R&D-Report

Emergency management competence development

Concepts for education and exercises within emergency management in the maritime Arctic environment

MARPART2-(MAN), Project Report 3

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MARPART

INTERNATIONAL R&D PARTNERSHIP ON MARITIME SAFETY AND SECURITY IN THE HIGH NORTH

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- World Maritime University (Sweden)
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Introduction

This report is written within the project: *Joint-Task Force Management in High North Emergency Response - Cross-Border Knowledge Acquisition and Training for Increased Joint-Force Effectiveness (M2M).* The purpose of this project is to increase understanding on management of capabilities needed at operational, tactical, and strategic command levels in cross-country high-risk operations in the High North region, and to contribute to cross-border knowledge transfer between institutions responsible for education, training, and exercise programs in this region.

The report focuses mainly on education and training concepts for competence development for the key management personnel who can be involved in the management of large scale events in the Arctic sea regions. The management skills needs are in particular related to the demanding coordinator roles at tactical, operational, and strategic levels needed in large-scale incidents under the unique Arctic conditions. We have collected recommendations for education concepts and training at different management levels, as well as provided examples of tailor-made solutions of the courses related to disasters at sea. We also look into the special challenges of the sea areas in the Arctic and implications for preparedness management education and training.

Data was collected through observing maritime SAR exercises and courses, discussions at the Advisory Board meetings at the MARPART 2 (MAN) project conferences, questionnaires to masters of the shipping companies, interviews and dialogues with SAR responders in different countries. We base our reflections on observation, interviews, analyses of course and training plans, exercise plans and evaluation reports.

Background

This report builds upon former studies within the MARPART "Maritime Preparedness in the High North - Institutional Partnership and Coordination - Cross-institutional Coordination and Task-force Management in Complex, Integrated Operations".

The focus of the earlier reports has been on the maritime activity level and vessel types in the High North up to 2025 (Marpart report 1). The estimates showed a significant increase in maritime activity in challenging areas. This includes an increase in the number of cruise ships in the High Arctic, and an increased number of tank ships transporting dangerous goods from oil and gas fields in the Barents Sea and North-western Russia. The Marpart project has also elaborated on the risks for incidents that can put a heavy strain on the maritime emergency preparedness system (Marpart report 2). Further the Marpart project emphasized the maritime preparedness system in Norway and neighboring countries, with special emphasis on the institutional framework (Marpart report 3), and the capacities of the preparedness system (Marpart report 4). The project has highlighted the organizational design and operational management patterns of the emergency response agencies and how the organizations of the preparedness system facilitate cooperation across borders in severe accidents (Marpart report 5).

The Marpart 2 (M2M) report 1 has focused on high risk incidents and emergency management competence, analyzing the demand for emergency management competence improvement at different levels of coordination. M2M report 2 has mapped the educational programs in the academic and training institutions in the High North and analyzed the gaps between the competence demands and the emergency management education and training institutions in four Arctic countries offering those.

The operational conditions in the Arctic set the demanding prerequisite for how an emergency response is undertaken and which resources are used. The earlier reports in the Marpart-series show that there is a need to include a strong contextual focus in the education and training programs. In this report we focus on large scale emergencies threatening the life and health of many people, risking pollution of vulnerable areas, and significant loss of values.

Large-scale operations require a coordinated response that is challenging because of multiple tasks and decisions that have to be made in a short period of time. Therefore, there is a need for better understanding of the action patterns of different coordination roles within an incident response, a high level of education, and frequent and relevant training and exercise schemes.

Objective

The purpose of this report is to provide recommendations for education and training concepts development within emergency management in the Arctic. We also provide examples of tailor-made solutions to the gaps illuminated in the earlier studies, with a special emphasis on competence needs related to managerial roles performed by key personnel within the emergency response agencies, including vessels in distress.

Recommendations for education and exercise concept development for key management personnel within maritime emergency management at the strategic level

Recommendations for key management personnel courses

According to the conclusions of the Marpart 2 (Man) Report 2, there is a gap in specific education for key personnel involved in SAR operations at strategic levels, like Chief of Police and staff members. Since large-scaled maritime operations include different stakeholders within private and public sector, voluntary organizations, and civilian and military institutions, it is important to include staff management role in training. There is a need for training concepts for **staff management personnel** giving competence as to critical emergency situations.

The knowledge and understanding of the central management functions within emergency management contribute to the increased competence transfer between agencies and SAR actors.

The educational concepts for management and leadership at the strategic level should include reflection on an effective use of experience and sense-making skills development. There are certain principles that should be drilled by current and prospective mission coordinators and strategic managers. These should form part of the leadership development at the strategic level. The synthesis of High Reliability Organization (HRO) principles by Tangen and Vika (2015)—based on research by Weick and Sutcliffe (2007) as well as Weisæth and Kjeserud's (2007) work on functions—is of great use in this regard.

The principles of an HRO can be summarized as follows.

Preoccupation with failure	By analyzing any failure detected as well as keeping in mind possible failures, an HRO is better able to detect and adapt to unforeseen failures, and especially those failures, which herald greater problems down the line
Reluctance to simplify	An HRO is aware that there exists a general tendency to oversimplify in perceiving situations and actively resists this urge so as to have a better understanding of the situation as well as how and why problems can appear
Sensitivity to operations	It is important to an HRO to remain focused on the actual operations of the organization as opposed to the pre-laid plans or intentions. Too rigid a focus on what was supposed to happen leaves little flexibility for actually occurring surprises
Commitment to resilience	An HRO understands that no operation is impervious to failure. This means that it not only plans well but is also prepared for when the plan does not follow
Deference to expertise	The detailed knowledge about how to fix a problem often exists at the same level of the organization where the problem is detected. An HRO therefore gives mandate to operators at a low level to resolve problems instead of institutionalizing a needlessly drawn out hierarchical reporting system

Figure 1 High Reliability Organization (HRO) principles. Source: Weick & Sutcliffe, 2007

In addition to these principles, key management personnel should solve crises through an ideal crisis-organization. Tangen and Vika (2015) assert that it is valuable to combine the Weick and Sutcliffe's (2007) HRO-principles with management functions at different stages and levels in order to describe an organization of a crisis response. Within emergency management, a specific set of managerial tasks related to co-ordination are important within different incident command systems (ICS). Going through the different management functions of all the organizations and team members involved in a crisis response, their resources, procedures and by principles at all levels is important topic at this level. One

such categorization of ten central functions within crisis management is provided Weisæth and Kjeserud's (2007).

Organization of crisis leadership
Reporting
Plans and procedures
Information management
Crisis room – emergency preparedness center
Ability to solve problems
Media handling
Personnel
Backup for all vital resources
Rebuilding and return to normal function

Figure 2 Central functions within crisis management. Source: Weisæth and Kjeserud, 2007

There are many challenges associated with managing maritime operations in the High North. One challenge, however, is rather unique and can limit successful communication. Due to a confluence of several languages in the Arctic region, key management personnel should be able to understand each other through a common language and a common method of designation. While the example is an extraordinary one, NASA astronauts destined for the International Space Station are required to be adequately trained in speaking, reading and writing in Russian as well as their native English (Howell, 2018). This assures mutually intelligible communication in a very demanding environment. Such a practice should also be considered valuable to international cooperation closer to home.

As for other challenges, the knowledge and better understanding of the operational Arctic maritime conditions, especially the limitations of equipment, communication tools, rescue appliances, technology and procedures, are crucial for finding effective response strategies.

In terms of the strategic level, recommended learning outcomes of education and exercising concepts within maritime emergency management should include:

- **Understanding of roles and responsibilities of multiple emergency services involved, their authority, resources, and approved response protocols and procedures at all levels**
- **Competence in leadership at strategic level**
- **Knowledge of international procedures**
- **Better understanding of the operational Arctic maritime conditions**
- **Better knowledge and skills in multi-sectoral and multi-national collaboration approach**
- **Ability to more effective use of liaisons**
- **Competence in role improvisation and role adaptation in crisis management**
- **Competence in various models for decision-making**
- **Competence to assess the large-scale crisis from a variety of perspectives for proactive actions**
- **Language competence in marine English**
- **Competence in procedural standards and organizational awareness at the regional and national level**
- **Increased understanding of the chain of command in large scale incidents in order to ensure the escalation of resources to handle large-scale incidents**

Figure 3 Recommended learning outcomes for development of educational concepts within maritime emergency management at the strategic level

The joint competence development activities within the courses should include:

- Joint educational activities and exercises between different national organizations
- Mutual agreement on procedures: sector responsibility, similarity, proximity, cooperation, and precaution
- Joint analysis of previous experiences
- Sharing own practices with other actors
- Systems and routines for learning from others' experiences
- Joint evaluation and review of the existing regulations and procedures

Figure 4 Joint competence development activities

Recommendations for training and exercising

Training and exercising crisis management is valuable for practitioners across all levels of an organization, not least of all strategic and management personnel (Rosenthal, et al., 2001). Based on the study of Grunnan and Fridheim (2017), there were analyzed twelve crisis exercises between 2008 and 2015. The analysis offers insight into the structure and content of successful exercises, from which it is possible to elaborate on advantageous personnel training themes. While the exercises reviewed by Grunnan and Fridheim are not necessarily SAR- or maritime-related, they are still relevant for the operations at the strategic level, where best practices are generally transferrable between multiple arenas. The inputs aid in describing some general training scheme themes particularly valuable to operational managers and mission coordinators.

In their study of exercises, Grunnan and Fridheim (2017) manage to succinctly describe a set of criteria for successful crisis management exercises at the strategic level. Successful exercises are characterized by:

- clear goal-setting,
- good dialogue between participants,
- a limited number of participants,
- relevant and specific scenarios,
- a precise and well-communicated purpose and format of the exercise.

Less successful exercises fail to define exercise goals and formats in advance. They are overly ambitious in their scale and scope, demanding too much in too little time. Poorly executed exercises often choose scenarios that are less ideal, either because they are too tied to finding something 'realistic' or they use pre-existing scenarios whose main value is their convenience (Grunnan and Fridheim, 2017).

Abiding by the criteria for successful exercises will assist in training strategic and operational management staff for the event of an actual crisis.

Training needs to uphold and sharpen skills, as well as create strong team relationships. A particular strength of training is the ability to inject unpredictability, thereby testing the limits of planning and entering into a more spontaneous zone. In this sense, it is important to remember that training should mirror actual crises, and that as such, the value of training lies not only in reinforcing routines, but also in establishing and internalizing lessons learned across the board. The effectiveness of lessons learned is best if these are considered holistically. Context matters, and all too often, the artificial compartmentalization of training and/or crisis reporting into disparate silos fails to take into account the complexity of real-life crises. Grunnan & Maal (2014) have developed the following holistic framework for lessons learned.

Communication (all phases)

- Inter-agency communication
- Crisis communication to the population
- What was the role of media and social media?

Knowledge (all phases)

- Knowledge or awareness in the population
- Knowledge/awareness/learning among the operational personnel

Coordination and decision-making (all phases)

- How was the coordination and decision-making in terms of roles and responsibilities of different actors?
- Management

Risk assessment (all phases)

- How to be prepared for a crisis with cascading effects?

- How did the natural disaster affect critical infrastructure?
- Were risk assessments conducted during the crisis?

Logistics (all phases)

- Were there any challenges related to logistics?

Prevention (pre-crisis)

- Specific training of operational personnel?
- Education of operational personnel/the public?

Interoperability (during a crisis)

- How was the interoperability between the different actors?
- Management of volunteers

Recovery (post-crisis)

- What was done in the recovery phase and by whom?
- Debrief

Figure 5 Framework for lessons learned during exercises. Source: Grunnan & Maal, 2014

The framework is recursive. It takes into account also the education and training of operators. This is an important feedback effect, which recalibrates successive training schemes. Adaptation of the educational and exercising concepts is a valuable quality.

In training, there are few avenues of specialization at the strategic level. Two points should, however, be touched upon.

Firstly, training should incorporate some cross-institutional or even international elements at least some of the time. Since the strategic level in a real crisis may have to rely on external institutions or foreign counterparts, having established contact and routines with these is a positive quality. This relates back to Grunnan and Fridheim's (2017) study where they highlight that selecting relevant participants is very important in order to achieve intended goals.

In addition, there is some value to training strategic coordinators and managers in scenarios that are particular to and realistic in the Arctic maritime domain. The strategic level must be aware of and well versed in the particular challenges of maritime operations in the High

North. The operators at the operational level certainly have expertise. For example, Naval Special Operations Forces train specifically in maritime operations during their entrance course. Among other skills learned, operatives are trained in navigation with maps and compasses, kayaking, diving, and handling and navigating a dinghy. Operators designated to become special boat operators are further trained in navigation, and the technical use of advanced vessels and engines. Special boat operators have in effect earned the same kind of specialized role as pilots (Melien, 2012). Thus, it is clear that this particular context, which is in itself a unique domain for operations, must also be understood at the top level in order to fully utilize all available resources.

As for the recommendations for training the increased joint-force effectiveness, it is necessary to exercise response to situations related to the new types of accidents not occurring before, as well as situations with a large number of victims. To respond effectively in such situations, managers of all emergency organizations and at all levels are required to be highly qualified in interacting with various actors. The crucial competence for the leading personnel is to effectively coordinate their subordinates' activities and properly interact with the representatives of other departments and agencies. In the maritime context in the Arctic the main challenge may be an unfolding emergency situation. Furthermore, in the situations under uncertainty, there can be seen stress reactions or a psychological effect of being afraid to deviate from the prescribed rules of action, even if the deviation can prevent the occurrence of more serious consequences. Exercises with high complexity may develop better skills for improvisation. Large-scale exercises should be incorporated into the training for the staff at the strategical level and be close to real conditions to increase capacities in coordination.

It is also of great importance to train skills to communicate emergency cases to population and warnings. Media communication should be included in trainings and courses and become a part of the exercises.

Best practice example: Maritime Resource Management courses at the Admiral Makarov State University of Maritime and Inland Shipping

The training in maritime operations is represented at the high level in Russia. As an example, the training of ISM Code designated persons and specialists responsible for navigation safety, harbor masters, heads of seaport administrations, assessors of maritime educational institutions and seaport certification departments is conducted at the Admiral Makarov State University of Maritime and Inland Shipping (SUMIS).

The target group is the following:

- company security officers (CSO);
- port security officers (PSO);
- professional development of personnel with designated security duties at transport infrastructure entity\ facility\ vehicle;
- ISM Code for shipping companies management and staff (SMS experts).

The courses for the management and seaport administrations staff consist of:

- harbor masters professional development course (the first part of the training is conducted in St. Petersburg Training Centre, and second part takes place in Moscow in premises of Moscow State Academy of Water Transport);
- professional development for executives and deputy executives responsible for navigation safety.

Programme “Maritime Resource Management (MRM)” is taking into consideration that 60% of world fleet crews are multinational. This is a human factors training programme aimed at the maritime industry. The MRM training program was launched in 1993, at that time under the name Bridge Resource Management - and specializes in preventing accidents at sea caused by human error.

In MRM training it is assumed that there is a strong correlation between the attitudes and behaviors of the seafarers on board a ship and the cultures that these seafarers belong to. The most relevant cultures in this respect being the professional, national, and organizational cultures. Important target groups for MRM training are therefore, besides ships’ officers and crew, all people in shore organizations who have an influence on safety at sea and the work on board a ship.

According to the MRM training concept, training should be carried out by bringing disciplines and ranks together in the same training class, providing them with the same course contents, terminology, and training objectives. The aim is to tear down barriers between people, departments, ship and shore, open up for efficient communication, and establish a genuine safety culture within the whole organization.

Best practice example: Crisis Staff Management course at Nord University

The course is tailor-made for the personnel with leadership responsibility for crisis management in companies and organizations. The course focuses on areas of responsibility related to crises with a particular focus on strategic management, resource management, and coordination at the strategic level of the emergency response system. The course has a focus on the topics such as organization of the personnel and roles in crisis management team, interaction with operational and tactical levels, and co-operation across organizational boundaries. Systems for increased situational awareness, operational control and management control are illuminated. Allocation of crisis management tasks and functions, and linking up to the political strategic management in the various phases of a crisis is discussed in particular. Challenges related to management of several crises or safeguarding activities, including measures to return to normal operations are highlighted.

The participants discuss how different types of crises and actions require an adaptation in staff organization and functioning to protect personnel, environment, values, organizations, and socially critical infrastructure in an emergency situation. Overall leadership in complex crises such as cyber-attacks and hybrid threats is discussed.

Course themes:

- Risk and vulnerability assessments
- Organization of emergency staff - roles and functions
- Team management
- Planning and procedures in own organization
- Strategic-level decision support tools
- Communication between levels and situational awareness
- Resource coordination and logistics
- Quality and safety management systems and HSE

- Maintaining other activities during crises and normalization processes
- Interaction under hybrid threat scenarios and from a total defense perspective

Learning outcomes:

Knowledge

Students:

- Will have advanced knowledge of roles in crisis staff management
- Will have in-depth knowledge of the strategic levels of the emergency response system
- Can assess and address the managerial consequences of changes in risk and threat picture
- Have a special understanding of cyber and hybrid threats
- Will have knowledge of total defense principles and civil-military operation concepts

Skills

Students:

- Can analyze how crisis teams are organized, and assess which patterns of action and procedures are most relevant
- Will have insight into different types of decision support tools and communication systems at the strategic level
- Can coordinate interaction with other agencies regionally, nationally, and internationally
- Can analyze and reflect critically on own and others' efforts in crisis management processes

General competence

Students:

- Can apply knowledge of collaboration with emergency responders at different levels
- Can apply knowledge and skills for building and working overall in emergency response unit

- Can contribute to innovation of the emergency response system and the overall management of the emergency preparedness

The content and examples in the course are adapted to the industry sector activity. In relation to the maritime emergency response, examples are included from marine and maritime industries, industrial companies, oil and gas, the municipal sector, etc.

Recommendations for education and exercise concept development for key management personnel within maritime emergency management at the operational level

Key management personnel at this level include management positions in all organizations within SAR response. The need for collaboration between various actors in a large-scale maritime emergency response calls for development of courses and exercises in a way to foster understanding of the roles of different actors and agencies. For maritime emergency management it is especially valuable to gain an experience in coordinating SAR operations involving many actors, because the professional education may have been developed within own professional institutions. Courses and programs then should include exercising of interaction and collaboration with all actors as well as with neighboring countries, and in particular the response to major incidents, like mass rescue operations. The maritime rescue coordination center and subcenter specialists learn both from the practice of incident coordination and exercises. When it comes to mass rescue operations, exercises are seldom because of the need for resources and challenging because of the very complex didactical planning. There is a need for series of the tabletop, simulation and large-scale exercises for competence development efforts in the challenging Arctic waters.

As for the recommended themes, the courses and exercises at the operational level should include most updated formal components that manage the coordination systems, including regulations and procedures, roles and functions of the interacting organizations.
For maritime SAR operations, the international IAMSAR Manual serves as a platform as to tasks and roles. International conventions and standards for maritime and aeronautical SAR services are set by the International Maritime Organization (IMO) and International Civil Aviation Organization (ICAO). The International Convention on Maritime Search and Rescue (IMO, Hamburg Convention) and the Convention on International Civil Aviation with its Annex 12 (ICAO, Chicago Convention) provide the rules and regulations for SAR services. The International Aeronautical and Maritime Search and Rescue Manual (IAMSAR Manual), published by the IMO and the ICAO contains procedures for the organization of maritime and aeronautical SAR, mission coordination, operations of search and rescue units (SRUs),

and provision of SAR-related training. The Manual is not binding but provides an internationally accepted foundation for the appropriate provision of maritime and aeronautical SAR services.

It is important to build the competence in using the operative coordination procedures and also to obtain knowledge through experience and informal interaction. Informal contacts help actors to solve practical challenges and understand the patterns of interaction in an emergency.

At the operational level, recommended learning outcomes of education and exercising concepts within maritime emergency management should include:

- **Better knowledge and understanding of roles and responsibilities in mission coordination**
- **Competence in coordination both formal and informal mechanisms**
- **Better knowledge of communication and information sharing mechanisms for operational leaders of fire, health, and rescue services, and establishing "sharing and aligning" working communication**
- **Enhanced ability to communicate and coordinate effectively, quick understanding whom to contact - ship owner, operator, etc.**
- **Better skills in communication in English with neighbouring countries**
- **Better knowledge on coordination mechanisms to face challenges of the large-scale operation with many different actors involved**
- **A more holistic approach and flexibility to bring together diverse elements int harmonious relationship in support of common goal**

- **Heightened competence with regard to constructing, sharing and understanding common situational awareness**
- **Knowledge on coordination mechanisms to face challenges of the dynamic interplay for improvisation**
- **Ability to be creative and test new possible and impossible scenarios, as well as between countries, etc**
- **Better understanding and testing approaches of the Arctic conditions**

Figure 6 Recommended learning outcomes for development of educational concepts within maritime emergency management at the operational level

Effective interaction in crisis management should be the focus of courses for key management personnel in roles as operational managers and mission coordinators. Courses should develop the ability to think on one's feet, encourage knowledgeability and cooperation, facilitate good communications skills, and foster reflection. Tangen and Vika (2015) arrive at the following principles of effective crisis management that may be of use in the education and training development.

1. Preparations a. Well known plans and procedures that still allow for improvisation if necessary. b. A dedicated situation center where mostly first-hand observation is fed into an easy-to-understand hub of situational awareness containing all relevant resources. c. Well-thought through contingencies if things do not go according to the plan.
2. Handling a. A crisis management team selected on the basis of competence and authority, with clear roles and decentralized decision-making.

b. A crisis management team that is cooperative in nature and is focused on what it is currently doing, instead of what it has planned. c. A situational awareness that enables the crisis management team to give accurate and concise explanations of the situation to the media.
3. Afterwork a. An ability to return to normal operations and learn from mistakes as well as the crisis itself.

Figure 7 Principles of effective crisis management. Source: Tangen and Vika (2015)

The SAR mission coordinators in the Arctic are well-exercised for small-scale incidents through the daily operations. However, training for competences in case of mass rescue incidents at sea may be in need. The joint actions providing SAR and OSR require vast experience, and the joint activities clearly face obstacles. The annual joint full-scale and table-top exercises to practice these tasks are of great importance. However, mostly only the strategic level leaders usually participate in such international exercises unfortunately. It is recommended to organize a joint Search and Rescue co-ordination training involving SAR and OSR coordinators at the operational level directly at the rescue coordination centers in the Arctic. Especially co-ordination training involving SAR and OSR co-ordinators at the operational level at the MRCCs in Russia or JRCCs in Norway could be a remarkable experience (Gerasun, 2020).

Operational leaders in fire brigades, health and rescue services also need the training on overall management and interaction patterns. Tailor-made exercises for large-scale maritime operational management and competences in communicating in English are highlighted. Ship owner crisis staff may require to enhance competences on reporting, and interaction communication with emergency actors, and better knowledge of operational Arctic conditions.

Best practice example: The Staff and Leadership Development Programme at the Norwegian Police University College

(*in Norwegian*: Stabs- og lederutviklingsprogrammet)

The Staff and Leadership Development Programme (hereinafter referred to as "the programme") has been developed and implemented by the Norwegian Police University College (*in Norwegian*: Politihøgskolen, PHS) together with the National Police Directorate (*in Norwegian*: Politidirektoratet, POD). The official website of PHS states that the participation in the programme is obligatory for all police districts and their crisis management personnel. Furthermore, POD has decided to continue to run the programme until 2023. The **objective** of the programme is to strengthen the quality of the Police's response to extraordinary incidents and crises (PHS, 2018) of natural or man-made origin, when the organization shifts from line management hierarchy to **Incident Management (IM) Staff**. Within the individual police districts, IM Staff and the Chief of Staff represent the operational level (MARPART-2 MAN, 2020). During crisis situations, the main role of the IM Staff is to assist the Chief of Police's management through decision support, implementation of measures and their follow-up. When IM Staff is established, there are eight so-called P-functions in addition to the Chief of Staff. Police Emergency System Part I (PBS Part I) describes the functions as follows (POD, 2020):

P1 – personnel

P2 – intelligence and investigation

P3 – operation

P4 – logistics

P5 – communication

P6 – legal

P7 – evacuees and relatives

P8 – task-dependent function

The Chief of Staff represents the top manager of the police district at the operational level in case the IM Staff has been established. His/her tasks include *inter alia* leading the IM Staff in compliance with PBS Part I, provision of professional advice to the Operation

Manager and Chief of Police in terms of operational issues, planning and managing preventive work within social security and emergency preparedness.

The programme's description is based on the publicly accessible evaluation report prepared by the Norwegian Police University College (Hoel & Barland & Lillevik, 2019). The evaluation uses data gathered by the authors' participation/observation in several IM Staff exercises, and data from interviews with informants and from surveys. To illustrate the importance of the Staff and Leadership Development Programme for the professional confidence, the evaluation report's authors decided to use a quote of the Chief of Staff "I would not have been without it" (*in Norwegian*: "ville ikke vært det foruten") in the title as the statement also reflects the experience of the vast majority of the informants.

In January 2014, PHS decided to introduce a program for staff and leadership development and its revised plan was adopted in 2016. The program aims at improving the police districts' crisis management capability via strengthening basic knowledge and skills, as well as developing the staff as a team, with focus on role understanding, communication, cooperation, and efficient processes. Additionally, the emphasis is given to investigation and intelligence to reflect the increased focus on their significance as a base for strategic decisions. The evaluation report represents an essential source for further amelioration of the program, however, this part of M2M Report 3 mainly focuses on explaining the content and goals of the program.

The **target group** of the program comprises:

- Chief of Police
- Chief of Staff
- Deputies of Chief of Police and Chief of Staff
- P-functions (P1 - P8)
- Operation Leaders
- Assignment Managers (*in Norwegian*: oppdragsledere)
- Chief of Staff's Secretariat (referee)
- Permanent members of the Chief of Police's strategic groups
- Rescue management and their deputies
- Task Leaders

Learning outcomes after completing the programme are listed as follows:

1/ General competence

- Expanded role understanding of IM Staff work in general and the IM Staff functions in particular
- Strengthened preparedness to resolve unwanted or extraordinary incidents

2/ Knowledge

- National emergency preparedness system
- Key concepts as well as important principles for IM Staff work
- Organization, responsibilities, and tasks of IM Staff
- Assistance to IM Staff
- Teamwork
- Processes and methods in IM Staff work
- Interaction with key collaborating agencies and assistance resources
- Importance and use of planning activities
- Situation reporting and decision-making
- Experiential knowledge and learning

3/ Skills

- Use of relevant tools and techniques
- Quality operational planning
- Preparation of situation reports (different levels and channels)
- Communication and cooperation with the rescue management/advisors/liaisons
- Organization and leadership of the work within its own function
- Implementation and application of known procedures for communication flow, decision-making processes, and crisis communication

The programme runs over two years with planned learning activities. The programme begins with an exercise – either a rescue exercise in the police district or a police exercise at JKØ (Justice Sector Course and Training Center, *in Norwegian*: Justissektorens kurs- og øvingssenter) in Stavern. The Chief of Staff is in a leading position of the learning processes in his/her own police district between the exercises. The responsibility of the Chief of Staff

to ensure that IM Staff employees have the necessary competence and training is anchored in PBS Part I. An online training on IM Staff and crisis management developed by PHS is also included in the programme and takes form of short lectures and assignments for participants. Furthermore, the programme employs GAP analysis to map the strengths and challenges of the individual IM Staff in crisis management. Function leaders have responsibility for competence building in the police district in addition to the Chief of Staff. It is highlighted that the programme takes place mainly in the individual police districts, except for a 2-day gathering at JKØ, emphasizing the responsibility of the police districts for their own learning and development. The learning activities of the programme to improve the competence of IM Staff in crisis management take form of e-learning, reflection tasks, and experiential learning through exercises and evaluation of exercises.

Recommendations for education and exercise concept development for key management personnel within maritime emergency management at the tactical level

The Marpart 2 (Man) report has identified competence demands at the tactical level both from the professional emergency response perspective, including all emergency units operating in the Arctic (rescue helicopters, coast guard, coastal administration, navy, rescue company, SAR vessel, patrol aircraft), as well as at the commercial players perspective, including all types of vessels operating in Arctic waters (fishing, oil and gas, transport, leisure, cruises, research).

Recommendations for the tactical level, professional emergency response perspective

Courses and training in terms of on-scene coordination should have a baseline in **institutional understanding of the SAR system in the Arctic** countries (presented in Marpart Report 3 and 5) and the IMO requirements - the international guidelines and standards set in the International Aeronautical and Maritime SAR Manual (**IAMSAR Manual**). The tactical level coordination during operations is delegated to an OSC, who is normally the person in charge of the first SAR facility to arrive at the scene. If the coast guard is present, they will normally serve as the on-scene coordinator (JRCC NN, 2017). The OSC operates at a tactical level coordinating search and rescue units (SRU), aircrafts, and other assisting units or vessels arriving to the incident site.

The courses at this perspective should have an ambition to train management skills that may be necessary for coordination a complex organization during combined maritime events.

The SAREX exercise brought the discussion of the need for training of the OSC role:
"The understanding of the OSC and ACO roles are to some extent unclear. More detailed standard operating procedures such as practiced by the Norwegian coast guard should be developed and trained on. The training activities should be done where both theoretical studies and the practice training program are better harmonized. Procedures

on how to act as an OSC and ACO, as collecting information, reporting status, deciding operations, using decision support tools, etc. are elements that should be part of the materials (IAMSAR). In addition, development of easy procedures to be distributed to non-SAR professionals such as to fishing vessels should be considered. The Arctic SAR Agreement stipulates that the parties "shall enhance cooperation among themselves in matters relevant to this Agreement" (Arctic SAR Agreement, Article 9). This includes information exchange "to improve the effectiveness of search and rescue operations" (ibid) and the promotion of mutual SAR cooperation (ibid). The parties are encouraged to conduct "joint search and rescue exercises and training" (ibid) and to disseminate lessons learned. Mass rescue operations should have a special focus in training and full-scale exercises" (SARINOR WP7 Report).

Figure 8 An example from the SAREX exercise

One of the necessary learning outcomes refers to the **assigning a new role or assigning several roles within a team**. As it is discovered in the Sarinor WP7, the role of the OSC demands several persons to fulfill all the obliged tasks especially in combined maritime events. Therefore, team organizing and team management competences are essential for this course. As the circumstances and resources may be changing rapidly, there is a need to focus on the organizing flexibility principles and functions rather than on the fixed task lists and plans.

The on-scene coordination tasks may be challenging under the time pressure and situational uncertainties, therefore the skills should be exercised in TTX or simulation laboratories. **Exercising the team processes together with understanding of the roles within the team** may contribute to better competences of rearranging roles and procedures among the coordinators.

The following examples of the themes from the OSC courses show the mainstream themes:

Example: the on-scene coordinator course of the Finnish Border and Coast Guard Academy

The OSC course of the Finnish Border and Coast Guard Academy held 22 January 2018 in Turku included themes such as:

- SAR-system theory
- Role of OSC theory
- US SAR-System / USCG-Morse
- Search Areas and Patterns / terminology and meaning
- Search Areas and Patterns – table-top exercises
- Case study: m/v Estonia disaster
- GMDSS-system
- Distress communication exercise
- Familiarization with simulator systems

Figure 9 An example from OSC course of the Finnish Border and Coast Guard Academy

Communication skills are important and include different aspects that should be focused on. **The themes in communication** should include the communication skills with different actors involved and using different communication tools, knowledge and skills of communication under stress, knowledge and skills of communication with other actors in a combined maritime event, knowledge of information flow structure and hierarchy of command chain and instructions.

The course and exercises should include reflections on how the OSC should act in case when communication technology is not working in the High Arctic; what the solutions are in reality. On-site improvisation is also crucial when it comes to communication when language obstacles may occur. Knowledge about systems of other Arctic countries and joint collaboration exercises should be part of the course. Various realistic scenarios should be introduced and practiced.

Example: Polar Code course at Nord University and Bodø Maritime

The Polar Code course provides participants with the knowledge and skills in execution of safe operations with vessels in polar waters, with a particular focus on ice and ice navigation. The course is aimed at maritime actors and senior personnel responsible for vessel operations, safety, and preparedness in polar regions. The course is specifically aimed at positions with formal certificate requirements in accordance with the Polar Code - the international regulations for safety on ships operating in polar waters.

The course emphasizes the important educational aspects:

- Polar Code, regulations, standards and documentation on board
- Vessel characteristics and operation of vessels in low temperature waters
- Vessel operation / maneuvering in ice
- Route planning
- Ice breaker operations
- Ice characteristics, detection, dynamics
- Reports and reporting
- Arctic meteorology and ice maps/images
- Search and rescue in polar waters
- Environmental protection, health and security
- Simulator exercises on advanced vessels and emergency management simulators

Source: https://www.nord.no/no/om-oss/fakulteter-og-avdelinger/handelshogskolen/Documents/Polarkodekurs_2019_A5.pdf

Figure 10 An example of Polar Code course at Nord University and Bodø Maritime

Example: Courses at the Naval Station in Fredrikshavn

The Naval Station in Fredrikshavn owned by the Danish Joint Rescue Coordination Centre personnel run OSC and ACO courses. The courses emphasize on the common aspects as follows:

- Rendering assistance (SAR mission)

- Overview and basis of a SAR (Search and Rescue) Service;
- Teamwork
- Problems for an on-scene coordinator arising from complex SAR missions and tools to cope with such challenges
- Coordinating operations of all SAR facilities on scene
- Receiving the search action or rescue plan from the SAR mission
- Coordinating and modifying it
- Coordinating on-scene communications
- Ensuring that operations are conducted safely
- Keeping the SAR Mission Coordinator advised with periodic situation reports e.g. regarding rescue plan modification, number and names of survivors, names and designations of facilities with survivors aboard, which survivor is in each facility, etc.
- Simulated exercises include realistic virtual scenarios covering the areas of:
    - Man overboard
    - Coordinated searching for missing ship and persons
    - Searching under adverse weather conditions
    - Coordinated searching by ship and helicopter
    - Searching for survivors during night time

Figure 11 Example: Courses at the Naval Station in Fredrikshavn

At the same time the coordination in complex environment demands advanced knowledge of **decision-making** theory and competences to be able to apply it in a difficult situation. This includes problem definition and diagnosis, analysis of the rational options, ongoing risk assessments and, importantly, understanding the risk mitigation measures in case when "everything goes wrong".

Ability to maintain overall situational awareness, as well as improvisation capability is necessary to be trained in this course. The gap, which is identified in the Report 2, is constructing situational understanding. The course may contribute to the gap by introducing the socio-psychological perspective on leadership, including theories in **shared mental models and situational awareness,** which are particularly critical in case of mass rescue incidents.

We recommend to include a learning objective that may allow an OSC to act in an additional role as a **coordinator at distress vessel.** This function of the OSC role may be seen as optional just like it is done in case of a governmental oil spill response operation according to the Norwegian ELS. The coordinator may be sent to the distress vessel. This is an additional role; the coordinator who is initially trained for an OSC role serves as a liaison between the OSC and the vessel owner staff management at the strategic level.

To sum up, at the tactical level, the recommended learning outcomes of education and exercising concepts within maritime emergency management should include:

-	**Better knowledge of communication and coordination both horizontally and vertically**
-	**Better knowledge about resources and capabilities between agencies**
-	**Ability for the role changing and stepping in as substitutes**
-	**Competence in dynamic staff coordination**
-	**Competence in using common communications methods, and effective use of liaisons**
-	**Knowledge of coordination in multinational operations**
-	**Better competence to arrange testing and exercises of procedures and learn from training and exercises, also to prepare proper rescue and firefighting training for unskilled passengers**
-	**Competences to take care of personnel at distress vessel management in case of remote operations**
-	**Knowledge of alarming procedures**
-	**Understanding of principles and standards of planning for communication with passengers**

-	**Understanding of communication tools of all involved actors**
-	**Decision-making under uncertainty: exercising various models for decision-making and managing under unclear and complex situation**
-	**Knowledge and skills of managing chaos and "limbo phase", improvisation management**

Figure 12 Recommended learning outcomes for development of educational concepts within maritime emergency management at the tactical level, professional emergency response perspective

Recommendations for the tactic level, vessels management perspective

Masters are key persons involved in the emergency operations at the tactical (on-scene) level. The masters are responsible for rescue and evacuation measures on board the vessel in distress, maintenance of the record of the events and decisions taken to reach situational awareness, alerting and informing relevant authorities about the emergency situation and requesting assistance. The overall coordination is handled only by the master usually while the situation is under control. The masters are also responsible that training and exercises are carried out regularly for enhancing the crew members' skills and competence relevant to cope with large-scale emergency situations. All crew members should understand the sequence of actions in case of fire or other emergency and their duties in the response operation.

The analysis in the Marpart 2(Man) Report 2 shows the gaps in the training programs to prepare the master and crews for taking the role of Samaritan vessel and interacting with other emergency services in case of large-scale accidents. The masters of the vessels, which can be appointed as OSC, are usually unexperienced in coordination of large-scale SAR operations.

It is recommended to have a special attention at communication following the chain «vessel — rescue coordination center — air traffic authorities — aircraft/helicopter» and backwards, as well as liaison patterns between aircrafts and sea vessels, which use different frequency bands and cannot communicate directly. When the rescue operation takes place in the High North, the quality of radio signal suffers frequently, which adds further complications to the communication between the emergency services and vessels

appointed as OSC. Masters of the shipping companies specifically point out on the importance of real actions training in operational circumstances, close to the reality as much as possible.

Hypothermia is a key factor of many deaths in the Arctic maritime incidents. The response time and hypothermia treatment competences are crucial in the Arctic.

The major danger for an efficient rescue operation is associated also with ice condition. The life rafts and rescue boats are most effective in iceless waters. They may be not effective if there is drifting ice or ice cover as rubber life rafts are fragile in ice conditions and cannot be maneuvered easily in extreme weather conditions being surrounded by ice blocks and fragments.

As for the special forces, most emergency agencies have their own specialized courses for the rescuers and paramedics involved and incident commanders at sea (oil response, rescue helicopters, and special police / military forces). Many competences are developed through on-the-job training. Since large-scale SAR operations at sea appear seldom, there is a need for both education and relevant training and exercises for this important target group.

The IMO report (MSC, 2006) identified 3 major weaknesses regarding maritime education and training:

- STCW (Standard of Training, Certification and Watchkeeping for Seafarers) is the minimum requirement and not the desirable criteria;
- there are failures due to automation on board;
- there is a compelling evidence that the deficiencies in English language competences are a point of concern.

The STCW was revised in 2010 and 2017 but these important issues still need to be resolved.

Partnership of training institutions and industry partners may well solve these shortcomings. Such cooperation can provide sharing of knowledge and following best practices from each other.

Management rules and regulations generally stem from two sources - either national or international or company-based policies, procedures, and systems. This generates a plenty of information for seafarers to absorb, understand, and follow. It is impossible to write a

set of procedures that covers every potential scenario. It is important to learn to rely on the expertise, experience, mitigation, and decision-making of the front line managers – marine officers. In addition, one cannot expect every shipping document to be perfect. Each rescue operation has unique features and every plan will need to be adapted to the situation. So, competences for flexibility should be provided to the masters in order to assess risks and implement changes if required.

Regular drills and exercises (more frequent than appointed by SOLAS – 1 per month) should be a priority. Malta Flag, for instance, has demands for one training every 14 days. Even with strict regulations for training and qualification of seafarers, the crew gets panicked and forgets the management pattern during such emergency. The crew should be trained well on board by regular drills. They should be well informed about the use of life saving equipment on board, firefighting and communication equipment, the use of the equipment and their operating procedures. If a new person joins the vessel, he/she should be well familiarized with vessels, emergency procedures, escape routes, location of life saving equipment, etc. before the vessel leaves the port. Any emergency requires quick and prompt response from the crew and this can be only achieved by regular training and practice of such emergencies. The issues within maritime emergency management education for the masters may include managing the safety of the persons being rescued and the safety of the crew.

All ships are required to have plans and procedures in place to recover casualties from the sea (SOLAS Regulation III\17-1). The critical factor when dealing with large-scale rescue at sea will be the number of people involved. The requirement for plan and procedures was not designed to address the large-scale rescue. Such additional plans should provide procedures and educate and train Masters and crew for:

- Rescuing large number of people from the sea or from other vessel
- Accommodating and managing rescued people on board
- Managing the security of the ship with rescued persons on board

Safety management within large-scale rescue should prevent access to sensitive areas of the ship, search and rescue and confiscate offensive items or potential weapons, smoking materials, and even mobile telephones on tankers, establish controlled areas in order to facilitate supervision and monitoring, limit the availability of information to rescued

persons regarding the number of crew, naval vessels. It may also be necessary to control the taking and sharing of the pictures of the rescue operation.

The master retains the absolute authority in this regard at all times. The priority on board will remain the safety of ship and the crew. That is why the masters should have special training.

Management of rescued persons: for example – initial actions following embarkation such as recording the total number, age, gender and required medical support; providing water, food, sanitation and medical attention; establishing good communication with the people embarked (IAMSAR Vol III, Section 2- Debriefing of survivors).

Knowledge of human factors is of great importance. Maritime training traditionally focuses on technical skills and competence. However non-technical skills and human factors, safe behavior and performance are important themes recommended for the courses and training.

Efficient emergency response can be achieved by continuous exercising and by practical training on board the vessel. However, in spite of adequate training, people get panic attacks and eventually do not follow relevant action patterns in an emergency situation.

Even if requested by a MRCC or other shore officials, the master has no authority, obligation or responsibility for listening to, acting upon or communicating information concerning the legal status of rescued persons or applications for asylum. The master has no responsibility for determining the status of those rescued. The sole responsibility of the master and the crew is to maintain the safety and, as far as practicable, ensure the human treatment of rescued people and cooperate in their transfer to a safety place.

Seafarers may experience stress or psychological effects following the rescue operation. The company should assure appropriate education: psychological training and intercultural competence development/communication, support and monitoring of the crew members. Multi-cultural crews may be cheaper but they are posing a greater challenge to successful interaction in an emergency response. Quality of the work on board the vessel and even safety and security depends on the whole team, not just an individual (master).

Seafarers should be able to manage the factors of negative impact to avoid professional destruction (Professional destruction are changes in the existing structure of the individual

negatively effecting the productivity of labor and interaction with other participants in the process, E.F.Zeer, 2005).

To sum up, at the tactical level the recommended learning outcomes of education and exercising concepts within maritime emergency management should include:

- **Better knowledge and skills in communication and coordination on board vessels, with the emergency organizations and between them**
- **Understanding of the response protocols integration of different emergency actors**
- **Competence in more efficient use of liaisons**
- **Knowledge of the on-scene coordination and SAR patterns in the darkness and cold environments, hypothermia treatment**
- **Competence to arrange testing and exercises of procedures and learn from training and exercises, also to prepare proper rescue and firefighting training for unskilled passengers**
- **Competences and skills in providing detailed reporting and analyses of emergencies**
- **Knowledge of alarming procedures concerning sufficient content of communication**
- **Competences and skills in providing information and communication with media and external actors in large-scale emergencies**
- **Understanding decision-making processes under uncertainty: how to act under unclear and complex situation and managing chaos and limbo phase, improvisation management**
- **Skills and knowledge of organizing and directing personnel involved in exhausting actions with high level of mental load**

Figure 13 Recommended learning outcomes for development of educational concepts within maritime emergency management at the tactical level, vessels management perspective

Best practice example: Training of the chief mate and master of a sea vessel in Russia

The main component of the training process for chief mate and master of a sea vessel is higher professional education in the field of navigation from the marine educational organization within the program approved by Rosmorrechflot. The academic teaching staff of the university has to include at least 10% of employees of maritime enterprises and companies. The availability of facilities and resources should ensure all types of disciplinary and interdisciplinary training, laboratory, practical and research work for students, including acquiring of STCW competences.

Nowadays in Russia several training courses (including "Navigation") are included into specialist's degree programs. Priority is given to the in-depth study of the disciplines, which are necessary to train a specialist to work in the sphere connected with an increased level of danger to human life or to ensure the national defense capability.

The scope of the professional cycle is aimed at forming 34 professional competences among trainees. The competences mostly related to emergency situations at sea include skills to deal with emergencies in accordance with international and national requirements; to perform the necessary risk assessment; to organize the team work in difficult and critical conditions; to select, justify, make and implement management decisions within the acceptable level of risk; international standard language skills required to fulfill functional duties and to organize international crew management; emergency skills including life safety at sea. Important courses in the program for the professional cycle are Marine English, first aid training, naval training of civil ships' crews.

Practice is divided into educational one and internship. The scope of each type of practice, as well as its content, is determined by the institution independently. It can include an educational sea-going practice, internship, pre-graduation navigational practice, simulator practice.

An integral part of all types of practices is exercising arranging of survival at sea. These exercises are organized under the supervision of the ship's master or STC instructor (for simulator practice).

Secondary vocational education schools offer vocational training majors such as Navigation and Ship Power Plants Operation. Students majoring in Navigation and Ship Power Plants Operation receive training in operation of vessels; safety of navigation; pollution

prevention; international and domestic shipping legislation; shipping traffic control; ships and shipborne power installations service and maintenance. In addition, students obtain skills in ensuring shipping safety and ship's survivability; emergency/accident response and ship abandonment; operation of lifeboats, life rafts and other rescue equipment; safe loading operations and planning thereof, etc.

At present, the situation with the development of educational programs and programs for additional training of maritime rescuers in Russia is controversial. On the one hand, during the last 5 years, there has been a significant improvement in the quality of maritime education: current educational standards include clear information about the professional competences of graduates (in the standards for navigators' training the term "competence" was not introduced until 2014); the facilities of educational institutions have been significantly improved; special attention is paid to simulator training according to the conventions.

On the other hand, there is a tendency to unite several universities into single educational center on the basis of one of the united universities. This process has both advantages and disadvantages. Among the most "painful" negative factors we should mention that within such integration management of the specialists' training of one sector (for example, "navigation") is entrusted to managerial personnel without relevant experience (for instance, a faculty of navigation may be headed by a specialist from the field of automation of technological processes, etc.). This situation becomes worse in the case of merging higher educational institutions from completely different spheres (for example, the merging of technical and humanitarian universities). As a result of the merging a decrease in the effectiveness of managing the specialists training is observed.

Another deterrent factor for development of SAR at sea educational programs in Russia is a significant number of departmental services that perform similar tasks, often in the same regions (locations), but do not solve SAR at sea problem as a whole, usually due to imperfections in the legal framework and the prevalence of departmental tasks. The implementation of measures for the development of maritime SAR system is carried out according to various departmental programs and plans of the relevant ministries and departments. Many of these services (the Ministry of Transport, EMERCOM, the Ministry of Defense, the Federal Security Service) train specialists in subordinate educational institutions whose tasks also include helping people in distress at sea. Thus, "departmental"

disunity also affects the development of training programs for marine rescuers. Besides, the common area lacking is equal between industry experience and non-technical, soft skills. It appears that very few small-medium sized organizations are able to utilize graduates straight from the university. There does not exist a good cooperation between companies and educational organizations in developing special courses.

Finally, the third significant factor that has a negative impact on the quality of training of maritime rescuers is the low level of international cooperation among universities of different countries. The legal basis for such cooperation is the Education Law of RF, which gives universities great possibilities in the sphere of implementing educational programs. Russia, Denmark, Iceland, Canada, Norway, the United States, Finland and Sweden signed the Agreement on Cooperation in Aviation and Marine Search and rescue in the Arctic. One of the items of this Agreement is international cooperation in the Arctic SAR training. All these factors create the basis for a significant improvement in the quality of educational programs. However, serious shortcomings are also observed in this area.

Since any forms of cooperation should be backed by financial obligations and the Russian part in most cases cannot guarantee their fulfilment at a sufficient level, the implementation of these agreements does not achieve a perceptible effect of interaction between Russia and foreign countries in the field of education. Nevertheless, the funding of Russian universities for the implementation of international cooperation programs is constantly increasing.

Another deterrent factor influencing the development of international educational programs and programs of additional professional training is low level of English as a tool for communication between representatives of different countries. However, the situation has been improving recently. Over the last 5 years in many universities, English as a teaching language has become a part of courses for teachers' advanced training. The number of students are fluent in English and their ability to study abroad is also increasing.

As to the educational program quality, our analysis of navigation accidents and emergencies has shown that they were caused mainly by digressions from the patterns which represent a series of repeated algorithms or sequences of actions performed by personnel in case of an emergency. It can be caused by the lack of the special courses for large-scale operations with cooperation between different emergency services and vessel staff in the educational programs. All trainings between SAR authorities and vessels should

be planned by authorities together with shipping companies. Furthermore, more hours for real actions training in circumstances, which will be as much as possible close to the reality, are of great importance.

English is the maritime language, thus all seafarers and emergency actors involved should have good knowledge and practice of professional English language; not only speaking but also a listening practice.

Use of simulators or other forms of training infrastructure:

The final stage in completing the chief mate (captain) education is specialized training and exercises. Most of the training is an integral part of simulator training and is arranged as a rule in the form of management decision simulations under the supervision of a qualified instructor or the STC. It should be noted that the number and organization of such training (scenario, amount of time) is also determined by the instructor, depending on the students' level of education. A common teaching practice is the organization of one decision-making simulation for each section of the simulation training program.

Survival at sea training complex includes a swimming pool or open water area, the size and profile of which allow launching, departure from the vessel side and raising the lifeboat, operating the rescue boat and raft on the water, rescue boat with a launching and lifting system, throw overboard life raft, davit launched life raft with a rotary single arm davit with automatic release hook, device for lifting a person from the water surface to a height of up to 3 m, diving tower of at least 2.5 m high; medical aid post in the place of training. Firefighting ground with smoke maze simulator can have a variable configuration of bulkheads, simulator-compartment filled with high expansion foam (foam simulator) for passing without a breathing apparatus, fire area control simulator. Water aboard simulator, including a dry compartment for exercises in bulkheads reinforcements and sealing holes, compartment with types of holes and cracks, manholes and pipelines that are damaged, pumps that create the necessary pressure.

To assess the competences students acquire in the process of simulator training, a special testing system for each training stage is developed by STC. Before the start of the exercises on the simulator, the instructor gives a briefing, explaining the purpose of the exercise, the tasks and the competences acquired (thus the instructor is sure that the trainees understand the structure of each session). In the process of performing practical exercises,

the instructor draws the students' attention to the necessity of forming an ability to comprehend and understand the exercise. In the course of simulator training, attention is also paid to the systematic mistakes of students in meeting the requirements of operational regulations. The instructor continuously monitors the progress of the exercise and the students' actions, indicating possible mistakes during the exercise without stopping it. At the end of each exercise, the instructor gives debriefing with exercise description and errors discussion. To assess the knowledge of students at the final stage of preparation (final attestation), the STC develop the Student Assessment System (SAS) for each training program. Final testing is carried out in the form of written or computer testing using the updated databases of test tasks approved by Rosmorrechflot. To assess the students' knowledge during the final attestation, a commission consisting of two or three examiners is formed.

Makarov Research Center configuration of simulator complex includes:

- Two full-scale multirole 360° view navigation bridges.
- Four multifunctional 180° view navigation bridges.

Control stations:

— crane control panel;
— marine operations control panel – towage of large size structures (platforms);
— platform-to-tanker oil transfer control panel.

- System of tools for physical modeling of operations in ice-infested waters.
- Virtual ice – unique mathematical (FEM) ice model enabling high-accuracy simulation of real ship behavior sailing in ice-infested waters, overcoming ice ridges or towing icebergs.
- System of tools for real-time simulation of ship navigator's operational environment.
- Training session master control panel.

A top-table exercise using simulators may provide a fictional disaster event created with the purpose of testing the plans and procedures that would come into effect during a real emergency, helping to identify strengths and weaknesses and to improve competences. Emergency responders may be given the chance to develop their skills and knowledge. The simulator training also provides a valuable opportunity for the various stakeholders to meet

and work together to improve coordination. Such exercise can be big or small depending on the aims of, and resources available to, the organizers. The size does not really matter, simulations are a highly effective training and educational tool that develop skills and deepen people's understanding of disaster response through practical experience.

For the past 30 years Russia like the other countries-participants of the International Maritime Organization (IMO) has experienced great changes in the sphere of navigation safety. These changes have significantly increased the level of safety of shipping and sea freight, including the waters of the High North. At the same time, it should be emphasized that such improvement is the result of complex measures affecting both the infrastructure of search and rescue services and the training system for these organizations.

Best practice example: Training for ships operating in Polar waters

In November 2016, the IMO Maritime Safety Committee adopted amendments to STCW 78 Convention and included requirements to competences of masters and deck officers on ships operating in polar waters. The amendments are made to Chapter V (Regulation V/4) and to Sections A-I/11 and A-V/4 of STCW Code, and took effect from July 1, 2018.

New model courses IMO 7.11 and 7.12 were adopted in February 2017 by the 4th session of Human Element, Training and Watchkeeping (HTW) Sub-Committee. The courses were developed by Canada that leads the review group, which included experts from several countries having experience in ship operation in polar waters. The experts represented Norway, Denmark, Chile, Argentina, and Russia. The IMO Model Courses are recommended and are used for development of training programmes by maritime educational institutions and Training Centres (TC).

In 2017, the Admiral Makarov State University of Maritime and Inland Shipping (Admiral Makarov SUMIS Training Center) successfully passed accreditation for the courses and obtained certificates of compliance of basic and advanced courses for ships operating in polar waters (Basic training for ships operating in polar waters, advanced training for ships operating in polar waters, training crew members for ships operating in polar waters) to requirements in amendments of STCW Convention. The courses were also approved by the administration of the Marshall Islands.

Basic training for ships operating in Polar Waters (PWBT) is provided according to the applicable standards: STCW Convention – Regulation V/4, STCW Code – Section A-V/4, Table A-V/4-1, STCW Code – Section B-V/g (Guidance regarding training of masters and officers for ships operating in polar waters), IMO model course 7.11 – Model course: Basic training for ships operating in polar waters, 2017.

The audience of the advanced training for ships operating in Polar Waters includes masters and chief officers with certain knowledge and experience of ice navigation in a position of chief officer and above, and holding certificate of basic training for ships operating in polar waters. The course includes training on personnel health and safety at below zero temperatures, and crew rescue at emergency. One of the topics is polar nature preservation and environmental safety.

The training for ships operating in polar waters is aimed at ship engineers, deck officers, rating on ships operating in polar waters.

The programme covers the following main elements:

- information on structure, major provisions and requirements of the Polar Code;
- safe work methods in polar conditions and their implementation in everyday work;
- influence of human factors on life and work in polar areas;
- neutralization of negative impact of polar conditions on humans;
- use of protective equipment;
- shipboard damage control in polar conditions, abandoning craft and survival on ice;
- use of life saving appliances on ice;
- limitations for use of firefighting equipment and life-saving appliances in polar conditions, specifics of emergency drills and trainings in polar conditions;
- MARPOL requirements on environmental safety in polar areas.

The section of the program on survival in polar areas is held in the Centre for Survival at Sea, where shipboard damage control methods and ship escape and evacuation in polar areas are practiced. Use of emergency facilities and equipment and life-saving appliances for survival on ice and in ice-covered waters is presented.

STCW Code Tables A-V/4-1 и A-V/4-2 provide a wide range of knowledge and practical skills in areas not previously covered by ice training programs. This includes issues of survival in cold climates, evacuation to the ice, the use of so-called personal and group survival kits, new MARPOL requirements, the use of ice radars, knowledge of the basic requirements of the international Polar Code, the restriction of rescue, fire equipment and OSR equipment, the elimination of oil spills in the ice, etc.

Admiral Makarov SUMIS linked up its Polar Code courses with the specific features of the Yamal-LNG project. According to the agreement between the University and the Krylov State Research Center navigational simulation complex was supplemented with models of the vessels participating in the Yamal-LNG project. New precise mathematical models of the «Christophe de Margerie » type tanker/gas carrier, «Taymyr» type icebreaker, «Ob'» type icebreaker, «Pur» and «Yuribey» type ice tugs are set up on the simulator and included

into the exercises scenarios for joint training of tanker, icebreaker and tug crews and company-specific tasks.

Admiral Makarov SUMIS signed the agreement with the Krylov State Research Center and seafarers can get training in the Center within the specific programs.

At the research center, the following ice management trainings are provided:

- simulation of marine operations in ice-infested waters at any desired level of complexity;
- training sessions and drills for ship and offshore platform crews in preparation for joint operations including oil platform installation on site, tanker approach to oil terminal in ice conditions, etc.;
- practice of emergency response actions to minimize accident risks during cargo loading and ice management operations;
- training of navigators for handling newly designed ships before construction is actually completed.

Admiral Makarov SUMIS signed the agreements with PAO Sovcomflot, Gazprom JSC, Gazflot JSC, State Corporation Rosatomflot, Rosmorport for staff education and training according to the Polar Code requirements. Admiral Makarov SUMIS plans to start training specialists who will operate nuclear icebreakers of the new generation and floating nuclear thermal power plants for the development of the Northern sea route.

Best practice example: On-scene Coordinator Course at Nord University, Nordlab

The purpose of this on-scene-coordinator (OSC) course is to educate and train maritime personnel in the role as on-scene-coordinator in search and rescue (SAR) operations at sea. After completion of this course, students will be able to understand and follow advice given by the search and rescue (SAR) mission coordinators at a maritime rescue coordination center, coordinate SAR-operations on-scene including the contributions of other search and rescue units, and conduct assistance to persons and vessels in distress.

The course is especially relevant for merchant- and cruise vessels, navy and coast guard officers, and other key personnel taking part in SAR-operations at sea.

The course highlights the task of coordination, communication and control of the resources available for saving life, environment and values in critical distress situations. A special emphasis is laid on coordinating search and rescue units (SRUs), including coordination of

units both on land, at sea, and in the air. On land, we elaborate on the role of the coordinating unit such as the police, and the cooperation with the persons, companies or organization in distress, other emergency response services, and volunteer groups. At sea, the role of the on-scene-coordinator (OSC) fulfilling the tasks of the international IAMSAR-manual supporting vessels in distress. The OCS tasks and the interaction between the distress vessel, the shore SAR mission coordinator, the maritime incident response groups (MIRGs) launched and Samaritan vessels are emphasized. Specialized training session will focus on the incident commander roles on land, at sea, and in the air. Coordination of specialized incident response groups as fire and rescue, pollution prevention and response.

Requirements

The course is conducted in accordance with the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR) Volume III, and the International Maritime Organization (IMO) Model Course "SAR ON-SCENE COORDINATOR". The participants should have practical experience at management level.

Course contents

- International and national legal regulations
- Responsibilities and tasks
- Organization and managerial roles in SAR- operations
- OSC duties
- The role of the Air Coordinator (ACO)
- Bridge resource management and team work
- Search and rescue units (SRU) coordination
- Search areas and search patterns
- Communication
- Challenges and limitations in different sea areas
- Table-top and simulator exercises

Learning outcomes:

The candidate shall have knowledge about:

- *The emergency response systems in different countries*
- *International rules and regulations related to emergency response in the air, on land, and at sea*
- *The IAMSAR rules and the roles of the on-scene-coordinator*
- *The structuring of an incident command system*
- *The organization within different accidents*

The candidate shall have skills within:

- *Taking care of the on-scene-coordination role within SAR-operations*
- *Take leading roles within the incident command system*
- *Communication procedures within operations*
- *Providing search patterns and coordinate involved units*
- *Team work and improvisation management*

The candidate shall have general competence within:

- *Operational safety and preparedness management*
- *The main patterns of emergency response*
- *Dialogue with different actors within the emergency response system*
- *To contribute and learn from R&D within the field*

Teaching language

English

The training takes place in advanced tactical simulators including decision support tools for SAR operations at NORDLAB, Nord University and Bodø Maritime.

Source: https://www.nfk.no/fagskole/vare-utdanninger/maritim/maritime-kurs-i-bodo/osc-on-scene-coordinator-course.1027381.aspx

Summary

In this report we collected recommendations for the development of courses and exercises concepts within maritime emergency management. We summarized the important learning outcomes that should be reached for the key personnel that may be involved in large-scale emergency response operations in the Arctic. We focused on the themes and learning outcomes, providing reflections as for each management level. We have also described best practice examples of the key management personnel courses schemes.

The recommendations we presented include both suggestions for competence development courses and for training and exercises particularly needed in the maritime operations and the Arctic environment. Knowledge about Arctic conditions, hypothermia, emergency response in possible ice conditions should be included in courses and educational programmes at all emergency management levels. The use of simulations is advantageous in maritime Arctic operations as this allows training scenarios, which are difficult to reproduce faithfully in real life.

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