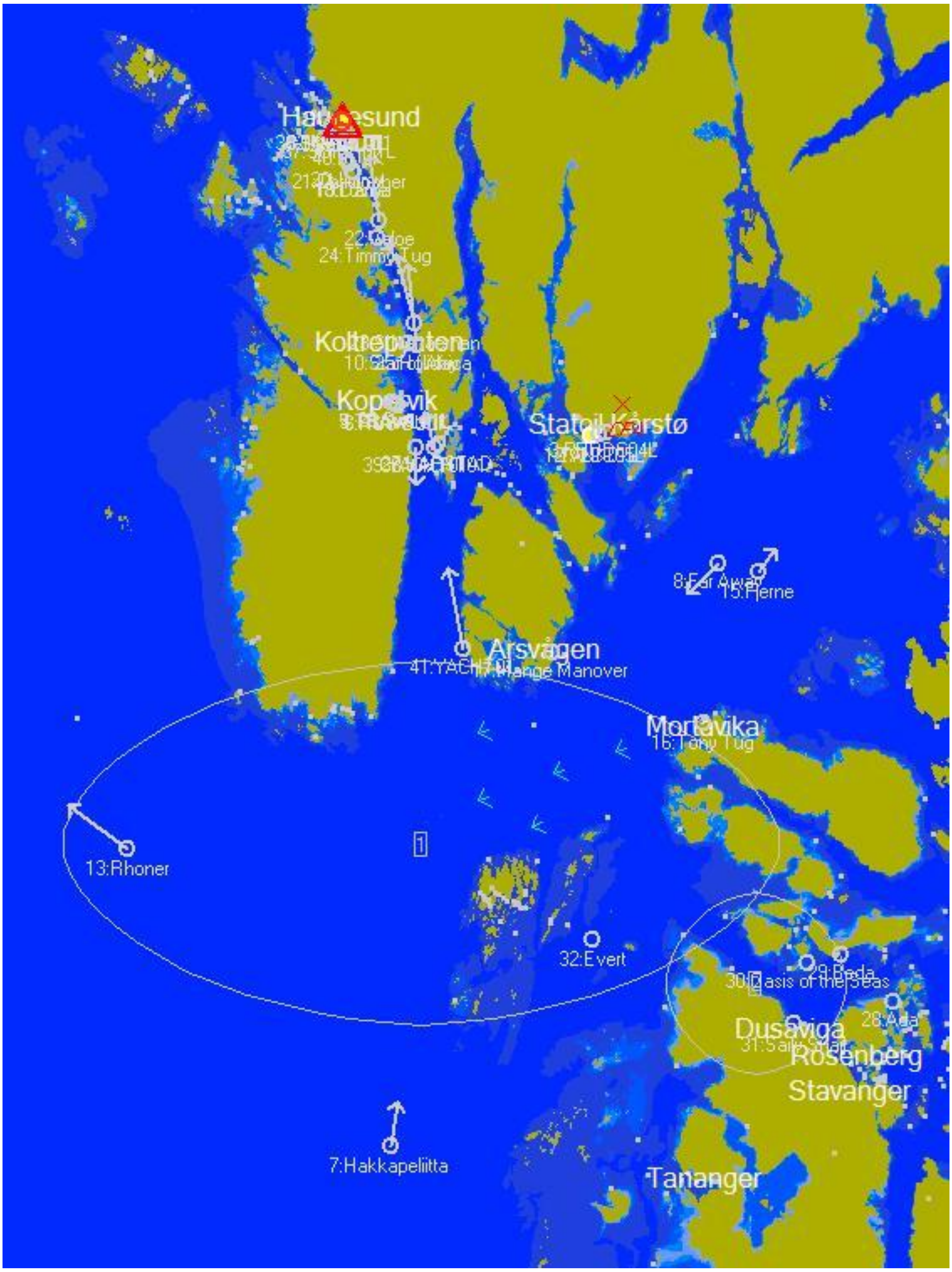
The instructor has the following roles:

- VTS Ålesund
- Police
- Controls other vessels

EXERCISE 3 - DETAILS

<table>
<tr><td colspan="2">Exercise file: EX3 Germany Norway 3-0</td><td colspan="2">Level: Operational
Module: HSC</td></tr>
<tr><td colspan="2">Ship model:
Bridge: Herøy</td><td colspan="2">Voyage data:
From: Molde
To: Ålesund</td></tr>
<tr><td>Area:
Nor_Aalesund_Molde_Lepsoybro</td><td>Crew Herøy:
Captain, deck officer, AB and Engineer
POB: 25</td><td>Date: N/A
Time: N/A
Time in sim:</td><td>Day/Night:
Night</td></tr>
<tr><td colspan="2">Initial data Herøy:
Position: N62.42.893 E007.00.866
Course: 240
Speed: 18 kt</td><td colspan="2">Environmental data:
Visibility: Good visibility
Wind: 8 knots, east
Current: Chart
Seastate: Wind waves (0.6m)</td></tr>
<tr><td colspan="4">Learning Objectives:
• COLREG §6, Safe speed
• BRM/ERM – Problem solutions, maintaining overview etc.
• Low speed maneuvering (if they decide to make a quick stop in Brattvåg)
• Crisis management – Log keeping, reporting, contacting agencies etc.
• Technical specifications
• Risk Analysis</td></tr>
<tr><td colspan="4">Based on “Emneplan hurtigbåt inkludert BRM og ERM, FOR-2011-12-22-1523, § 65”</td></tr>
<tr><td colspan="4">Tasks:
• Planning the route Molde-Ålesund
• After Lepsøyrevet (or when approaching a port) the starboard engine fails</td></tr>
<tr><td colspan="4">Instructor notes:
• Just before Brattvåg simulate a fight in the passenger area
• Make the fight more intense by making the AB report that there is a knife involved
• The backpacker shall be disturbing the crew on the bridge
• Simulate an engine failure which causes maneuvering difficulties</td></tr>
</table>

EXERCISE 4 –"HAUGESUND"



Riva starts in central Haugesund, heading south for Stavanger

PURPOSE

The stress level is highly increased in this exercise, as well as decision making and the direct and indirect consequences of the decisions made. The intention is to increase the situational awareness in all levels, and for the participants to understand tunnel vision.

STORY

In this exercise the area is shifted to Haugesund – Stavanger to create a disturbance for the participants, as they are moved into a new area and will have to adapt to it. The navigators will have to actively search for creative solutions by using their navigational skills. This may cause an increase in tunnel vision, and thereby enhance the risk of missing vital information.

The HSC "Riva" is on its way from Haugesund to Stavanger. As the crew starts to relax, 10-15 minutes into the exercise, the company calls to the bridge with an everyday conversation (For example; asking for the bunker figures, asking the captain to work overtime). As they are speaking over the telephone, an old man contacts the bridge feeling nauseous and dizzy. Does the crew send someone down to look after him? After about 25 minutes into the exercise the man suffers from a heart attack. They have no defibrillator onboard, but they do have an AT – doctor traveling with them. After a few minutes this doctor will show up, and take care of the man.
Should the crew call the Norwegian Rescue, or VTS, they will recommend "Riva" to proceed to Stavanger since they have an ambulance ready there. Unfortunately, the closest helicopter is already out on a SAR mission and the closest standby helicopter is 1 hour away.

- Do they identify the man?
- Do they contact company/ coast radio/ coast guard?
- Further decision?
  - Heli evacuate? (negative response)
  - Any closer port?
  - Proceed to Stavanger?
- Any other measures?
- Distributing resources?

A Finnish container vessel "Hakkapelitta" is inbound and reports to the VTS. Supply vessel "Far Away" is outbound and also reports to the VTS. As "Riva" is entering the archipelago south of the fairway, "Hakkapelitta" runs into "Far Away" and the vessels begin sinking. One of the vessels sends out a VHF-DSC distress message, which the coast radio acknowledges. Since "Riva" is the closest vessel, and the fastest one, she's requested to turn around and rescue the crew members of the sinking vessels.

There's still no helicopter available. Both crews of the distressed vessels are shouting on their portable VHF radios as they are entering life rafts.
If "Riva" decides to turn around, the doctor onboard will start to shout and say that the man with a heart attack is more important and that they have to go to Stavanger. If they continue to Stanvanger, the VTS will continue to request them to turn around to the collision scene.

This will force them into the decision; the heart attack, or the collision?

There are vessels in the vicinity, but they are so slow that "Riva" would be on the scene 1 hour before them. These slow vessels are steaming to the collision scene.

Some passenger onboard has updated their social media, taking video of the injured man and making posts saying there's "CHAOS on the HSC RIVA". This causes the media to call the vessel and asks about the situation, making false accusations and so on.

How will the crew handle this situation? They have to decide which situation that is more important, and deal with the consequences of their decision. A SAR operation requires all resources and focus to be on point. This may cause the tunnel vision to increase, and small pieces of information goes lost.
To enlighten the participants on this matter, a few more details can be added into the exercise, which the instructor can ask for during the debrief session.

The instructor needs to be active during this exercise. There's radio reporting to be done, ships that are supposed to collide and sink and Norwegian Rescue to coordinate the situation.

Roles for the instructor

- Company staff
- The injured passenger
- Controlling other vessels (and their radio traffic)
- VTS
- Norwegian Rescue
- Media

EXERCISE 4 – DETAILS

<table>
<tr><td colspan="2">Exercise file: EX4 Haugesund</td><td colspan="2">Level: Operational
Module: HSC</td></tr>
<tr><td colspan="2">Ship model: FERRY22
Bridge: Herøy</td><td colspan="2">Voyage data:
From: Haugesund
To: Stavanger</td></tr>
<tr><td>Area:

Nor_Tananger_Haugesund</td><td>Crew Herøy: Captain, deck officer, AB and Engineer
POB: 50</td><td>Date: N/A
Time: N/A
Time in sim:</td><td>Day/Night:
Day</td></tr>
<tr><td colspan="2">Initial data Herøy:
Position: N59.24.807 E005.15.910
Course: 140
Speed: 0 kt</td><td colspan="2">Environmental data:
Visibility: Moderate visibility
Wind: 10 knots, east
Current: Chart
Seastate: Wind waves & swell
Rain: 60% showers</td></tr>
<tr><td colspan="4">Learning Objectives:
COLREG Rule 6 “Safe speed”
Crisis management
Media
Focus
Decision making (no right / wrong decision)</td></tr>
<tr><td colspan="4">Based on “Emneplan hurtigbåt inkludert BRM og ERM, FOR-2011-12-22-1523, § 65”</td></tr>
<tr><td colspan="4">Tasks:
Sail from Haugesund to Stavanger
Plan the route in ECDIS
Use the radar in a adequate way
“Bad weather” -navigation</td></tr>
<tr><td colspan="4">Instructor notes:
When the participants are comfortable in the simulator the company calls with an everyday question or message
During this call, a man contact the bridge feeling nauseous
(developing to a heart attack)
An AT doctor is onboard and will assist with the heart attack
“Hakkapeliitta” and “Far Away” are on collision course and “Hakkapeliitta” does not answer when called on VHF.
After the collision between “Hakkapeliitta” and “Far Away” the VTS demands “Riva” to steam towards the sinking vessels.
Life rafts and unknown number of people in the water</td></tr>
</table>