R&D-Report

Maritime emergency preparedness resources in the Arctic – capacity challenges and the benefits of cross-border cooperation between Norway, Russia, Iceland and Greenland

MARPART Project Report 4

Editors:
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Odd Jarl Borch
Johannes Schmied

Nord University
R&D-Report no. 33
Bodø 2018

NORD University

www.nord.no

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R&D-Report no. 33
ISBN 978-82-7456-794-8
ISSN 2535-2733
Bodø 2018

NORD University

NORD universitet

Godkjenning av dekan

Tittel:	Offentlig tilgjengelig:	Publikasjonsnr.
MARITIME EMERGENCY PREPAREDNESS RESOURCES IN THE ARCTIC - capacity challenges and the benefits of cross-border cooperation between Norway, Russia, Iceland and Greenland	Ja	33
	ISBN 978-82-7456-794-8	ISSN 2535-2733
	Antall sider og bilag: 146	Dato: 28.09.2018
Forfatter(e) / redaktør(er): Natalia Andreassen, Odd Jarl Borch, Johannes Schmied	Prosjektansvarlig (sign). Odd Jarl Borch	
	Dekan (sign). Erlend Bullvåg	
Prosjekt: MARPART	Oppdragsgiver(e)	
	Oppdragsgivers referanse	
Sammendrag:	Emneord:	
Summary: This report provides an overview of maritime emergency preparedness capacities in Arctic Norway, Russia, Iceland and Greenland. It also discusses capacity challenges and the benefits of cross-border cooperation between Arctic regions.	Keywords: Search and rescue Oil Spill Response Violent Action Response Preparedness Capacities Arctic High North	

MARPART

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

The report "**Maritime emergency preparedness capacities in the Arctic - capacity challenges and the benefits of cross-border cooperation between Norway, Russia, Iceland and Greenland"** is developed under the project:

"MARPART" (MARITIME PREPAREDNESS AND INTERNATIONAL PARTNERSHIP IN THE HIGH NORTH), Work Package 2 "Institutional framework, governance, resources and institutional strategies within different sea regions"

Project period: 2014-2017

The project is financed by:

- The Ministry of Foreign Affairs of Norway
- Nordland County Administration
- Nord University
- Project partners' own contribution

Project partners:

- High North Center at Nord University Business School (Norway)
- Norwegian Defense University College (Norway)
- Norwegian Police University College (Norway)
- UIT-the Arctic University of Norway (Norway)
- University Center in Svalbard (Norway)
- University of Greenland (Greenland)
- University of Iceland (Iceland)
- Northern (Arctic) Federal University (Russia)
- Murmansk State Technical University (Russia)

THE MARPART RESEARCH CONSORTIUM

The consortium focuses on management, organization and governance of cross-border collaboration related to emergency operations in the High North.

The key purpose of the Marpart research consortium is to increase understanding of the emergency management challenges in large-scale emergencies in the Arctic sea areas. We start with an assessment of the risk related to different types of maritime activity in the High North and the implications for the preparedness institutions in this region. We focus on cross-institutional and cross-country partnerships between preparedness institutions as well as private companies in the Arctic region. We elaborate on the operational crisis management of joint emergency operations including several parts of the preparedness system and resources from several countries.

We emphasize the responsibility of the governments as to safety, security and environmental protection in the High North. Maritime preparedness is defined as the system for damage avoidance and reduction related to unexpected and unwanted incidents at sea. We elaborate on the need for enhanced measures to respond to composite challenges including Search and Rescue (SAR), Oil Spill Recovery, firefighting and salvage, and actions against terror or other forms of destructive action. To increase both effectiveness and efficiency within the preparedness system, we are in need of management tools for coordination and control making optimal use of the joint resources of several institutions both within and between countries.

In this project, we take as a starting point the commercial activity in the High North and the vulnerability related to human safety, environment, and physical installations/vessels. The commercial activity in the High North includes intra- / interregional transportation, search for and exploitation of petroleum and mineral resources, fisheries, and cruise tourism. Limited infrastructure, low temperatures with ice and icing, polar lows and a vulnerable nature, challenge maritime operations in this region.

MARPART project goals:

- To increase understanding of future needs for joint operations within a preparedness system in the High North including both Search and Rescue, Oil Spill Recovery, firefighting and salvage, and actions against terror or other forms of destructive action;
- To provide analytical concepts for studying coordination challenges in cross-border, multi-tasking operations;
- To contribute with organizational concepts for inter-organizational partnership and management of joint operations.

The cross-disciplinary, international research network consists of 16 universities and research institutes that focus on emergency management and crisis preparedness. The consortium is coordinated by Nord University in Bodø, Norway. Universities, police and naval academies and research institutes from Norway, Russia, Iceland, Greenland, Denmark and Sweden are now part of the Marpart network. In addition, universities from Canada, USA, and Finland are part of an extended academic network called UArctic thematic network on Arctic Safety and Security. The project partners have established Advisory Boards in each country including government preparedness authorities and industry representatives. The Marpart projects currently include two interlinked projects: Marpart 1 "Maritime Preparedness and International Partnership in the High North" and Marpart (2)-MAN "Joint-task Force Management in High North Emergency Response".

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ACKNOWLEDGEMENTS

The "MARITIME EMERGENCY PREPAREDNESS RESOURCES IN ARCTIC – CAPACITY CHALLENGES AND THE BENEFITS OF CROSS-BORDER COOPERATION BETWEEN NORWAY, RUSSIA, ICELAND AND GREENLAND" is the 4th MARPART project report conducted within the Work Package 2 "Institutional framework, governance, resources and institutional strategies within different sea regions". The MARPART project team would like to express their gratitude **the Norwegian Ministry of Foreign Affairs** and **the Nordland County Administration** for funding this project. We are also thankful to Nord University and the partner universities for own financial contributions.

In addition, we appreciate support and expertise provided by different professional actors, operating in the field of emergency preparedness, Search and Rescue in Norway and other countries. We are particularly thankful for input and support from: High North Center at Nord University Business School; The Norwegian Coastal Administration; Resources and Competence Center for Safety and Preparedness in the Northern Region; Salten Regional Police Department; Maritime Forum Nord; Joint Rescue Coordination Center North Norway; the Preparedness Department of the Nordland County Governor; Nordland County Administration; Norwegian Directorate for Civil Protection; The Petroleum Safety Authority Norway; Norwegian Coast Guard; Icelandic Coast Guard; the Environment Agency of Iceland; the Department of Civil Protection and Emergency Management at the National Commissioner of the Icelandic Police; Maritime Rescue Coordination Center of Murmansk (Russia); Arkhangelsk Regional Rescue Service (Russia); Arkhangelsk Regional Agency for State Fire Service and Civil Protection (Russia).

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EXECUTIVE SUMMARY

This report "MARITIME EMERGENCY PREPAREDNESS RESOURCES IN ARCTIC – CAPACITY CHALLENGES AND THE BENEFITS OF CROSS-BORDER COOPERATION BETWEEN NORWAY, RUSSIA, ICELAND AND GREENLAND" is a result of the Marpart-projects funded by the Arctic 2030 program of the Norwegian Ministry of Foreign Affairs, the Nordland County Administration, Nord University and the partner institutions. It provides an overview of emergency preparedness capacities in the following fields:

- Search and Rescue (SAR)
- Oil Spill Response (OSR)
- Violent Action Response (including anti-terror action).

The report elaborates on the available physical and personnel capacities in the four countries, including stationary facilities, specialized personnel, vessel capacities, airborne capacities, and management coordination capacity. It builds upon the three earlier reports from the Marpart project emphasizing maritime activity and risk aspects in the four countries, as well as the institutional framework and agreements both nationally and internationally between those countries.

In this report, we highlight the challenges regarding Arctic maritime preparedness capacities for each of the countries based on the findings in the earlier reports, analyses, as well as secondary information from each country. We reflect on the potential benefits of cross-border collaboration in complex, large scale emergencies.

Response capacities

Norway

Norway has the largest maritime traffic in the Arctic in its area of responsibility – however, access to emergency preparedness resources is always a challenge. This is especially the case in the light of increased activity in the most remote regions of the Barents Sea and the Svalbard region, particularly in the autumn and winter seasons. The capability for survival onboard distress vessels are currently improving since the introduction of the Polar Code. The Polar Code demands for more adequate rescue equipment suited for Arctic conditions. It will, however, take time for the code to be properly implemented. Furthermore, the Polar Code has its limitations with regard to training and exercises.

Telecommunication is also crucial in large scale emergency response. Communication is a challenge, in particular north of 75 degrees where satellite- and radio coverage is limited. A specific challenge is found due to the increased size of cruise vessels. Additionally, Spitsbergen bound vessels are more often

taking routes via remote waters to and from the Greenlandic coast and the Northernmost Russian islands. Normal day to day incidents are handled well however mass evacuation incidents with several hundred and maybe several thousand evacuated people represent a challenge.

Norway has capacity to mobilize significant SAR resources. However, the response time highly depends on air transport capacity, the availability of other suitable SAR vessels, coast guard positioning, and distribution of medical personnel and hospital capacities from the mainland. Within Search and Rescue, Norway has heavily invested in increased capacity.

Two modern SAR helicopters with distributed fuel depots and a government hired supply vessel with SAR capacities are currently located at Longyearbyen. 16 new AWSAR helicopters are introduced during the next couple of years for the mainland stations with an option for six more. The Norwegian Coast Guard is also introducing new high capacity helicopters dedicated for the coast guard vessels. Three new coast guard vessels for the Barents Sea are commissioned and will be built during the next five years period. For the Svalbard region, SAR equipment including a field hospital is stored at Longyearbyen, where a large number of volunteers from the Red Cross represent a significant reinforcement of capacity.

In addition, the operating commercial actors and especially the oil and gas industry are obliged by law to have further emergency response capacities. That means added capacity for both SAR and Oil Spill Response along the Norwegian coast, including the Barents Sea.

The Joint Rescue Coordination Centers (JRCC) have a central position when it comes to Norway's preparedness efforts. They are focusing strongly on competence, innovation and international SAR cooperation. The police in Nordland, Troms and Finnmark police districts and the Governor of Svalbard are also focusing on similar developments. The coast guard has, among other capabilities, special competences to perform the role as an On Scene Coordinator and function as a link to the JRCC.

JRCC Northern Norway maintains close dialogue with the RCCs of neighboring countries, including MRCC Murmansk. Norwegian helicopters have performed several SAR missions in Russian waters. There are also some exercises run by various authorities, such as the joint SAR and oil spill exercise between Norway and Russia. Yet, two committees under the Ministry of Justice and Preparedness have concluded that there is still limited analytical capacity for gap analyses and too little efforts towards joint training and exercise programs in Norway.

The Oil Spill Response resources are operated by various organizations: the Norwegian Coastal Administration (NCA), the Norwegian Clean Seas Association for Operating Companies (NOFO), the municipalities (IUA), refineries, terminals, ports and private businesses. While private level needs to directly deal with acute pollution on site, the municipal level can provide

personnel and equipment to deal with smaller acute spills. NCA has the main responsibilty for the governmental preparedness against acute pollution, and to take the lead in larger incidents.

NCA is active in facilitating cross-border cooperation in the Arctic, for example within the Arctic Council working group for Emergency Preventation, Preparedness and Response (EPPR). The combined capacity of government and NOFO resources makes Norway well equipped when it comes to heavy oil recovery equipment. However, oil recovery in rough weather with high waves, strong currents, icing and ice is still a significant challenge. Also, significant traffic of heavy fuel oil fueled vessels, including cruise vessels to and from Svalbard may present a challenge. An increasing transit traffic of crude oil tankers from Northern Russia and Barents Sea oil fields are another aspect of concern.

With the above in mind, cooperation between NCA and the Russian Maritime Rescue Services is highly important. Norwegian authorities are prepared to call for Host Nation Support (HNS) capacity, and Norwegian and Russian authorities have a close cooperation both on SAR and Oil Spill Response. These relations are partly based on international agreements, and the bilateral agreement between Norway and Russia on SAR and Oil Spill Response calling for annual exercises.

With regards to Violent Action Response, Norway's response regime is based on police authority and regulated according to the procedures for Ongoing Life-threatening Violence (PLIVO). PLIVO is a joint procedure for the emergency services, under the command of the police. For anti-terror operations, additional rules and regulations are used. Norway may mobilize both police special task forces as well as the military special forces. Challenges have been seen with a complicated mobilization process and limited helicopter capacities, hampering the response time. This problem has been dealt with during the last few years, with increased capacities both for the police special forces and the military. Especially when it comes to offshore anti-terror operations, the military resources play a special reinforcement role. Within both European police agreements and the NATO system, Norway has a broad network of intelligence available. During the recent years, contact between Norwegian police and Russian border guard FSB has increased with frequent exchange of critical information.

Russia

In Russia, the most important capacities are the capacities of the maritime rescue coordination centers, the Marine Rescue Service (Morspassluzhba), the Northern Expeditionary Unit of rescue and salvage operations, the Boarder Guard of Federal Security Service (FSB), EMERCON, the Search and Rescue Administration of the Northern Fleet, and regional SAR capacities.

Also in Russia, the availability of adequate resources and mobilization time is a challenge. A program introduced for modernization of SAR and Oil Spill

Response vessels will increase this capacity. This is especially true for the private resources of the offshore oil and gas industry.

The fleet of Morspassluzhba has lately been updated. Rosmorrechflot is updating 41 vessels by 2020. EMERCOM which is responsible within the 12 miles maritime zone, is also advised to further update their fleet and airborne resources.

A challenge is the coordination of resources across institutional borders. Cooperation on information sharing between the Air Northern Fleet which is a unit of the Navy SAR, as well as coordinators in Murmansk is in needed.

Communication challenges are present in Russian maritime SAR. According to the legislation of the Russian Federation, aircrafts and sea vessels use different frequency bands and have problems communicating directly. Furthermore, the quality of long distance radio wave communication needs to become more robust.

The authorities in charge of coordination of oil spill preparedness capacities are similarly diverse as they are with SAR. They include federal executive bodies (Rosmorechflot and its branches, Energy Ministry, EMERCOM, Federal Fishery Agency, etc.), regional executive bodies, local self-government bodies, and private companies. Regional vessels, state facilities as well as multipurpose facilities of the RF Ministry of transport etc. are available. Further development efforts should be focused on improved cooperation between the state and industry resources.

When it comes to Violent Action Response in Russia, there are five national legal regimes with different responsibilities. The Western Arctic Area includes the Barents Sea and the high Arctic border region between Svalbard and Franz Josef's land. The Frontier Service of FSB is the body to implement border protection at sea. The Ministry of Internal Affairs (MIA) line departments of water transport in the Murmansk and Arkhangelsk regions are in charge of counteracting any criminal activity in the coastal region.

Due to limited helicopter capacity, fast response with adequate resources in remote areas in the Northern Russia represents a challenge. Other vessels in the northermost regions including the Nothern fleet can be used as a resource. However, due to the many organizations involved and hierarchical layers of decision-making, mobilization of larger resources may take time.

Iceland

In Iceland, SAR operational capacity focuses mainly on response to vessel incidents within Iceland's Exclusive Economic Zone involving fishing vessels and cargo ships. Multilateral collaboration with authorities from Denmark, Faroe Island, Norway etc. are essential in case of larger incidents, for example cruise ship accidents. The mobilization of adequate SAR resources is therefore a challenge. The preparedness system is mainly based on the Icelandic Coast Guard's three patrol vessels and two helicopters on continuous standby. An ICG

surveillance aircraft frequently participates in financed missions abroad, up to six months a year. Response to fire at sea would be much more effective if resources with class 1 firefighting system would be available and fire fighters trained for maritime rescue of people.

The Ministry for the Environment and Natural Resources is in charge of pollution prevention, fire prevention and fire brigades. The ICG's vessel Þór is equipped with a 300 m oil boom and an oil skimmer. It is the only patrol vessel in the region that has oil recovery equipment needed to maintain control of a larger oil spill situation until further assistance arrives. It could take many days for vessels with sufficient towing capacity to arrive from Norway or from continental Europe.

When it comes to Violent Action Response, Iceland has no military, but has "soft security" cooperation arrangements. The Minister of Justice is responsible for Maritime Security and the police has a special force with anti-terrorist training in maritime situations.

Being a small country, Iceland has altogether very limited resources taking into consideration the considerable traffic activity in its area of responsibility. Host Nation Support is a crucial aspect for Iceland.

Greenland

In Greenland, the main challenge is the vast area of responsibility, lack of infrastructure in the small communities and the distance to mainland resources in Denmark. The responsibility for SAR and oil spill is shared between the Joint Arctic Command of the Danish Navy and the Greenlandic government. The Joint Arctic Command provides an overall picture of the maritime situation in Greenland waters by utilising satellite surveillance of maritime activity and environmental pollution. This endeavour is partly based on cooperation and information sharing between Canada, Norway, Iceland, the USA and Denmark.

A limited number of navy vessels and helicopters are available in Greenlandic waters. Greenland is therefore heavily dependent on civilian resouces, among others mobilization of civilian helicopters, and samaritan vessels at sea.

A limited amount of Oil Spill Response equipment is available in Nuuk and in Aasiaat. It is still a question on how fast the equipment can arrive at other possible waste sites. More equipment dedicated for Greenland is located at depots in Denmark.

Violent Action Response is the responsibility of the Danish police. Special police units for anti-terror are located in Denmark.

In total, Greenland has very limited preparedness resources in every area of response. It is heavily dependent on transport of resources from Denmark and neighboring countries. With an increased tourist activity, including a significant number of cruise ships, the challenges may increase over the next years.

SAR-response cooperation

The analyzed capacity challenges connected to the Arctic operational context and the management challenges within the four countries call for stronger cross-border cooperation focus and not the least more realistic training based on the new scenarios appearing. The changes in traffic patterns with more all-year cruise ship activity in remote waters, fishing fleets operating close to the ice ridge, and more dangerous goods transport from Russiand and Norwegian oil and gas fields in the North call for a significant emphasis on and analyses of future capacity needs. None of the countries included in this report have adequate resources for major incidents outside the more densely populated mainland regions. How large the gaps are, is difficult to estimate because most countries lack systematic evaluations based on defined risk areas, clear response objectives and capacity assessments.

However, there is increasing interest and development happening within international forums. The Arctic Council with working groups such as EPPR (hosting the SAR and MER Expert Group) and PAME-Protection of the Arctic Marine Environment provide an arena for analysis and information exchange. Also, the Arctic Coast Guard Forum represent a platform for further cooperation on routines for coordination and control, operational tasks and competence sharing. Both arenas should be followed up by central governments.

The governments should also provide programs for frequent visits, exchange and development of joint plans, systems and procedures. Personnel exchange and shared exercises – both full scale, functional and table top – are in demand as means to improve cooperation as well as understanding of each other's capacities. The annual bilateral Norwegian-Russian "Exercise Barents" on SAR and Oil Spill Response has a potential for further development both in including more countries and more challenging exercise areas and contents.

Increased studies of each organizations' operational culture, shared operational systems and IT- tools may also provide a more fluent coordination of resources. Each nations' military preparedness system, including the navy and air forces, represent significant capacity. However, we know too little abouth their capacities and mobilization times, and they should be more involved in joint exchange and competence programs. Efforts to make the military resources more available for civilian purposes may be a great opportunity in the High North. Furthermore, the capacity of private cooperation including oil and gas, cruise industry and other maritime activity should be further assessed for preparedness operations to give more insights on avaiability, mobilization time and potential capacity.

For all countries there is a challenge with silo thinking and fragmented responsibility between institutions, companies and organization. Reflections on linking up organizations more closely, exchange and overlap of tasks, and close cooperation on strategic, operational and tactical levels are in demand.

Oil Spill Response cooperation

For major oil spills in the High Arctic, the capacities are in general limited. Preparedness is costly. The Oil Spill Response equipment has limitations for operation in heavy wave and current, and not the least ice and icing contexts. The mobilization time for heavy equipment is long. Most countries have a very limited amount of offshore Oil Spill Response booms and collectors, as well as OSR vessels. Norway is an exception, especially due to the capacities and developments of the oil and gas industry. The transport and mobilization capacity represent a significant challenge for this type of heavy equipment. A large-scale spill will in most cases have significant negative consequences and long term ripple effects. Legislation as to dangerous goods and fuel types and increased preparedness capacities of industries in the Arctic also within pollution response are in demand.

There is a need for joint research to develop better methods for separation of oil, ice and water. Additionally, further development of the coordination of preparedness capacities is needed. It is crucial that equipment from several countries can be transported to the maritime spill area quickly and efficiently in case of an incident.

For areas closer to shore, also cooperation with voluntary organizations should be enhanced. This may increase capability and potentially availability of capacity in large scale maritime operations throughout the whole preparedness value chain. More education and training for voluntary groups in the Arctic communities could be at hand, as among others the Red Cross has shown.

Violent Action Response cooperation

When it comes to Violent Action Response, all individual country sections of this report highlight the potential benefits of further bilateral and international cooperation of Violent Action Response capacities, yet in some cases political conditions for sharing information have to be considered. There is a strong European cooperation on intelligence exchange in case of terror, however there has not been much focus on maritime based activity. Joint exercises should be considered between the police and border guard special forces in the Barents Sea region. As much of the activities of the police and military anti-terror capacities are classified, cooperation across borders is a challenge. This is especially true for cooperation between Norwegian and Russian forces. However, the coast guard, the border guards, and the police in Norway and Russia are cooperating well on a day to day and ad hoc basis if it is a matter of Violent Action Response.

1 INTRODUCTION

MARPART report 4 seeks to present an overview of maritime directed preparedness capacities in the fields of Search and Rescue (SAR), Oil Spill Response (OSR) and Violent Action Response (including anti-terror action) available in the northern areas of Norway, Russia, Iceland and Greenland (Denmark) for maritime operations. The ealier reports of the Marpart-project show a change in maritime activity with a larger number of both passengers and amount of dangerous goods transport. Accidents, especially in the coldest waters may have severe consequences and may lead to a significant risk for human lives and the environment, especially in remote and isolated areas. Response time and type of resouces may vary due to long distances to base and limited emergency response capacities. Therefore, there is a need for better knowledge about emergency preparedness resource capacities and how to facilitate smooth cross-institutional and cross-border support. Helicopters, aircrafts, ships, equipment and personnel capacity from many organizations and companies also call for efficient management. This report gives a substantial overview of the preparedness capacities in the four countries, and discusses potential challenges in capacities and opportunities for adding resources through cross—border cooperation.

The data within this report is based on the material provided by the preparedness institutions, analytical reports, articles and interviews. Data sources include analyses on preparedness capacities, reports on assessments of preparedness capacities, and reports after emergency exercises revealing challenges related to capacities, accident reports and interviews.

Each of the four countries starts their report with the description of the national institutional preparedness capacities, which include physical resources that the main preparedness institutions have at present or in some cases which are to be invested in. The main resources include helicopters, aircrafts, vessels, communication and navigation resources, rescue and Oil Spill Response equipment, personnel, medical services etc. available for the different sea regions. The next subsection highlights particularly the potential challenges in the preparedness capacities and challenges of the capacities in this region. Finally, reflections on the need for cooperation and opportunities for solving capacity problems through cross-border cooperation are discussed.

2 NORWAY'S PREPAREDNESS CAPACITIES, CHALLENGES AND NEED FOR COOPERATION *BY NATALIA ANDREASSEN, JOHANNES SCHMIED AND ODD JARL BORCH*

2.1 PREPAREDNESS CAPACITIES

2.1.1 Search and Rescue capacities

Norway's maritime SAR responsibility goes beyond its territorial-, economic- and fishing zones and comprises a very extensive area roughly extending from 57 degrees north all the way up to the North pole along from the zero meridian and to 35° East (Barentswatch 2013). In North-east, the border is towards Russia, in the North-West the border is towards Iceland and Greenland.

The largest industry players such as the oil and gas industry have their own SAR capacity. In the Norwegian and Norwegian part of the Barents Sea there are capacities built up to match the defined risk areas related to the exploration and exploitation activity.

According to a report by the Norwegian Maritime Authority (Norwegian Maritime Authority 2014), the Norwegian SAR preparedness system has experienced around 500 registered incidents on commercial vessels per year between 2009 and 2014. Half of the incidents have involved person injury or deaths, and the other half have been incidents with ship damage. Within these 6 years a total of 89 people (out of 1639 total incidents with injury or deaths) died. In addition, there has been a large amount of leisure boat incidents with casualties involving almost 200 people in the same period. Marpart Project Report 2 on "maritime activity and risk patterns in the High North" gives a deeper insight and further statistics on these issues (Borch et al. 2016a).

Larger incidents with vessels come in more irregular intervals and then SAR capacities need to be available and on point. Special concern is often raised for SAR incidents on large passenger vessels such as cruise ships. Incidents in highly remote areas off the coast are deemed critical.

Another very difficult SAR incident will be in case of nuclear accidents and radiation. The JRCC then has to link up to the Norwegian Radiation Protection Authority and the Crisis Committee for Nuclear Preparedness. The Crisis Committee consists of representatives from key government offices, who have a special responsibility for a sector in the management of a nuclear or radiological event with the responsibility for implementing protective measures.

2.1.1.1 The Joint Rescue Coordination Centers and the Rescue Management Board

The Norwegian Rescue service carries out the Norwegian duty according to the relevant international SAR agreements. The most relevant SAR agreements for maritime and aeronautical SAR are especially the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR), International Convention for the Safety of Life at Sea (SOLAS) and the International Ship and Port Facility Security (ISPS)-code. Others are the STCW Convention – International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, the International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel (STCW-F), the recent Polar Code, as well as other IMO conventions with indirect relevance to SAR and standards by standardization societies. In general, the UN law of the sea (UNCLOS) is important with respect to responsibilities in cross-boundary coordination of SAR incidents. Marpart Report 3 (Elgsaas & Offerdal, 2018) gives detailed insights on the most relevant agreements.

The two Norwegian Joint Rescue Coordination Centers (JRCC) are responsible for coordinating SAR action in Norway at both sea, land and air. The Royal Decree of 19 June 2015 gives the formal instructions for the public rescue services and explain in detail the organisation, tasks and responsibilities of the Joint Rescue Coordination Centers (JRCC) (chapter 2) and the rescue sub-centers (chapter 3) (FOR-2015-06-19-677). The JRCCs are administrative agencies under the authority of the Ministry of Justice and Public Security (Ministry of Justice and Public Security Norway 2013).

The two Joint Rescue Coordination Centers (JRCC) serve as Maritime Rescue Coordination Center (MRCC) and Aeronautical Rescue Coordination Center (ARCC). One is located in Stavanger (JRCC South-Norway) and is responsible for SAR activity below 65 degrees north, where there is a border between Nord-Trøndelag and Nordland. JRCC North-Norway is located in Bodø and is responsible for Northern Norway above 65 degrees, hence also for the Arctic maritime regions.

On the regional level, the JRCCs work closely with regional Rescue Sub-centres (RSC) led by the chiefs of Police in the regional Police districts. For rescue operations on shore, the JRCCs normally monitor the operation, and delegate the responsibility for the coordination of the rescue operation to the RSCs located in the operations centers of the local Police district. The Norwegian police districts have recently been re-organized into 12 regional police districts (13 including Svalbard). Each police district is responsible for the management of the overall emergency response resources within their area of jurisdiction. The JRCCs support the operation by providing rescue helicopters or other relevant SAR resources which are not available in the Police district. Most of the land SAR

operations are coordinated from the 13 RSCs which are connected to the following police districts in Norway: Agder, Finnmark, Innlandet, Møre og Romsdal, Nordland, Oslo, Sør-Vest, Sør-Øst, Troms, Trøndelag, Vest, Øst, and the RSC connected to the governor of Svalbard. The RSCs are on the daily basis managed by the local police stations and their chiefs, but are under the JRCCs chain of command when involved in SAR. For SAR operations in the Svalbard area, the RSC of the Svalbard County Governor has the same responsibility as the RSCs in the local police districts on the Norwegian mainland. JRCC North-Norway monitors and provides reinforcements from the Norwegian mainland if necessary (JRCC Norway 2016).

Currently the JRCCs and the RSCs are aiming to increase the interaction with each other, to increase the role of JRCC as auditor as well as to support the RSCs in their operations. In terms of cooperation with each other, they comprise now of a joint management system for information, joint operational plans and data-storage and replication (JRCC Norway 2016).

In major incidents, the chiefs of police in Bodø and Sola act as the leaders of the Rescue Management Boards of the JRCCs (see figure below). In this role they report directly to the Ministry of Justice and Public Security, and not to the directorate of the Police as they do in their role as chief of their Police districts. The National SAR Management Board consists of representatives of various authorities that coordinate the national emergency preparedness and response – the Armed Forces, the Civil Aviation Authority, the Norwegian Coastal Administration, the Norwegian Maritime Directorate, the National Communications Authority, the Norwegian Directorate of Health and the Norwegian Directorate for Civil Protection.

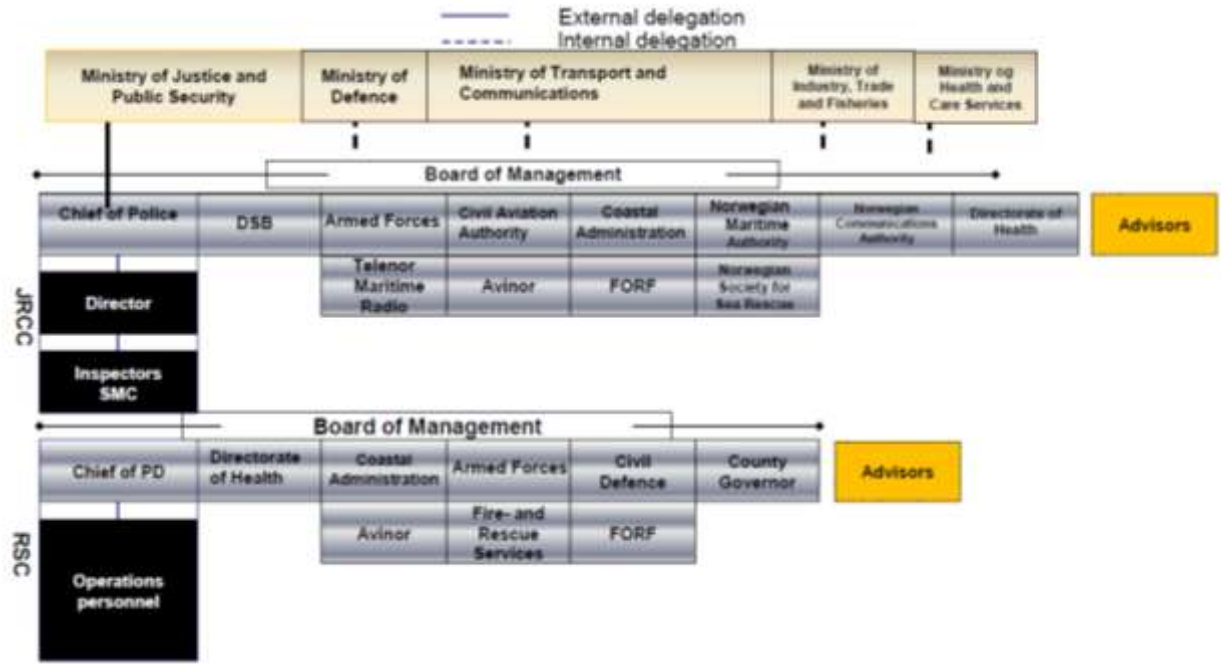

Figure 1: *The Rescue Management Boards of the JRCCs (Jamtli, 2017)*

The JRCCs aim to increase the quality of cooperation with all rescue resources. As such they highlight their role as a hub when it comes to the Cooperation Principle both with national and international agencies and companies. Actions include experience seminars, rescue conferences, the national rescue council (NRR) and as organizer and participating in rescue exercises (JRCC Norway 2016).

The centers, which have an operations room each, have the capacities to unite their resources if necessary, or they may take over each other's SAR operation if needed. The JRCCs have at their disposal the dedicated AWSAR helicopters, and may mobilize whatever resources they find necessary including military forces and support from other countries.

According to the Norwegian JRCC annual report of 2016, JRCC North Norway has had 22 employees and JRCC South Norway has had 26 employees. The report states that strengthening the strategic level including administrative personnel and staff-functions is in priority. However lately they had to put focus on ensuring enough staff to lead the rescue operations (JRCC Norway 2016).

When it comes to large-scale incidents in the Arctic, the JRCC North-Norway has long-lasting connections with the SAR agencies in the neighboring Arctic countries. As soon as human life is at risk, and with the existence of a relevant SAR agreement (bilateral, multilateral, International), the JRCC in accordance with these agreements may directly request assistance from the other countries' SAR-services. Several agreements on Cooperation in the Barents Sea and the Arctic Ocean, the Agreement on Search and Rescue for persons in distress in the Barents Sea - October 1995, the Agreement on Oil Spill Response in the Barents Sea between Norway and Russia - April 1994 are important when it comes to capacities. These agreements connect the JRCC North Norway with the capacities of the Maritime Rescue Coordination Centre (MRCC) Murmansk/Russia, the Russian Northern Fleet and the Russian Federal Security Service (FSB) including Russian Coast Guard duties. The annual Exercise Barents is important for the relation between Norway and Russia with SAR practice at sea. Similarly, Exercise Barents Rescue connects the Norwegian agencies with Russian, Swedish and Finish SAR-actors and their capacities when it comes to land operations (JRCC Norway 2016).

When the SAR operation extends beyond national capacities and assistance is needed from abroad, the responsible authority in Norway has to make a formal request. In case of SAR there is a possibility to contact Alarm helpline 24/7 of the Joint Rescue Coordination Centers. The JRCCs can also request international assistance from neighboring countries. In SAR situations the JRCC or the Regional Rescue Sub-centres (RSC) can request assistance directly from other countries' SAR services in accordance with existing agreements and principles.

2.1.1.2 SAR at Svalbard

The Governor of Svalbard has police jurisdiction and leads the RSC in conducting SAR operations on shore. Maritime SAR operations and major emergencies will be coordinated by JRCC NN. The Governor of Svalbard has at his disposal both helicopter and vessel capacities.

The Governor of Svalbard (Sysselmannen) has available a modern 89 meter long supply vessel ice-class 1b which is located in the Longyearbyen area including Svalbard, Bjørnøya and Hopen from early spring to the autumn (9 months of the year). The vessel "Polarsyssel" is supporting the preparedness body of the region. It has a movable helicopter deck, fire fighting equipment, and good accommodation capacity. Particularly in consideration of cruise ship scenarios its capability of towing vessels is useful (Sysselmannen på Svalbard 2016).

The Governor of Svalbard also has available two Super Puma AS332L1 AWSAR helicopters. They have 250nm operational radius and there are several helicopter fuel depots around the Svalbard area for extended range. Also, there are two Dornier Do-228 airplanes stationed at Svalbard. These resources are also central during maritime and aeronautical SAR when JRCC North-Norway is in charge of the operation and RSC Svalbard supports.

2.1.1.3 Coast Guard

The Coast Guard is part of the Norwegian Armed Forces and belongs to the Royal Navy. However, the coast guard has its own law, the law of the Norwegian Coast Guard, and serves the civilian government in several fields. According to the law of the Coast Guard (Ministry of Defence Norway 1997) the Coast Guard has a role in Rescue Operations stating that the coast guard are to participate in SAR operations in case of danger and risk situations at sea.

Together with the rescue helicopters, the Coast Guard is the most important SAR platform at sea, especially when it comes to large scale incidents. The Coast Guard resources are particularly important when it comes to operations in ice infested waters, with the use of their ice breaker class vessel KV Svalbard, and the ice strengthened Nordkapp-class. The homeport for all the vessels is at the Norwegian Coast Guard Base in Sortland, Northern Norway. The Coast Guard has the following capacities:

- **NoCGV Harstad** – The ship is equipped for SAR, Oil Spill Response, towing and fire fighting. It has long range capacity and crew of 22+ people. It is used as supply vessel for stations at Jan Mayen, Hopen and Bjørnøya.
- **NoCGV Svalbard** – icebreaker and offshore patrol vessel. It is especially relevant for high arctic waters because it has Icebreaker class. CGV Svalbard is currently the heaviest Norwegian Coast Guard ship with a crew of 48+ persons. It is mostly used in the Svalbard area and suitable for

sovereignty asserting, resource control, Search and Rescue, Oil Spill Response, diver assistance and towing.

- **NoCGV Ålesund** – KV Ålesund is normally operating only south of Norwegian Arctic. It has a 22+ crew size.
- **NoCGV Barentshav-class of offshore patrol vessels** – These vessels were especially constructed for the Norwegian Coast Guard duties and are most relevant for Oil Spill Response, towing and fire fighting. They have 23+ crew size.
- **NoCGV Nordkapp- class of offshore patrol vessels** –KV Senja, KV Nordkapp and KV Andenes are operative certified until 2020. They have 60+ crew size and are well prepared for Northern waters and equipped with hangar and helicopter deck.
- **5x NoCGV Nornen-class of offshore patrol vessels** – These vessels support Police and customs according to Coast Guard Law. They are long range ships with good towing capabilities.
- **2x NoCGV Reine-class of offshore patrol vessels** – These vessels operate along the coastline and assist cooperative agencies like the police, customs, the Directorate of Fisheries and other public agencies. The vessel KNM «Olav Tryggvason» is used as training vessel. They have 32+ crew size (Ministry of Defence of Norway)

All the Coast Guard vessels can support the JRCC as On Scene Coordinator in SAR, OSR and ship-accidents.

Every year the Coast Guard releases information on the quantity and structure of their human resources (as part of the military year's report). Coast Guard's personnel counted 724 persons in 2016 (Ministry of Defence Norway 2016).

Due to the law of the Coast Guard, certain Norwegian Coast Guard staff has to be particularly trained with respect to policing. They also have education and frequent training as On Scene Coordinators during incidents. This includes being a resource for providing On Scene Coordinator and support roles, Air Coordinator roles, and rescue coordination with triage as well as evacuation capacities on their vessels. Even though not specified, these tasks are often a task for a team of several persons at each level in larger operations. The main tasks of the coordinators are to assess the scope of the incident, analysing the need for resources to prevent and avoid the impact of incident, communicate with emergency units, contribute to decision-making process related to recourse coordination, logging data about all facts and activities, and summarizing and evaluating data for reporting to other units. With their well-equipped bridges, long-established internal manuals which go beyond the regular "Norwegian Coast Guard preparedness manual" and the substantial experience of the captains and

officers, the Coast Guard should be seen as a major resource for cooperation on scene (tactical coordination)[1].

2.1.1.4 The Royal Norwegian Navy

The JRCCs or the police may also mobilize resources from the rest of the Norwegian Navy. Different types of vessels are available along the Norwegian coast, even though the mobilization time may vary. The navy has the following resources that may be included in SAR operations:

- **5x Fregates – Fridtjof Nansen-class**
  The five frigates have high capacity for SAR operations including helicopter capacity and advanced surveillance capacity including long range radars and communication capacities. They are well manned and may operate for a long time. The speed is 26 knots, and the crew size is 120+. The vessels may accommodate a large amount of rescued people on board, and have hospital and medical personnel onboard.
- **6x Coastal Corvettes Skjold-class**
  These very mobile and fast vessel with 60 knots max speed, is well suited for SAR operations and support close to coastal areas. It has IR-camera equipment and has 20+ in crew size.
- **6x mine-clearance vessels**

  Three minesweepers (Alta-class) and three mine-hunting vessels (Oksøy-class) have speed of 23 knots and their crew size is 32+.

2.1.1.5 The Royal Norwegian Air Force

The resources of the Norwegian Air Force include surveillance planes and fighter jets with advanced sensors that may be used for search operations, helicopters for Search and Rescue, and transport planes for transport of equipment and personnel. The Royal Norwegian Air Force is also responsible for operating the Sea King rescue helicopters coordinated by the JRCCs (Ministry of Defence Norway s.a.).

<u>The Rescue helicopter service</u>

- **The 330-Squadron**

The 330-squadron of the Military Helicopter Service has been the biggest squadron in Norway, especially when it comes to air support in maritime SAR. The helicopters are owned by the Ministry of Justice and Public Security and operated by the Norwegian Air Force. There are five bases which are located in Sola, Rygge, Ørland, and in the Arctic cities of Banak and Bodø. The resources bases have 15 (25) min. preparedness 24/7/365.

[1] From an observation report of Sarex Spitzbergen see also:(Solberg et al. 2016)

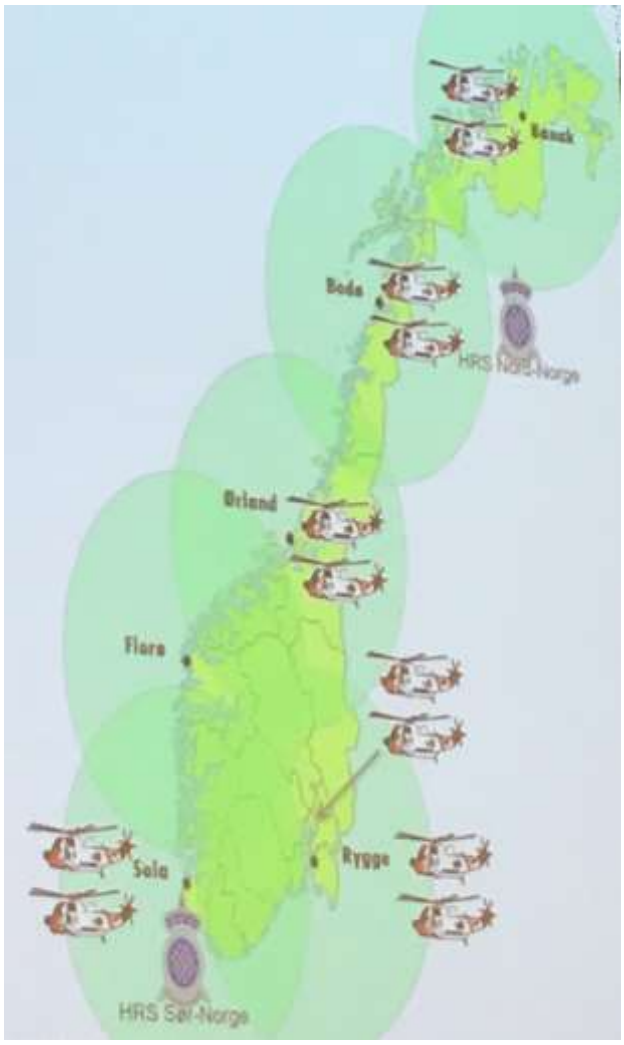

Figure 2: *330 Squadron bases (Forsvaret, 2018)*

12x Sea King Helicopter – Sea King is operational in Norway since 1973. However they are being replaced by the AW101 according to NAWSARH. Crew size is of 6 persons: 2 pilots, engineer, systems operator, rescuer and anaesthesiologist. The capacity is to carry up to 18 passengers or 6 stretchers.

16x AW101 Helicopter – The Augusta/Westland AW101 will between 2018 and 2020 replace the Sea King helicopters' role as the rescue helicopter. According to information from the Ministry of Justice and Public Security, the first helicopters will be tested between November 2017 and November 2018 (JRCC North-Norway 2017). They require a crew of 6 persons and can carry 25 passengers and have a reach of 500 kilometres.

They are able to rescue 20 people up to 150 nm outside of the Norwegian coastline within 2 hours. Also medical evacuation (MEDEVAC) should be provided for two persons within 400 nm outside of the coastline. In addition, the whole coastal area and land area shall be covered.

339 Squadron. The 339 squadron has 2 bases which are located in Rygge and Bardufoss. Their resources are used for multiple purposes including SAR over

land and close to the coast. These helicopters have very limited maritime SAR capability

18x Bell 412 SP Helicopter. The 412 SP may be used for SAR and as mobile command stations. Maximum flying time is 4,5 hours with extra tank. Crew size of 2 plus potential space for doctor, rescuer or coordinator (Ministry of Defence of Norway).

134 Air Wing, 139 Air Wing, 337 Squadron. The squadron is based at Bardufoss Air Station and operates eight NH90 helicopters. The helicopters are used by the Norwegian Coast Guard and serve on the Nordkapp-class, the Barentshav-class and on NoCGV Svalbard.

14x NH90 Helicopter – These helicopters are dedicated to maritime operations and divided between the largest coast guard vessels and the frigates. Their tasks include SAR, medical evacuation, anti-submarine and terror control as well as surveillance. Operation time is of over 4 hours and they have capacity of 16 passengers. At present (2018), only a few of these helicopters are operative (Ministry of Defence Norway s.a.).

335 Squadron. The 335-squadron is based in Oslo-Gardemoen and all of the larger long-haul cargo aircrafts with relevance to SAR are located there.

- **4x C-130J Hercules Airplane** – Provides tactical transport and support to logistics and can also be used for emergency situations. (Ministry of Defence Norway s.a.)

331, 332 Squadrons. These squadrons are operating the fighter aircraft which may also be used as observation flights within large scale incidents. Resources include:

- **55x F-16 fighter aircraft** – There are always two F-16 Quick Reaction Alert (QRA) on 15 minutes mobilization time in Northern Norway. They may provide observation flights with information of the incident site. These resources will be replaced by the F35.
- **52x F-35 fighter aircraft** – They will be established from 2017 until 2025. They also have only 15 minutes mobilization time and replace the old F-16 fighter aircrafts. They may provide observation flight information of incident site.

333 Squadron:

- **6x P-3 Orion** – Orion are maritime long haul patrol aircraft stationed at Andøya. They have been an important resource for border control but also SAR operations and information gathering and transport of eg. SKAD (Survival Kit Air Dropable) and two Rescue floats are possible. They have 8000 kilometres reaching distance. These planes will be replaced by P8 Poseidon planes with more advanced sensors.

717 Squadron

- **3x DA-20 Jet Falcon Airplane** – DA-20 provide passenger transport, radar and navigation supports. (Ministry of Defence Norway s.a.).

2.1.1.6 National Air Ambulance Services of Norway

The Air Ambulance Services which are owned by Helse Nord RHF, Helse Midt-Norge RHF, Helse Vest RHF and Helse Sør-Øst RHF provide advanced emergency medical transportation between the hospitals, especially for specialized treatment. As such, they represent an important part of the preparedness logistics system taking care of injured persons from the sea accidents. Also, they employ smaller ambulance helicopters that can be utilized for land area SAR operations. All helicopters are staffed with a pilot, one rescue crew/HEMS Crew Member and anesthesiologist/emergency doctor. The helicopters are equipped with advanced medical equipment and have room to transport two stretcher patients.

Also, there are ambulance airplanes for transport of patients and carrying of advanced medical equipment (Luftambulansetjenesten s.a.).

Norsk Luftambulanse AS which has helicopters and focuses more on seasonal preparedness and arranged emergency preparedness for events (NorskLuftambulanse s.a.).

The Air Ambulance Services have **nine ambulance airplanes** which are available between Kirkenes, Alta, Tromsø, Bodø, Brønnøysund, Ålesund and Gardermoen. Alta and Gardemoen have two additional aircraft. Eleven locations (Tromsø, Brønnøysund, Trondheim, Ålesund, Førde, Bergen, Stavanger, Arendal, Ål, Lørenskog and Dombås) have **twelve ambulance helicopters** in service. Lørenskog has **two helicopters** (Luftambulansetjenesten s.a.).

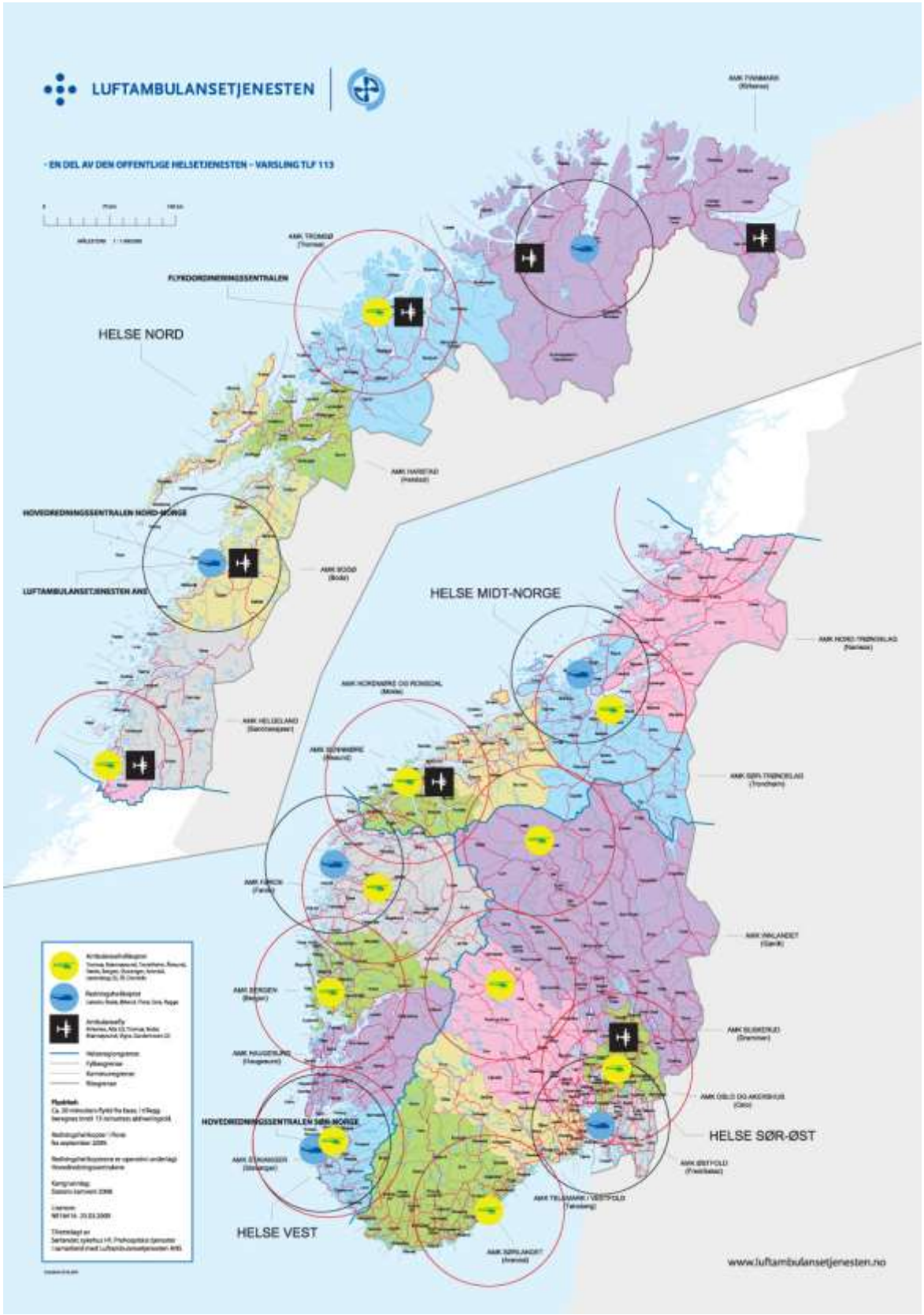

***Figure 3**: National Air Ambulance Services of Norway*

2.1.1.7 The Norwegian Society for Sea Rescue (RS)

The Norwegian Society for Sea Rescue (RS) is a Norway wide, non-profit humanitarian organisation owned by its members providing rescue capacities along the Norwegian coast. This includes vessels, equipment and personnel. RS is part of the International Maritime Rescue Federation (IMRF) with resources and therefore has the potential for cooperation with members in 112 organizations in 48 countries.

The RS have 50 rescue vessels and 4 ambulance boats stationed along the Norwegian coast. Of these, 25 rescue vessels and 4 ambulance boats are professionally manned and 25 rescue vessels are manned by 1.300 volunteers. They are most of the time equipped with water/foam fire pumps, thermal cameras, night lights and first aid. Sizes are mostly in the range around 10 to 20+ passengers and the crew sizes are around 3-4 people. In total, RS has around 1.500 rescuers. RS accounts the following locations and boats to their fleet in the North (from Brønnøysund north) (Redningsskøytene s.a.):

Table 1: *Resources of the Norwegian Society for Sea Rescue (Redningsskøytene s.a.)*

Vesseltype	**Vessel**	**Location**	**Specifications**
Fosen-klassen	RS 150 Odin	Havøysund	29 knots speed, 600nm reach,
Simrad-klassen	RS 145 Vekteren	Alta	36 knots speed, 165nm reach
Simrad-klassen	RS 144 Uni Helgeland	RSRK Brønnøysund	36 knots speed, 165nm reach
Petter C.G. Sundt-klassen	RS 138 Sundt Flyer	Svolvær	40 knots speed, 350nm reach
Fosen-klassen	RS 132 Gjert Wilhelmsen	Sørvær	24,9 knots speed, 600nm reach
Simrad-klassen	RS 129 Køpstad	RSRK Harstad	30 knots speed, 200nm reach
Simrad-klassen	RS 128 Gideon	RSRK Tromsø	34 knots speed, 165nm reach
Fosen-klassen	RS 125 Det Norske Veritas	Ballstad	24,9 knots speed, 600nm reach
Simrad-klassen	RS 122 Simrad Færder	Harstad	30 knots speed, 200nm reach
Koss-klassen	RS 110 Reidar von Koss	Båtsfjord	25 knots speed, 800nm reach
Skomvær-klassen	RS 107 Knut Hoem	Myre	24,9 knots speed, 600nm reach
Adeler-klassen	RS 106 Skuld	Træna	24,9 knots speed,
Adeler-klassen	RS 105 Ruth Opsahl	Bodø	24,9 knots speed, 300nm reach
Skomvær-klassen	RS 104 Oscar Tybring IV	Tromsø	25 knots speed, 422nm reach
Skomvær-klassen	RS103 Dagfinn Paust	Andenes	25 knots speed, 417nm reach
Skomvær-klassen	RS 99 Skomvær III	Røst	25 knots speed, 300nm reach
Ambulance-boat	RS 420 Eyr Ytterholmen	Bjørn	40 knots speed, 300nm reach
Ambulance-boat	RS 421 Eyr Bremstein	Rørøy	40 knots speed, 300nm reach
Ambulance-boat	RS 422 Eyr Myken	Rødøy	40 knots speed, 300nm reach
Doctor shuttle boat (Legeskyssbåt)	RS 423 Eyr Åsvær	Ørnes	29 knots speed,
Petter C. G. Sundt-klassen	RS 162 Klaveness Marine	Bodø	42 knots speed, 400nm reach

2.1.1.8 Norwegian fire brigades – Maritime Incident Response Groups (MIRG)

The municipalities are responsible for the fire brigades in Norway offering a fine-grained system of fire and rescue services. Most of the fire brigades are manned by volunteer personnel. After the tragic fire-incident on the passenger ferry "Scandinavian Star" in 1990 on its way between Norway and Denmark where 158 persons died, seven fire-brigades along the coast were given the task of establishing a Maritime incident rescue group (MIRG) to provide support in maritime emergency operations if necessary. These are located in Tromsø, Bodø, Ålesund, Bergen, Stavanger, Larvik and Oslo.

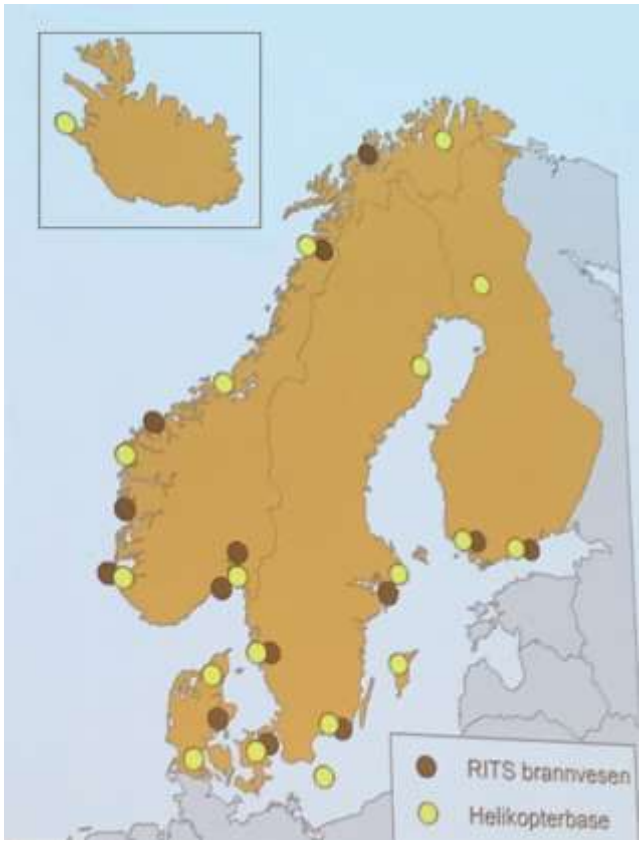

Figure 4: *MIRG and helicopter bases in Norway (Fure, 2018)*

All Fire and Rescue Brigades that are located along the Norwegian shoreline are obliged by law to respond to incidents at sea or close to their sea shore if called upon. The fire departments have, upon request, the duty to assist in fires and other maritime accident situations within or outside the Norwegian territorial boundary. When called upon by the JRCC they shall respond to severe fires, in particular fires on board passenger vessels.

MIRG-personnel estimate a response time of a 15min, and the decision to start a MIRG-operation is taken by the JRCC. In most cases, MIRG personnel and their equipment are transported to the incident site by the local rescue helicopters or by boat. MIRG personnel has self-contained breathing apparatus (SCBA) capacity to operate under smoke and gas conditions.

A MIRG team usually consists of one leader, one SCBA-leader and four SCBA-equipped rescue personnel[2]. Equipment consists of a Norkapp-suite (or other approved survival suit or fire-suits), SCBA, helmet, gloves and extra bag with clothes and equipment.

Typically, MIRG operations focus on ship fires, but may also involve a range of damage-prevention tasks, help with evacuation and first aid. In 2011, DSB and the Coastal Administration agreed to investigate the possibility of MIRG services providing assistance for the Coastal Administration related to chemical preparedness. MIRG preparedness is also available in case of accidents on land. In addition to the MIRG teams there are several fire brigades that have built up their maritime preparedness locally, but do not have a separate agreement with DSB (DSB, 2018).

2.1.1.9 Maritime medicine advice - Radio Medico Norge

Radio Medico Norway is a 24/7 helpline to provide tele-medicine to seafarers in distress when medical issues appear. They cooperate both with JRCC as well as Coastal Radio. They have focus on medical emergencies, general medical services, special advice and preventative care (Radio-Medico s.a.).

2.1.1.10 SAR – communication systems

The Norwegian system for maritime distress communication is structured according to international law. The Coastal Radio has stations with 24/7 assistance. The service is provided by Telenor and top priority is to be the hub between vessels in distress and JRCCs. The maritime radio is co-located with the JRCCs operation centers in Bodo and Stavanger giving maximum cooperation between the two agencies.

As requested by the Ekom-rules, emergency authorities are connected via the emergency communication network "Nødnett". Nødnett – the Norwegian Emergency Public Safety Network is a separate radio network, built specifically for rescue and emergency users. Nødnett provides TETRA standard communication which includes "secure, encrypted radio communications in talk groups and in direct one-to-one communications. It is also possible to transfer data at moderate speeds" (DSB 2016). Nødnett is terrestrial-based, hence, built similarly to a mobile network (DSB 2016). As of May 2018 there were over 56.000 terminals and over 2.000 base stations (Nødnett s.a.)

Motorola Solutions currently has a contract until 2026 to operate and service the net, but the time afterwards is open. The current Nødnett technology may be increased in life-span for another 5 years until 2031. At any cause, the preparedness institutions are expecting NGN (Next generation Nødnett), a mobile broadband for critical data communication, to be installed (DSB 2017).

[2] Interviews with representatives of Saltenbrann

While Nødnett and NGN are land-based, Norway has also put effort into establishing a maritime mobile broadband radio (MBR) connection. The project is managed by Kongsberg Seatex and Radionor, the network is capabale of connecting ships without internet but can also connect to the internet. The Norwegian Coastal Administration and NOFO the Norwegian Clean Seas Association for Operating Companies have been the first to install the technology on their affiliated resources (Kystverket 2017).

2.1.1.11 Industry SAR-capacities

Commercial vessels as SAR capacities

The earlier Marpart reports have shown the change in the maritime activity patterns taking place. One trend is larger cruise vessels visiting the Arctic. An increasing amount of smaller expedition cruise vessels go to remote areas North East Spitsbergen, Franz Josefs Land, the North-East passage and West passage as well as Greenland. These areas have limited SAR capacity and resources (Keil 2017).

Both commercial passenger vessels and transport vessels, according to MARPOL Annex I, Ch. 5, Reg. 37.4, Oil Pollution Act 33 CFR 155.240 [OPA 90], SOLAS Ch. II-1, Pt. B-1, Reg. 8-1 [Safe Return to Port] and OCIMF-Guidelines, have to provide their own Emergency Response Service (ERS system). This includes 24/7 decision making capacities and coordination of the operator's resources in case of SAR incidents. Officers and crew have to be skilled in SAR operations and fire-fighting. On passenger vessels, the safety crew needs a passenger crowd and crises management course, and frequent training. This means that the commercial vessels have certain capacity to respond to own problems as well as help out other vessels in distress.

The vessels operating in the Arctic represent an important asset in SAR operations. This includes the cruise vessels. They have significant capacities on board and may host many persons. The vessels bring with them large supplies of food and water, berths, clothes, tender boats, potentially helicopters, submarines, drones and diving-equipment, pumps, welders, medicine, potentially hospital, doctors, nurses, fire-fighters and other experts. Some of them may also have Oil Spill Response equipment. They are sailing in areas with limited SAR-capacities. The fishing fleet represents a similar capacity.

The oil and gas industry – area and field SAR-capacities

The oil and gas industry operating in Norwegian territorial waters needs to have a significant capacity for their own emergency preparedness based on predefined risk areas. The oil majors have their own preparedness organizations, while the smaller operators have sourced these tasks to emergency response organizations such as OFFB and RESQ. This organization will cooperate closely with the

JRCCs when a SAR situation arise or with other authorities if an emergency situation occur.

The Norwegian Oil and Gas Association has published Recommended Guidelines which shall serve as the benchmark for offshore activities in several areas. This includes emergency preparedness and SAR response and guideline 064 "Regional preparedness" defines the requirements for available capacities in Norwegian waters (NorskOlje&Gas 2015). According to "DFU" Defined Hazard and Accident Conditions, there are four scenarios with relevance to existing SAR-capacity. DFU1 on man over board during work, DFU2 on personnel in the water after helicopter accident, DFU3 on personnel in the sea with emergency evacuation, DFU6 on fire with need for external assistance and DFU7 on injury or sickness with need for external assistance. Particularly DFU3 deals with upper limits of the capacities and requires the operators to perform a quantitative risk analysis and establish and operate emergency resources accordingly. These resources are normally a shore located rescue helicopter, a stand by vessel close to the field, and supply vessels serving as additional SAR capacity.

2.1.2 Oil Spill Response (OSR)

The Norwegian oil spill preparedness and response system is a combined effort of government and large industry players. In Northern Norway, a growing petroleum activity has brought more capacity to the region. The range of actors involved in oil spill preparedness system has various responsibilities and obligations. The Ministry of Transport and Communications has overall responsibility for the state's preparedness for acute pollution, while The Ministry of Climate and Environment has the overall responsibility for demanding private and municipal emergency response to acute pollution. Oil Spill Preparedness and Response capacities may be referred to the three levels of actors in the system for Oil Spill Response in Norway – private, municipality (local government) and state (Sydnes&Sydnes, 2011). *The private level* includes offshore oil companies which have to deal with acute pollution on site. NOFO, the Norwegian Clean Seas Association for Operating Companies develops, on behalf of the oil companies' contingency plans and provides operating companies with response equipment and technical personnel. *The municipal level* preparedness capacities refer to coastal municipalities, which provide personnel and equipment to deal with smaller acute spills. In addition, the local authorities will be involved in shoreline operations when the state preparedness is mobilized after shipping incidents with major spills. They have also agreement with NOFO to take part in Oil Spill Response operations after spills from the offshore oil industry. Local authorities cooperate on preparedness through 32 inter-municipal preparedness regions, headed by inter-municipal emergency response committees (IUAs). The fire brigades or the larger harbors have the main coordinating responsibilities for the IUAs. *The state level* is responsible for emergency response in case of major acute

pollution incidents not covered by local authority or private-sector plans. The Norwegian Coastal Administration (NCA) is responsible for the governmental preparedness against acute pollution, and has nation-wide administrative authority in the case of acute pollution incidents. In addition, authority has been delegated to the NCA to ensure the best possible coordination of operational emergency preparedness for acute pollution in a national system.

In an effort to build capacity and to advance technologies, the Norwegian Coastal Administration (NCA) and NOFO have been experimenting with different types of capacities and action patterns, and promoted innovations and new technology. The Norwegian Coastal Administration, NOFO, and private companies manage equipment depots.

For major coastal and beach cleaning operations, this basic scheme will be the starting point for building a long-term response plan. It is reasonable to assume that the agreements between NOFO, IUA, NCA and other private organizations will provide access to nearly 1,000 people in the acute phase of an Oil Spill Response action. In addition to this, the response organization might use the labour market in combination with the established structures for training and skills management. It will also be appropriate to request international resources through international agreements which are managed by NCA and through international cooperation agreements in oil industry (Norsk Olje&Gass, 2014, p.45).

2.1.2.1 The OSR-capacities of the oil industry

The oil companies and NOFO can mobilize heavy resources on short notice. Stand-by emergency response vessels are at hand close to the oil installation. Supply vessels can be mobilized to carry several hundred meters of floating booms out from the supply bases. The slicks are pumped into the vessels' tanks by floating skimmers (de Nanteuil, 2015).

The oil company or operating companies are responsible to initiate measures and handle oil spills from their own activity, ref. Norwegian Pollution Control Act. If pollution has been caused by offshore petroleum activities, the NCA will be notified by the Petroleum Safety Agency (PSA) and contact will be established between these agencies.

Oil spill contingency planning in Norwegian offshore petroleum industry is based on the barrier concept and includes five barriers to be mobilized from the source of pollution until the coastline. Organization and dimensioning of emergency preparedness are important prerequisites for effective handling of acute pollution (St.Meld 35, 2016). The following table overviews the barriers and capacities as followed by the oil and gas companies for offshore drilling and production (Oljevern.no, 2011):

Table 2: *Oil spill preparedness barriers and capacities for the offshore oil industry in Norway*

	Location	**Purpose**	**Equipment/measures**
Barrier 0	At the production facility, or close to a platform	Procedures are established and equipment is in place to detect abnormalities and initiate measures for rapid shutdown to prevent spills, fire or explosion	For the oil and gas sites, we are here talking about advanced sensors, alarm equipment, mechanical valves and duplicated barriers are examples of systems which are intended to prevent and limit damage. These are located both at the seabed and on the drilling facility.
Barrier 1	Combating close to the source. A standby vessel and helicopters are always close by.	If a spill should occur, the contingency plans on board and in the vicinity of the platform will come into operation	The standby vessel is equipped with oil spill protection equipment in compliance with Norwegian standards. The vessel will be capable of commencing damage-limiting operations immediately, in the form of the deployment of marine booms and skimmer equipment. In parallel with this the operator, in co-operation with the authorities and the Norwegian Clean Seas Association for Operating Companies (NOFO), will commence the mobilization of the next safety barriers.
Barrier 2	Combating along the drift trajectory of the spill	Work of recovering oil in the open sea before it reaches land	With the help of infrared cameras and oil-detecting radar systems, an oil slick can be followed even in conditions of poor visibility and darkness. Small buoys are also used which transmit signals to satellites. These are deployed in an oil slick so that the effect of wind and currents on its trajectory can be monitored accurately. In addition, drift trajectory calculations are prepared with the assistance of specialist groups connected with the contingency apparatus.
Barrier 3	Combating in the coastal zone	Deploying resources closer to the coast too, in case any of the oil should penetrate Barriers 1 or 2.	Equipment depots with modern, efficient equipment. One of the innovations is the use of boom systems and skimmer equipment, which can be operated by smaller vessels, paving the way for collaboration with coastal fishermen.
Barrier 4	Recovery of oil in the shore zone	If oil reaches the coast, the operations will enter two phases: an emergency phase and a long-term phase. In the emergency phase, special task forces will be mobilized in the shore zone.	The efforts on sea include the establishment of new equipment depots for shore zone contingency equipment and a contingency scheme in collaboration with the local fishing fleet. In coastal operations, amphibious landing craft may be used. These are highly flexible and can be used for collection and recovery, as well as transport functions such as landing equipment and personnel where access to the shore zone from land is difficult.

Increased petroleum activities in coastal areas, combined with limited infrastructure and long distances in Northern Norway, require special attention to the preparedness at oil fields near Lofoten and in the Barents Sea.

Equinor (Statoil)'s preparedness map with resources supply bases and heliports is presented in the figure below.

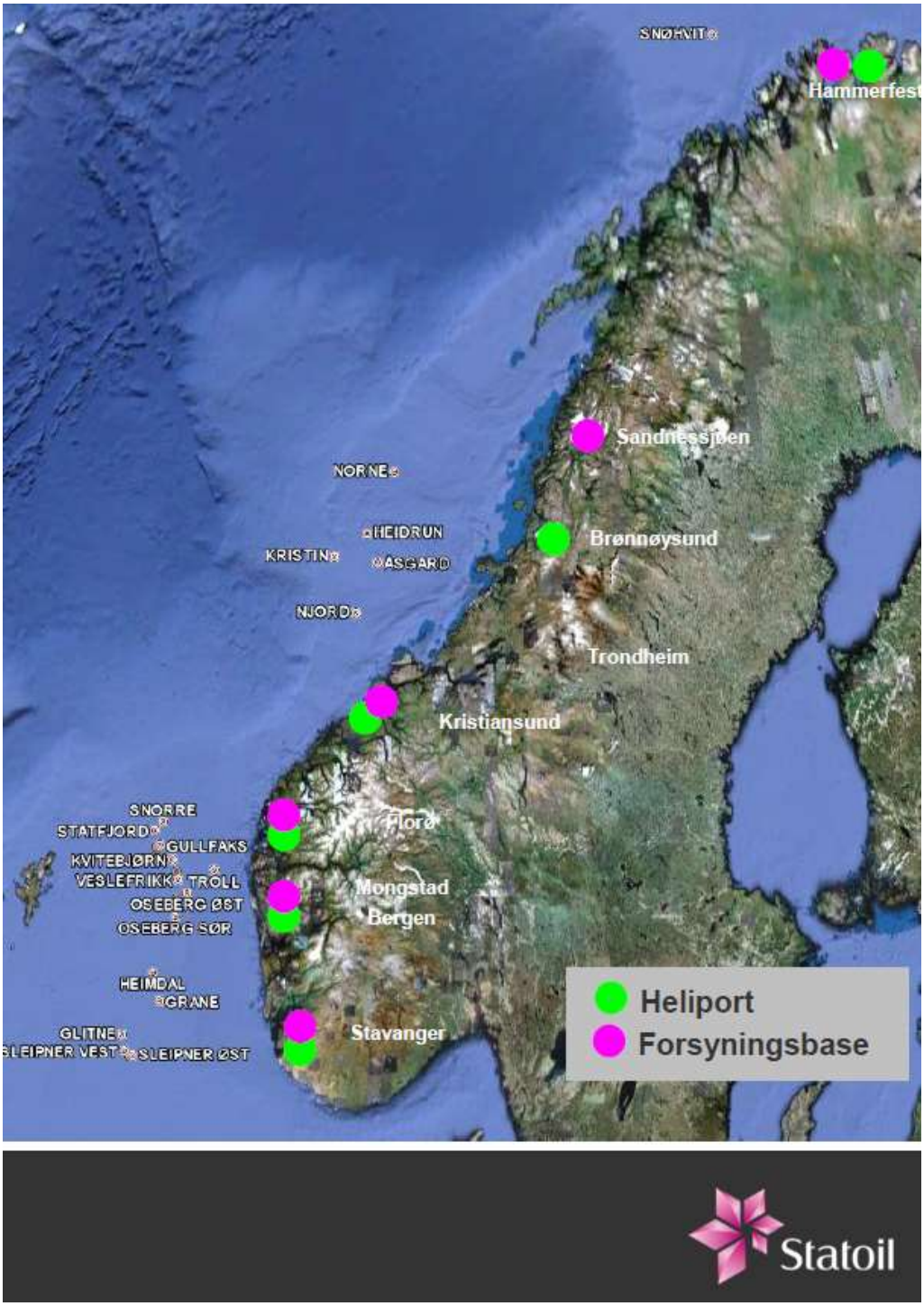

***Figure 5**: Preparedness at Norwegian continental shelf, Statoil (Hauge, 2017) (supply base)*

In the Barents Sea Eni Norge's preparedness activity for the Goliat field is tailored to the area and strengthens the resource capacity related to Oil Spill Response, emergency towing as well as Search and Rescue. The oil spill preparedness at sea consists of six large, ocean-going vessels designed specifically for Oil Spill Response, with ocean-going lenses and collection and storage capacity. Three of these vessels also have dispersion equipment. Two of the Eni Norway-contracted

vessels, (Esvagt Aurora and Stril Barents), have new solutions for dispersion where the equipment is stored and installed inside the vessels and can be controlled automatically from the bridge. The vessels are also equipped with Infrared (IR) camera and oil radar that can detect and follow a discharge in the darkness or bad visibility. In addition, airplanes and helicopters can be used in an Oil Spill Response operation; these are also equipped with IR and oil radar (Eni Norge http://www.eninorge.com/no/Miljo-og-samfunn/Oljevern/Oljevern-til-havs/).

If pollution has been caused by a vessel, the owner of the ship has the primary responsibility for preventing spills to the marine environment and for initiating damage limitation measures when pollution occurs or threatens. If the pollution has been caused by offshore activities, the responsible operator will normally mobilize NOFO to take charge of the pollution clean-up on its behalf. NOFO is responsible for maintaining emergency preparedness on behalf of the companies operating at the Norwegian Continental Shelf. NOFO serves as a coordinating organization if a spill occurs and is responsible for the tactical and operational management of response resources in use.

All resources available to NOFO are also available to member companies. About 30 operating companies are currently members of NOFO. NOFO's resources consist of own, public and private contractual resources. The core of the seagoing preparedness consists of 25 large mechanical collection system and 31 sea-going oil recovery vessels that meet NOFO's standards. 11 of the 25 major NOFO systems are permanently located on board the vessels located on the shelf (Norsk Olje&Gass, 2014).

NOFO has bases and depots spread along the Norwegian coastline with Oil Spill Response equipment for all barriers available (booms, skimmers, etc.). In addition, they have stocks of oil dispersants as well as remote sensing equipment. Dispersants are chemical products formulated to produce 10s-microns size oil droplets that will be dispersed, diluted and eventually biodegraded in the environment. New generations of dispersants have low toxicity and high efficiency (Source: IMO).

The available standby personnel includes people from local municipalities and others (approx. 60 persons) and managers of a special task force. In Northern Norway, there are 2 NOFO bases and 2 NOFO depots (NOFO, 2014). The depots are located in Træna and Hammerfest, bases are in Sandnessjøen and Hammerfest. NOFO holds an Emergency Response Centre which will support the responsible oil companies' emergency organizations in handling a situation.

In regard to ocean preparedness, NOFO has at its disposition 31 Oil Spill Response vessels of NOFO-standard (OR), 34 ocean-going Oil Spill Response vessels, 25 ocean-going mechanical oil collection systems, 10 ocean-going dispersing systems, access for dispersion from aircraft, a large resource of

dispersants (about 750m3) and vessels specialized for surveillance (NOFO, 2014).

In regard to coastal preparedness, NOFO has contracted 30 vessels for Oil Spill Response (mainly fishing vessels) in Finnmark, 30 vessels are located from Vestfjorden to Stadt, 3 supporting vessels, 4 speed barges, 1 large and 2 smaller work fleets, different Oil Spill Response equipment, 25 coastal and fjord systems, and oil booms (NOFO, 2014).

NOFO's special task force (IGSA), whose aim is to combat oil spil along shorelines has capacity to respond within 36 hours to acute pollution onshore, and combat up to 100m3 oil per day. The IGSA consists of 40 trained and well-skilled personnel, work boats and speed barges, oil recovery equipment (booms, pumps, aggregate, storage devises, tents, field equipment and others), supporting vessels with operational level management (NOFO, 2014). This group is specialized in collecting free-flowing oil in the coastal zone and has access to equipment specially designed for this purpose.

Two new large depots have been established in Hasvik and Måsøy, where extensive Oil Spill Resources have been stored for operations in the coastal areas. This equipment is purchased specifically for Goliat, but can be used for all events.

One of the most significant innovations for the preparedness system in Northern Norway has been to incorporate the coastal fishing fleet into a permanent emergency structure in the north. This system is also in place for other parts of the Norwegian Coast. Through cooperation projects with the fisheries organizations, the suitability of various types of vessels has been studied, both in terms of the territory of oil spill preparedness, technical aspects, and a robust organization (oljevern.no). Eni Norge, the Fishermen's Association in Northern Norway and NOFO are collaborating to build a new permanent contingency organization, in which fishing vessels from Finnmark will contribute to oil recovery operations. Fishing boats can operate light and mid-weight boom systems [3]. 30 local fishing vessels have become a part of the emergency preparedness organization of the Norwegian continental shelf and can assist during possible emissions that can reach coastal areas. The vessels are adapted and equipped with newly developed oil collection equipment from NOFI (Tromsø) that can be operated by a single fishing vessel and at higher speeds than the traditional system of lenses drawn by two vessels. The vessels exercise at least twice a year. The different fishing vessels have different size and capacity and will be set in areas where these are suitable. In addition, it is possible to use the ocean-going vessels in the coastal preparedness[4].

[3] http://www.eninorge.com/en/Environment-and-Society/Oil-conservation/Oil-spill-protection-measures-along-the-coast/

[4] Eni Norge http://www.eninorge.com/no/Miljo-og-samfunn/Oljevern/Oljevern-ved-kysten/

There are several Norwegian companies, such as NOFI, MIROS, NorLense AS, Skimmer Technology AS, Jason Engineering AS, Framo, Kaliber and others, which are world leading providers in oil spill technologies and equipment.

For aerial surveillance NOFO has an agreement with NCA to use their surveillance aircraft. In addition, helicopters can be used for surveillance. NOFO has also wave radars, aerostat and satellite connection.

NOFO and KSAT (Kongsberg Satellite Services) have entered into an extended agreement on satellite-based remote sensing on the Norwegian continental shelf for detection of acute pollution from petroleum activities. KSAT[5] is the world's leading commercial satellite center. KSAT has a unique global terrestrial network for satellite data reception and has specialized for satellite-based near-real-time surveillance services from its head office in Tromsø. KSAT has provided satellite-based oil detection service to industry, through NOFO, since 2005. Due to the latitude, KSAT can offer extremely high coverage frequency and rapid delivery in the High North. Synthetic Aperture Radar (SAR) imagery is used for operational ice management purposes during drilling activity, seismic activity and can also be used for finding leads within the ice, avoiding areas of heavy ice to save time and ensure a safe journey (https://www.ksat.no/en/services%20ksat/ksat%20in%20the%20arctic/).

The service includes oil detection using images from radar satellites. The pictures are read at KSAT's back stations and analyzed experts in Tromsø. The results are then delivered in near real time to NOFO, which is responsible for disseminating the results to the oil field operators. This information is delivered in very small geo-referenced files suitable for delivery to vessels in low-bandwidth conditions – letting them know within minutes exactly where the ice has moved rapidly across areas thousands of square kilometers in size.

2.1.2.2 The OSR-capacities at municipality level

The municipalities have the responsibility to handle oil and chemical spills from minor spills of acute pollution that occur as a result of normal activities in the municipality and which are not covered by private emergency preparedness. Responses to acute pollution caused by shipping accidents which involve small vessels and which fall within the scope of local government emergency preparedness will be led by the local authority. The municipality also has a responsibility to assist in case of state response action. All municipalities in the country participate in inter-municipal cooperation through the Inter-Municipal Committees for Acute Pollution (IUA). Through this scheme, each municipality can receive assistance in the form of personnel, equipment and expertise to handle spills that are larger than the municipality can manage on its own (St.Meld.35, 2016).

[5] NOFO https://www.nofo.no/om-nofo/nyhetsarkiv/fjernmaling-satelitt/

There are 29 inter-municipal depots that are part of the state response equipment (Kystverket, 2014). About 70.000 m of lightweight booms and 300 oil skimmers are stored at municipal and intermunicipal depots (Knol & Arbo, 2014). The figure below shows the IUA depots with equipment owned by NCA.

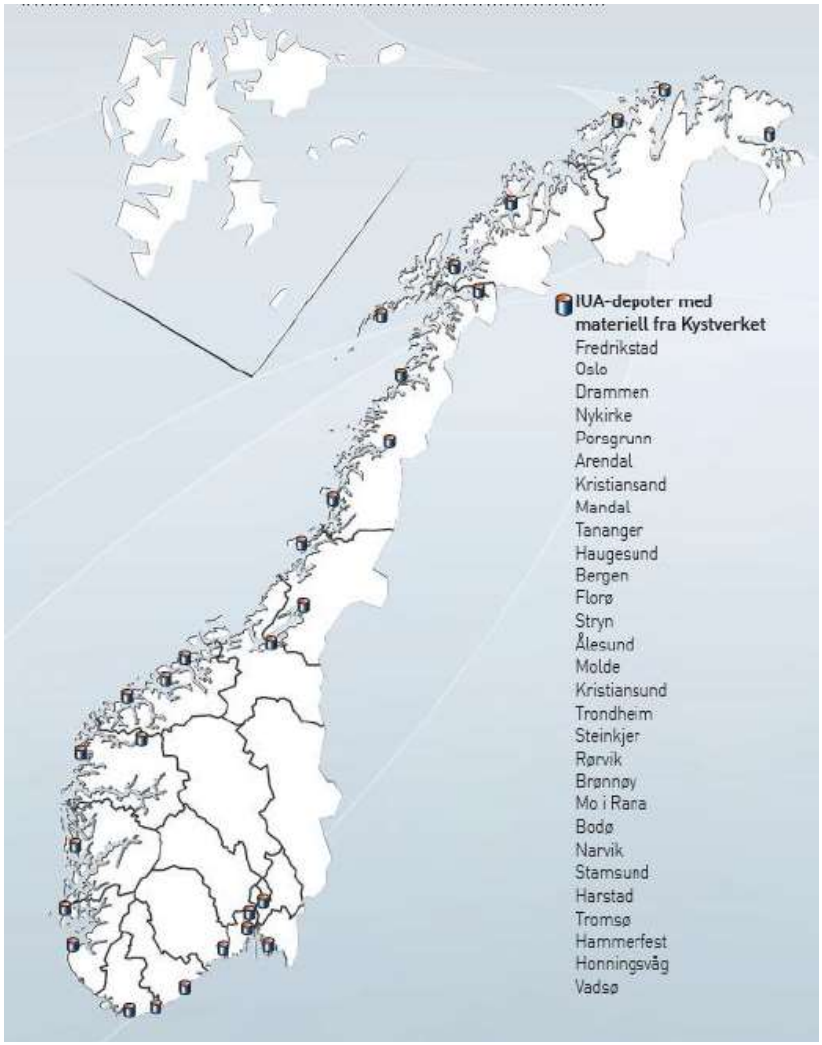

Figure 6: *The IUA depots with equipment from Norwegian Coastal Administration (NCA, 2015b)*

The depots of the Northern region are situated in Vadsø, Honningsvåg, Hammerfest, Tromsø, Harstad, Stamsund, Narvik, Bodø, Mo I Rana and Brønnøy. In case of acute pollution from an oil company on Norwegian continental shelf the IUA can contribute with management, professional personnel and equipment for Oil Spill Response in coastal areas and shoreline. 21 IUAs have agreements with NOFO to provide support in Oil Spill Response operations in coastal areas in case of oil spills from the offshore oil industry. The regional fire and rescue brigades often have the responsibility to run IUA operations.

In the event of major accidents the IUA may request reinforcement support of the Norwegian Support Team of the Norwegian Civil Defence, and personnel from volunteer organizations, like the Red Cross, World Wildlife Fund, Norwegian People's Aid and Rescue and others.

The municipalities have a duty to provide assistance to the state and duty to act on all events as needed according the Pollution Control Act.

2.1.2.3 The state level OSR-capacities

Responses to acute pollution caused by shipping accidents which involve large vessels and which exceed the scope of local government emergency preparedness will normally be led by the NCA on behalf of the central government. The IUAs are expected to continue their work under the leadership of the NCA in line with the duty to assist as specified in the Pollution Control Act. The responsible polluter is also obliged to initiate measures after central government has assumed command (NCA, 2015a).

The main objective of state preparedness is to prevent and limit environmental damage through acute pollution, or the risk of acute pollution. The state preparedness consists of a variety of equipment to prevent or limit environmental damage. For instance, if a ship incident happens near mainland, then efforts should be directed towards towing the vessel from ground and coast. In case of grounding there is a risk of acute pollution and oil spill, so the capacities to collect contamination is important. Using oil booms, the source of pollution is rounded and isolated, so it is possible to collect oil. Oil on sea is collected by sea-going Oil Spill Response vessels. If the oil spreads over a larger area, booms will be deployed to prevent that the beaches will be affected by the spill. If the oil reaches the coast, there will be carried out a beach cleaning operation if necessary.

The Norwegian Coastal Administration (NCA) has 15 main Oil Spill Response depots and 10 supplementary depots along the Norwegian coast. The depots are equipped with booms, skimmers, beach cleaning- and Emergency pumping equipment, personnel and one supervisor. Geographical location of the depots and the type of equipment stored there is based on the Contingency analysis of the NCA from 2011. The analysis indicates the likelihood and consequences of acute pollution incidents in different parts of the coast (NCA, 2014). In Northern Norway, 7 main depots are located in Sandnessjøen, Bodø, Lødingen, Tromsø, Hammerfest, Vadsø and Longyearbyen. In addition, there are 6 secondary depots located in Narvik, Sortland, Skjervøy, Honningsvåg, Båtsfjord and Ny Ålesund (Figure 8).

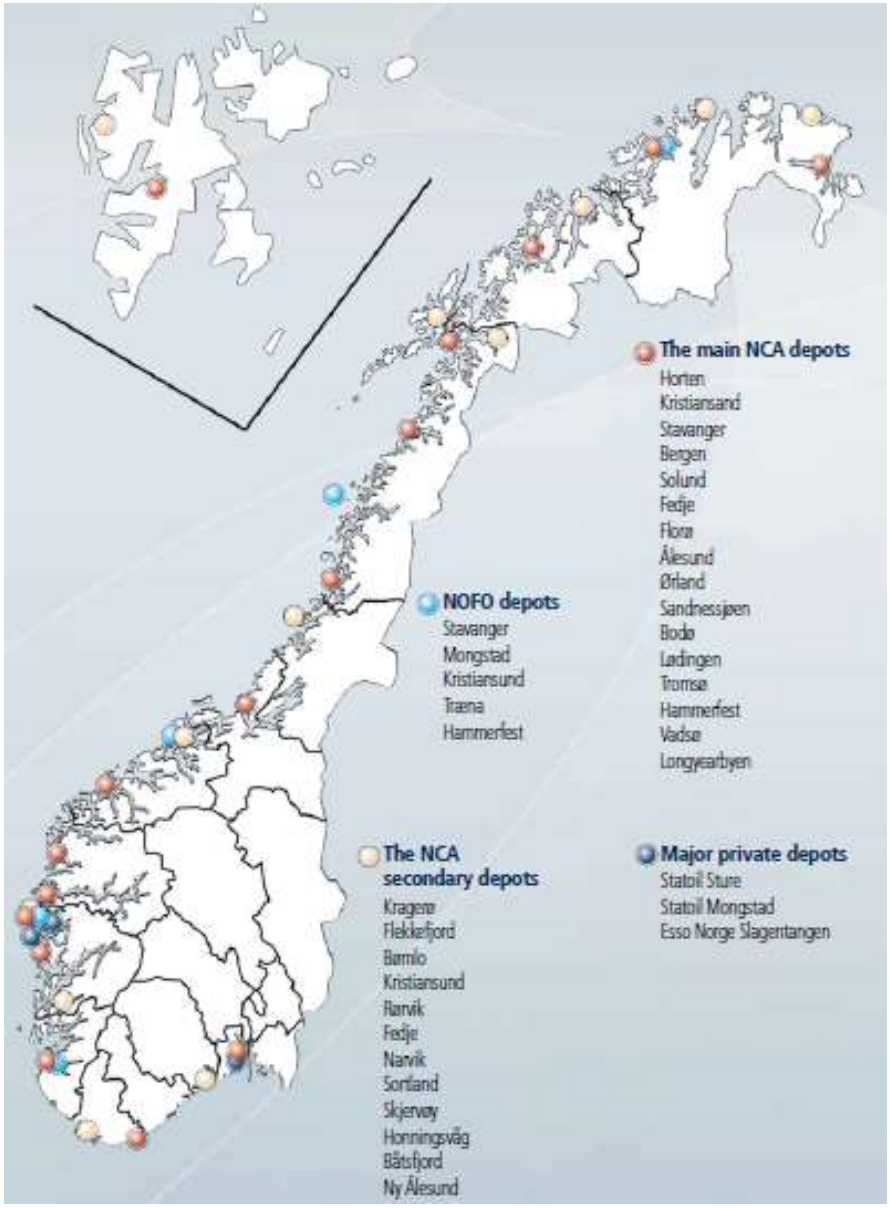

Figure 7: *The Norwegian Coastal Administration's depots (NCA, 2014)*

The depots have equipment for mechanical recovery of oil, such as different types of booms, skimmers and beach cleaning equipment. Some of the depots also have emergency offloading equipment for bunkers oil. Each depot is connected to a team of 10 people and a supervisor. Furthermore, 13 pilot boat stations and four rescue boat stations operated by Norwegian Society for Sea Rescue (RS), can be quickly mobilized with oil booms. The depots do not have equipment for chemical dispersion of acute pollution, but the NCA has access to the dispersants in NOFO's depots. The NOFO dispersants are primarily developed for crude oil. NCA have not implemented the use of dispersants as a tool for the state preparedness, but this is under development.

The NCA owns 7 specialized Oil Spill Response vessels, three of which are new multifunctional vessels (St.Meld. 35, 2016). The NCA may also deploy 11 Coast Guard vessels with oil booms, skimmers and pumping systems. The crew of these

vessels are trained by NCA in using the equipment in Oil Spill Response operations (NCA, 2014). The Coast Guard resources are particularly important when it comes to large-scale incidents and operations in ice infested waters.

At Svalbard, the NCA has preparedness resources stored in a depot in Longyearbyen and some oil spill equipment located in Ny-Ålesund. The depot in Longyearbyen has a task-force of 20 people. When it comes to larger vessels with oil spill capacities, the Governor's MV "Polarsyssel" and Coast Guard vessels are normally located in the area. MV "Polarsyssel" is an important resource in the emergency response to acute pollution. The vessel's presence is limited to nine months a year (St.Meld.35, 2016).

NCA has contracted 4 emergency towing vessels as well as 1 surveillance aircraft (www.kystverket.no). These vessels can also be mobilized for Oil Spill Response. Together with equipment depots, NCA has 45000 m of oil boom available (Knol & Arbo, 2014). Vardø Vessel Traffic Service has a special responsibility for monitoring the outer sailing routes along the Norwegian coast, where vessels with the highest pollution potential sail.

These towing preparedness tasks are about to be taken over by the Norwegian Coast Guard.

The NCA has signed contracts with 36 smaller vessels with trained crew connected to the different equipment depots. These are private boats, most of them fishing vessels, which shall assist NCA in Oil Spill Response. These boats do not have their own Oil Spill Response equipment on board, but may use equipment from the state depots.

The Vardø Vessel Traffic Service (VTS) is responsible for daily allocation and operational use of the vessels for emergency tow response in the event of undesired or acute incidents at sea based on the current traffic situation (NCA, 2011). The VTS' therefore play an important role in the NCA's first-line response to avoid acute pollution and other undesired situations and incidents at sea. The primary task of these vessels are preventing risk vessels (oil and HNS tankers) drifting ashore (www.kystverket.no).

An NCA's contracted surveillance aircraft is patrolling along the Norwegian coast 600-800 hours annually. It has a wide range of facilities, and is specially built for monitoring oil spills in coastal and marine areas. The aircraft can exchange site-attached photos and video with the watch team or action management on land. Today, the plane is also the most important source of information about oil spread and localization where it is possible to collect. It is mainly the NCA that uses the aircraft, but it is employed in cooperation with the Norwegian Coast Guard and NOFO. Therefore, it is used both for surveillance of shipping and petroleum activities on the Norwegian shelf, fisheries inspections and other surveillance missions. In addition, the aircraft is equipped to assist the Joint Rescue Coordination Center in Search and Rescue operations (St.Meld.35, 2016).

Remote sensing equipment on board of the surveillance aircraft makes it possible both to detect illegal discharges and calculate pollution levels. During Oil Spill Response operations aerial surveillance is used actively to survey the spreading, and thus detect where Oil Spill Response efforts should be made (kystverket.no). The NCA's three new multifunctional vessels and 9 coastguard vessels have equipment for remote sensing of oil spill, which can detect emissions in poor visibility conditions.

NCA uses satellite services to detect possible pollution at sea. These services are provided by KSAT and European Maritime Safety Agency (EMSA). If the satellite images indicate signs of contamination, NCA can send out its surveillance aircraft or a vessel to verify satellite observation. Possible indication of spills from an offshore oil installation will normally be followed up by contacting the operator responsible. Satellites may be used also to identify those responsible for the spill. Such observations will normally apply to illegal discharges. Monitoring of illegal discharges is done in cooperation with the police and Norwegian Maritime Directorate (NCA, 2014).

The Pollution Control Act gives NCA the possibility to use Oil Spill Response equipment from the municipalities and private sector when necessary (kystverket.no).

In order to carry out an effective Oil Spill Response it is important to have a good overview of the size and extent of the oil spill, as well as precise information on weather conditions and vulnerable environmental resources in the area. The NCA' map tool on coastal information ("Kystinfo") has been significantly developed during the past ten years. Kystinfo gives the possibilities for compiling different information in a map / situation picture and are constantly under improvement. This also applies to the sharing of information. During an Oil Spill Response operation, the situation image will be updated continuously, including other remote sending data from surveillance aircraft and satellite, name and position of the resources participating in the action, information about vulnerable environmental resources in the area, video and map data from ships, as well as forecasts for oil movements and weathering (St.Meld 35., 2016).

2.1.3 Violent Action Response

The police is responsible for Violent Action Response in Norway. Violent action most often includes sharp assignments such as kidnapping, hostage situations, barricades and threats with weapons, specific hostage situations and terror. Violent Action Response calls for very close cooperation with other parts of the preparedness system especially the paramedics and hospitals, and the fire and rescue brigades. At the "sharp" end where weapons may be used, the regional police has special trained officers for Violent Action Response. In addition, they may ask for support from national resources such as the national Police Preparedness special response team and the national Bomb squad. Violent action

may escalate during terrorist acts. This may call for additional anti-terror capabilities. The regional chief of police may ask for additional support from the military forces. For maritime anti-terror operations, the police cooperates closely with the military special forces (FSK/MJK) and may request assistance. For anti-terror actions towards oil and gas installations, four police districts (Troms, Nordland, Møre Romsdal and South-West police districts) have special responsibility and train for such actions.

The national plan for Violent Action Response and counter terrorism includes the civil preparedness system and the Military preparedness system. Since May 2012 there are also new guidelines for "Support to Allies", an alliance work on counter-terrorism with a focus on awareness, adequate capabilities and increase in cooperation with partner nations and international actors (NATO 2012).

On a national basis, Violent Action Response in Norway during peace time is from a tactical and operational level regulated according to the procedures of Ongoing Life-threatening Violence (PLIVO). The PLIVO concept is a standardized procedure developed in cooperation with all the emergency services: police, fire and rescue, and health. It also includes a standard training concept that involves all three actors (Madsen, 2017).

The PLIVO procedure is a joint procedure for emergency services, the police, fire- and health personnel: "*A PLIVO – operation is an on-going situation where one or more offenders exerts life-threatening violence with weapon/dangerous objects towards innocent persons, and where the police in a direct effort shall neutralize the offender(s) to save life, and limit damage. The Fire and rescue brigades and Health authorities shall actively give support with lifesaving measures*" (PLIVO, 2015, p. 4). The leader of capacities and main responsible for anti-terrorist measures is the Police Operational leader. However, a shared understanding of the situation, and common procedures is regarded crucial for cooperation. The police itself is bound by instructions of the Ministry of Justice and Public Security (DSB s.a.).

National resources for Violent Action Response are in particular the Emergency Response Unit (Delta) with around 100 to 120 people (NRK, 2014). For transportation and off shore operations, they use among others the air force planes and helicopters.

Terror at sea, such as a mass-shooting on a cruise ship may include the national police response unit (Delta), the military special forces (FSK/MJK) and/or the police district special response unit (UAE). In addition they will have support from others for transport, bording the ship, mapping and orientation, including the crew of the ship.

FSK have since 1975 been given and developed specific capacities on maritime counter terror activity. Their marine commando "Marinejegerkommando" (MJK) are currently located in Bergen as well as in Northern Norway. Their duty also

includes anti-terror action against offshore oil platforms and ships (Forsvarsdepartementet 2011-2012).

In general, vessels are covered by a specific regulation on security, pirate and terror preparedness activity (ISPS) and use of power on board a ship or oil rigs (Ministry of Trade and Industry 2005). It ensures that ship, crew passenger, cargo and port facility security are somewhat prepared against terrorist acts. It calls for regular assessments of risk and security incidents and operational plans to counter such scenarios.

When it comes to further reaching agreements, Ministry of Defence and Ministry of Justice and Public Security have established a joint task force to analyse and understand international terrorism dangers and set up a Counter-terror centre (NSD 2014).

2.2 CHALLENGES REGARDING ARCTIC MARITIME EMERGENCY PREPAREDNESS CAPACITIES

2.2.1 Search and Rescue capacity challenges

2.2.1.1 Government agencies and SAR-capacity challenges

Sea and airborne capacities.

Norway has a very large area of responsibility in the Arctic with limited infrastructure available. The activity and risk factors vary during seasons, and it its both challenging and costly to keep up a high level of preparedness in all sea regions. The first reports from the Marpart projects have emphasized different sea areas in the Arctic and the potential risks for accidents in each region (www.marpart.no). The Norwegian government has only partly done such analyses, and it is not clear goals for response levels and the capacities needed. In several white papers and other government documents, however, there has been a focus on the need for modernization and increased capacity to match the large responsibility area of Norway and the maritime activity, especially when it comes to more passenger traffic in the Arctic. The Sarinor reports commissioned by the industry organization Maritime Forum North have revealed several areas of limitations as to capacities (www.sarinor.no). When it comes to sea area capacities, except for the ice breaker KV Svalbard, the offshore coast guard vessels serving in the Barents Sea are old, and do not have any ice class. There are also too few ships for fulfilling the broad range of coast guard tasks in the region. Three new vessels were contracted in 2018 for deployment in 2022 and onwards. However, even replacing the old vessels with new ones is not sufficient to fulfill the obligations of continuous presence in the sea areas of jurisdiction.

As for air lift capacity, additional resources have been established on Svalbard with two rescue helicopters from 2014. These helicopters may pick up 18 persons within a radius of 120 nautical miles. The helicopters performed 30 sea area SAR operations in 2015, where support to fishermen were the dominating reason (Governor of Svalbard, ROS analysis, 2016). Also, a multi-functional vessel "Polarsyssel" commissioned for nine month of the year add significantly to the capacity. Sixteen new AW 101 SAR all weather helicopters and the deployment of NH90 helicopters on the coast guard vessels and the frigates will almost double the range and capaicity for helicopter-based SAR. Delays in deliveries, and the coast guard helicopters not meeting the expectations as flying hours may represent a non-planned limitation in helicopter preparedness for the coming years.

For accidents in the Svalbard-region and further up north, long distances and weather conditions may increase the reponse time beyond survival limitations in case of larger accidents.

A forward SAR-base with rescue equipment at Longeyarbyen may as stated by the Sarinor project represent a great capacity improvement for the first response services.

Surveillance. Quick response as to search activity and the creation of situational awareness is important. The P-3 Orion aircraft at Andøya is an important resource for SAR surveillance, since they have substantial reach and advanced sensors. However, mobilization time due to lack of funding may result in a long response time. Aircrafts stationed at Svalbard are also a good resource. Yet, they too have long mobilization times (Antonsen et al. 2015).

Increase in manned hours may improve overall preparedness on a large area. Air resources provide also air coordination capacities for handling mass rescue operations with multiple airborne resources from different countries. Here, cooperation facilitation both through more advanced technology and personnel will be crucial, also to ensure the safety of the pilots and aircrew.

Another tool currently under development when it comes to airborne search is surveillance drones. Drones have already been used in full-scale exercises such as Barents Rescue and Exercise Nord. These tools provide images from the accident sites to facilitate the mission management. Still, drones are a resource not well implemented within the SAR system, for example at the coast guard vessels.

Mass evacuation and rescue facilitity challenges. An increased amount of larger passenger and cruise vessels in the High Arctic waters represent a challenge as to evacuation and resuce. Accidents such as the ice collision of Maxim Gorkij in the Barents Sea, the grounding of Costa Concordia at the Italian coast and the fire onboard Le Boreal outside the Falklands Islands are examples of evacuation challenges related to SAR operations at sea. Both evacuation and rescueing people from tenders, lifeboats and rafts is very challenging in cases where the distress vessel lists heavily and under rough waves and wind conditions. Cooperation to develop new technology such as mass-lifting equipment in rough weather (cages, platforms etc.) needs further focus. The EU-funded ARCSAR project led by the JRCC North-Norway is now creating an innovation platform for new technology in this area (www.arcsar.no).

Shore-based reception and medical support. Taking care of a large amount of wounded persons is a challenging taks both as to treatment, accommodation and transport. The most challenging area of the Norwegian SAR system is the northern and eastern part of the Barents Sea and the Svalbard region. A study conducted by DNV GL (2015) shows that emergency response concepts and technologies must be diversified in response to different challenges in the sea areas of the Barents Sea. Efforts should be directed towards determining environmental conditions, enhancing evacuation and rescue capacity, improving emergency response cooperation and developing joint emergency response concepts based on the principles of shared area-based emergency response resources (DNV GL

2015). This means that the ROS analyses of the different regions should be more fine-grained, more adapted to local conditions, and should provide a clear picture of the SAR capacity needed through the whole SAR-value chain. In the Svalbard region, there are hospitals in Longyearbyen and in Barentsburg. The hospital in Longyearbyen has a capacity of four doctors and eight nurses, while the hospital in Barentsburg has one doctor and three nurses. In addition to the Longyearbyen hospital capacities, the University hospital of Tromso (UNN HF) in 2015 organized a task force with medical personnel ready to fly out to remote areas for increased support.

The Norwegian Civil Defense reinforcement teams also represent a capacity for first line response with advanced equipment for large scale operations. The mobilization time for the Norwegian Civil Defense reinforcement teams is a couple of hours. Their arrival on the scene will, however, depend on the transport capacities available.

For immediate first line response, the government capacities may be limited in the most remote areas. The Governor of Svalbard states the following in the 2016 Risk and Vulnerability analysis:

The general health preparedness at Svalbard is highly vulnerable and Longyearbyen hospital is not today equipped to handle large incidents. One will relatively often face a gap between needs and available resources (Governor of Svalbard ROS analyse, 2016)

As shown, for the remote areas fast first-line response may represent a challenge for the limited government capacities in major incidents. Thus, the use of available capacity within the communities and within units present in the region is crucial. The vessels in the vicinity such as cruise ships have trained personnel on board within first-aid. The same may be the case for shore-based companies on shore, the voluntary organizations represent an important mobilization potential. Among others, the Red Cross voluntary teams within the Search and Rescue Corps represent a significant capacity with 300 local units all over the country with 6000 volunteers certified for Search and Rescue and first-aid. These teams may be mobilized on short notice as they are already in the region. The voluntary organizations also have significant local knowledge that may be of great value in major incidents.

One important aspect is, however, to have the necessary competence in running large scale operations, and operations at both sea and on shore. This calls for much training and exercises on large scale operations with many units and large needs for coordination and control. Unfortunaltely, there are few full-scale exercises giving these opportunities.

Resource databases. Fast access to resources in Norway and in the neighboring countries is crucial. A problem for international cooperation is the lack of up-to date knowledge of available resources in the Arctic countries. This is due to

limited resource registers. These should be updated frequently enough to provide good knowledge for cooperation. Current systems such as the resource system of JRCC Norway "Narre" are not automatically updated by resource-owners, and therefore have a delay when it comes to new resources or repositioning. The project BarentsWatch has developed a shared resources register (felles ressursregister FRR) that will include land, sea and air resources. For other countries, the overview may be limited. Some efforts are made within the Arctic Council work group for emergency preventation and response (EPPR) to map resources in the Arctic countries. However, the overview of response times and capacities for different sea areas is not well developed.

SAR coordination capacities. Mass evacuations, long-lasting operations and SAR-operations in remote areas put a heavy burden on SAR mission coordinaton. Additional resources are needed for coordination and control. The presence of the coast guard is important to take care of the on-scene coordination. The JRCC states in their annual report (2016) the need to enhance their capacity to manage large-scale accidents. There is a need for additional capacity with regard to SAR mission coordinators. The JRCC annual report comes to the conclusion that the roles of all the Norwegian SAR actors need to be as clear as possible (JRCC Norway 2016). This calls for increased focus on revisions and audits within the emergency response systems, as well as plan systems that covers all eventualities within each agency. Tailor-made training and exercises are in demand. A government committee initiated by the Ministry of Justice, Preparedness and Immigration (2016) emphasized the need for an Analysis center at each of the JRCCs for conducting analysis of real incidents and provide training and exercises for joint operations for the emergency agencies.

Command and control systems for emergency management. The Norwegian SAR system is based on close cooperation between a broad range of responders. A challenge as to coordination is the command, communication and control systems (C3) currently limited with a multitude of different emergency management support platforms among the most critical emergency agencies JRCC (SARAS, Police (PO), paramedics and fire and rescue brigades (AMIS/Transmed/Tronsmobil). The governor of Svalbard has their own system and the military have limited interface with the civil systems. A few solutions such as an interface for Marine Traffic exchange and vector-information between coastguard, military headquarters, coastguard headquarters and JRCC have been introduced – yet further improvements both nationally as well as internationally may provide potential for improved coordination and control.

Broadband and telephone communication. Several projects have focused on limited communication infrastructure. Sharing of information between RCCs, ship owners and emergency resources is subject to low automatization degrees in some of the areas (Haugstveit et al. 2016). More automatization could save time and increase efficiency of cooperation both nationally and internationally.

Radio and internet communication challenges emerge around 72 degrees north. There is limited capacity for satellite communication even though the emergency radio communication network in the GMDSS system is working. For large scale operations the current systems are not sufficient.

As an example, the Iridium system is criticized for having too much down-time. Iridium NEXT may change this lack and provide improved Arctic wide connectivity and cooperation potential in emergencies (Fjortoft et al. 2015).

One solution is the Maritime Broadband radio (MBR) that may serve as an ad hoc system (see SAR chapter). Varying ice conditions demand high cold climate adaptation of emergency equipment and vessels. The solutions must have better capacity, efficiency and a larger weather operating possibility, considering light, visibility, temperature and icing. Weather conditions vary, with rapid changes in visibility and ice conditions. Long periods of darkness or bad visibility due to snow or fog call for good remote sensing capacities (St.Meld. 35, 2016).

The Norwegian government has decided to support the launching of two communication satelites for the High North regions expected to be launched in 2022 by Space Norway. If realized, these satelites may improve broadband communication capacity significantly.

VHF Data Exchange System (VDES) shall be in full operation by 2020. It will be a worldwide system to enhance the capacity of the GMDSS system. Particularly smaller vessels which have no satellite communication equipment will benefit from VDES, as the VDES will improve connection of ship to ship and ship to land connections via the aid of satellites.

Iridium NEXT satelites launched in 2018 will enhance the current Iridium network to provide their resources to the GMDSS system. Iridium NEXT includes 66 cross-linked Low-Earth Orbit (LEO) satellites also covering the polar regions. Iridium NEXT may be able to replace some of the current systems and offer improved bandwidth within the L-band for broadband maritime communication and first responders.

2.2.1.2 The industry and SAR capacity challenges

The industry operating in the Arctic has to follow international regulations with demands for both safety measures and emergency preparedness. For icy waters, the Polar Code of the International Maritime Organization (IMO) represents a signficiant upscaling of the demands as to vessel design, equipment, planning and competence. However, for large cruise ships with a mix of passengers of high age, the rescue capacity in remote areas are limited. Even though the government SAR agencies such as the coast guard try to allocate resources according to traffic, the capacity is limited. Even though the Polar code demands certain capacities for survival over five days, the SARex- exercises at Svalbard show that the standard rescue equipment does not fullfil the requirements (SAREx report, 2017). Even

though risk assessments have to be made for the polar water manual obligatory on board the vessels, there is no certification of the equipment onboard, nor demands for survival times according to passenger and area characteristics. Some countries have made it clear that the companies operating in remote waters have to support themselves. One example is the tour with the passenger vessel Crystal Serenity trough the North West Passage where US and Canadian coast guard made it clear that the risks where too high with the resources available. As a consequence the ship owner hired an extra SAR ship that followed the cruise liner on its voyage. The cruise companies are now working on finding solutions to increase safety and preparedness. In particular the expedition cruise operators are working with the governments to improve preparedness.

Within the oil and gas industry the Petroleum Safety Authority has come up with clear standards for the operators. For emergency response and rescue vessels there are clear objectives as to capacities and response time for the most expected risk types. The table below shows the Norwegian Oil and Gas Association recommendations for response in defined situations of hazards or accident (DSHA), and BASEC (Barents Sea operators) recommendations for the more remote parts of the Arctic.

Table 3: *The response capacities recommended on Norwegian Continental Shelf (Source: Hauge, 2017).*

DHSA	**Norwegian Oil & Gas Association**	**Recommended for more remote Arctic**	**Resources**
Man overboard from rig	8 min	8 min	Stand by vessel
Personnel in sea after helicopter accident	120 min (21 pers.)	4 hours	Helicopter Supply vessels
Personnel in sea after emergency rig evacuation	120 min		Stand by vessel Helicopter Supply vessels
Rescue from lifeboats		24 hours	Helicopters Other vessels
External assistance illness/accidents	60 min		Helicopter
Evacuation illness/accidents	180 min		Helicopter
Risk of collision	50 min		Stand by vessel
Fire with need of external assistance	Field specific		Standby vessel Supply vessels
Acute oil spill	Field specific Goliat SBV: 120min Goliat PSV1: 8 hrs Goliat PSV2: 13 hrs	Field specific: Korpfjell SBV 120 min PSV1: 13 hrs PSV2: 30 hrs	Standby vessel Supply vessels Specialized oil response vessels

The table above shows that there will be challenges as to response time in the more remote operational areas. The hours above are under ideal conditions. However, fog and waves may create significant challenges. The oil and gas

operators in the Barents Sea will have to add more capacity to deal with long distances. This may include both helicopters, specialized standby emergency response vessels and platform supply vessels equipped for SAR and oil response operations, and specialized depot and passenger transport vessels. The oil and gas activity will represent an additional challenge and strain on the response capacities, but will also represent a significant increase in capacity. In this area, more emphasis may be put on coordinating government and industry capacity development. There should be a focus on how the government and industry capacities can be better synchronized. This may call for another way of organizing the SAR operations in the North, including more influence over the capacity development and the operations from the government emergency agencies.

2.2.2 Pollution response and capacity challenges

2.2.2.1 Government capacities and pollution response capacity challenges

Except for the offshore oil and gas activity, the government is fully responsible for the maritime pollution response in Norwegian waters. Vessels sailing in Norwegian waters are not required to bring their own resources for acute pollution response. The government emergency preparedness has to take the full action when pollution occures. Oil Spill Response in the High North requires sufficient resources adapted to cold climate operations, and resources located in the region. This equipment is very expensive. There will be capacity limitations in the high North Sea regions should a major incident occur, and the response time may be high. It is vital that the equipment should be transported to the maritime spill arena quickly and efficiently, something that may prove difficult in the Arctic (Borch & Andreassen, 2017). St.Meld. 35 (2016) describes the main challenges of operations in the Arctic areas:

- Long distances between potential discharges and resources such as depots, crews, workshops, airports and destinations for collected oil and waste will be a major challenge.
- Access to efficient logistics solutions will be very demanding in the High North. Collected oil has to be transported out of the area if it is not dispersed or burned on site. If case of large spills, tank capacity for oil collected will be a challenge.
- There is a need to develop better methods for separation of oil, ice and water.
- Mechanical collection and absorption of oil in ice-filled waters is challenging. Even at low ice coverage, ice in booms and collecting systems have operational limitations.
- There is a need for product development, winter adaptation of existing equipment and technology development for better detecting oil in ice.

- Logistics challenges in the High North are increasing the need for better technology and knowledge for treatment of oil on the spot, such as burning and chemical dispersion in ice.
- There is a knowledge gap related to environmental effects of acute oil spill in the Arctic areas in general, about the ecosystem on the ice edge, the environmental vulnerability and how oil spill measures affect species and the ecosystem.

Various organizations have argued that infrastructure and technologies are not sufficent to deal with the consequences of acute pollution (Knol & Arbo, 2014). To manage an acute pollution response is a complex interplay of strategic, tactical and practical considerations and actions. The NCA's report on Oil Spill Recovery capacities (2015b) claim that coordination is as a challenge for Oil Spill Response in Norwegian waters. The services are operated by a long and varied list of organizations: the NCA, municipalities (IUA), refineries, the oil and gas field operators, terminals, ports and private businesses. These organizations must collaborate closely for an effective joint response. Efforts to improve the Norwegian emergency preparedness system therefore should aim to ensure effective interplay and coordination between these organizations. There is still a need for more realistic exercises to make the most of the resources (St.Meld. 35, 2016).

Within nuclear and radiation pollution as well as chemical pollution special competence for situational awareness and specialized reponse units are needed. The Norwegian Radiation Protection Authority has sensors in different regions including on Svalbard for early detection and warning. As such events happen seldomly, fast response from specialists, as well as training and exercises with local forces is needed. Also, continuous evaluations for improvement of capacities and procedures are in demand.

Managerial, social and technological skills are crucial factors for implementing good and effective recovery measures. Different approaches to both organization and management systems have previously been a challenge during government action. The NCA, the Directorate for Civil Protection and Emergency Planning and the Norwegian Environment Authority has accordingly developed an Incident command system (ELS) with accompanying guidance. Both the municipalities, Civil Defense, the NCA and several private actors today use this management system. Responses to actual or threatened acute pollution are organised in accordance with the Incident command system model (in Norwegian: Enhetlig Ledelsesystem [ELS]). The introduction of ELS has contributed that emergency preparedness actors can interact more effectively and it has become easier to draw on each other's personnel resources (St.Meld. 35., 2016). However, this system has to be evaluated. Research shows that this management system may be efficient in standardized and easy predictable incident response, but may prove challenging when it comes to high complexity, high uncertainty incidents where limited

mobilization may be the situation and improvisation with a broad range of different resources are needed (Borch & Andreassen, 2015).

Access to sufficient personnel is challenging in case of a large-scaled event. The Pollution Control Act requires that municipalities take care of pollution prevention related to minor events that may occur within the municipality and which are not covered by private preparedness. In addition, the municipalities are affiliated with an intergovernmental committee against acute pollution (IUA) served by the regional fire and rescue brigades to ensure local response to events that exceed the capacity and competence of each municipality. Therefore, in order to ensure sufficiently robust response to a large-scaled incident, it will be necessary to involve municipalities and IUAs who are not directly affected by the incident to assist personnel and necessary equipment to a greater extent than has been the case with previous government actions (NCA, 2015a).

The NCA's comprehensive investigation of the depot structure of the state emergency preparedness response commissioned by the Ministry of Transport and Communications, analyses capacity and competence distribution of state depots and other actors. A new depot structure and supervisory and maintenance system is recommended. Geographical distances between Svalbard and the mainland, the local community organization in Svalbard and vulnerability of nature indicate that the solution with depot in Longyearbyen and the advance depot in Ny-Ålesund should still exist. The investigation, however, shows that with today's logistics solutions it will be possible to meet the response time requirements with a significant number of fewer deposits than the current deposit structure. A new structure with fewer depots and container storage equipment, as well as a framework agreement for logistics and transportation will enable far more targeted and efficient use of depot personnel. It is recommended to change the name of the depot teams to the NCA's task forces and to increase personnel capacity from today's 10 days to 20 days of availability. It is also highlighted that training and exercises are needed (NCA, 2015b).

Riksrevisjonen in 2015 issued recommendations for coordination resources of the authorities involved in the emergency preparedness system in Norway. They included:

- to reinforce monitoring of the authorities' work with the national preparedness system,
- to improve coordination and partnership between agencies within the national preparedness system,
- to ensure the learning outcomes out of past accidents and organized exercises, and
- to clarify responsibilities of the Ministry of Justice and Public Security and the DSB for better practice of coordination and partnership (Riksrevisjonen 2015).

Some coordination resources should be directed towards better cooperation on emergency preparedness and development of joint emergency response concepts based on the principles of shared area-based emergency response resources (DNV GL 2015).

For oil spill preparedness the question of organizational responsibilities has gained importance, as well as the question of private–public partnership. The NCA's report on Oil Spill Recovery capacities (2015) describes as a challenge for Oil Spill Response that technologies and services are operated by a long and varied list of organizations: the NCA, NOFO, municipalities (IUA), refineries, terminals, ports and private businesses. There are many arenas where such collaboration is ongoing. Nevertheless, these organizations must still continue to collaborate on effective joint response. Efforts to improve the Norwegian emergency preparedness system therefore should aim to ensure effective interplay and coordination between these organizations.

Sea currents and winds can carry pollution far away from the place of origin and affect ecosystems and humans elsewhere. There is a risk that the problems associated with this may become even more extensive as a result of expected population growth in the coming decades. The operational conditions in Northern Norway may reduce the functionality of equipment and facilities. There is a need for capacity development, more environmentally friendly production and purification technology, better waste prevention, collection and management, as well as more environmentally friendly consumption (Meld.St.22, 2017).

The EPPR committee of the Arctic Council is working continuously to improve cross-border cooperation between the Arctic countries both as to surveillance, warning systems, cross-border support and coordination (https://www.eppr.org/).

2.2.2.2 Industry capacity challenges

As for the maritime industry, a significant preparedness capacities' challenge relates to the risk of heavy fuel oil leakage from large cargo and cruise vessels. The heavy fuel oil is easier to contain, but may prove more challenging to pump. Another challenge is leakage and blow out from oil fields.

Capacities for Oil Spill Response is about finding efficient tools for removing the oil spill. Among these tools we find booms and skimmers for collecting the spill, techniques for burning on site, and dispersants. New generations of dispersants have low toxicity and high efficiency. They produce 10s-microns size oil droplets that will be dispersed, diluted and eventually biodegraded in the environment (Source: IMO). Booms and skimmers have been much developed and have become more effective. The effectiveness of new Oil Spill Response equipment means that some oil spill operations that previously required up to three vessels can now be carried out by one vessel. However, mechanical Oil Spill Response equipment for the absorption of oil at sea still has weather constraints. In general,

oil booms have reduced effect at wave heights above three meters, but this will depend on the type of waves. It is estimated that effective damage limitation in outer waters with mechanical equipment can only be carried out for approx. 60 percent of the year's days (St.Meld. 35, 2016). Natural conditions may pose challenges to the operation of the Oil Spill Response system. Weather conditions can impact the efficiency of the technology. Oil spill equipment has limitations when it comes to high waves, strong winds, poor visibility, little daylight and cold climate with ice and icing (NCA, 2015b). There are demands for alternative ways of getting rid of the oil including the use dispersants to make it disappear better into the water, or to burn it. In-situ burning is a method which is not in use in Norway, but this is an option that might be considered in the future.

Oil Spill Response operation is about platforms for using skimmers for collecting oil, facilities for receiving and tank capacities for storing it, running oil booms, and dispersant capacity. Some of the contracted Oil Spill Response vessels do not have the OSR equipment on board. They have to sail ashore, unload, proceed to a depot, and load the equipment and then transit to the site for Oil Spill Response. This takes time both for making the equipment ready at base, transport it (11 hours from Hammerfest to Korpfjell distance 340 nm), and make it ready on site (min 2 hours).

The height of the seas and icing may reduce capacities of the booms for keeping the oil inside. There will be limitations as to how much oil is able to be recovered, and not more than 40% are expected in these regions (BASEC, 2016). Currently this percentage is less. The main Oil Spill Recovery methods in the Arctic areas give only 15 % result to remove the oil[6].

Thus, there are significant challenges related to how much capacity there should be for a major oil spill, the technology available for Oil Spill Response, and the mobilization time.

As commercial activity moves further from the mainland, the emergency response system’s capabilities are stretched. The logistics are challenging when equipment, crew and collected oil must be transportws over long distances. The biggest challenge for oil spill preparedness is therefore posed by activity in the northern areas, especially offshore operations in the northern part of Barents Sea.

When it comes to industry exercises for Oil Spill Response, NOFO plays a central role. As an example, as part of the work of verifying, maintaining and continuous development of the national oil spill preparedness, NOFO, together with the Norwegian Coastal Administration, arranges an annual realistic trial involving discharge of oil, called an oil-on-water trial, and documents implementation of this (OPV 2015). The trial helps to reveal challenges in Oil Spill Response capacities like lack of crane capacity at the base that lead to delays during mobilization, limits of transmission capacity that present a constant challenge to

[6] The 7th Marpart conference in Nuuk, 29-30 August 2017.

the exchange of information between sea and shore, limitations on the detection ability of the sensors (OPV 2014), limitations of oil recovery by some equipment like barrier boom, oil trawler or current buster (OPV 2015).

2.2.3 Violent Action Response and capacity challenges

The capacities for Violent Action Response have been significantly increased after the July 22 tragedy. Each police district now has personnel with more training in sharp, armed operations. The police special force Delta has been significantly strengthened, and so have the military special forces FSK. A weakness has been the helicopter transport capacity for both special forces. This has been improved by investments in police helicopters close to Oslo, and plans for moving some of the military transport helicopters from the North to support the FSK operations. There is a need for even closer cooperation across borders in the North to mobilize enough resources, to safeguard critical installations such as oil platforms that are being moved or are on location. Joint exercises should be considered across borders between the special forces in the Barents Sea region. As more activity is taking place in the North, additional special forces capacity for the police should be considered in the North.

As for regional police forces, they have limited experience in maritime operations. Thus, more active training together with the special forces at sea is recommended. Here the cooperation between the police and the Norwegian coast guard is of special importance and should be highlighted as to competence and coordination.

2.3 OPPORTUNITIES AND BENEFITS FROM CROSS-BORDER COOPERATION

2.3.1 Institutionalized cooperation

Crisis response cooperation between Norway and the other Arctic countries are regulated by a broad range of agreements. The Marpart report 3 (www.marpart.no) has provided detailed description on national relevant levels and agreements. From the national perspective, appropriate marine environment management requires local experience and knowledge. Cooperation through regional cooperation mechanisms, as in the regional marine programs related to the UN Environment Program (UNEP), the Convention for the Conservation of the Northeast Atlantic (OSPAR) and not the least the Arctic Council, are important.

Regarding Oil Spill Response the IMO International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) is the platform for cross border cooperation. Parties to the OPRC Convention are required to establish measures for dealing with pollution incidents, either nationally or in co-operation with other countries.

Ships are required to carry a shipboard oil pollution emergency plan. Operators of offshore units are also required to have oil pollution emergency plans or similar arrangements, which must be co-ordinated with national systems for responding promptly and effectively to oil pollution incidents. Ships are required to report incidents of pollution to coastal authorities. The convention details the actions that are to be taken. The Convention calls for the establishment of stockpiles of oil spill combating equipment, the holding of oil spill combating exercises and the development of detailed plans for dealing with pollution incidents[7]. Parties to the convention are required to provide assistance to others in the event of a pollution emergency. Provision is made for the reimbursement of any assistance provided.

The Arctic Council plays a leading role in developing a common knowledge base and the necessary relations for cross-border cooperation in the Arctic when it comes to sea safety (PAME) and Oil Spill Response and Search and Rescue (EPPR). The Arctic Council's Working Group on Emergency Prevention, Preparedness and Response (EPPR) is responsible for the prevention, efforts and preparedness of accidents in the Arctic. EPPR facilitates the implementation of the Arctic Search and Rescue agreement and the Arctic oil spill preparedness and response agreement. EPPR has established two Expert groups reporting to EPPR. These are the SAR Expert Group and the Marine Environmental Response (MER) Expert Group. These groups are among others focusing on increased cooperation, information exchange and experience sharing from joint exercises and events. The

[7] IMO http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-on-Oil-Pollution-Preparedness,-Response-and-Co-operation-(OPRC).aspx

working group PAME –Protection of the Arctic Marine Environment is focusing on protection of the Arctic marine environment, and safety issues, including fulfillment of the Polar Code for vessels and ship owners.

The multi-lateral agreements on cross-border cooperation provides opportunities to assess resources, people and share knowledge and experience in several countries. Bilateral agreements provide more in-depth relations. As an example, Norway and Russia cooperate bilaterally on important issues In the High North, such as Search and Rescue, oil spill preparedness, nuclear safety, environmental protection, fisheries management and people-to-people cooperation. The Norwegian Government wishes to continue contact and constructive cooperation in these areas, which are mutually beneficial and contribute to low voltage and high predictability (Meld.St.22, 2017).

Through a multitude of commitments, the JRCCs have a central position when it comes to Norway's efforts for international SAR cooperation. Important meeting places, projects and platforms where the JRCCs participate on behalf of Norway are:

- IMO (International Maritime Organization) and ICAO (International Civil Aviation Organization) participation
- COSPAS / SARSAT – international satellite-based SAR system for emergency signals and information sharing
- Emergency Prevention, Preparedness and Response Working Group (EPPR) of the Arctic Council
- EPPR SAR Expert group (SAR EG)
- Barents Euro-Arctic Cooperation (BEAC) Joint Committee
- NORDRED – permanent cooperation of the rescue responsibles of the Nordic countries Denmark, Finland, Norway and Sweden
- Implementation of a new control center (MCC) in Bodø connected to EU's ground station (project SARSAT MEOLUT NEXT)

The two Norwegian JRCCs also participate in a broad range of national and international R&D projects to improve the SAR system. Among others, the EU-funded ARCSAR project is lead by the JRCC North Norway with its goals to facilitate innovation within the Arctic preparedness system. The current approach to enhance the potential for collaboration is to increase trust and mutual understanding of each other's capacities via common working groups.

Within Oil Spill Response we find the same combination of multilateral and bilateral argreements. Through UN Sustainability Goal 14, Interim Objective 1, the world community has committed itself to preventing and significantly reducing all types of marine pollution by 2025, especially from land-based activities. The bilateral agreements between Norway and Russia include both SAR and oil spill. Annual exercises (exercise Barents) provide a meeting place for experience sharing and consultations.

The Norwegian Coastal Administration works closely with sister organizations in other Arctic countries to improve the system. The NCA and the oil and gas operators' organization NOFO run the annual "Oil –on-water" trials that may be developed further as an innovation arena for new technology (NCA, 2015b).

Also, projects like SARiNOR (Search and Rescue in the High North) and MARPART (Maritime Preparedness and International Partnership in the High North) are important (Meld.St.22, 2017). These projects have highlighted both maritime activity changes, challenges and areas of improvement. The Marpart project has contributed to increased focus and debate on cross-border cooperation potential. Both these projects have created a meeting place for the preparedness professionals, the industries and the academia. These arenas are stimulated by the Arctic 2030 program of the Norwegian Ministry of Foreign Affairs and provides new platforms for cooperation and innovation. The NCA is active within the Marine Environment Response Expert group to improve innovation within the Arctic Council member states.

2.3.2 Host Nation Support on SAR and Oil Spill Response

When an incident overwhelms national capacities and assistance is needed from abroad, the responsible authority in Norway has to make a formal request. DSB has established such a national contact point - international desk staffed 24/7 (reached by int@dsb.no or phone +47 975 11 658). This contact point can assist competent authorities with requests concerning international assistance. Host Nation Support (HNS) in SAR operations is defined by DSB as follows *"HNS will constitute a concrete set of resources organised in a specific manner"* (DSB 2014). This means that the Norwegian SAR-stakeholders have plans available to what to do and how to a) request, b) receive, c) support, and d) end the terms of HNS. This includes the elimination of administrative and legal obstacles and and adequate procedures to reduce mobilization time.

Capacities for cooperation in Norway are specifically defined by the nomination of the lead ministry, emergency coordination by the Government Emergency Management Council (GEMC), and support function by the Government Emergency Support Unit (GESU). GEMC is there to increase the potential for cooperation between the responsible ministries and coordinates strategic decisions and communication (Lægreid and Rykkja 2013).

This figure shows the international cooperation of capabilities of Norway when it comes to HNS. It illustrates the procedure for how Norwegian authorities can request assistance from abroad.

Figure 8: *Illustration of procedure for how Norwegian authorities can request assistance from abroad (DSB, 2014)*

When international assistance is requested, an assessment must be made of whether receiving this assistance will require extra resources on the part of Norway. The request for HNS is directed to the Civil Defense district, which has a 24-hour watch system. Norwegian Civil Defense and Norwegian Armed Forces may in addition provide escort-resources. DSB has to make a plan for HNS, involving Norwegian Civil Defense, Norwegian Armed Forces and other resources, make sure to arrange administrative support, clear customs, provide facilities, accommodation, transportation, logistics support etc. All emergency help from abroad (personnel, equipment or other resources) utilizes a special visa exemption, easing of quarantine regulations, exemption from import customs etc. Special exemptions apply for different categories of resources, however goods may still have to be processed upon entry and go via staffed customs (in most cases during office hours 08:00-15:30). DSB provides HNS liaisons and acts as link, communicator, control between the Norwegian response leader organization and the foreign resources. Yet, also the sectoral authorities relevant to emergency preparedness including JRCC also have their own liaison responsible person. HNS liaisons will work together with each sectoral authority's leader and customs to ensure tracking the foreign resources when they leave Norway.

When it comes to the potential for cooperation in Host Nation Support from Norwegian side, it is the authority with "sectoral responsibility" such as the JRCCs and the Norwegian Coastal Administration which has the obligation to request assistance. If this authority has no arrangements with foreign capacities they may collaborate with another authority which has contact points with foreign entities, such as DSB in Norway holding fixed lines of communications and procedures with international organizations UN, NATO and EU. Yet in most cases, requests for assistance have to go through approval of the political leadership, and pass via the Ministry of Foreign Affairs. In case of acute pollution

or major oil spill, the Norwegian Coastal Administration will take care of this contact (DSB 2014).

An example of significant international cooperation was the forest fires in Southern Norway and Southern Sweden in the summer of 2018. Reinforcements were sent from the fire and rescue brigades, the Civil Defense as well as fire fighting helicopters and planes from several EU countries to strengthen the local forces.

Few countries have sufficient resources for combating major oil spills and other pollution incidents on their own over a longer time. NCA have the responsibility on behalf of Norway to follow up the different international agreements on mutual assistance. The following agreements and international cooperation is currently in place.

Copenhagen Agreement

Denmark including Greenland and the Faroe Island, Iceland, Finland including Åland, Sweden and Norway are parties to this agreement, which covers mutual notification, assistance and aerial surveillance of oil and other chemicals at sea.

Bonn Agreement

In order to limit acute oil and chemical pollution in the North Sea including Ireland, all countries bordering on the North Sea have entered into an agreement on mutual notification, assistance and environmental surveillance.

Norway–Russia Oil spill agreement in the Barents Sea

Norway and Russia have signed agreements on, among other issues, mutual notification, drills and combating acute oil spills in the Barents Sea.

NORBRIT Plan

Norway and the UK have developed the Norbrit Plan for joint counter pollution operations in the zone extending 50 miles either side of the median line separating the UK and Norwegian continental shelf.

Arctic oil spill agreement and Arctic Cooperation

The eight Arctic States signed in 2013 the Agreement on Arctic Marine Oil Pollution Preparedness and Response on, among other issues, mutual notification, drills and combating acute oil spills in the Arctic.

The Arctic Council

The Arctic Council consists of eight countries that have interests in the Arctic. NCA is involved in the Council's work on acute pollution preparedness through the committee for Emergency Prevention, Preparedness and Response (EPPR). EPPR has established a Marine Environmental Response Expert Group (MER EG) with the primary task to follow up the Arctic oil spill agreement, often named MOSPA.

European agreements

Norway is a member of EMSA (European Maritime Safety Agency). NCA participates in the cooperation on Marine oil and chemical Pollution. NCA is Norway's contact unit for notifications and request for assistance related to marine pollution via the Emergency Response Coordination Centre (ERCC). This is the similar role as DSB have for Civil Protection issues.

IMO (The International Maritime Organization)

NCA is involved in the IMO's work on preparedness against acute pollution. NCA participates in the Pollution, Prevention, Response (PPR) sub-committee, which among other things follows up the International Convention on Oil Pollution Preparedness, Response and Cooperation. To a certain extent, the department also participates in the Marine Environmental Protection Committee (MEPC).

(Source: www.kystverket.no)

If NCA activates one of the agreements above and requests assistance, NCA will also have to establish the Host Nation Support (HNS) plan. This plan is based on the EU HNS Guidelines, IMO International Offers of Assistance Guidelines and the Norwegian guidelines from DSB. In case of major emergencies, HNS might be relevant with respect to addressing the international assistance and including other actors in response. Within oil spill preparedness the responsibility lies with the Ministry of Transport and Communications and the Norwegian Coastal Administration. Requests for assistance from abroad will go through the established channels for which this sector is responsible (DSB, 2014).

2.3.3 Cross-border cooperation on Violent Action Response

The maritime dimension has received increased focus within the security policy in recent years. In Norway, the offshore oil and gas installations and platform have to be protected. Larger passenger vessels such as ferries and cruise vessels represent vulnerable communities of up to six thousand persons. And the traffic of vessels with dangerous goods also represent a security challenge. For Norway, it is crucial to pursue a security policy that also safeguards the interests at sea. It is about the law of the sea, sovereignty, government exercise, security, defence and alliance policy, and free movement. The security challenges at sea are complex and vary considerably from region to region.

The coast guard represents the first line of protection as to security in close cooperation with the police. Access to other military forces is important for the police in case of larger maritime incidents. Norway is a driving force for NATO to safeguard the maritime dimension and to have good understanding of the situation in the High North. Norway contributes significantly to the Alliance's standing maritime capabilities, especially in Northern Europe, and is a driving force for modernizing NATO's maritime strategy. It is important benefit if the

alliance fleet may strengthen collective defense and crisis management (Meld.St.22, 2017).

It is very important that the standing fleet forces do not bind up with the ongoing operations, but are also available for collective defence and crisis management. Cooperation through NATO strengthens the potential resources against violent action, terror or piracy.

In addition, Norway provides funds for combating environmental crime through the United Nations Office for Drugs and Crime (UNODC), Interpol and UN Environment Program. This includes dumping of chemicals and hazardous waste in the sea (Meld.St.37, 2015).

There is a strong European cooperation and Host Nation Support scheme in case of terror. This includes cooperation of police and enforcement authorities as well as provision and receiving of support beyond borders. Itincludes, among others, access to the European Union Integrated Political Crisis Response.

International cooperation within the Norwegian energy sector focuses also on security. A significant part of the petroleum activity takes place at or across the boundaries, or across the boundary lines between different countries' continental shelves. Therefore, close cooperation will give an opportunity to exchange experiences between the authorities in the oil and gas sector in various countries, both in terms of regulations, enforcement and learning from incidents (Meld.St.22, 2017).

Violent Action Response at sea represents a significant challenge inluding an unstable operatonal field as well as logistics barriers. Also, there may be a need for special forces over a longer time period and attacks on different locations. This may wear down the existing capacity for a country, and additional support from other countries may be needed. Also, incidents may take place or mitigate across borders. Norwegian police has a close cooperation with Swedish, Danish and Finnish police on land-based events based on a Nordic agreement from 1972. Norway also has a bilateral agreement with Russia established in 1998 on information exchange related to crime. In 2017, there was also agreed on direct contact links between Finnmark police district and FSB Murmansk to combat crime in the sea regions between the Finnmark and the Murmansk district. At sea, a cooperation between the Norwegian coast guard and the coast guard part of FSB will be at hand.

However, a closer cooperation on major maritime violent incidents in the Barents Sea between Norwegian and Russian police and special forces should be considered. Improved cooperation on policing and Violent Action Response call for frequent training and realistic exercises between the police, the special forces and the other SAR resouces. In the maritime Arctic, these types of exercises are today non-existing.

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3 RUSSIA'S PREPAREDNESS CAPACITIES, CHALLENGES AND NEED FOR COOPERATION BY *SVETLANA KUZNETSOVA, ALEXANDER SUSLOV, IVAN SAVELIEV, DMITRY KOCHEGAROV AND MAXIM ZADORIN*

3.1 SEARCH AND RESCUE CAPACITIES

This chapter examines the establishment and prompt provision of Search and Rescue and Oil Spill Resources in the Russian Arctic from the Barents Sea in the west to the Novaya Zemlya in the east.

According to the IMO recommendations, the Russian government must ensure that necessary arrangements are made for distress communication and co-ordination in their area of responsibility and for the rescue of persons in distress at sea around its coasts. These arrangements shall include the establishment, operation and maintenance of such Search and Rescue capacities deemed practicable and necessary, having regard to the density of the seagoing traffic and the navigational dangers. They shall, so far as possible, provide adequate means of locating and rescuing such persons [IMO, 2016].

The aim of this chapter is to show how political intentions related to providing safety and security are being implemented in practice.

3.1.1.1 Search and Rescue-capacities

Under the Search and Rescue (SAR) services we understand the performance of distress monitoring, communication, co-ordination and Search and Rescue functions, including provision of medical advice, initial medical assistance, or medical evacuation, through the use of public and private resources, including co-operating aircraft, vessels and other craft and installations [IMO, 2016].

The ship's captain is required to inform the following institutions immediately about the accident:

- State Marine Rescue Coordination Center or Marine Rescue Coordination Centers/Subcenters if a ship is in the Search and Rescue area/territory of the Russian Federation:

- Shipowner;
- Russian State Transport Supervision Administration (Rostransnadzor);
- Master/Captain of the nearest Russian sea port or estimated port of arrival;
- Russian Fishery Agency if emergency case occurs with fishing fleet boat;
- The Administration of the Northern Sea Route in an emergency case occurring during navigation in the waters of the Northern Sea Route.

The preparedness agencies exchange information about the current situation, availability, dislocation (redeployment), capabilities and resources and degree of preparedness of SAR forces. This is carried out at least once a week and immediately, if any changes occur. Primarily such information is forwarded to the Maritime Rescue Coordination Centers (MRCC) and Rescue Coordination Subcenters (MRCS) of the Ministry of Transport, and the regional crisis management centers of Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters within EMERCOM -the Russian Federation Ministry for Emergency Situations.

In general, for the implementation of safety and security, the following organizations are responsible in the northwest: MRCC/MRCS, EMERCOM, the Northern Expeditionary Unit of rescue and salvage operations, the Boarder Guard of the Federal Security Service (FSB), the Search and Rescue Administration of the Northern Fleet, the regional SAR units, etc.

3.1.1.2 Maritime Rescue Coordination Centers/Subcenters

In the marine basins, the responsibility for deployment and coordination of SAR assets lies with the head rescue coordination center based in Moscow, and rescue coordination centers and sub-centers within marine basins. Currently there are 7MRCCs (Murmansk, St. Petersburg, Kaliningrad, Novorossiysk, Astrakhan, Vladivostok, Dikson) and 8 MRCSs (Arkhangelsk, Yuzhno-Sakhalinsk, Petropavlovsk-Kamchatsky, Taman, Tiksi, Pevek, Sevastopol, Kerch) (http://gmssr.ru/en/smrcc/about-smrcc). MRCSs Tiksi and Pevek function only during the navigation period of the Arctic waters.

The Murmansk MRCC and Arkhangelsk MRCS are responsible for providing coordination of SAR operations in the northwest including the Pechora Sea (http://www.smrcc.ru/).

MRCC and MRCS have the necessary equipment designed to operate in harsh Arctic conditions and fully comply with the International Convention on Maritime Search and Rescue at Sea, 1979, and the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual**.** Only former captains can be appointed as SAR mission coordinators in the MRCC and MRCS having passed the advanced training courses in Global Maritime Distress & Safety System, etc.

The response time for air resources such as helicopters and planes is 45 minutes in winter and 30 minutes in summer. The response time for vessels is up to 2 hours.

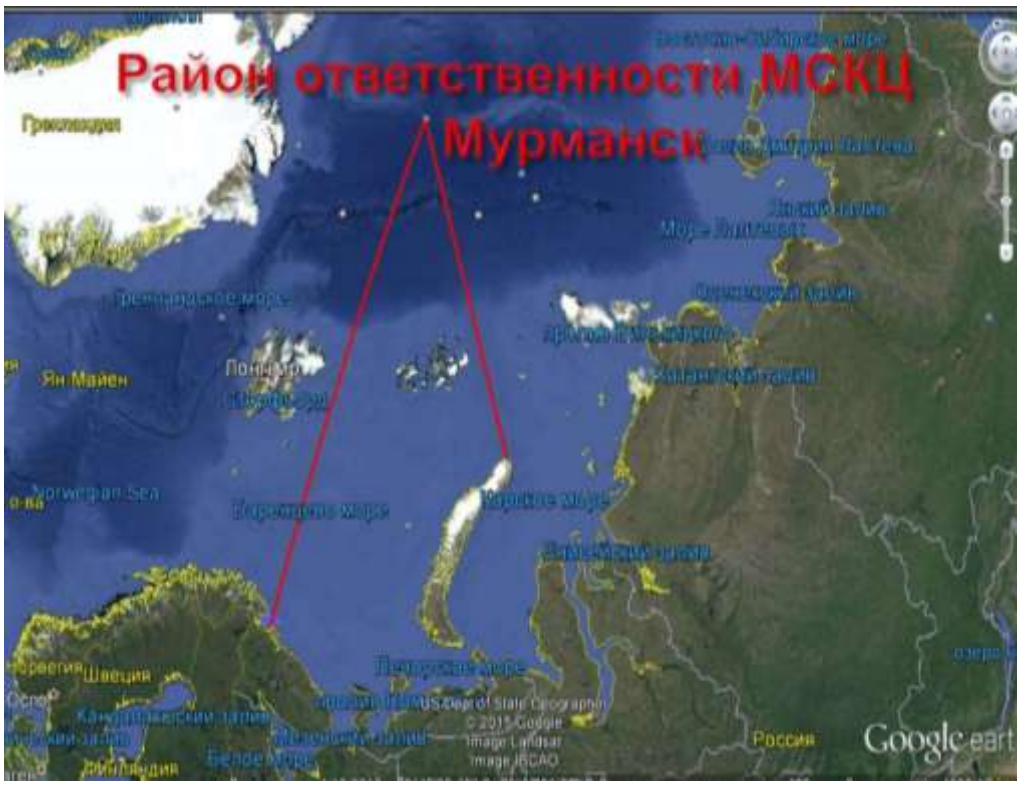


Figure 9: *Responsibility area of Murmansk MRCS*

3.1.1.3 Maritime Rescue Service

The responsibility for maritime SAR operations is the responsibility of Morspassluzhba (Maritime Rescue Service) of the Federal Marine and River Transport Agency (hereinafter, Rosmorrechflot), reporting to the Transport Ministry.

The maritime SAR resources and equipment in the northwest are owned by 9 Morspassluzhba's branches and emergency rescue and underwater engineering divisions in the regions.

There are 5 types of Morspassluzhba vessels according to the order 05/08 from 2009:

1. Rescue tug boats (mean lifetime: 28 – 36 years);
2. Supply vessels (mean lifetime: 30 – 32 years);
3. Maritime diving vessels (boats) (mean lifetime: 37- 42 years);
4. Rescue salvage vessels and boats (mean lifetime: 18 – 20 years);
5. Auxiliary vessels (mean lifetime: 22 – 25 years).

Northern branch of Morspassluzhba - Murmansk Maritime Rescue Service (*http://sevmss.ddns.net/*).

I. Multipurpose salvage tug "Kapitan Beklemishev" project 1454, built in 1985, place of construction – Yaroslavl (joint stock company «Shipbuilding Plant of Yaroslavl»), and navigation area— unlimited. Register of Shipping class: КМ μ UL [1] AUT2 tug/salvage ship.

Table 4: *Main characteristics of the multipurpose salvage tug "Kapitan Beklemishev"*

Main characteristics:	
Length, m	58,61
Width, m	12,23
Depth, m	5,9
Displacement, t	1662
Gross tonnage, t	1160
Deadweight, t	404
Capacity of the main engine (6ЧН 30/38 (5-2D-42) or Zulcer 8 AL 25/30), hp	2 x 1500
Speed, knots	12/9,5
Freeboard draft (maximum), m	4,69
Carrying capacity of stern cargo boom, t	5
Maneuvering device – bow, capacity, kW	130
Tractive force on the winch (NORWICH), tf	35
Diving equipment	Pressure chamber, two posts in the hose version that supports two divers at a time, up to a depth of 60 meters.

2. Sea coastal tug «Sever-7», project 16332, place of construction – Murmansk, built in 1989, navigation area – Kola Bay, A1. Register of shipping class: КМ μ R3 tug.

Table 5: *Main characteristics for the tug "Sever-7 "*

Main characteristics:	
Length, m	12.41
Width, m	3.42
Depth, m	1.5
Draft, m	1.03
Displacement, t	19.93
Gross tonnage, t	16
Deadweight, t	02
Crew, pers.	8
Capacity of the main engine (6 ЧСП 15/18), kW	1 x 110
Speed, knots	9
Autonomy, days	5

3. Multipurpose salvage vessel (MSV) "Kapitan Martyshkin", built in 1987, project V-92/I and V-92/II, place of construction – Poland (Szczecin), navigation area — unlimited. Register of Shipping class: КМ μ UL [1] AUT2 Supply vessel.

Table 6: *Main characteristics of the salvage vessel (MSV) "Kapitan Martyshkin"*

Main characteristics:	
Maximum length, m	81,16
Length between perpendiculars, m	71.45
Theoretical width, m	16,3
Theoretical depth, m	7,2
Freeboard draft (maximum), m	4,9
Displacement (summer loadline), t	4017
Deadweight, t	1329
Gross tonnage, t	2737
Cargo boom – carrying capacity, t	12,5
Main engine, total capacity, kW	2 x Zulzer-Zgoda 6ZL40/482pcs, 5300
Fuel type	Diesel
Variable pitch propellers, quantity	2
Steering control	PZL
Diesel generators, total capacity, kW	Zulzer 6AL 20/24, 3x412
Maximum speed, knots / fuel consumption, t/day	15/30,0
Economical speed, knots / fuel consumption, t/day	10,0/20
Towage speed, knots / fuel consumption, t/day	5,0/20
Tractive force on the winch (ND-150A), tf	82
Diving equipment	diving station for rapid deployment, VSBR-2, hose option.

4. Firefighting boat «Tchasovoy», project 14613, built in 2002, place of construction – Rybinsk. The boat is designed for fire-fighting services of sea ports, specialised ports handling petroleum products, fire protection of off-shore oil- and gas fields and intended to:

- escort and support vessels carrying fire-hazardous cargo;
- extinguish fires on floating and coastal facilities approachable from the sea, as well as fuel burning on sea surface;
- tow wrecked vessels and craft;
- perform surface and undersea salvaging operations;
- conduct primary special treatment of outside surfaces of vessels and craft;
- carry out decontamination operations and remove oil spills from sea surface.

Table 7: *Main characteristics of the Firefighting boat «Tchasovoy»*

Main characteristics:	
Length, m	39,8
Width, m	7.8
Draft, m	2.2
Deadweight, t	389
Main engine, total capacity, kW	764
Maximum speed, knots	12
Crew, pers.	20

5. Salvage and boom boat «Markab», project HS-2000, built in 1989, place of construction — Norway, navigation area – at the distance of 50 miles from the coast. Register of shipping class: KM μ L2 R2-RSN.

Table 8: *Main characteristics of the salvage and boom boat «Markab»*

Main characteristics:	
Maximum length, m	15.4
Width, m	5
Depth, m	1.55
Draft, m	1.2
Light displacement, t	34.9
Gross tonnage, t	37
Deadweight, t	9.6
Allowable number of persons on board	15
Total capacity of the main engine (diesel Fiat-Aifo 828 ISRM 70/10), kW	2 x 794
Speed, knots	20
Autonomy, days	5
Type of boon on board	EXPANDY, total length 243 м
Skimmer Mini Max — Desmi capacity, m^3/h	32

6. Diving boat “Vodolaz Petchkurov”, project A-160, built in 2012, place of construction Nizhny Novgorod. The vessel is intended to perform underwater activities at the depth up to 60 meters by sea disturbance of 3 points, to provide SAR.

Table 9: *Main characteristics of the diving boat «Vodolaz Petchkurov»*

Main characteristics:	
Maximum length, m	28,43
Width, m	5,68
Draft, m	1,5
Deadweight, t	94,6
Crew, persons	3
Divers	5
Total capacity of the main engine, kW	2 x 442
Speed, knots	14,1
Autonomy, days	20
Tank capacity, cubic meters	1,41

7. Dumb crane boat «SPK-19/35» project D-9040, built in 1989, place of construction – Hungary, navigation area – Kola Bay, A1. Register of Shipping class: КМ μ R3 floating crane.

Table 10: *Main characteristics of the dumb crane boat «SPK-19/35»*

The main characteristics:	
Gross tonnage, t	606.00
Net tonnage, t	181
Deadweight, t	211.00
Length, m	36.30
Width, m	18.50
Depth, m	3.20
Carrying capacity, t	35

8. Multipurpose salvage vessel "Murman" project MPSV06, built in 2015, place of construction – Wismar, Germany (joint stock company «Nordic Yard Wismar»), navigation area is unlimited. The ice class is Icebreaker6. The vessel is intended to assist in Oil Spill Response, SAR, dragging, towing. It is equipped with the firefighting system. It has two large cranes, for salvage, and a landing platform for helicopters. It is capable of operating remotely operated underwater vehicles, and has decompression facilities sufficient to support a team of deep divers.

Table 11: *Main characteristics of the multipurpose salvage vessel «Murman»*

Main characteristics:	
Maximum length, m	85,38
Width, m	19,10
Deadweight, t	5127
Gross tonnage, t	4372
Main engine, total capacity, kW	2 x 3500
Maximum speed, knots	15
Economical speed, knots	11.00
Crew, persons	12
Passenger capacity, persons	75
Container capacity, FEU	12
Tank capacity, cubic meters	800
Diving equipment	Deepwater diving vehicle GVK-300 (diving depth 300 m), remove control deep water operating vehicle Sperre SUB fighter 7500v, side-scanning sonar , inboard oil-gathering device with cranes manufactured by LAMOR

9**.** Salvage and boom boat «Viktor Petrov», project A40-2Б, built in 2011, place of construction — Rybinsk, navigation area – R3-RSN. Mixed (river-sea) navigation with the distance from the harbor up to 50 miles. Register of Shipping class: КМ Ice 2 R3-RSN AUT3 oil recovery ship (>60^0). The rescue boat for

booms installation is a vessel functioning within the coastal infrastructure of sea and river ports which is to provide safe shipping and to protect the environment at oil spills. It is intended for:

- transportation and installation of floating slick-bars, delivery of emergency and nature-conservation equipment to the places of oil spills;
- localization of the spread of spilled mineral oil into rigid floating tanks of not less than 2 m3, and its subsequent towing to the receiving point of the shore or floating stations;
- construction of oil collecting orders.

Table 12: *Main characteristics of the salvage and boom boat «Viktor Petrov»*

The main characteristics:	
Maximum length, m	19.90
Width, m	4.70
Deadweight, t	45,6
Draft, m	1,05
Main engine, total capacity, kW	2x442
Maximum speed, knots	20.0
Economical speed, knots	12.0
Crew, persons	2

Arkhangelsk branch of Morspassluzhba *(http://arkh.morspas.com/)*

1. Salvage tug «Vyborg», project 8059.1, place of construction – Germany, year of construction - 1970.

Table 13: *Main characteristics of the salvage tag «Vyborg»*

Main characteristics:	
Length, m	34.75
Width, m	8.6
Mean draught, m	2.84
Deadweight, t	71
Total capacity, kW	640
Navigation area	20 miles
Speed, knots	10
Crew, people	8

2. Maritime salvage tug of coastal navigation «ASPTR-5», project - P-100, place of construction – Taganrog, year of construction - 1967.

Table 14: *Main characteristics of the salvage tag «ASPTR-5»*

Main characteristics:	
Length, m	19,5
Width, m	6
Mean draught, m	1,03
Deadweight, t	9,6

Total capacity, kW	2 x 150/110,4
Main engine	2 x 3Д 6
Navigation area	1000 miles by wind of 4 on Beaufort scale and waves height of 2 m
Speed, knots	9,5
Crew, people	6

3. Rescue Sea vessel «Metel», project – 1458, place of construction – Astrakhan, year of construction - 1981.

Table 15: *Main characteristics of the rescue sea vessel "Metel"*

Main characteristics:	
Length, m	27.07
Width, m	6.64
Mean draught, m	1.60
Deadweight, t	8
Total capacity, kW	1693
Main engine	3Д12А1
Navigation area	А1, А2
Speed, knots	17
Crew, people	10
Places for the rescued, persons	40

4. Diving boat «Signal», project - PBM-376, place of construction – Sosnovka, year of construction - 1985.

Table 16: *Main characteristics of the diving boat "Signal"*

Main characteristics:	
Length, m	19
Width, m	3.8
Mean draught, m	1.2
Deadweight, t	9.7
Total capacity, kW	110
Navigation area, miles	А1, 10
Speed, knots	10
Diving equipment	air compressor, pressure chamber, 2 diving station provided for 2 divers at the depth of 60 m, underwater welding, cutting, video.

4. Rescue boom boat «Hitek-85C», project – Hitek, place of construction – Ireland (EK MARINE).

Table 17: *Main characteristics of the rescue boom "Hitek-85C"*

Main characteristics:	
Length, m	7.58
Width, m	2.65
Mean draught, m	1.0
Navigation area, miles	50
Speed, knots	30
Persons onboard	10

5. Rescue dump barge «ASPTR – 8», project M – 10, place of construction – USSR, year of construction - 1973. Navigation area: coast.

Table 18: *Main characteristics of the dump barge "ASTR - 8"*

Main characteristics:	
Length, m	16.03
Width, m	4.97

6. Diving vessel «Rybinsk», project SDS08, place of construction – Yaroslavl, year of construction - 2012. Ice2 class. Can provide firefighting, tugging, OSR, load-lifting of objects of 2 tons.

Table 19: *Main characteristics of the diving vessel "Rybinsk"*

The main characteristics:	
Length, m	38,35
Width, m	7,92
Mean draught, m	2,35
Deadweight, t	45
Total capacity, kW	2 x 442
Speed, knots	12
Crew	7
Tanks volume for oil product waters, m^3	1,41
Diving equipment	Underwater activities at the depth of 60 m, remote controlled device, underwater welding, cutting

7. Diving boat "Vodolaz Sazonov", project A-160, place of construction –Nizhny Novgorod, year of construction - 2012. Ice2 class, navigation area: river-sea, 50 miles from the coast.

Table 20: *Main characteristics of the diving boat "Vodolaz Sazonov"*

Main characteristics:	
Length, m	28,43
Width, m	5,68
Mean draught, m	1,5
Deadweight, t	94,6
Total capacity, kW	2 x 442
Speed, knots	14,1
Crew	3
Tanks volume for oil product waters, m^3	1,41
Diving equipment	Underwater activities at the depth of 60 m

The Northern Expeditionary Unit of rescue and salvage operations

(http://www.seoasr.ru/RescueFleet/rf)

The main tasks of the Federal State Institution "The Northern Expeditionary Unit of rescue and salvage operations" are to ensure navigational safety of fishing vessels and to perform Search and Rescue operations in the areas of fishing. Currently the Northern Expeditionary Unit has 5 ships. They are mainly marine salvage tugboats - multi-purpose diesel-electric ships for transportation and disembarkation, diving or deep-see salvage operations, fire-fighting operations. One is an ice-breaking Search and Rescue vessel.

1. Salvage tug "Purga", project 1454, place of construction – Nikolaev city, year of construction – 1974.

Table 21: *Main characteristics of the salvage tag "Purga"*

Main characteristics:	
Length, m	58,3
Width, m	12,6
Mean draught, m	4,68
Deadweight, t	1618
Main engine type	5-2Д42
Total capacity, kW	2x 1104
Navigation area	Unlimited
Speed, knots	13,5
Crew, people	27

2. Salvage tug «Murmanryba», project 1454, place of construction – Yaroslavl, Russia, year of construction - 1979.

Table 22: *Main characteristics of the salvage tag "Murmanryba"*

Main characteristics:	
Length, m	58,3
Width, m	12,6
Mean draught, m	4,68
Deadweight, t	1618
Main engine type	Wartsila 9L20
Total capacity, kW	2x 1215
Navigation area	Unlimited
Speed, knots	13,5
Crew, people	27

3. Salvage tug "Mikula", project 1454, place of construction – Yaroslavl, Russia, year of construction - 1980.

Table 23: *Main characteristics of the salvage tag "Mikula"*

Main characteristics:	
Length, m	58,3
Width, m	12,6
Mean draught, m	4,68
Deadweight, t	1618
Main engine type	Wartsila 9L20
Total capacity, kW	2x 1215
Navigation area	Unlimited
Speed, knots	13,5
Crew, people	27

4. Salvage tug "Atriya", project 1454, place of construction – Yaroslavl, Russia, year of construction - 1985.

Table 24: *Main characteristics of the salvage tag "Atriya"*

Main characteristics:	
Length, m	58,3
Width, m	12,6
Mean draught, m	4,68
Deadweight, t	1618
Main engine type	5-2Д42
Total capacity, kW	2x 1104
Navigation area	Unlimited
Speed, knots	13,5
Crew, people	27

5. Icebreaking salvage ship «Stahanovets», place of construction – Finland, year of construction – 1980.

Table 25: *Main characteristics of the salvage ship "Stahanovets"*

Main characteristics:	
Length, m	72,07
Width, m	18,0
Mean draught, m	6,7
Deadweight, t	4191
Main engine type	PC2-SL400
Total capacity, kW	2x 2846
Navigation area	Unlimited
Speed, knots	16,2
Crew, people	25

3.1.1.4 Federal Agency of Air Traffic (http://www.favt.ru/)

It is a managing body of the unified system of the aerospace Search and Rescue in Russia at the federal level and reports to the Ministry of Transport. 127 aircrafts and helicopters in total must be on duty at airports in Russia. The main task of these divisions is to provide assistance to aircrafts, their crews and passengers in distress but the SAR resources of the aerospace Search and Rescue in Russia can also be involved in SAR operations providing assistance for example to ships.

There are 3 helicopters MI-8 always on duty in airports of Murmansk, Arkhangelsk, and Naryan-Mar.

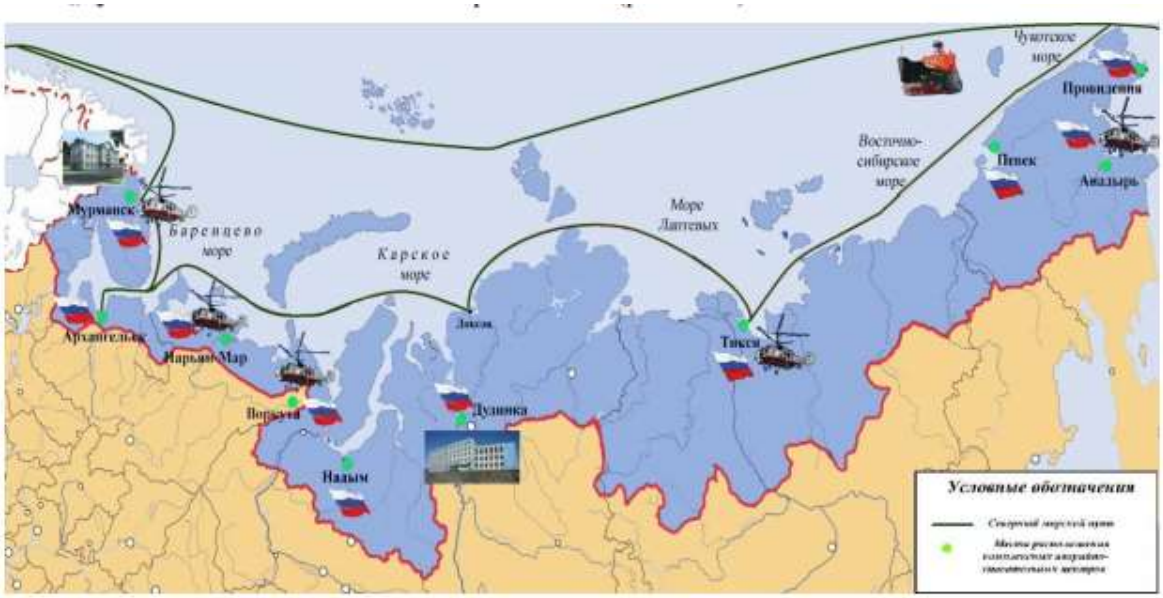
Table 26: *Main characteristics of MI-8 helicopter*

Crew, number of people	3
Engine	2xTB2-117A
Thrust, kilogram-force	1700
Aircraft empty weight (kg)	12000
Payload weight, kg	4000
Number of passengers, people	28
Winch carrying capacity, kg	150
Cruising air speed (km/hour)	230 – 250
Maximum flying distance (km)	445-465 (300-350 if hovering over an object in distress during 20 min)

3.1.1.5 EMERCOM

10 Arctic maritime rescue centers of EMERCOM will be located in Dudinka, Murmansk, Arkhangelsk, Naryan-Mar, Vorkuta, Nadym, Tiksi, Pevek, Provideniya and Anadyr. A total of 980 persons will be working at the centers, according to EMERCOM. 6 of these centers are already opened.

Figure 10: *Main characteristics of MI-8 helicopter*



[http://severpost.ru/read/33644/bank_view_info.php?bank_id=2],
[http://51.mchs.gov.ru/pressroom/intervju/item/337810/]

On October 21, 2015 a specialized Arctic Rescue Center of EMERCOM was opened in Murmansk (www.regnum.ru/news/society/1996001.html). The Center was created in the framework of the federal target program "Risk reduction and mitigation of natural and man-made disasters in the Russian Federation". The Center's main tasks are prevention and elimination of emergency situations of natural and man-made disasters in the Arctic zone of the Murmansk region, the area of which is 847,000 square kilometers. Staff number of the Emergency Rescue Center is 65 people. There are 9 units of equipment in the center, including 2 boats, aircrafts used for Search and Rescue operations. But the center aircrafts' base is located in Saint-Petersburg, currently the issue of polar aviation revitalization and creation of an air base for aircraft in Murmansk is under discussion.

3.1.1.6 Arctic Rescue Center's Search and Rescue equipment

1. **Boat «Leader-12M»**. Length overall is 13.3 m (13.0), transport width is 4,5 m (4,0), maximum speed is up to 35 knots. With a cruising speed of 30 knots boat's range is up to 500 miles. The boat uses two engines of Volvo Penta type (Sweden) with a capacity of 575 horsepower each, as well as water-jet propeller Hamilton. Ship hull is made of aluminium. The boat is equipped with berths for 6 people with passenger capacity up to 12 people.

2. **Boat «Stringer-550P».** The boat can be used in the coastal zone in the seas with wave height of up to 4-8 FT-1.25-2.50 meters (4 grades). The boat is equipped with inflatable sides. The boat's inflatable tubes are made of reinforced polyvinyl chloride with density of 1300 g/m² - it has 5 separate sections. External surface of the inflatable tube is protected from damage by sticking to it additional layers of polyvinyl stripes. There is built-in fuel tank in the hold of Aft cockpit. The stern part of the boat along transom is protected with a seem - welded stainless railing. There are automatic bilge pump and 4 armchairs. The boat is equipped with a searchlight with remote control, navigation lights, ship first-aid kit, life jackets in the amount of 8 pieces.

Table 27: *Main characteristics of the boat "Stringer-550P"*

Length, m	5,6
Width, m	2,45
Height (m)	2,15
Boat empty weight (kg)	640
Full fuel (l)	120
Cargo carrying capacity (kg)	700
Number of passengers (people)	8
Full engine power (h.p.)	150

3. **IL-76** – transport long range aircraft designed to carry large equipment and cargos. It has sturdy fuselage, wings and undercarriage allowing extending maximum payload range.

Table 28: *Main characteristics of IL-76 aircraft*

Length, m	46,6
Wingspread (m)	50,5
Height over tailfin (m)	14,76
Height over cab (m)	7,04
Aircraft empty weight (kg)	86700
Full fuel (l)	90,0
Fuel consumption (kg/hour)	8000
Cruising air speed (km/hour)	750
Operating ceiling (m)	12000
Maximum flying distance (km)	7500
Maximum Takeoff Weight (t)	190,0
Maximum Landing Weight (t)	151,5
The maximum cargo weight (t)	50,0

4. **Hydro airplane Be-200** is a multi-functional aircraft. It can be used for protection and patrolling the waters, goods and passengers transportation, fire fighting and rescue missions.

Table 29: *Main characteristics of Be-200 hydroplan*

Crew, people	2
Engine	2хД-436ТП
Thrust, kilogram-force	7500
Aircraft empty weight (kg)	28000
Payload weight, kg	6000
Number of passengers	65
Cruising air speed (km/hour)	610 – 710
Maximum flying distance (km)	3600

5. **AN-148** – patrol aircraft.

Table 30: *Main characteristics of AN-148 aircraft*

Crew, number of people	2
Engine	2xTRDD D-436-148
Thrust, kilogram-force	6830
Aircraft empty weight (kg)	38550
Payload weight, kg	9680
Number of passengers	85
Cruising air speed (km/hour)	800 – 870
Maximum flying distance (km)	2100

6. **Helicopter MI-8** (see characteristics on page 81).

3.1.1.7 Arkhangelsk Arctic Rescue Center

September 23, 2014, a specialized Arctic Rescue Center of EMERCOM was opened in Arkhangelsk. Like the Murmansk Arctic Rescue Center, it is a branch of the North-Western SAR Department whose main office is located in Saint-Petersburg. The staff is 63 people, 45 of them are rescuers.

Arkhangelsk Arctic Rescue Center' tasks are to respond to emergency situations in the Arctic areas and to provide firefighting, underwater works, OSR, SAR, etc. The responsibility area includes the territory of the Arkhangelsk region (587,400 square km); inland waters and territorial waters of the White, Barents, and Kara Seas (http://29.mchs.gov.ru/document/4908927).

The SAR vessels and equipment of the Arkhangelsk Arctic Rescue Center:

1. Maritime Rescue Tug «Neotrazimy» built in 1981 is equipped with the three level icebreaker head and can provide underwater activities at the depth up to 50 meters.

Table 31: *Main characteristics of maritime rescue tag "Neotraziny"*

The main characteristics:	
Length, m	58,3
Width, m	12,6
Mean draught, m	3, 75
Deadweight, t	408
Main engine type	25/30 8AL
Total capacity, kW	1900 кВт
Navigation area	Limited A-2
Speed, knots	13.5

1. **Firefighting vessel «Vyun»**, project 16640, is intended to assist vessels in distress and coastal construction by fires. The crew of the vessel can use both hoses and fire monitors - an aimable controllable high-capacity water jet used for firefighting designed to accommodate foam which has been injected in the upstream piping to extinguish oil products fires. This vessel can tow burning objects to safe places and dewater.

Table 32: *Main characteristics of firefiting vessel "Vyun"*

The main characteristics:	
Length, m	30,95
Width, m	5,24
Mean draught, m	0,85
Deadweight, t	70,14
Main engine type	2 x 124HC 18/20 (МУ19А)
Total capacity, kW	810
Navigation area	Limited: rivers and lakes
Speed, km	36
Crew, persons	2
Firefighter crew, persons	6
Fire monitors	3
Jet distance, meters	70 (water), 40 (foam)
Firefighting equipment	117 hoses of different diameters: 150, 77, 66, 51 mm, 4 pumps with capacity of 60 liters per second, 9 foam generators, etc.

2. Boat **«20 years of EMERCOM»** of the Leader-12M type (mail characteristics see above). http://fleetphoto.ru/projects/2933/

3. Boat **«Stringer-550P»** (mail characteristics see above).

4. Boat "**BL-820"** constructed in 2008 in Saint-Petersburg can be used in the coastal zone at the maximal distance of 50 miles from the harbor with the wave height up to 3 meters. The boat is equipped with inflatable sides. The passage capacity is 12 persons. The speed is 25 knots.

5. Boat **«Kasatka»** constructed in 2008 in Nizhny Novgorod can be used in the coastal zone at the maximal distance of 3,600 meters from the harbor with the wave height up to 2 meters. The passage capacity is 6 persons.

6. Patrol rescue boat **«KS-7S»** constructed in 2008 in Kostroma can be used in the coastal zone at the maximal distance of 12 miles from the harbor with the wave height up to 1,5 meters. The passage capacity is 12 persons.

7. Boat **«Hitek-75»** constructed in 2007 in Nizhny Novgorod can be used in the coastal zone at the maximal distance of 2,000 meters from the harbor with the wave height up to 0,5 meter. The passage capacity is 10 persons.

8. Boat of the **AK-690 project** constructed in 2007 in Saint-Petersburg can be used in the coastal zone at the maximal distance of 2 miles from the harbor with the wave height up to 1 meter. The passage capacity is 4 persons.

9. Boat **«Favorit F500»** constructed in 2008 in Saint-Petersburg can be used in the coastal zone at the maximal distance of 3,000 meters from the harbor with the wave height up to 1 meter. The passage capacity is 8 persons.

10. Boat **«Favorit »** constructed in 2009 in Saint-Petersburg can be used in the coastal zone at the maximal distance of 2,000 meters from the harbor with the wave height up to 0,5 meters. The passage capacity is 10 persons.

11. Hovercraft boat **«Argo»** constructed in 2011 in the Leningrad region can be used in the coastal zone at the maximal distance of 2,000 meters from the harbor with the wave height up to 0,6 meters. The passage capacity is 10 persons.

12. Hovercraft boat **«Khivus»** constructed in 2007 in Nizhny Novgorod can be used in the coastal zone at the maximal distance of 2,000 meters from the harbor with the wave height up to 0,4 meters. The passage capacity is 10 persons.

13. Hovercraft boat **«Khivus-10»** constructed in 2016 in Nizhny Novgorod can be used in the coastal zone at the maximal distance of 3,000 meters from the harbor with the wave height up to 0,6 meters. The passage capacity is 10 persons.

In addition, there are 10 EMERCOM fire stations located in the cities of Arkhangelsk, Kotlas, Severodvinsk. Some of them are trained to provide assistance at water in emergency situations.

3.1.1.8 Other regional SAR capacities

The responsibility for SAR and fire safety in communities lies with each region of the Russian Federation. It means that regional fire stations, fire brigades, rescue services are equipped, trained at the expense of the regional budget. There are 62 regional fire stations and 89 fire brigades (1,716 firefighters).

The Arkhangelsk region Agency for State Fire Service and Civil protection as an organisational body within the regional government is responsible for managing the regional fire stations and other emergency organisations (https://dvinaland.ru/gov/-64eh614g).

Arkhangelsk Regional Rescue Service operates under the jurisdiction of the Agency for State Fire Service and Civil Protection of Arkhangelsk Region and performs rescue missions, including firefighting, SAR, mitigation of large-scale chemical accidents, OSR, etc. The staff is 122 people. In 2007, an Aviation Rescue Swimmer division was established in ARRS in order to help the injured at sea. It is the only unit in the northwest of Russia whose rescue swimmers perform direct deployment by jumping in water from the helicopter (www.aocc.ru).

The Civil Protection Center is another emergency organization with the staff of 65 people that operates under the jurisdiction of the Agency for State Fire Service and Civil Protection and has the tasks to provide SAR, underwater works, etc. It owns 5 boats. One of them – the boat «Barents» - has the characteristics to navigate in seawaters. Its overall length is 11 m, maximum speed is up to 60 km/h. The boat uses two engines with a capacity of 340 horsepower each. Passenger capacity is up to 12 people (http://29.mchs.gov.ru/document/1324021).

The "2nd Arkhangelsk United Aviation Division" is the largest enterprise operating helicopters in North-West region of Russia which provide transportation of passengers, cargo, and SAR. The company has a special agreement with the Agency for State Fire Service and Civil Protection to provide helicopters for SAR and firefighting, rendering of medical service to the population, etc. One helicopter is always on duty at the airport Vaskovo. At present, the helicopter fleet includes Mi-8T, Mi-8MTV and Mi-26 helicopters and planes – An-2 and L410-UVP-E planes (http://2aoao.ru).

Table 33: *Main characteristics of Mi-8T helicopter*

Crew	3 members
Quantity of passengers	22 people
Length (with rotating wings)	25,24 m
Height (with rotating steering rotor)	5,65 m
Diameter of main rotor	21,3 m
Weight empty	6934 kg
Normal take-off mass	11100 kg
Max take-off mass	12000 kg
Engines	2 x TB2-117

Engine power (on taking-off mode)	2 x 1500 h.p.
Max speed	250 km/h
Cruising speed	190 km/h
Service ceiling	4500 m
Range	1035 km

Table 34: *Main characteristics of Mi-8MTV helicopter*

Crew	3 members
Quantity of passengers	22 people
Length (with rotating wings)	25,35 m
Height (with rotating steering rotor)	5,52 m
Diameter of main rotor	21,3 m
Weight empty	7381 kg
Normal take-off mass	11100 kg
Max take-off mass	13000 kg
Engines	2 x TB3-117BM
Engine power (on taking-off mode)	2 x 2000 h.p.
Max speed	250 km/h
Cruising speed	190 km/h
Service ceiling	6000 m
Range	1300 km

Mi-26 is a multipurpose, wide-body transportation helicopter for air fright lift of cargo up to 20 tons both inside of cargo compartment and on a sling load. Power specifications of the engine make it possible to use the helicopter in an effective way in wide range of altitudes and ambient air temperatures, also to perform forward flight and approach with one engine operative. Design, equipment and systems of Mi-26 helicopter enable to operate it in day and night time in heavy weather conditions, over flatland, rolling country and mountains. Operation of the helicopter does not require special ground support equipment (such as stepladders, since engine and transmission cowlings in open position are bridges) and the helicopter is capable to long-time and independent basing.

Airborne auxiliary power provides independent engines starting, power supply during cargo operations, test of aircraft equipment, air conditioning in the cockpit, heating and ventilation in the cargo compartment on the ground in the time of loading/unloading of vehicle.

Table 35: *Main characteristics of Mi26 helicopter*

Crew	6 members
Quantity of passengers	4 people
Length (with rotating wings)	40,03 m
Height (with rotating steering rotor)	11,6 m
Diameter of main rotor	32 m
Weight empty	28150 kg
Normal take-off mass	49500 kg
Max take-off mass	56000 kg
Engines	2 x ГТД Д-136

Engine power (on taking-off mode)	2 x 10000 h.p.
Max speed	270 km/h
Cruising speed	235 km/h
Service ceiling	6500 m
Range	1920 km

L-410 is the universal twin-engine plane for domestic airlines. It has increased, relative to An-2 plane, speed, convenience and flight regularity, up-to-date avionic, providing performance of flights in heavy meteorological conditions in day and night and in any season. The plane, as the base passenger variant for transportation of 19 persons, can be used in cargo, medicine, airplane mapping, and patrol and fish survey variants.

Table 36: *Main characteristics of L-410 aircraft*

Crew	2 members
Quantity of passengers	19 people
Length (in land position)	14,42 m
Height (in flight line)	5,83 m
General span of wing	19,98 m
Weight empty	4050 kg
Normal take-off mass	6400 kg
Payload	1710 kg
Engine	2 x ТВД Motorlet (Walter) M 601E
Engine power (on taking-off mode)	2 x 750 h.p.
Max speed	350 km/h
Cruising speed	330 km/h
Service ceiling	8400 m
Range	1150 km

3.1.1.9 MiIlitary SAR resources

The main military resources able to be involved in SAR operations in the Arctic region include rescue tow and rescue vessels of the Departments for SAR activities:

- rescue tug vessels of the 5757 project («Foty Krylov»; «Nikolay Chiker»);
- the rescue vessel of the 537 project («Alagez»);
- rescue tug vessels of the 712 project («SB-406»; «SB-408»);
- rescue tug vessels of the 714 project («SB-521», «SB-522»; «MB-105»; «SB-523»);
- rescue tug vessels of the 1452 project («Alatau»; «Mashuk»; «Pamir»; «Altay»);
- the diving vessel of the 11980 project («BM-596»).

Within SAR operations in the Arctic, the military helicopter Mi-8AMT and aircrafts Il-76 are at hand. The rescue container can be hoisted down on the water to provide means for people to survive.

There are always 2-3 rescue vessels of the Navy on duty in different responsibility areas to be ready to respond within 1 hour [Taranukha, 2014].

The Northern Fleet, based in the Murmansk region, can if necessary, provide its rescue vehicles and equipment for the maritime Search and Rescue operations (http://flot.com/nowadays/strength/surfaceships/#spas-tug. This includes the following units:

1. **Helicopter KA-27** PS is designated for Search and Rescue operations at sea and on-shore at any time of day or night and in all seasons and weather and in seas with Significance Wave Height (SWH) up to 2,5 - 4,0 m. It can fly on a SAR mission within a radius of about 200 – 250 km and hover above a ship or a person in distress for 20 minutes. It has lifting winch onboard with freight-carrying capacity of 300 kg. External load system provides transportation of spacecraft or other cargo weighing up to 3 tons. The unique undercarriage design provides taking off and landing on the deck during ship's motion in waves. For an emergency landing on water helicopter has emergency airbags/ballonets. If necessary a seat or a belt can be attached to helicopter's lifting winch to lift people aboard. In addition, there are the inflatable belts, two boats, rafts on board. It can also serve as an emergency medical service helicopter. There is a possibility to set up to 4 stretchers, 2 folding chairs, a table for medical staff/doctor, oxygen apparatus on board. The crew of the helicopter is four people, including a doctor's assistant - rescuer, which compulsorily has a special diving and medical training.

2. **Helicopter MI-8** (the main characteristics and tasks shown above).

3. Multirole and multifunctional boat **"Saver Kononenko"**. The crew of the boat can carry out Search and Rescue, underwater technical operations, as well as dive to a depth of 45 meters. There are advanced diving and fire-fighting equipment on board, as well as hydraulic crane-manipulator with lifting capacity of up to five tons, and cargo boom with a mechanical winch with carrying capacity up to 250 kilograms.

The Northern sea route – the ROSATOM FLEET *(www.rosatom.ru)*

One of the main challenges for more use of the sea route is the need for new icebreakers. Now the Russian nuclear-powered icebreakers fleet consists of 6 vessels. It should be noted that the icebreakers and ice class rescue vessels are and will also act as “floating” SAR and oil response units. During the Northern Sea Route navigation season (June-October), SAR and OSR equipment and response teams are placed on two icebreakers – an atomic one and a diesel-powered one.

Murmansk is the base for Rosatomflot vessels. In the event of a maritime accident in areas with heavy ice conditions nuclear icebreakers of Rosatomflot may be involved (when possible) into Search and Rescue operations. The most multi-functional vessels of Rosatomflot are nuclear - powered icebreakers “Yamal” and “50 years of Victory”. They have similar technical characteristics. "Yamal" has a cruising speed of 20.6 knots, is capable of breaking through ice up to 2.5 meters (9.2 feet) thick. As emergency and life saving equipment the atomic icebreaker "Yamal" can carry covered plastic motor lifeboats and inflatable rescue rafts PSN-10 MK as well as a tugboat "Orlan". There is a range of facilities and appliances, including a hangar for helicopters.

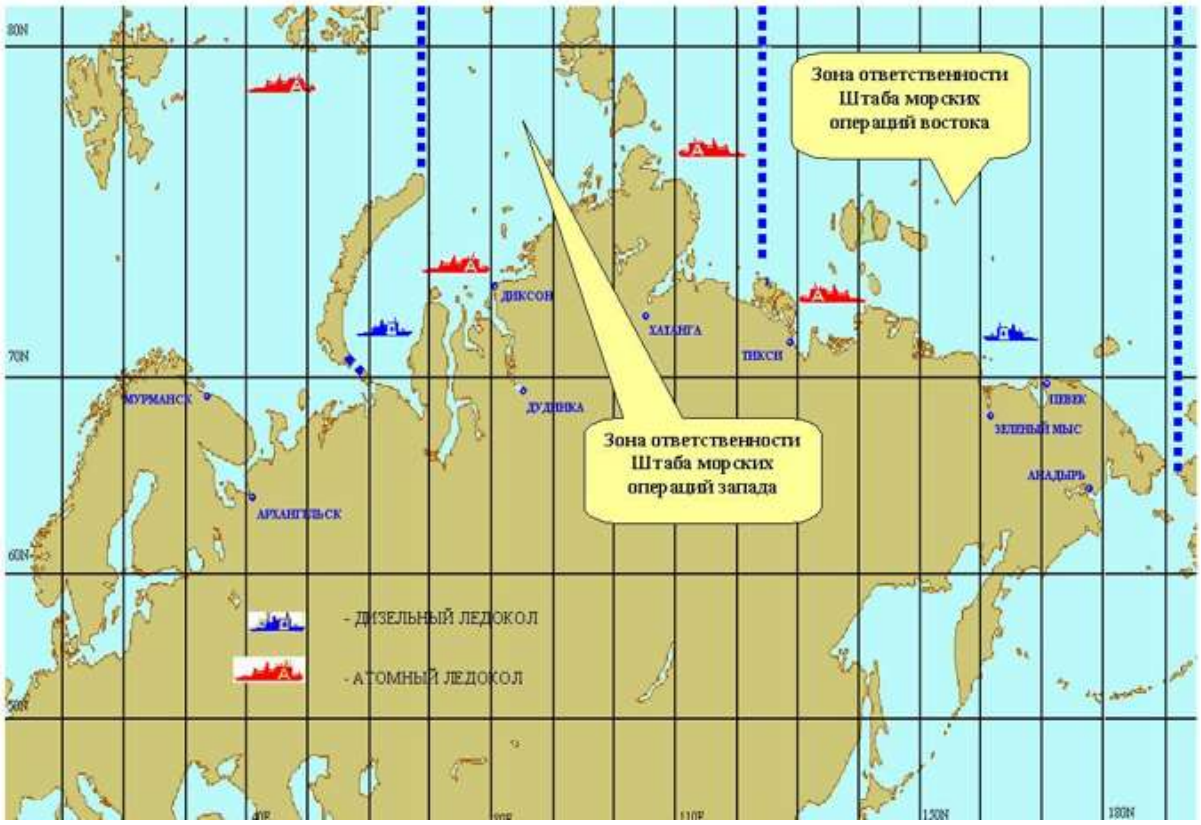


Figure 11: *Location of icebreakers (in red – diesel-powered icebreakers, in blue – atomic icebreakers).*
Source: Rosmorrechflot http://www.morflot.ru/lenta/n15.html

3.1.1.10 Hospital capacities

In the Murmansk region, there are 51 hospitals, from them 33 regional, 18 municipal, 3 middle level ones. Besides, 7 federal and 16 private hospitals are situated in the region [State health care programme of the Murmansk region].

In 1992, a team of the rescue doctors was established in the regional hospital. They are able to provide assistance in the very extreme Arctic conditions.

Today, there are 11 such teams. Only the experienced intensivists, neurosurgeons, heart surgeons, chidren's doctors, etc. [Murmansk vestnik, 2010].

In the Arkhangelsk region, there are 38 regional, 6 federal and 5 private hospitals; 150 clinics. In total, the hospitals can provide almost 10,000 places for ill and injured people [State health care programme of the Arkhangelsk region, 2015].

Air ambulance service was established in the Arkhangelsk region in 1938. The "2nd Arkhangelsk United Aviation Division" provides the helicopters MI-8, aircrafts AN-2, L-410 for doctors and medical staff of the Arkhangelsk regional hospital [https://minzdrav29.ru].

The response time of the air ambulances is 40 minutes.

3.1.2 Oil Spill Response

According to some statistical data, more than half of accidental discharges (oil spills) occur when oil tankers transfer it. 75% of oil tanker's accidents occur due to human failure. According to accidental oil spills statistics for 2012-2016 years, the greater number of violation of rules of safety regulations and tanker incidents involving large oil spills in Russia occur during loading and unloading operations at the terminals.

The authorities in charge of Oil Spill Response/OSR organization include federal executive bodies (Rosmorechflot and its branches, Energy Ministry, EMERCOM, Federal Fishery Agency, etc.); regions' executive bodies; local self-government bodies; and organizations engaging in petroleum exploration, production, processing and transportation.

Global Maritime Distress and Safety System receives signals and alerts a vessel about oil spillage, organizes communication between vessels and MRCCs as well as provides mariners with vital maritime safety information.

3.1.2.1 OSR resources of the Murmansk region

In the Murmansk region, the Murmansk branch office of Morspassluzhba and the Arctic Sea Specialized Inspectorate are responsible for prevention and response of the emergency situations related to the exploitation of oil and gas facilities, as well as for the implementation of state control in the field of environmental management and protection of marine environment. The Murmansk regional

branch of EMERCOM is to exercise overall control over security and participate in SAR operations.

The Northern branch of Morspassluzhba provides OSR and oil spill prevention from the Norwegia-Russian border to 125°E in the west: in the Kola bay, in Vitino in the White Sea, at Varanday terminal in the Pechora Sea and at Rosneft fields in the Kara Sea.

The total number of staff employed by Murmansk branch office of Morspassluzhba is 209 people, including branch office in Kandalaksha city (84 people). Murmansk Basin Rescue Department is responsible for Oil Spill Recovery at regional level (oil spill scale at 500 to 5000 tons maximum). Murmansk Basin Rescue Department is an owner of special-purpose vessels such as "Svetlomor-3", "Captain Martyshkin" and others vessels equipped with oil socks and skimmers. Currently "Svetlomor-3" is used in Black Sea area as supply vessel, "Captain Martyshkin" – in World's oceans and seas. For Search and Rescue operations in Kola Bay "Markab" – high-speed oil garbage collector/boom pitter vessel, "VRB-4" and "VRB-10" are used. "Captain Nikolaev" is used in the Arctic.

Table 37: *Vessels of Morspassluzhba (Marine Rescue Service), Murmansk branch*

Vessel	**Function**
motor vessel UMKA	Headquarters vessel. Trawling and oil skimming with trawl, boom and skimmer. Oil pumping from ship in distress
motor vessel SVETLOYE MORE	Boom laying, trawling oil areas, receiving oil collected from other vessels. Oil pumping from ship in distress. Oil sweeping. Coordination of small vessel operation
boom-laying boat MARKAB	High velocity boom-laying boat
Boat MOB-207	Small cargo vessel with the crew of 9 members, passenger capacity of 22 people and weight-carrying capacity of 3075 tons

Technical facilities of Morspassluzhba (Marine Rescue Service), Murmansk branch

Table 38: *Technical facilities of Morspassluzhba (Marine Rescue Service), Murmansk branch*

Technical facility	**Specifications**		
Boom OCEAN- 2000	length 1000 м (4x250 м)		
	1 container	2 containers	3 containers
	weight 6400 kg	weight 6400 kg	weight 3200 kg
	Measurements		
	2800x2200x2200 mm	2800x2250x2200 mm	2800x2200x2200 mm
Boom EXPANDY	Length 243 м		
	weight 2700 кг		
	measurements 1900x1900x1700 mm		

<table>
<tr><td rowspan="6">Outboard side trap ROSVIP</td><td colspan="3">fixed on board, can operate at maximum wave height of up to 3 m. measurements 2250x1950x1700 mm</td></tr>
<tr><td>1 container</td><td>2 containers</td><td>3 containers</td></tr>
<tr><td>weight 2200 kg</td><td>110 kg</td><td>2000 kg</td></tr>
<tr><td colspan="3">Measurements</td></tr>
<tr><td>2400x1300x1850 mm</td><td>2500x1750x1800 mm</td><td>800x2260x1800 mm</td></tr>
<tr><td colspan="3">Pumping capacity:
ТК-8 – up to 1000 cu m per hour, ТК-5 – up to 450 cu m per hour</td></tr>
<tr><td>Skimmer WALOSEP W2</td><td colspan="3">capacity – 45 cu m per hour
power plant unit weight – 1100 kg,
power plant unit measurements 1650x1100x1100 mm
skimmer weight – 450 kg
skimmer measurements 2000x2000x1900 mm</td></tr>
<tr><td>Skimmer DESMI-250</td><td colspan="3">capacity – 70 cu m per hour
container weight – 3145 kg
container measurements 2440x2900x2440 mm</td></tr>
<tr><td>Skimmer FOXTAIL УАВ 4-9</td><td colspan="3">Capacity – 30 cu m per hour
power plant unit weight – 750 kg,
container measurements 1500x800x1100 mm
container weight – 585 kg,
container measurements 2250x1950x1700 mm</td></tr>
</table>

3.1.2.2 OSR resources of the Arkhangelsk region -Morspassluzhba, the Arkhangelsk branch

Arkhangelsk branch of Morspassluzhba is responsible for Oil Spill Recovery at regional level (oil spill scale at 500 to 5000 tons maximum). It is an owner of special-purpose vessels “Metel”, “Signal”, “Diver Sazonov”, “ASPTR-5”, “ASPTR-5”, “ASPTR-9”, “Hitek-85C” (description see above), 3 outboard motorboats, 2 oar boats.

Table 39: *Vessels of Arkhangelsk branch of Morspassluzhba*

“Metel”	Skimmer “MiniMax-12” with capacity 12 m^3 per hour, 250 running meters of booms, motorboat “Yaxe”
“Signal”	Skimmer “Desmi-250” with capacity 70 m^3 per hour, 345 running meters of booms, inflatable boat “Favorit F-500”
”Diver Sazonov”	Skimmer “Walosep W2” with capacity 45 m^3 per hour, 255 running meters of booms, inflatable boat “Zodiac”
“ASPTR-5”	Skimmer “Walosep W2” with capacity 45 m^3 per hour, 255 running meters of booms, inflatable boat “Favorit F-500”
“ASPTR-7”	Skimmer “Walosep W2” with capacity 45 m^3 per hour, 255 running meters of booms, inflatable boat
“ASPTR-9”	Skimmer “Walosep W2” with capacity 45 m^3 per hour, 255 running meters of booms, inflatable boat

To provide OSR, the Arkhangelsk branch of Morspassluzhba has the following equipment: floating booms of 420, 1455, 200 running meters, inflatable boom of 250 running meters, log boom (for ice condition) of 50 running meters, 12 skimmers ("Lamor Multi", "Lamor Rock Cleaner", "SP-7", "Mini Max-12", "Mini Max-10", "Fortail Vab 4-9", "Mini-Transrec-250"), 26 OSR suits of dry type and 4 rescue swimmer suits. The vessels are also equipped with firefighting facilities: 10 units of firefighter gear, 4 breathing apparatus, 51 and 66 mm diameter hoses of 140 and 210 running meters, 22 nozzles, 0,5 tons of foam.

In addition, the Arkhangelsk Arctic Rescue Center of EMERCOM include booms of 2,300 meters in total, tanks for oil products, etc.

3.1.2.3 Private industry resources

Organizations engaging in petroleum exploration, production, processing and transportation are also obliged to ensure Oil Spill Response either via their dedicated divisions or outside, contracted, SAR units certified for oil spill emergency response. In case an oil spill occurs, organizations will immediately report to relevant governmental and local self-government authorities and arrange for response operations. For these purposes, organizations will have standby funds and material resources necessary to localize and respond to oil spills.

Rosneft and Gazprom, the oil producing companies on the Barents Sea shelf, are either owners or operators of special purpose vessels. Their specifications and types of facilities used to clean up oil spill are identical. The following table provides information about the specifications and the number of such vessels.

***Table 40**: V*essels *of Oil&Gas Compnmay Rosneft in Murmansk*

Rosneft vessels	Function
Multi-function ice-class vessel - CAPTAIN REUTOV - CAPTAIN AVDUKOV	The vessels are identical to Gazflot company

***Table 41**: Vessels of Gazflot*

Gazflot vessels	Function
Multi-functional ice-class vessels: - VLADISLAV STRIZHOV - YURI TOPCHEV	Ice-class Search and Rescue vessel capable of operating all year round; boom placing; oil removing and skimming. The following facilities are installed on board the vessels: - skimmer Lamor Free Floating Offshore (in the iceless season; with capacity of 115 cu m per hour; - skimmer Lamor Arctic (in ice season; with capacity 115 cu m per hour; - a set of booms with the total length of 400 m, height of 2,000 mm; - inflatable ice-class boom with total length of 300 m, height of 2,020 mm. - containers for temporary storage of the collected oil with the total storage volume of 1,000 cu m; - sorbent – 10tons; - diesel-power installation for hot water washing A new ice-class scoop oil skimmer is to be installed on board multi-functional ice-class vessel with the total capacity of 140 cu m per hour

For safety reasons, the oil shipment from Varandey terminal is being monitored by Murmansk Port's captain, or his assistants onboard every tanker. This offshore fixed ice-resistant shipping terminal is being assisted by the Kapitan Nikolaev icebreaker and an icebreaker-type tugboat, both designed to ensure safe tanker maneuvering, mooring and cargo handling. Onboard the icebreaker and the tugboat are the employees of Morspassluzhba branch in Murmansk, whose job is to ensure that all operations are performed in safe manner. On board these vessels are also divers who are there to inspect the buoy and repair it and the subsea facilities, if necessary. Both the vessels are installed with firefighting systems and advanced Oil Spill Response facilities, whereas the terminal is equipped with fully automatic three-level oil spill prevention and response system able to handle even an emergency oil spill.

The Prirazlomnaya platform's oil spill contingency plan, for instance, provides for the use of the following facilities to handle oil spills under 1500 tons [Gaspromneftshelf, 2013]:

- 2 multipurpose icebreaking vessels with 115 m3/h capacity Lamor Free Floating Offshore skimmer (summer modification) and Lamor Arctic skimmer (winter modification) onboard;
- 1 dedicated vessel with marine OSR arrangement (summer, winter skimmers, etc.);
- marine floating booms Lamor HDB – 1200 m;
- 2 boom boats;
- 3750 kg of absorbent.

To handle larger marine oil spills, booms will be delivered and installed from a multipurpose icebreaking vessel, i.e. involving the resources of the RF Ministry of Transport.

Handling oil spills as large as 10 000 tons will employ the facilities owned by GazpromNeftShelf oil company, namely, marine floating booms (1200 m), permanent flotation booms (600 m); 2 boom boats; 2 skimmer-equipped multipurpose icebreaking vessels; one 10 000 ton DWT tanker, etc. – all to be handed over to units handling the emergency.

An oil spill of 10 000 tons is classified as a federal-scale Oil Spill Response operation. The assets and resources currently available to rescue teams and businesses are deemed sufficient to ensure the initial Oil Spill Response operations before the federal-level assets arrive – those of EMERCOM, the Navy, GosMorSpasSluzhba or adjacent countries' coast guard. The available OSR resources may also be contributed by LUKOIL (JSC) according to a mutual assistance agreement.

According to Joint Shipbuilding Corporation, GaspromNeftShelf plans to build 3 icebreakers to ensure oil production and transportation safety.

To develop offshore areas in the Arctic, Joint Shipbuilding Corporation assesses the need for civil vessels and maritime equipment until 2030 in 50 rigs/platforms/oil terminals, 85 special purpose transportation vessels, and 100 tenders.

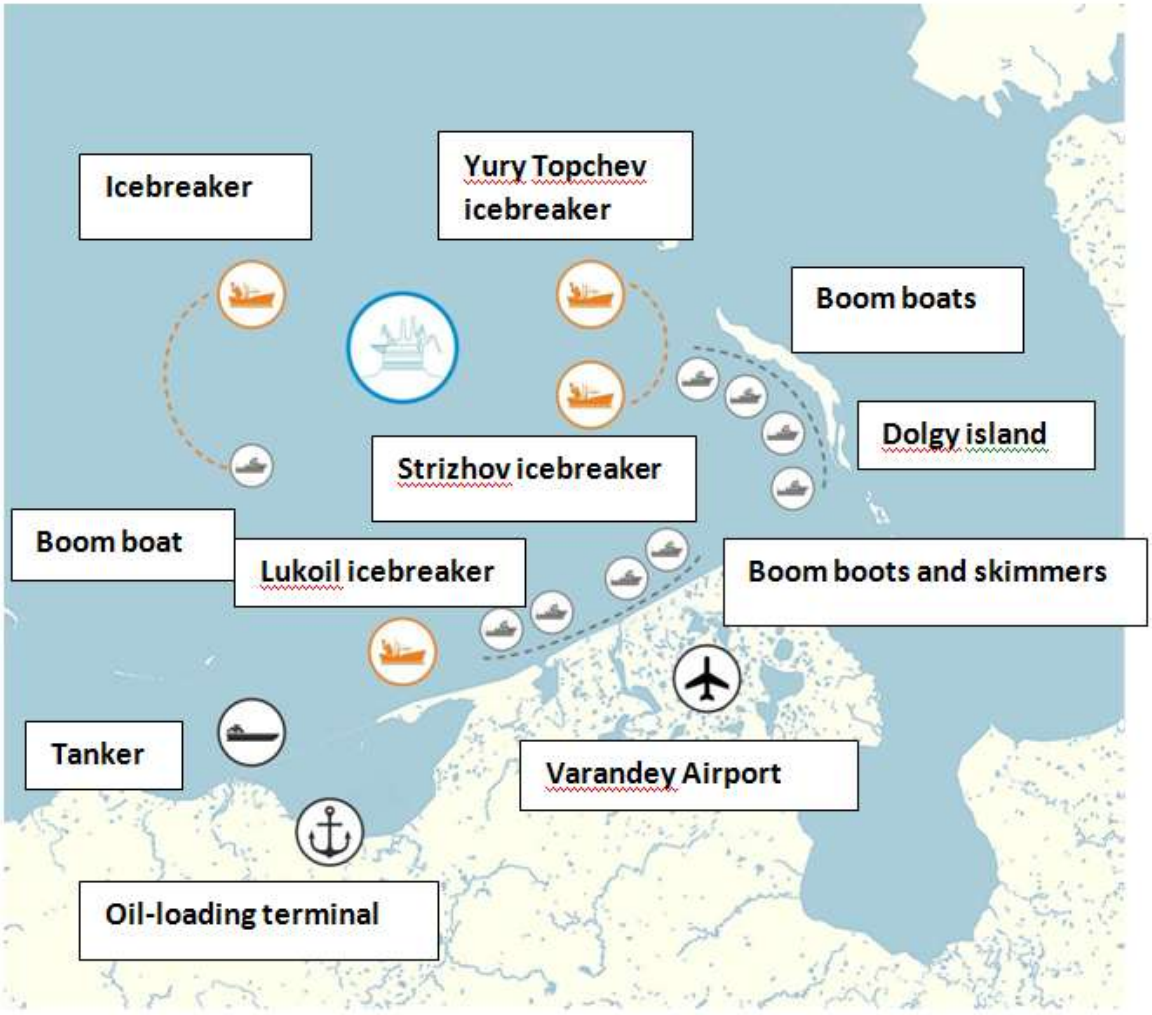


Figure 12: *Alignment of response resources, "Prilozlomnaya". Source: Alexander Mandel, GaspromNeftShelf.*

3.1.2.4 Private OSR companies

There are 3 companies located in Arkhangelsk which have licenses to provide OSR.

The company "SMARP" (http://solarn.ru/services/likvidaciya-razlivov-nefteproduktov) has its main office in Saint-Petersburg and several branches, i.a. in Arkhangelsk.

The company "Arcticspezservice" (http://www.arctic-asf.ru/index.php?id=1) is a professional emergency organization to provide OSR on the territory of the Arkhangelsk region and Nenets Autonomous Okrug in the waters of White and Barents Seas. One of the OSR groups is always on duty in the village Varanday of the Nenets Autonomous Okrug. The company has a cooperation agreement with the Northern branch of Morspassluzhba to provide OSR.

The company is an owner of the skimmers 6 «Lamor Minimax - 10» with capacity of 10 м3 per hour, «Lamor DWD» with capacity of 60 м3 per hour, 2 «Desmi Mini-Max» with capacity of 30 м3 per hour, Lamor Arctic Skimmer» with capacity of 115 м3 per hour, 2 «Lamor Rock Cleaner» with capacity of 10 м3 per hour, «Lamor Bow Collector» with capacity of 40 м3 per hour, «Lamor Free Floating Offshore» with capacity of 200 м3 per hour, «Lamor Backet» with capacity of 90 м3 per hour.

It has floating booms of 6,000 meters, self-inflating booms of 500 meters, coastal isolating booms of 300 meters, heavy marine inflatable booms of 1,000 meters.

The fleet includes the boats "Arcticspezservice-1" and "Arcticspezservice-2" of "BB-100M" type, boat "Yushar", vessels "Merkury " of the К 354 project and "Solombalez-3", tug "Toboy", and icebreaker ""Varanday"

3.1.3 Violent Action Response

The state management in the Arctic zone of the Russian Federation is carried out by public authorities (state bodies) in a process of governing activities for the implementation of embodied state functions, providing 5 national legal regimes in the Arctic:

1. Emergency regime which is set by the presidential decree and by the resolution of the Council of Federation of the Federal Assembly on the approval of the presidential decree[8];
2. Martial law regime is set by a presidential decree[9]. However, the presidential decree approved by the resolution of the Council of Federation.

[8] Federal Constitutional Law of May 30, 2001 No. 3-FKZ "On State of Emergency"

[9] Federal Constitutional Law of January 30, 2002 No. 1-FKZ "On Martial Law Regime" in contrast to the Law "On State of Emergency" prescribes to address the presidential decree to the both chambers of the Federal Assembly.

The State Duma is actually in need to be informed of the imposition of martial law;

3. Frontier regime[10];
4. Mobilization[11];
5. Seaports regime[12].

The above-mentioned regimes characterized by the special importance of the regulated social relations, and the use of legal means provide a regime of restriction of the rights of citizens and organizations. Hence, all of the legal regimes in the Arctic zone have several common features:

- a normative legislative determination;
- the legal norms of different branch accessory, characterizing by strict and detailed regulative quality;
- a variety of territories with different legal regime depending on legal norms;
- specially established state governmental bodies with a list of competences.

[10] Is directly established by the Article 16 of the Law of the Russian Federation of April 1, 1993 No. 4730-I "On the National Frontier of the Russian Federation".

[11] Its standard fastening the regime received in the Federal Law of February 26, 1997 No. 31-FZ "On mobilization training and mobilization in the Russian Federation". The Rules of "mobilization" contained in a large number of legislative acts (11 (eleven) normative legal acts) including federal constitutional laws and federal laws:

Federal Constitutional Laws: Federal Constitutional Law of December 17, 1997 No. 2-FKZ "On the Government of the Russian Federation" (see: Article 114(2) of the Constitution of the Russian Federation); Federal Constitutional Law of January 30, 2002 No. 1 FKZ "On Martial Law Regime" (see: Article 87(3) of the Constitution of the Russian Federation); Federal Constitutional Law of May 30, 2001 No. 3-FKZ "On State of Emergency" (see: Article 56 (1 and 2) of the Constitution of the Russian Federation);

Federal Laws*:* Federal Law of December 13, 1994 No. 60-FZ "On the Supply of Production for Federal State Purposes"; Federal Law of December 29, 1994 No. 79-FZ "On the State Material Reserve"; Federal Law of July 15, 1995 No. 101-FZ "On International Treaties of the Russian Federation"; Federal Law of May 31, 1996 No. 61-FZ "On Defence"; Federal Law of February 12, 1998 No. 28-FZ "On Civil Defence"; Federal Law of June 19, 1998 No. 14-FZ "On the Military-Technical Cooperation of the Russian Federation with Foreign States"; Federal Law of October 06, 1999 No. 184-FZ "On General Principles of Organization of Legislative (Representative) and Executive Bodies of State Power of Subjects of the Russian Federation" (note: "Subjects" means "Regions of the Federation"); Federal Law of October 06, 2003 No. 131-FZ "On General Principles of Local Self-Government in the Russian Federation" etc. In addition, there are a large number of by-laws and rules specifying these above-mentioned laws.

[12] Federal Law of 31 July 1998, No. 155-FZ "On the Internal Waters, Territorial Sea and Contiguous Zone of the Russian Federation", other federal laws and other normative legal acts of the Russian Federation, applicable to sea ports, establishes "seaports regime" of the Russian Federation, taking into account the climatic, hydrological, meteorological and other peculiar properties (NB: Russia is a member-state of the United Nations Law of the Sea Convention 1982 (from March 02, 1997).

As for the terrorist threat in the water basins, regional Frontier Service forces of FSB, the regional transport departments of MIA-The Ministry of Internal Affairs and the regional departments of EMERCOM are to respond to terrorist attacks.

The Frontier Service of the Federal Security Service in the Western Arctic Area

The basic principle of the fight against terrorism connected with the unity of the goals and objectives of all state institutions are under the supervision of the Frontier Service of the Federal Security Service (FSB).

Currently, the protection of the frontier border of the Arkhangelsk and Murmansk Oblast' (Regions), Nenets Autonomous Okrug (District) etc. are implemented by the Frontier Service of the FSB in the Western Arctic Area (hereinafter – Arctic Frontier Service) including the zone:

- from the Norwegian-Russian frontier to Taimyr Peninsula (Krasnoyarsk Krai (Territory));
- the western sector of the Northern Sea Route,
- 15 seaports: 1) Amderma; 2) Arkhangelsk; 3) Belomorsk; 4) Varandey; 5) Dickson; 6) Dudinka; 7) Kandalaksha; 8) Mezen; 9) Murmansk; 10) Naryan-Mar; 11) Igarka; 12) Onega; 13) Khatanga; 14) Vitino; 15) Sabetta.

The coastline stretching: over 10,500 km.

The area of responsibility also includes the internal waters, territorial sea areas, the exclusive economic zone and the continental shelf of the Russian Federation in the Barents, White and Kara Seas.

The FSB Arctic Frontier Service also solves issues in the maritime areas adjacent to the archipelago of Spitsbergen (see: Spitsbergen Treaty 1920) in the NEAFC Regulatory Area (NEAFC – North East Atlantic Fisheries Commission) – outside the exclusive economic zone of the Russian Federation. The units of the Arctic Frontier Service are responsible for the sovereignty and presence of Russian Federation at the remote territories in the Arctic, i.e. Franz Josef Archipelago and Severnaya Zemlya.

Arctic Frontier Service has 4 tasks:

1. Defense of the state frontier;
2. Defense of marine biological resources;
3. Monitoring and control of the movement of vessels on the Northern Sea Route in the Western sector of the Arctic;
4. Implementation of compliance with the state's national interests.

The central part of this activity is a complex measure to the use of forces and special equipment by 3 structural units of the FSB:

1. The coast guard;
2. The operational units;
3. Aircrafts.

The FSB Regional Frontier Service forces coordinate the actions of the Coast Guard which is directly responsible for the following tasks:

- defence and protection of the state border;
- protection of national economic interests;
- control over national law and international agreement observation;
- life saving at sea;
- security of sea transportation along the Northern Sea Route;
- environmental protection.

Monitoring the situation in order to counter terrorism threat is carried out with the use of modern technical equipment adopted for use in the FSB. The Arctic Frontier Service forces utilize radio-location and radio-technical observation efforts along the most actively used routes of the Northern Sea Route. An interdepartmental regional Information and Coordination Centre (I&C Centre) was set up in Murmansk to meet the objectives of marine security, oil and gas facilities security, transport communication security, marine resources and environmental protection. The I&C Centre is there to achieve the goals of coordination and enhancement of interdepartmental cooperation of the federal agencies responsible for the complex control of the situation in the sea surface areas. The information is provided to the center in real time through a number of media including satellite communication channels. Besides other federal agencies, executive bodies and organizations pass on the information to the control center. Following the interdepartmental and inter-ministerial agreements, the Frontier Service forces have access to information resources in the automated information systems and monitoring systems of the federal executive bodies, i.e. the Russian segment of vessel identification and long-range tracking system; VIKTORIA, Ministry of Transport global automated system of monitoring and control of vessel position; Federal Fisheries Agency industrial automated system of biological resources monitoring; the National Information System of Global Monitoring in the world ocean, etc. The Complex Integrated Information System, to monitor and control the location of Russian sea and sea-river vessels is to be connected to I&C Centre.

Also, there are efforts to set up an integrated automated system with technical control of the surface picture taken, with the use of information technologies and large-scale departmental monitoring systems. More work is done to increase the range of its functional application by integrating it with the existing vessels, means of passive ranging and distance Earth sounding system. Automated

systems of technical control over the sea surface are being introduced now. In 2014, the latter was implemented along the Northern Sea Route in the Barents Sea. A number of technical observation posts of the Frontier Service forces of Murmansk and Archangelsk region were integrated in one single system as they are a part of transport-infrastructure potential of Russian Federation.

Regional border security forces are equipped to duly react to any criminal actions and terrorist threats that are targeted against people's life, property and environment in the sea areas of the region.

Table 42: *Vessels of regional border security forces*

Ships	Boats	Patrol vessels	Logistic and supply vessels
– 97P – 1135.1 – 1124 – 745 – 1241.2 – 1208 – 205P – 1248 – 10410 – 22460 – 22100 "Ocean"	– 1496 – RM376 – P1415 – 1400 – 371U – 12200	– 502 – 13031 – "Commander" – "Hurricane" – 22120 – 12150	– 1595 – 16900A – 16931 – 1481

a) Technical control: automated technical control system "Frontier-North".

b) Joint Strategic Command "North" ("Arctic troops"): from Murmansk to Anadyr. "Arctic troops" also include the 80th separate motorized "Arctic brigade".

c) Frontier post "Nagurskoe".

d) Transport:

1) multi-purpose fully amphibious auxiliary armoured tracked vehicle;
2) ATVs "DT-10" and "DT-30";
3) ATVs "TM-140A" and "TREKOL-39294";
4) Articulated tracked snow and marsh buggies floating high cross-4902PS TTM-10;
5) Snowmobiles "A-1", "TTM-1901 "Berkut" with a heated cabin;
6) Army ATVs "AM-1A";
7) Hovercrafts;
8) All-wheel drive trucks "Ural" and "Kamaz" adapted to extremely low temperatures (up to -52 ° C).

e) Arms:

1) Tanks "T-72";

2) Self-propelled howitzers “2S1” and “2S3”;
3) Combined short to medium range surface-to-air missile and anti-aircraft artillery weapon system “Pantsir-S1”;
4) 82-mm mortars “2B14”,
5) Unmanned aerial vehicle “Orlan-10”.

Source: https://xn--g1aohgee.xn--b1aew.xn--p1ai/UT_MVD/podrazdeleniya/item/720886/

The Ministry of Internal Affairs (MIA) line departments of water transport in the Murmansk and Arkhangelsk regions are in charge of counteracting against any criminal activity in the coastal parts.

The areas and spheres covered by the regional line departments of water transport are:

- sea ports and navigable parts of their water basins;
- sea ports;
- hydrotechnical infrustructure and navigational facilities located in the areas of navigable parts of sea ports;
- vessels and other floating facilities at the quay and in the harbour;
- storage and processing facilities in the sea ports.

The operation of MIA line departments of water transport in Murmansk region is characterized by such factors as a long stretch of the coastal port zone, a big number of companies located there and port access control regime. As Murmansk region border on Finland and Norway, most of the port facilities under control are border check points. The length of the quay line is 10 km. More than 130 companies are located in the port zones with more than 6000 employees.

Being in charge of the water transport security, personal security and public order and safety on the sea vessels and port facilities, Murmansk regional line departments of water transport plays a key role in providing security and safety on the water transport.

Their responsibilities for people’s security and public order and safety include active involvement in handling emergency situations such as accidents, catastrophies, fires, natural disasters etc and cooperation with other MIA departments in saving lives and giving the injured people the first aid, standing guard over the scene of action and somebody’s unprotected property. Besides, MIA provides security along the transport routes, stations, railway stations, airports, sea ports, river boats and aircraft.

Murmansk regional line departments of water transport is also engaged in the crime and wrongdoing prevention work by organizing Search and Rescue actions to prevent and stop criminal activity in the sphere of cargo and passenger transportation, transportation economy, detecting circumstances leading to criminal offences and making efforts to eliminate them.

3.2 CHALLENGES REGARDING ARCTIC MARITIME EMERGENCY PREPAREDNESS CAPACITIES

3.2.1 Search and Rescue capacity challenges

We analyzed typical emergency situations in the northwest of Russia for the last 5 years. The most frequent accidents in Murmansk region are connected with trawl winding onto the propeller, vessel running aground and engine breakdown.

We can provide the description of a typical study case: On 9th October 2015, Purga, a rescue tug of the Northern rescue expeditionary force, provided assistance to Norvag, a Norwegian tanker, which was lying dead due to the fact that the cable had wound into the propeller. The towing operation to Båtsfjord was complicated by severe weather conditions with Beaufort Force 7 and wind at 20 m/s in the dark. Both navigators and safety divers performed their duties very successfully. The rescue tug approached the tanker at safe distance and shot a synthetic line from the line throwing machine to transport a towing rope to the vessel in distress. After the towing rope had been fixed, the rescue tug started to move. Although the rescue team worked professionally in timely manner, it took almost an hour due to the nasty weather conditions. The distance between the place of accident and the Norwegian coast was about 200 miles and it took two days to tug the Norwegian tanker to Varangerfjord in accordance with the schedule, but the Norwegian pilot recommended another port, Båtsfjord. There were no injured crew members and no threat of oil spill [http://seoasr.ru/News/mm/8].

According to the rules and regulations governing the rescue procedure for vessels in distress, the basic principle is the interaction between different ministerial and departmental rescue services: Ministry of Transport, EMERCOM, etc. In practice, in the Murmansk region it is the Northern rescue expeditionary force which bears the heavy load of all the Search and Rescue operations with all other rescue services and their facilities being hardly ever brought in for help. This causes longer duration of the rescue operations from several hours to several days. Such approach can be partly justified when the situation is not life threatening for the crew of vessels in distress. But in practice all the potential risks cannot be assessed properly at the initial stage, which can result in wrong conclusions leading to higher level of risk for the vessel to be wrecked and the crew to be harmed.

Most of the available vessels and equipment has operational time limits. All vessels of the Northern rescue expeditionary force, mostly involved in SAR and salvage operations, were built in the 20th century. At the same time, the fleet of Morspassluzhba is being updated, some SAR and salvage vessels have increased ice class.

In total, 41 new rescue and salvage vessels are ordered by the Rosmorrechflot to be delivered by 2020 [http://morspas.com/].

The EMERCOM Arctic recue center fleet in the Murmansk region has a very limited navigation area and cannot be involved in the SAR operation in the open sea along the Northern Sea Route. The Arctic Rescue Center in Arkhangelsk owns a more efficient fleet but the location of the center at the entry of the Northern river entry makes it complicated to arrive at the emergency site offshore within relevant time. Actually, the fleet resources correspond to the EMERCOM's function to provide safety and assistance within the 12 miles maritime zone.

There is a growing activy in these waters so that in the near future (in 5 - 10 years), even if the number of life-saving craft and their service characteristics remain the same, carrying out Search and Rescue operations would become difficult. Therefore, taking into account ships age and decommissioning, further construction and development of an up-to-date rescue fleet is required, with priority on the construction of rescue tugboats, supply vessels, multimission rescue vessels with unlimited navigation area.

Unfavourable navigational, hydrographical and hydrometeorological conditions in the Arctic as well as the requirements of rules and regulations for specifications of rescue vessels to be exploited in the Arctic zone are quite demanding. Ice class vessels can meet such demands almost fully. However, their main disadvantage is the speed, which is a vital factor in SAR. With maximum time period for a person in the survival suit being 6-8 hours and the icebreaker speed being 18-20 knots, the maximum distance to the emergency scene should be no more than 300 km. It is evident that with the existing system of complex Search and Rescue centers and marine Search and Rescue forces being located far from the probable emergency scenes at sea, the rescue of people and vessels in distress with the help of icebreakers is not always technically feasible.

In Russia, the main maritime SAR strategy is based on surface vessels. The analysis of SAR resources shows that ice class Search and Rescue vessels equipped in accordance with requirements of International Maritime Organization (IMO) and meeting other demands are the best solution for rescue operations. However, long distances in the Arctic and hard weather conditions demand quicker response that only aircrafts can provide in some circumstances.

According to experts, it is necessary to decline the so called two-dimensional system of SAR in favour of a three-dimensional SAR system, which involves air support in case of any evacuation in the Arctic [http://szfavt.ru/wp-content/uploads/2013/03/insspasop.pdf].

In the Murmansk region, the civil emergency resources in the Murmansk area don't possess appropriate preparedness level to participate in the SAR missions and exercises like the Exercise Barents, according to Murmansk MRCC. The air resources of the EMERCOM Arctic rescue center are located in Saint Petersburg far away from the possible emergency sites. The air resources of the Northern Fleet are on duty to be involved in SAR if an incident occurs. The Air Northern

Fleet is a unit of the Navy responsible for the defense of northwestern Russia. SAR operations related to civil vessels and persons in distress is not a primary function of this air division. The unit does not report to the Murmansk MRCC and need not provide information about the availability of its resources.

In the Arkhangelsk region, the air resources of the civil air enterprise are used but have to be paid for. In the Nenets Autonomous Okrug, the SAR unit of the Agency for Air Transport is involved in SAR missions.

The different patterns in air SAR in the regions should be replaced by a unified system to provide efficient assistance at sea. To provide aircrafts to the EMERCOM centers is one of the main strategy task of the ministry. EMERCOM is planning to increase the number of upgraded aircrafts and helicopters also for operation in the Arctic conditions within the next three years:

- The aircrafts IL-76 and IL-114
- The helicopters MI-26 and MI-8.

"They must be multipurposed, equipped with the special rescue devices, i.a. to provide evacuation of the injured persons", according to EMERCOM minister Vladimir Puchkov [EMERCOM, 2017].

According to the legislation of the Russian Federation, aircrafts and sea vessels use different frequency bands and cannot communicate directly. Therefore, the communication between the rescue helicopter and the vessel in distress is provided following the chain «vessel in distress — rescue coordination center — air traffic authorities — aircraft/helicopter» and backwards. Emergency information transfer through this chain is very complicated, takes much time and does not meet the requirements of the 1979 SAR Convention.

It has been noted that when the rescue operation takes place in the northern parts of the Barents Sea, the quality of radio signal suffers frequently, which adds further complications to the radio exchange between the rescue service and vessels in distress. This is caused by disturbances in the upper layer of atmosphere during daily or seasonal solar variability or by worse weather conditions. These natural processes impair the quality of radio wave reception especially in the medium frequency (MF) and high frequency (HF) ranges, which are used for radio transmission for medium and long distances (more than 30 nautical miles) [http://dspace.nbuv.gov.ua/bitstream/handle/123456789/10849/10%20-%20Kostina.pdf?sequence=1].

Inmarsat C, the global maritime distress satellite communication network, is effective up to the latitude of 70ºN. Other satellite communication networks, which can provide high quality radio signal reception, such as Globalstar and Iridium, are not obligatory to be installed at marine vessels according to the requirements of Global Maritime Distress and Safety System (GMDSS).

Other significant factors to achieve increased efficiency of management and coordination of all SAR organizations are the use of information technology, which provide the reception and processing of data about the unit in distress from various sources of information; planning SAR and taking effective decisions and controlling their executions afterwards. The SAR organizations involved in the rescue operations in the Arctic seas, the existing rescue vessels and icebreakers are not fully equipped with the automated control systems.

Taking into consideration the current facilities and forces available to deal with SAR and specific state demands, a conclusion is that there is a need for an advanced Search and Rescue system which is capable of meeting all the organizational and technical requirements at all the stages of SAR.

The reason for the shortcomings is a so-called bottleneck approach to the problem solution, i.e. vessels and rescue facilities are equipped in accordance with requirements of international maritime conventions. Any extra facilities or technical systems, which are capable of making the rescue operations more efficient, are not stipulated in the documents. All the attempts by the crew of showing initiative that are coming from the bottom of the hierarchy to the vessel owners and heads of regional and federal ministries and departments fail. Their proposals to enhance and improve the existing security systems are mostly ignored or realized within a very long period of time due to bureaucratic procedures of consideration and coordination.

The researchers of the Russian academic and research institutions, i.e. Research Centre for Complex Transport Problems, State Research and Development Institute of Marine Transport, St. Petersburg State University of Water Communication have developed a plan to improve the current marine Search and Rescue system in various parts of Russia. The content of the plan was reflected in the Federal target program ”Development of the transport system of Russia” and its implementation included the tackling of the following tasks and objectives:

- provide the necessary quality of technical facilities and Search and Rescue forces to guarantee SAR service in the Arctic region;
- build new icebreakers, specialized Search and Rescue vessels;
- form the fleet of marine Search and Rescue aircrafts;
- develop new technical facilities to carry out Oil Spill Response at low temperatures, in ice and fractured ice;
- develop new technical facilities for search and examination of sunk units;
- develop new navigational and hydrographic software for high latitudes;
- set up new technical facilities for communication with the use of space facilities and equipment;

- establish new coastal Search and Rescue centers and improve the existing coordination centers;
- enhance quality and mechanism of coordination of forces that can be involved in SAR in high latitudes at sea;
- develop new methods and techniques of SAR in high latitudes;
- advance the basing systems of forces and technical means for SAR in the Arctic, etc. [http://base.garant.ru/1587083/1/].

One major weakness as to efficient rescue operations at the facilities comes from ice conditions. Suffice to say, that throw overboard life rafts and rescue boats can be used only in iceless waters, while they are 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.

The analysis of SAR shows that ice class salvage vessels equipped in accordance with requirements of International Maritime Organization (IMO) and meeting other demands are the best solution for rescue operation from arctic platforms. However, such vessels cannot be located in close proximity to platforms all the time. It is necessary to involve air support in case of crew and staff evacuation from oil platforms in the Arctic.

3.2.2 Pollution response and capacity challenges

Taking into account the presented information, it is possible to make the following conclusions:

1) The oil producing companies in offshore Russia are capable of oil spill liquidation in the amount of 1,500 tons in case the oil well control is lost;

2) The oil companies' available facilities and vessels are enough to liquidate the oil spill of 10,000 tons at the first stage of the recovery operation in case of oil tanker emergency until the state rescue vessels arrive at the place of the emergency. The state rescue vessels belong to such organisations as the Ministry of EMERCOM, Russian Navy, Federal State Organisation Gosmorrspassluzhby (state marine rescue service) and the cost guard service.

3) With rescue vessels equipped with the Oil Spill Response facilities being located in isolated and remote places from the deployment base, the efficient response in case an extensive oil spill occurs is slowed down. Special purpose vessels based in the port of Murmansk will arrive at the place of the emergency within the period of 6 to 8 hours, weather permitting and ice conditions being favourable.

The existing system of accident prevention at the oil platforms and drilling facilities and Oil Spill Response cannot be acknowledged as adequate.

In spite of the use of more advanced technical facilities, techniques and methods to prevent and respond to the emergency situations, there are leakages at the units of oil and gas connected with exploration, production and marine transportation, causing environmental and economic damage and lead to casualties.

Fortunately, there have not been large oil spill accidents in the Arctic. But, some oil spills have occurred in other regions. Due to rough weather conditions, the 1,139 DWT tanker Nadezhda crewed by eight people ran aground on November 28th 2015, damaging its hull and one of its cargo tanks 150 meters from the fishing port of Nevelsk (Sakhalin island). It was carrying 746 tons of fuel oil and diesel fuel. Significant environmental damage was reported in the area. Oil coated a 20-km stretch of the shore, with the sticky sludge extending up to 4 meters on land from the water line and resulted in deaths of animals and birds. Total damage to the environment and local communities was about 524 mln Rub. The master was found guilty and sentenced to a fine within 120,000 Rub.

Public investigation showed that up to 50% of oil tankers operating in the Far East don't have double hull that doesn't correspond to international requirements. Also, the lack of financial responsibility for environmental damage isn't determined in legislation for oil spills caused by the tankers loaded with less than 2000 tons of oil products.

The Nadezhda oil spill also demonstrated some shortcomings in Oil Spill Response system at sea. Clean-up procedures were not efficient due to booms and vessels absence. Monitoring, environmental assistance and the population warning weren't organized [WWF, 2017].

Russian legislation allows mechanical, chemical methods and in situ burning providing OSR. However, all branches of Morspassluzhba, as well as private teams, serving ports and terminals, are equipped with mechanical means which have traditionally served as the main means in Russia. Use of in situ burning is complicated due to fire safety regulations, and chemical dispersants and herders must be pre-approved by environmental and fisheries authorities for application in sea waters, as they are considered environmental pollutants. Rules for oil-dispersant application in sea waters in Russia entered into force in 2005. With expanding petroleum and shipping activities in the Russian Arctic, we can expect improvement in capacities for dispersant application in the case of oil spill [Bambulyak, 2015].

In Russia with the most extended maritime borders and continental shelf, there is no federal law which would govern issues of maritime environment pollution prevention, Oil Spill Response taking into account interests of the state and industry (and their interaction). The current legislation – federal laws, resolutions of the government and orders of federal authorities are not united, they don't take into account maritime links, are very general and sometimes adverse which can cause different reading and corruption.

A unified law is needed in the field of oil spill prevention and response with respect to the Arctic conditions [Ivanchin, 2014].

3.2.3 Violent Action Response and capacity challenges

Violent Action Response is a challenge in the Arctic due to long distances and mobilization of special forces especially in the case of bad weather conditions. The Analysis of the current situation in the Arkhangelsk Oblast' (Region) and Nenets Autonomous Okrug (District) allows to allocate 5 major challenges for the activities aimed at prevention of acts of unlawful interference:

1) Adverse weather and climatic conditions of the Arctic region, complicating the redeployment of anti-terrorist forces from the main places of stationing, and carrying out a special operation;
2) Substantial removal of the vast majority of potentially dangerous objects located in the Arctic zone of Russia, from the places of permanent deployment of special units of the security forces (FSB, the Ministry of Internal Affairs, the Ministry of Defence);
3) Insufficient load capacity at the airports and airfields located in the Russian Arctic zone, which makes it impossible to use large-capacity aircrafts;
4) Lack of firearms among private security personnel operating in the Arctic zone of Russia, which does not allow at the initial stage to organize the effective combating and countering of terrorist and other threats;
5) The ability to access into the staff of potentially dangerous objects by individuals hatching wrongful intent to commit acts of unlawful interference.

It should be noted that the "security flaws" in the Arctic region have allowed international environmental organization "Greenpeace" virtually unimpeded to implement in 2012 and 2013 provocative actions against offshore ice-resistant stationary platform "Prirazlomnaya" in the Barents Sea. These circumstances gave rise to the leadership of "Greenpeace" declaring Russia's failure to ensure the security of oil and gas platforms in the Arctic.

However, realization of provisions of the Federal Law of February 09, 2007 No. 16-FZ "On Transport Security" and the Federal Law of July 21, 2011 No. 256-FZ "On the Safety of the Fuel and Energy Complex" by organizations located in the Arctic zone of Russia, has not yet been completed, and separate companies ignore these requirements.

The responsibility of a number of persons in accordance with the current legislation of the Russian Federation may occur after the categorization of objects of transport and fuel and energy complex (FEC), taking into account the application of serious harm to human health or causing major damage (Article 217.1 "Violation of safety requirements and anti-terrorism protection of objects

of fuel energy complex", Article 263.1 "Violation of transport security requirements" of the Criminal Code of the Russian Federation).

Otherwise, even for the systematic avoidance of the realization of the requirements of the federal laws, enterprises could only be brought to administrative responsibility of regulatory authorities vested with this power.

Nevertheless, at the present stage, the main tool forcing enterprises to fulfill the requirements of regulatory documents in the field of security is the adoption by courts of "interim measures" for the implementation of the requirements of the federal laws and governmental resolutions.

According to the information presented here, it is possible to state that the structure and the number of forces formed in the Murmansk and Arkhangelsk regions is adequate to react to terrorist threats and counteract any criminal activity on the sea transport at the current rate of cargo and people transportation. This can be considered sufficient for the nearest future in case the rate of transportation stays the same.

3.3 OPPORTUNITIES AND BENEFITS FROM CROSS-BORDER COOPERATION

The data presented in the previous chapters give a positive characteristic of the existing system of emergency response in the marine waters of Murmansk region, which has a very good potential for further development. Nevertheless, the analysis of the efficiency of the SAR system brought forth a number of drawbacks and flaws as well as some recommendations to overcome them. It should be noted that the realization of the suggested strategy is not quite feasible as it is a complex task for regional departments and centers, and they need full assistance from federal and ministerial bodies.

There is strong evidence to suggest that SAR operations become highly effective when all the related services and forces, located in specific sea regions join their efforts to carry out international rescue operations.

Signed international agreements on SAR and OSR considerably decrease the time spent on communication between SAR services of different countries in case of emergencies. Thus, the rescue operation is carried out faster and more effectively due to better planning and management.

Taking into consideration the significance of this activity, the Russian and Norwegian government take considerable efforts to improve the SAR cooperation. One of them is the annual Norwegian-Russian "Exercise Barents", which is conducted in accordance with the "Agreement of 4 October 1995 on cooperation in connection with Search and Rescue of persons in distress in the Barents Sea and "Agreement concerning cooperation on the combatment of oil pollution in the Barents Sea of 20 April 1994".

The main exercise objectives are to exercise the cooperation between the Murmansk MRCC and Joint Rescue Coordination Center of North Norway related to Search and Rescue /SAR and between the Morspassluzhba and Norwegian coastal administration related to oil spill operations. As a minimum, the objectives include the coordination of scenarios of SAR operations and Oil Spill Response, communication and information exchange, clearance for aircrafts, vessels and other relevant resources to enter Norwegian or Russian territory.

In order to exercise SAR and Oil Spill Response objectives, the Russian and Norwegian rescue coordination centers performed proper initial notification, worked out search planning at Sea, exercised cooperation between rescue units on scene and the On Scene Coordinator, communication, air operations with special emphasis on the aircraft coordinator function and maritime/oil spill operations. The Barents exercise usually consists of two scenarios: SAR and OSR.

Besides, some times a year, the special-purposed OSR exercises are conducted in the cross-border area between Russia and Norway. As to the international projects aiming at oil spill prevention, a good example was the project "Enhancement of Oil Spill Response System by Establishing Oil Database" funded by the Kolarctic ENPI. The specific objective of the project was to generate a mechanism of effective coordination between international response forces in case of emergency spills of Russian oil in the waters of northern seas. The mechanism will take into account the forecast of oil behavior on the basis of laboratory studies [Kolarctic, 2015].

During oil spills, there may be changes in physical and chemical properties of oil that affect the behavior of the oil patch. Laboratory data on oil weathering makes it possible to predict the behavior of oil at sea more accurately under various weather conditions and, therefore, to choose the most efficient response measures, for example, mechanical recovery, use of dispersants, etc.

Taking into account the expected growth of production and transportation of oil in the Arctic the implementation of these activities would significantly contribute to reduction of the risk of accidents and, therefore, potential threats to the environment and traditional life-sustaining activities in the Arctic.

As results of the project, oil weathering studies and database were established, the dispersants performance with different types of oil were studied, the interaction pattern between response forces based on the created oil database was improved, and the recommendations for the application of the database and improvement of the technology of the emergency Oil Spill Response were provided.

It is necessary to mention that the ship-owner companies are often involved as full members into different international projects. For example, RosAtomflot Company has successfully carried out a number of international projects aimed at enhancing physical protection system of atomic vessels and coastal facilities, increasing the nuclear and radiation safety level when handling radioactive wastes

and spent nuclear fuel. The projects “Site for the temporary storage of containers with spent nuclear fuel of military fleet ships” and “Automated system of monitoring the site for the temporary storage of containers with spent nuclear fuel of military fleet ships at FSUE “Atomflot” were realized as part of the international cooperation with the governments of Norway and USA. Another project done at FSUE “Atomflot” is the “Reconstruction of the container-type depository for the long-term (up to 50 years) storage of unreclaimable nuclear fuel of atomic icebreakers”. The enterprise’s physical protection system is up-to-date and meets all international requirements in the sphere of nuclear material protection. FSUE “Atomflot” works in close cooperation with IAEA on the matters of radiation background monitoring. – [http://www.rosatomflot.ru/index.php?menuid=6].

As shown above, there are efforts to increase the exercise activity including private companies. The Northern fleet has taken part in the last year’s Exercise Barents, which is positive as they represent a significant capacity. Not the least the Northern fleet has helicopter capacity, a resource that is strongly in demand in the Arctic regions. Even though there are efforts to upgrade and renew the fleet of vessels there are limitations as to operational capacity both as to SAR and oil spill. The investments by the offshore oil and gas companies represent an added capacity both within SAR and Oil Spill Response. The limited amount of armed, anti-terror special forces in the North and long transport distances have opened for a discussion about armed capacities at the installations to increase security. Experiences with environmentalist organizations demonstrating at oil rigs in Russian waters have contributed to increased focus on local capacities and increased cooperation.

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4 ICELAND'S PREPAREDNESS CAPACITIES, CHALLENGES AND NEED FOR COOPERATION *BY VALUR INGIMUNDARSON AND HALLA GUNNARSDÓTTIR*

This section covers Icelandic maritime preparedness capabilities and potential for bilateral and multilateral cooperation to enhance maritime safety in the Arctic. It analyzes and evaluates Iceland's policies in relation to Search and Rescue (SAR); pollution prevention; anti-terrorist activities; and intergovernmental maritime collaboration. Together with MARPART reports on Icelandic institutional preparedness, maritime activity and risk factors,[13] it is based on interviews with key people within the Icelandic maritime preparedness system and reports on threat assessments and Search and Rescue plans and operations.

4.1 PREPAREDNESS CAPACITIES

Since Iceland does not have a military, its preparedness system is exclusively run by civilian governmental institutions and non-profit companies. This has not prevented its security organizations, especially, the Coast Guard, to cooperate with foreign militaries, such as the Danish Navy, on maritime safety. In terms of operational capability, the Icelandic preparedness system is highly dependent on regional and international collaboration, especially with neighbouring countries, such as Denmark and Norway, but also within multilateral forums, such as the Arctic Council, the International Maritime Organization (IMO) and the North Atlantic Coast Guard Forum.

4.1.1 Search and Rescue capacities

The Icelandic Coast Guard (ICG), under the auspices of the Ministry of the Interior, is the central organization responsible for maritime safety in Iceland's Search and Rescue Region (SRR), which comprises around 1.9 million square kilometers. Weather conditions within the SRR can be extremely difficult, particularly in the northern part, which stretches into very deep sea north of Iceland and east of Greenland. South of Iceland, the average waves are amongst the highest in the world.[14]

The domestic Search and Rescue operational capability focuses mainly on response to vessel incidents within Iceland's Exclusive Economic Zone (EEZ), involving fishing vessels and cargo ships. Weather conditions, drift ice and long distance from land can significantly hamper Search and Rescue operations in the area.[15] Larger incidents would pose great challenges to the SAR system and

[13] See Valur Ingimundarson and Halla Gunnarsdóttir, "Iceland: Maritime Preparedness Institutional Framework" (December 2014); idem, "Maritime Activity around Iceland" (April 2015); idem,"Iceland Risk Pattern and Types of Unwanted Incidents" (May 2015).

[14] "Search and Rescue in the Northern Seas. Report of a joint Steering Group within the Ministry of the Interior" (Reykjavik: Ministry of the Interior, 2016), 11.

[15] "Search and Rescue in the Northern Seas," 22.

require international collaboration, particularly in the case of cruise vessels, which increasingly pass through the Icelandic SRR with a large number of passenger. Such a scenario was the main theme of the Arctic Council's SAREX Greenland Sea 2013 exercise and related desk exercises. These exercises exposed huge operational difficulties with respect to large rescue efforts in the area, while also identifying potential for multilateral collaboration.

The preparedness system is mainly based on the Icelandic Coast Guard's three patrol vessels, three rescue helicopters, and one rescue and surveillance aircraft. The ICG strives for having, at least, two helicopters on continual standby. Still, every year there is a number of incidents that are too far from land for the helicopter's flight range, which is up to 250 nautical miles. Helicopters are not considered a viable rescue option, except for in special circumstances, where they would be operated from foreign patrol vessels. Under some conditions, Danish and Norwegian patrol vessels and aircraft could be enlisted in rescue operations in the SRR together with ships in the vicinity of accident sites.[16]

Due to financial restraints, the ICG surveillance aircraft frequently participates in financed missions abroad. In the past five years, the plane has been away from Iceland for up to six months a year. Currently, discussions are taking place between the Icelandic and Danish governments on joint surveillance flights around Greenland and Iceland. The proposal – which could provide possibilities to maintain TF-SIF permanently in the North – will require the approval of the Danish parliament.[17] No final decisions about such enhanced cooperation has been made, but there is a willingness on both sides to formalize it.

The main risk factors for maritime traffic in the sea around Iceland are the following: weather conditions; ships' condition and equipment; fire incidents; and human mistakes or errors in decision-making.[18] Any given SAR action, followed by a pollution prevention operation, is heavily dependent on the location of the ICG's helicopters and patrol vessels. Response to fire at sea would, for example, be much more effective if the ICG's Þór – which is equipped with class 1 firefighting system – is available. In the event of a large incident, the ICG would also rely on collaboration with the Metropolitan District Fire Brigade. Such cooperation is, however, hampered by the Brigade's lack of continuous training with respect to response to maritime fire incidents. Given the long distances and difficult terrain, fire fighting operations are likely to center on putting out fires and cooling down vessels rather than on saving lives.[19]

[16] "Search and Rescue in the Northern Seas," 22.

[17] Interviews with Icelandic Coast Guard officials, 13 June 2016; 9 September 2016.

[18] "Summary of Cruise Vessels Safety at Faxaflóahafnir" (Reykjavik: Faxaflótahafnir, 2012), http://www.faxafloahafnir.is/wp-content/uploads/2013/08/upload/files/fundargerdir_hafnarstjornar/fundir_2012/102._fundur/oryggi_skemmtiferdaskipa_-_samantekt_5__okt_2012.pdf.

[19] "Search and Rescue in the Northern Seas," 24.

Functional collaboration between the relevant institutions and multilateral collaboration, for example, between JRCC Iceland and JRCC Nuuk, are also essential to the success of SAR operations in the area. In addition, the entire SAR system depends on telecommunication equipment, including a mechanism to enlist support from nearby vessels. As with all major and minor incidents, pollution prevention is the top priority after saving human lives.

4.1.2 Oil Spill Response

In a recently approved National Security Policy for Iceland (2016) [20] environmental threats, sea pollution, or accidents due to increased maritime traffic in the North Atlantic and the Arctic are defined as key risks for Iceland because of its dependence on fisheries. The Environment Agency of Iceland is in charge of pollution prevention on land and sea and coordinates action against marine pollution. Pollution surveillance is mainly undertaken by monitoring satellite radar images from the European Maritime Safety Agency (EMSA). EMSA's data sharing between Iceland and Greenland (Denmark) needs to be complemented by the capability to explore the area in the case of pollution incidents. This further highlights the importance of collaboration between Iceland and Denmark on maintaining the presence of TF-SIF in the area, as it is the single pollution surveillance airplane available anywhere from Canada to Norway. Similarly, ICG's Þór is the only patrol vessel in the region that has the oil recovery equipment needed to maintain control of the situation until further assistance arrives from other countries on the basis of the Copenhagen Agreement (Agreement between Denmark, Finland, Iceland, Norway and Sweden concerning Cooperation in Taking Measures against Pollution of the Sea by Oil or other Harmful Substances) or through the Arctic Council Agreement on Cooperation on Marine Oil Pollution, Preparedness and Response in the Arctic. Still, in the event of a pollution accident within Iceland's EEZ, it could take up to 46 hours for Þór to reach the scene and much longer for assistance from other countries.

Reaction to potential pollution incidents, therefore, relies on the day-to-day location of Þór and of TF-SIF. The delay in removal of vessels that are stranded or without power can pose a further threat to the environment. In case of an incident involving large vessels, such as cruise vessels, assistance from other countries would be essential. It could take many days for vessels with sufficient towing capacity to arrive from Norway or from continental Europe. It is also worth noting that to this day most major pollution incidents have taken place at warmer sea areas, and there is much less experience and equipment tailored to the circumstances in the Arctic where lower sea temperature can change the course

[20] "Parliamentary Resolution on a National Security Policy for Iceland" (Reykjavik: Althingi, 145th legislative session, parliamentary document 1166, case no. 327, 2016).

of oil pollution.[21] Further scientific collaboration is, therefore, needed to ensure the most effective response to oil pollution in the colder Arctic sea areas.

The increased activities of private, marine salvage companies has added to the complexities of responding to, and preventing and pre-empting, sea pollution. In the past, conflicts have arisen between Icelandic authorities and salvagers contracted by insurance companies or ship owners regarding operational management on scene and on the salvage award.[22] This is a particularly sensitive issue in Iceland, with its small government administration, where huge financial interests are at stake.

4.1.3 Violent Action Response

The Act on Maritime Security, which came into force in 2004 with amendments in 2007, provides the legal framework for Iceland's anti-terrorist preparedness.[23] The Minister of the Interior is responsible for Maritime Security, with the National Commissioner of the Icelandic Police being in charge of anti-terrorist measures at sea in cooperation with the Icelandic Coast Guard. The National Police Commissioner benefits from international cooperation and information exchange in the field and has Special Forces under its command who have received anti-terrorist training in maritime situations. The purpose of the Act on Maritime Security was to ensure that ship, crew passenger, cargo and port facility security are not compromised by terrorist acts. It calls for regular assessments of risk and security incidents and operational plans to counter such scenarios. Together with the National Police and Coast Guard, the Maritime Traffic Service, which is within the ICG's operation center, and port authorities are covered by the Act. Shipping companies, flying the Icelandic flag, are also subject to the Act and are responsible for fulfilling mandatory security measures. The Coast Guard is responsible for compliance with the Act in Icelandic waters in accordance with the provisions of international conventions.

The 2009 government report on Risk Assessment for Iceland notes that terrorist and criminal organizations might target oil-, gas-, and passenger transportation in the Arctic.24 So far, however, such plans or activities have not been detected in or around Iceland. In general, the threat of a terrorist attack in Iceland at sea is considered low. Yet, according a 2015 Terrorist Risk Assessment report issued by the National Police, the general terrorist threat has, in line with the findings of similar assessments undertaken by other European governments, been upgraded to a medium level to take into account recent terrorist attacks in Europe and the

[21] "Search and Rescue in the Northern Seas" (2016), 23–25

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[22] Interviews with officials from Icelandic preparedness institutions, 27–29 July 2016.

[23] See Act of Maritime Security 2004 with 2007 amendments (http://www.lhg.is/media/vaktstod_siglinga/Act_on_Maritime_Security_no_50_2004.pdf)).

[24] Risk Assessment for Iceland: Global, Societal and Military Factors (Reykjavik: Ministry for Foreign Affairs, 2009), https://www.utanrikisraduneyti.is/media/Skyrslur/Skyrsla_um_ahattumat_fyrir_Island_a.pdf.

transnational nature of such violent acts[25]. This means that a terrorist attack on land cannot be ruled out in Iceland, even if no concrete information on such plans exist. This assessment, as well as the preparedness capacity, is under constant review with a view to national, regional, and international developments. As for counter-terrorist activities in Icelandic waters, periodic Air Policing by NATO countries in Iceland could also serve such purposes in exceptional circumstances, although its central focus is on the patrol of Iceland's airspace. Another future possibility is that the U.S. military would be enlisted in anti-terrorist operational activities at sea, that is, if the United States increases its military presence in Keflavik in response to increased military activities in the region.[26]

4.2 CHALLENGES REGARDING ARCTIC MARITIME EMERGENCY PREPAREDNESS CAPACITIES

Iceland participates actively in international cooperation on maritime safety in the Arctic, for example, within the Arctic Council and IMO. All relevant institutions are in contact with their sister organizations in the neighbouring countries. The ICG is active on SAR matters within the Arctic Council and is a part of the Arctic Security Forces Roundtable (ASFR), the Nordic Coast Guard Cooperation (NCGC), and the North Atlantic Coast Guard Forum. These platforms are considered important for information and intelligence exchange on law enforcement; marine security; pollution prevention; Search and Rescue, and fisheries surveillance. The Icelandic Coast Guard has put much recently on its participation in the North Atlantic Coast Guard Forum, which offers potential for increased cooperation between all the Arctic states.

Following the departure of U.S. troops from Iceland in 2006, Iceland negotiated bilateral, non-binding, "soft security" cooperation arrangements with three Arctic states, Norway, Denmark, and Canada, together with Britain (which has an Observer status in the Arctic Council). Iceland is also a member of the 1989 NORDRED-agreement, which seeks to strengthen cross-border cooperation between the Nordic countries on emergency response. While the Icelandic government has been in favour of a non-permanent NATO surveillance role in the Arctic, it opposes the remilitarization of the region.

On the operational level, the ICG and other institutions, depending on circumstances, participate in a number of international SAR exercises, such as the Arctic Council's SAREX, NATO's Northern Viking and DYNAMIC MERCY. The participating countries could extend their collaboration on "lessons learned"

[25] See National Police, "An Assessment Report: The Risk of Terrorist Attacks and Other Acts of Mass Destruction," (Reykjavik: National Policy, 2015), http://almannavarnir.gre.is/wp-content/uploads/2016/09/Mat-r%C3%ADkisl%C3%B6greglustj%C3%B3ra-%C3%A1-h%C3%A6ttu-af-hry%C3%B0juverkum-og-%C3%B6%C3%B0rum-st%C3%B3rfelldum-%C3%A1r%C3%A1sum.pdf.

from such exercises, which play an important role in increasing domain awareness in the region.

The ICG cooperates extensively with the Danish Navy through the Danish Joint Arctic Command (JACO) on maritime safety and surveillance around Iceland, Greenland, and the Faroe Islands. This cooperation, which has increased in the last few years, is formalized in a 1996 bilateral agreement (Standing Operational Procedures for Co-operation between the Icelandic Coast Guard and Danish Forces). All signs point toward increased Icelandic-Danish maritime security cooperation in the next few years and that it will lead to a permanent presence of TF-SIF in the area. Any such regional collaboration is likely to benefit both the Icelandic preparedness system and maritime security in the area. The Danish Navy already provides the Icelandic Coast Guard with up-to-date visual information of ship movements within Greenland's EEZ.

The ICG has also concluded a bilateral agreement with the Norwegian Coast Guard and with the Norwegian Costal Administration to facilitate information exchange. While this cooperation has proved useful, it is not as extensive as that with Denmark. Also, the existence of the IMO's Long Range Identification and Tracking system has made this information exchange less relevant since the ICG has access to all maritime traffic within a 300 nm radius around Iceland.

Iceland is usually not in direct contact with Russia on maritime security, with Norway serving as an intermediary between the two countries when needed. It is, however, possible to expand this cooperation, for example, through shared patrols of Russian fishing vessels near the Icelandic EEZ and through information exchange about the movements of fishing and container ships from Murmansk, which would, then, be an addition to the information exchange on maritime traffic taking place between the European Union, Russia, Iceland, Norway and Denmark (together with Greenland and the Faroe Islands) within the North-East Atlantic Fisheries Commission (NEAFC).

The civil maritime cooperation with the United States is formalized in a Memorandum of Understanding (2008) between the Icelandic Coast Guard and the U.S. Coast Guard. In addition, the Icelandic Coast Guard provides U.S. military forces with logistics support when stationed in Iceland as part of military surveillance activities. While the 1951 U.S.-Icelandic Defence agreement was meant to legalize the permanent presence of U.S. military forces in Iceland, it has been readjusted to fit current realities after the departure of U.S. forces from Iceland. Increased U.S. temporary presence in Iceland could serve maritime security and SAR purposes, even if this remains only a possibility at this stage. During the Cold War and in the post-Cold War period, the United States assisted in numerous maritime rescue operations in Iceland's SRR.

Information exchange and cooperation on maritime security are also outlined in a MoU between the Icelandic Minister for Foreign Affairs and the Canadian

Minister of National Defence. ICG has maintained good relations with relevant actors in both North American countries (such as the Rescue Coordination Centers in Boston and Halifax).

The Copenhagen Agreement is the corner stone of pollution prevention in the area. The geographical location of Iceland, however, has the disadvantage of creating a long response time for international assistance. The Nordic countries could increase administrative collaboration to respond to the challenges of the increasingly international nature of the shipping industry as well as of the growing activities of salvage companies. To be sure, many salvage companies are fully capable of undertaking difficult operations at sea. But there is no guarantee that all of them are fit for purpose. In addition, disputes have arisen over responsibility for pollution prevention and the salvage award. Given the huge importance of the ocean to livelihood and the economy in the North Atlantic and Arctic regions, a strong argument can be made for providing government authorities with increased legal means to take control on scene and to receive monetary reimbursement for involvement in any operations related to pollution prevention and oil recovery.

The prospects of increased maritime access and the opening of new sea routes – resulting from climate change – have fuelled discussions on Iceland's future territorial role in the Arctic. A Steering Group under the auspices of the Icelandic Ministry of the Interior, and with the involvement of the Ministry for Foreign Affairs, is currently evaluating the feasibility of establishing an International Rescue and Response Center in Iceland. The aim is to increase support capability in rescue and response operations in the Arctic region and to offer facilities and opportunities for joint SAR training. The idea is for the hub to be located in Keflavik with the aim of utilizing the territory and facilities of the former US Naval Air Station. The outcome of the project will not only be contingent on Icelandic resource commitments but also on the interest of other stakeholding countries in supporting it. So far other countries have waited for concrete Icelandic proposals before deciding on participation in the project. Several questions remain unanswered about the purpose and functional role of the proposed International Rescue and Response Center. There is, for example, unclarity about under whose ministerial and institutional control it should be placed and about whether participants should be limited to Iceland's closest security partners or include others.

As a first step, the Steering Group has suggested that an Icelandic Rescue and Response Cluster be formed in cooperation with foreign partners. Its purpose would be to prepare the groundwork for the International Rescue and Response Center; to bolster international research on search rescue environmental security, Search and Rescue together with supporting foreign research activities in Iceland; and to strengthen sea-based preventive and preparedness mechanisms, maritime surveillance activities, and transnational collaboration in these fields. Since an extensive preparatory work is still needed, it is unlikely that a political decision

on the establishment of an International Rescue and Response Center will be made any time soon.

4.3 OPPORTUNITIES AND BENEFITS FROM CROSS-BORDER COOPERATION

While the Icelandic Coast Guard has proven to be reasonably well equipped to respond to Search and Rescue incidents in the sea around Iceland, the level of difficulties would increase substantially if they took place further from land and/or involved more people. North of Iceland long distances and bad weather conditions could hamper rescue operations. In the event of a severe incident within the Icelandic SRR, the Icelandic preparedness system would be dependent on regional and international assistance both for Search and Rescue and for pollution prevention. Bilateral and multilateral agreements, along with operational exercises, are, therefore, essential for the maritime preparedness system in the area. There is also room for more administrative collaboration between countries in the area in the event of pollution prevention and oil recovery operations. Such collaboration also reduces the costs of operations that are derived from the increasingly international nature of the shipping industry and of insurance and salvage companies.

The idea to establish an International Rescue and Response Center in Iceland could raise Iceland's profile in regional maritime preparedness. Yet, while being under active government consideration, it is still too early to predict whether it will materialize.

On the operational level, Iceland cooperates most extensively with the Danish Navy Joint Arctic Command. Negotiations on further collaboration to maintain TF-SIF, the ICG's rescue and surveillance aircraft, in the North would significantly improve the rescue and pollution prevention capability in the area. There are also close security relations between Iceland and Norway and the United States as well as with other countries, such as Britain and Canada, even if they are not as extensive. The cooperation with Russia could be expanded, even if the current framework, which is based on Norway's intermediary role, works well. Finally, apart from multilateral forums such as the Arctic Council and the IMO, the Icelandic Coast Guard has recently put emphasis on its participation in the North Atlantic Coast Guard Forum as a multilateral cooperation venue for SAR-related questions.

5 GREENLAND'S PREPAREDNESS CAPACITIES, GAPS AND NEED FOR COOPERATION BY UFFE JAKOBSEN

Introduction

This chapter covers Greenland's maritime preparedness capacities, capacity gaps and potential benefits of cross-border cooperation with neighbouring states and Arctic or regional institutions to enhance maritime safety and security. It analyses and assesses Greenland's preparedness and response capacities in relation to Search and Rescue (SAR), Oil Spill Response (OSR) and Violent Action Response. The chapter builds on chapters on Greenland in earlier MARPART reports on maritime activities, risks and preparedness (Jakobsen & í Dali, 2016), (Jakobsen & Kern, 2016), (Poppel, 2018), (Jakobsen, 2018) and additional sources. To understand the implications of risks for emergency prevention, preparedness and response (EPPR) capacities a few facts on the politics, geography, climate and infrastructure of Greenland are important.

In terms of international law, Greenland is not an independent state but a constituent part of Denmark. Greenland has, however, obtained autonomy or self-government in most domestic policy areas but, constitutionally, as it were, not in e.g. foreign, defence and security policy areas (Ackrén & Jakobsen, 2015). Therefore, maritime preparedness capacities in Greenland are both Danish, Greenlandic and a mix of Danish and Greenlandic. Within domestic policy areas, Greenland has its own government (Naalakkersuisut) and parliament (Inatsisartut), and the relations between Greenland and Denmark are basically regulated through the 2009 Self-Government Act (The Prime Minister's Office; Nalakkersuisut). The Self-Government of Greenland, like the Home Rule of the Faroe Islands, is quite comprehensive in domestic policy areas, while central policy areas remain the prerogative of the Danish government (Kleist, 2010). Terminologically, Greenland together with the Faroe Islands and continental Denmark form the "Danish Commonwealth" or the "Community of the Realm" or the "Kingdom of Denmark" (Government of Denmark, Government of the Faroe Islands, & Government of Greenland, 2011: 10).

Greenland's territory is huge - more than two million square kilometers. The longest distance from south to north is 2.670 km, from west to east 1.050 km, and the total coastline amounts to 44.087 km. Also, the sea territory of Greenland within the 200 nm line is huge, covering more than two million square kilometers. Greenland has a typical Arctic climate with average summer temperature below 10 degrees Celsius and average winter temperature below minus 20 degrees Celsius in north-western Greenland. The coastal waters of Greenland are also partly ice covered or marked by icebergs and pack ice making shipping difficult, dangerous or impossible for ships without ice class hulls or icebreaker assistance. This goes for the northern coast and most of the eastern coast all year round and for the northern part of western coast part of the year. Only parts of the south-

western coastal areas of Greenland belong to the so-called "open water areas" that are ice-free all year round. So, Greenlandic waters are generally characterized by these special climatic circumstances or extreme weather and ice conditions.

The infrastructure or overall transport system is different from most countries and largely determined by Greenland's size, climate, settlement pattern or dispersed population and even its history as a colony and as a former integrated part of Denmark. Also, Greenland's military strategic importance for the US during World War II and the Cold War has remaining impacts on the transport system. Due to the large distances, dispersed population, rough geography and harsh climate, land transport is difficult and almost excluded, so no road system or railways exist in Greenland between towns and settlements. Therefore, transport between cities and towns must be done exclusively by flight or shipping. Due to ice conditions, especially in the northern and eastern parts of Greenland even shipping is impossible and supplies have to be transported by flight three to six months of the year in the winter season.

The total size of the population in Greenland is less than 56.000 and the island is very sparsely populated. Greenland has 17 towns with a population of more than 17.000 in the capital of Nuuk, and less than 500 in Ittoqqortoormiit in eastern Greenland. There are around 60 settlements with a population of less than 8.000. 80% of the population live in towns, 50% of the population live in the four biggest towns and around 6% of the population live in two towns of Ittoqqortoormiit and Tasiilaq and the settlements around Tasiilaq on the southern part of the eastern coast. The remaining north eastern part of Greenland is a national park (972.000 square km) with no permanent inhabitants (Statistics Greenland, 2017).

5.1 PREPAREDNESS CAPACITIES

Even if climate change will have positive effects in terms of economic development for business and society in general in Greenland, the increased maritime activity connected to an increase in fisheries, offshore and mining industries and tourism, as well, will result in increased risks of accidents in Greenland. Increased shipping, thus, has its security implications under the prevailing conditions and, consequently, creates a need for extended preparedness capacities trans-border cooperation.

5.1.1 Search and Rescue capacities

Greenland's maritime SAR responsibility region (SRR) covers an area of 3 million square km from south of Greenland (at 58 degree north) to the North Pole (a distance around 3.500 km) delimited by Canada's SRR to the West and Iceland's and Norway's SRR to the east (Forsvarsministeriet, 2016: 79). Compared to the size of the SSR, the Greenlandic capacities seem limited. The rescue capacities have, historically, been dimensioned in relation to the small population and in relation to fisheries as the traditional dominating offshore

activity in Greenland waters. Also, historically, the traffic of cargo ships between Europe and Greenland has been limited (Kudsk, u.å.).

Figure 13: *Greenland's EEZ and SSR zones. (Source: Forsvarsministeriet 2016: Frontpage)*

5.1.1.1 Divisions of SAR responsibilities

In case of incidents in Greenland that require SAR operations, these operations are provided by several actors of which some are part of Danish jurisdiction and others are part of Greenlandic central or local self-government.

The responsibility for maritime SAR operations is divided between the Greenland Police, which is a section of the Danish National Police, which is handling SAR operations in local coastal waters, and the Danish Defence's Joint Rescue Coordination Centre (JRCC) that is handling maritime SAR operations in an area from the coastal line to the outer limits of Greenland's SAR responsibility area (SSR) according to the SAR agreement made under the auspices of the Arctic Council (Arctic Council, 2013)

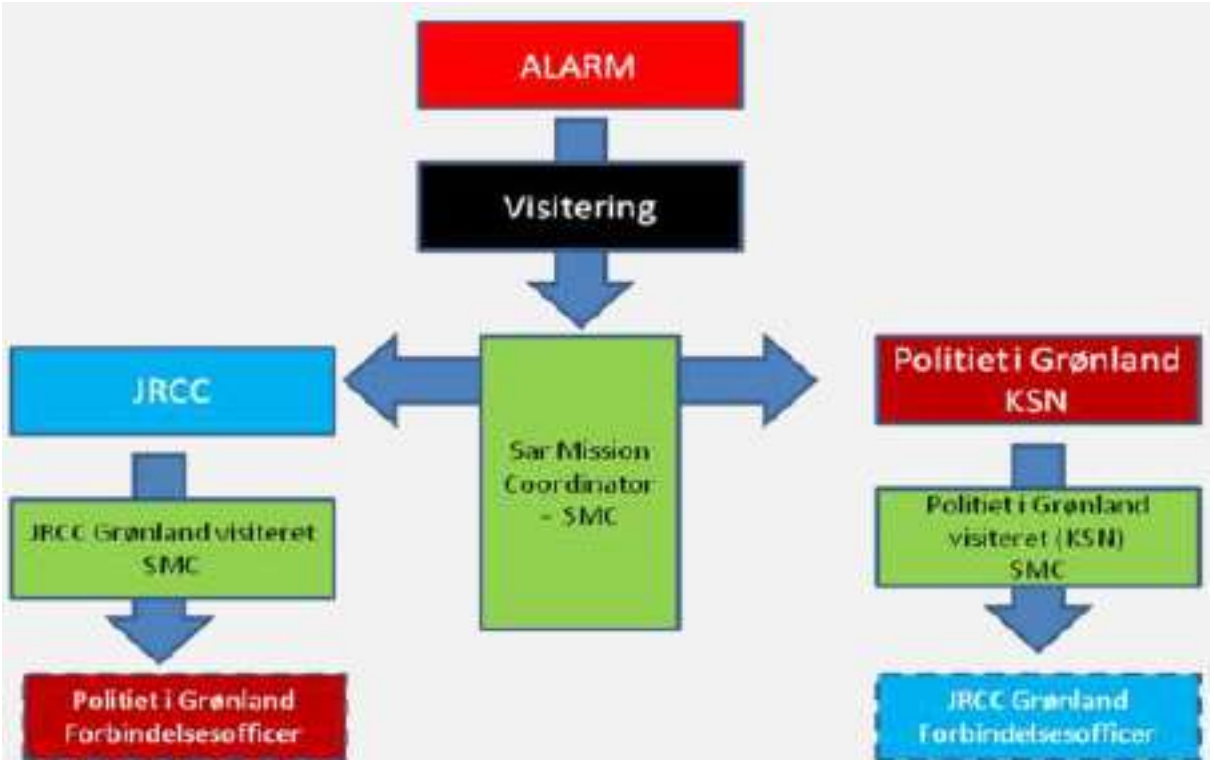

Figure 14: *The SAR Responsible Authorities in Greenland*

The SAR Responsible Authorities in Greenland have agreed on this principled outline of the procedures for allocation of responsibility as SAR Mission Coordinator (SMC): When an emergency call ("alarm") is received by one of the SAR responsible authorities in Greenland (either JRCC Greenland or Greenland Police Command Station ("KSN")), the other SAR responsible authority is contacted to determine who should be the responsible SAR Mission Coordinator (SMC) – a so called visitation process ("visitering"). A SAR event may change SMC as soon as it is realised that the other SAR responsible authority can more effectively coordinate the efforts. Further, it is the SMC who decides to designate the On Scene Coordinator (OSC) to handle the necessary on-site coordination and insertion of available capacities. The designated SMC must always seek to make decisions in cooperation with other SAR responsible authorities. If a SAR event,

after the designation of the SMC, develop in a way in which it is deemed necessary to call reinforcement from JRCC or/and the police, liaison officers ("forbindelsesofficer") are exchanged between the SAR responsible authorities. (Source: Skibsfartens og Luftfartens Redningsråd 2016: 4.)

Irrespecively of who has the reponsibility for the SAR operation, it is the Chief Constable of the Greenland Police who must coordinate all SAR operations according to the Greenland Parliament's act on emergency preparedness (Inatsisartut, 2010: § 13).

With few exceptions, authorities in Greenland do not have at their disposal SAR capacities that are acquired, equipped and utilised solely for SAR tasks. The SAR capacities normally have other main purposes but, additionally, they will also be available for SAR operations when needed (Skibsfartens og Luftfartens Redningsråd, 2016: Pt. II, Ch. 4)

5.1.1.2 Greenland Police

The Greenland Police is a section of the Danish National Police that is the police authority of the whole of the Danish realm including Greenland, the Faroe Islands and continental Denmark. The police is administratively placed within the responsibility area of the Danish Ministry of Justice. The main task of the police is, of course, to maintain order and ensure compliance with laws and regulations and to fight and prevent crimes in the Greenlandic society. However, the police is also an important actor within the emergency preparedness organisation in Greenland.

Organisation and management

The Greenland Police is headed by the Chief Constable of Greenland Police based in Nuuk. Administratively, the Greenland Police District has in 2012 been divided into four regions:

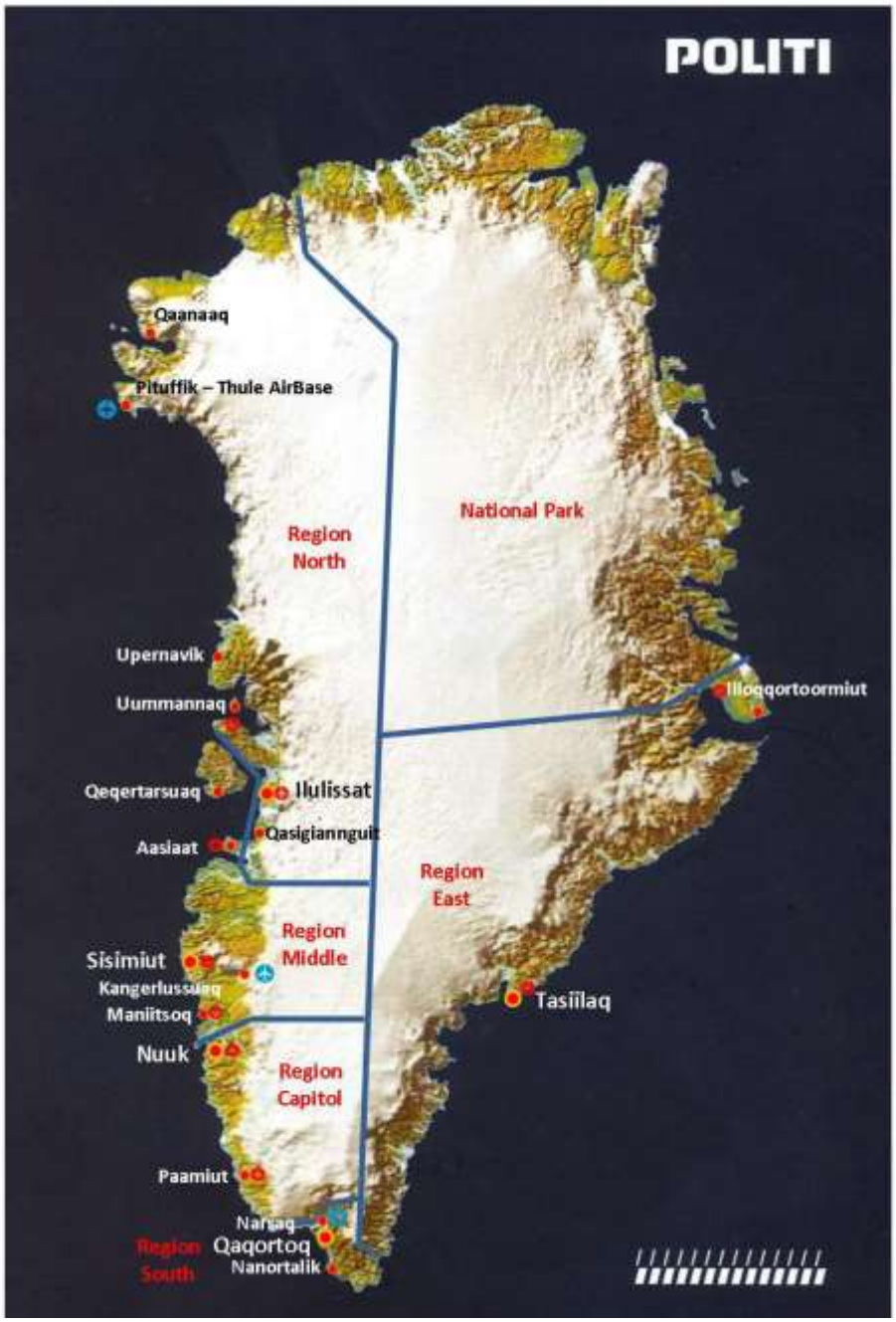

Figure 15: *The police regions of Greenland*

The figure above shows the North, Middle and South Region of the Greenland Police on the Western coast, the Capital Region that now covers both the Western part and the former "Region East" on the Eastern coast south of the National Park in the northwest corner of Greenland that covers 45 % of the total Greenland territory and where the police is not present (www.politi.gl; Forsvarsministeriet 2016: 78).

This is clearly a vast area for a police authority with all in all 321 employees. Especially, outside the capital of Nuuk it has been a problem to provide service for citizens after 16 p.m. on workdays and during weekends and holidays, since the local offices are often only manned by one person. Now, since 2015, a

nationwide control centre has been established, which is responsible for receiving and coordinating all inquiries to the police between 16 p.m. and 08 a.m. on weekdays, and on Saturdays and Sundays and public holidays all day long (www.politi.gl).

Internally, the Greenland Police is organized according to a three level model: a strategic level with leading staff members, an operative level at which the KSN (the Greenland Police Command Station) is situated, and a tactical level or the command stage. The SAR operations are directed by the KSN with or without backup from JAC (see the organizational chart above) and implemented at the tactical level.

SAR capacities

Among the police staff are 21 trained sailors that are engaged with the four police cutters that are available for SAR operations depending on the specific needs and whether they are not occupied with other police matters (Pedersen, 2015).

The police cutters also have other functions for the Greenland Police. A schedule for the usage of the cutters are issued by the Police to inform about the whereabouts and the availability of the police cutters for transportation etc.

- The police cutter Sisak is 28 m (length) x 7 m (beam) x 3 m (draft). The max. speed is 12 kn and the range 1400 nm / 5 days. The crew size is 6 person. It has space for another 6 persons and for sheltering 50 people for a shorter time.
- The three police cutters Sisak II, Sisak III and Sisak IV are all 24 m (length) x 6 m (beam) x 3 m (draft). The max. speed is 10 kn and the range 2900 nm / 12 days. The crew size is 5 person. It has space for another 3 persons and for sheltering 50 people for a shorter time ((Skibsfartens og Luftfartens Redningsråd, 2016: Pt. II, Ch. 4).

5.1.1.3 Joint Arctic Command

The Joint Arctic Command (JAC), since 2014 with its headquarters based in Nuuk, is the North Atlantic and Arctic part of the Danish Armed Forces with a unit in the Faroe Islands, as well.

Organisation and management

Like the Greenland Police, SAR operations are not the main tasks of the Joint Arctic Command (JAC). Its main tasks are military defence of Greenland and the Faroe Islands, surveillance and maintenance of sovereignty of the northern parts of the territory of the Danish realm. In addition to its main tasks, JAC also has civilian tasks as SAR, Oil Spill Response (OSR), fishing vessels inspection and other forms of support to the civilian society in different ways.

JAC also hosts the Joint Rescue Coordination Centre (JRCC Greenland) at its premises in Nuuk. JRCC in this way becomes an integrated part of the JAC. In

connection with SAR operations JRCC has all military units in Greenland at its disposal from the Royal Danish Navy and the Royal Danish Air Force. The Danish Ministry of Defence also has a contract with Air Greenland that allows JRCC operative access to the use of Air Greenland capacities for SAR purposes.

So, JAC has at its disposal SAR capacity resources from the Danish government (JRCC personnel, Navy and Air Force units) and from Air Greenland on contract with the Danish Ministry of Defence. This clearly illustrates that maritime SAR in Greenland beyond the coastal line is the responsibility of the Danish Government, primarily the Danish Ministry of Defence. The operative management is situated at JAC including JRCC. None of the military units at disposal for SAR operations are either acquired or designated solely for SAR tasks but for their main tasks of defence, maintenance of sovereignty and surveillance (Skibsfartens og Luftfartens Redningsråd, 2016a: 1).

SAR capacities

The maritime SAR capacities of the Joint Arctic Command consist of ships/vessels, aircrafts and helicopters.

Ships/Vessels

The Royal Danish Navy has a varying number of ships of different classes located in the Arctic at different times of the year:

- One or two ocean patrol ships of the *Thetis* class. The Thetis class ocean patrol ship is a large patrol ship of the size of 112 m (length) x 14 m (beam) x 6 m (draft). The max. speed is 20 kn and the range 9000 nm. The staff size can be between 51 and 91. It has also space for sheltering 200 people for a shorter time. It has ice-reinforced hull for navigating in icy water and ice-breaking capacity. All in all, the navy has four ships of this class (Skibsfartens og Luftfartens Redningsråd 2016: Pt. II, Ch. 4).
- One or two offshore patrol vessels of the *Knud Rasmussen* class. The size of a Knud Rasmussen class patrol vessel is 72 m (length) x 15 m (beam) x 5 m (draft). The max. speed is 17 kn and the range 7000 nm. The staff size can be between 19 and 45. It has also space for sheltering 200 people. It has ice-reinforced hull for navigating in icy water and ice-breaking capacity. The navy has three vessels of this class of which the latest one has only been in service since December 2017. This new vessel, Lauge Koch, has replaced the last patrol cutter of the Agdlek class that was 31 m (length x 8 m (beam) x 4 m (draft) with a max. speed of 12 kn and a max. range of 3500 nm (Skibsfartens og Luftfartens Redningsråd 2016: Pt. II, Ch. 4).

These ships are all equipped with electronic devices that qualify them as SAR vessels with capacities as On Scene Coordinators (OSC) (Skibsfartens og Luftfartens Redningsråd 2016: Pt. II, Ch. 4).

Aircrafts

- The Air Force has on a non-permanent basis a long range transport and patrol flight of the type Challenger CL-604 based at the airport in Kangerlussuaq at the disposal of JAC for surveillance etc. Its average range is 5500 km. The crew number is 2-5 depending on the type of mission. It can carry up to 12 passengers. Max. speed is 350 kn.
- Also on a non-permanent basis a long range transport flight of the type Hercules C-130J is in Greenland or used for transportation of goods or/and passengers between Denmark and Greenland. Its average range is 5900 km. The crew is normally 4. It can carry up to 123 passengers. Max. speed is 250 kn.

Helicopters

Navy helicopters - The Thetis type patrol vessels is equipped with a *Lynx* helicopter with an operational range of 2 hours or 200 km. However, the Lynx helicopters are being phased out with Seahawk helicopters with a higher level of capacity (Skibsfartens og Luftfartens Redningsråd 2016: 4-1). The MH-60R Seahawk has a larger operational range (3 hours or 230 nm) and can lift more weight than the Lynx helicopter. The Danish armed forces have ordered nine Seahawks from the US Navy to be delivered 2016-2018 (www2.forsvaret.dk).

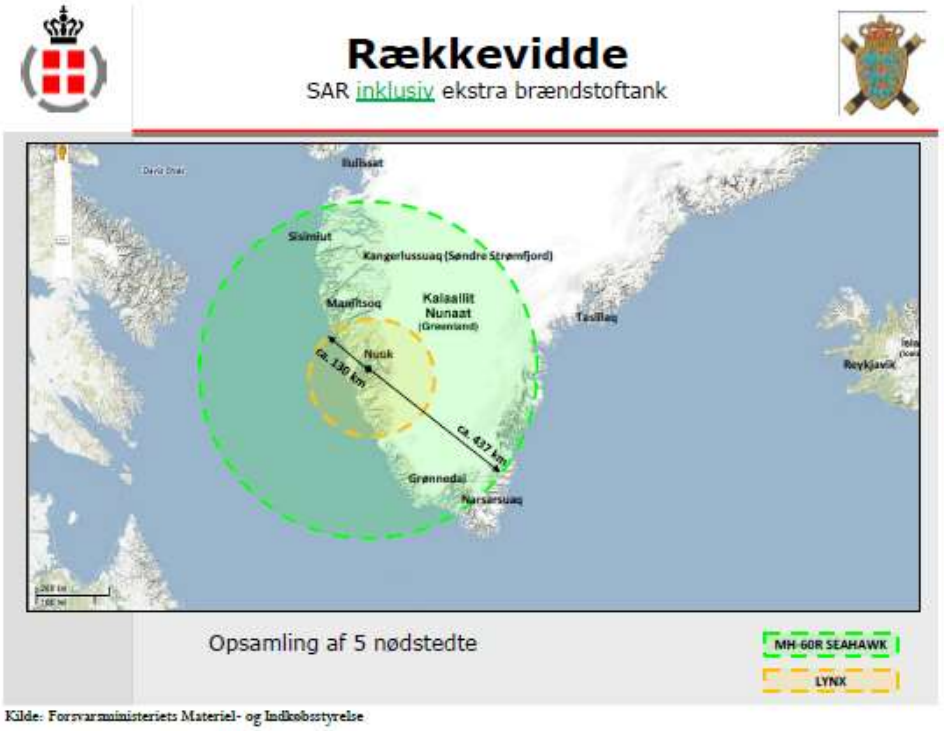

Figure 16: *Ranges of operation: Lynx helicopter and Seahawk helicopter equipped with extra tank of fuel and commissioned to rescue 5 persons in distress. (Source: Forrsvarsministeriet 2016: 48.)*

Air Greenland helicopters - In addition to the aircrafts and helicopters of the Air Force and the Navy, the Danish Ministry of Defence also agreed on a contract with the Air Greenland company on deploying one 24/7 available SAR Sikorsky S-61 helicopter at the Kangerlussuaq airport and one SAR Bell 212 helicopter at the Qaqortoq heliport available from Monday to Saturday from 8 a.m. to 16 p.m. (Skibsfartens og Luftfartens Redningsråd 2016: Pt. II, Ch. 4).

- The Sikorsky S-61 has an average speed of 220 km/h and a range of 4 hours or 600 km. It has space up to 19 passengers and it is equipped with an external hoist (Forsvarsministeriet 2016: 91).
- The Bell 212 has an average speed of 185 km/h and a range of 3 hours or 600 km. It has space up to 9 passengers and it is equipped with an external hoist (Forsvarsministeriet 2016: 91).

5.1.2 Oil Spill Response

The consequences of oil spill in Greenlandic waters is expected to be extremely damaging for the environment including flora, fauna and human beings, especially, in a country where relatively many people are living from fishing and hunting. Therefore, the capacity for Oil Spill Response is also very important. The low temperatures, the seasonal darkness during winter, the ice and the restricted infrastructure are also reasons why the effects of oil spills are expected to last longer in Greenland than in countries outside the Arctic (Mosbech, 2002).

5.1.2.1 Organisation and management

The organisation and responsibilities of Oil Spill Response in Greenland is, as is the case for the SAR organisation, divided between authorities of the Danish community of the realm and central and local Greenlandic authorities. The maritime environment emergency response system is divided in two geographical areas, the "Greenlandic" and the "Danish" (Departementet for Natur og Miljø) or between the Joint Arctic Command as a part of the Danish Ministry of Defence and the Government of Greenland (Forsvarsministeriet 2016). The Government of Greenland is responsible for the internal waters till the 3 nm line. This has been the case since 1993. JAC is responsible for Oil Spill Response in waters between the 3 nm and the 200 nm line for environment surveillance and response apart from issues related to natural resources (Forsvarsministeriet 2016). When the policy area of mineral resources changed from a Danish responsibility area to a Greenlandic responsibility area in 2010, maritime environmental issues in connection with mineral resource activity became part of the responsibility of the Government of Greenland also between 3 nm and 200 nm from the coastal line.

5.1.2.2 Incidents

One example that clearly illustrates the lack of sufficient capacities and the difficult conditions for operating in the Arctic is an incident in the waters between Greenland and Iceland 350 km east of the Greenlandic town *Tasiilaq*. A potential

oil spill was observed by the Joint Arctic Command and the development was followed by a Challenger C-130 aircraft from the Danish Air Force that surveyed the area when passing by. JAC wanted to confirm that it actually was an oil spill and to take a sample to determine the source of the oil spill. However, the nearest Danish navy patrol vessel was 1.280 km away. So, the Icelandic Coast Guard was contacted for assistance. But the Icelandic Coast Guard did not have available capacity for this task. Therefore, the Danish patrol vessel was directed to the area to investigate the oil spill. Due to the large distance from the location of the ship to the location of the presumed oil spill, and due to the weather conditions with 10 m high waves and drifting ice along the Greenlandic coast, the vessel arrived to the area five days after the oil spill was first observed, and at that point of time the potential oil spill had disappeared! This was noticed by Greenpeace, who took this as an occasion for criticising the Danish preparedness capacities for not being sufficient (Greenpeace 2015). Also, Danish National Audit Office had criticized the Danish Defence for not prioritizing surveillance of the Greenlandic marine environment, lacking assessment of the environmental risks and legislative enforcement in the area (Rigsrevisionen, 2013: 25). The lesson learned by the Danish Ministry of Defence was that satellite-based surveillance and surveillance flights and helicopters are needed for an efficient Oil Spill Response system (Forsvarsministeriet 2016: 116-118.)

5.1.2.3 Government of Greenland and internal waters

The Department for Nature and Environment upholds a maritime environment emergency preparedness based on personnel and equipment placed at the fire departments in the Greenlandic towns of Qeqertarsuaq, Ilulissat, Qasigiannguit, Aasiaat, Sisimiut, Maniitsoq, Nuuk, Paamiut, Narsaq, Qaqortoq, Nanortalik og Tasiilaq. This Greenlandic maritime preparedness organisation can primarily respond to pollutions in the harbour areas and coastal waters and - if the weather conditions allow - also in waters between the coastal line and the 3 nm line (Departementet for Natur og Miljø).

5.1.2.4 Greenland Oil Spill Response Company

The Greenlandic institution for preparedness and response in case of maritime oil spill in connection with natural resource activities is the government-owned company **Greenland Oil Spill Response (GOSR)** (Inatsisartut, 2012). GOSR is in control of quite a large amount of equipment for handling oil spill, e.g. different oil boomers for harbours, beaches and open waters, oil skimmers, temporary containment systems and chemical dispersants (www.gosr.gl). In 2014 GOSR's response equipment was moved from the airport area in Kangerlussuaq to the harbour areas in the towns of Nuuk and Aasiaat in order to ensure a better coverage of the whole country and faster mobilisation (Greenland Oil Spill Response, 2015: 5). Even though the response equipment is available in Nuuk and in Aassiat, there is still a question on how fast the equipment can arrive at a

possible waste site. GOSR has since 2016 recruited and trained groups of volunteer Oil Spill Responders in Nuuk and Aasiaat and also organised a number of courses like "IMO Level II Course - Response to Oil Spills for Supervisors & On-Scene Commanders (OSC)", "IMO Level III Course – Response to Oil Spill for Administrators & Senior Managers", "Arctic Shoreline Clean-up Assessment Technique Course" and others (gosr.gl).

Figure 17: *Speech by Lonnie Wilms of GOSR*
Director of the government-owned company Greenland Oil Spill Response (GOSR), Lonnie Wilms (standing to the right) gives a presentation at a panel organised by the MARPART project at the Democracy Conference (Qassimiuaarneq) in Nuuk, Greenland, 30 June 2016. The rest of the panel is sitting at the table – from left to right: Head of Contingency for the Kommuneqarfik Sermersooq municipality, Knud Petersen, Chief Constable of Greenland Police, Bjørn Tegner Bay, Lieutenant Commander at the Joint Arctic Command, Nils Westergaard, and Professor at the University of Greenland, Uffe Jakobsen, responsible for organizing the MARPART panel. (Source: Sermitsiaq.AG, 1 July 2016.)

5.1.3 Violent Action Response

As Greenland is a part of the Danish Kingdom and as foreign, defence and security policy as well as police enforcement are policy areas under Danish authority (Danish Parliament 2009), the territory of Greenland is included in the overall strategies of counterterrorism for the Danish realm.

5.1.3.1 The Danish National Police

In case of an emergency situation related to terrorism or other forms of violent action, Greenland Police would probably require assistance from the Danish National Police depending, of course, of the level of threat involved. But the

number of staff and the level of available capacity for counterterrorism in the Greenland Police would probably be very low. Therefore, any activity considered related to counterterrorism would be left to the Danish capacities in the form of special police units including their equipment that would have to travel from Denmark to Greenland, which means a comparatively long response time compared to independent states (more than six hours from Copenhagen airport to Nuuk airport as a minimum).

Even if the assessment of the level of the threat of terror formally is the same in the Danish realm as a whole, it is in practical terms much lower in Greenland that has no history of terrorism. Even if the threat in actual terms is not as high in Greenland as in Denmark, due to the remoteness, dispersed population patterns etc. in Greenland, it is of course still important to recognise that the probability might be less, while consequences might be more severe, e.g. due to the longer response time. The annual Danish Intelligence risk assessments include Greenland. However, Greenland is not discussed in the report in relation to terrorism. Terrorism is seen as the most important external threat to Denmark and to the West in general. But the threat of terrorism is not considered in relation to the Arctic or Greenland. Quite differently, the concerns are China's economic interest in maintaining a commercial involvement in Greenland that is considered as a risk of potential political interference in Greenland (Danish Defence Intelligence Service, 2017)(Danish Defence Intelligence Service 2017: 45).

5.1.3.2 The Greenland Police

Incidents of violent behaviour towards persons or/and physical installations may increase in Greenland. One example is the environmental activism by Greenpeace as related to the development of oil and gas activity from 2008 and onwards. In 2011 Greenpeace performed an action against offshore installations performing test drillings for oil off the western coast of Greenland. The Greenland Police prosecuted Greenpeace that after four years was sentenced to pay a large fine due to their physical occupations of the offshore installations, where one of the actions was assessed as producing security risks with regard to safety for humans and the environment (Reuters 2015). Even if Greenpeace is present in Greenlandic waters and does from time to time perform actions, the principle of Greenpeace is not to do violent actions but direct action. Therefore, the risk of human lives is estimated as insignificant in relations to all types of maritime vessels and activities. Since Greenpeace progammatically strives to protect the environment, the risk to the environment should also be estimated as insignificant!

5.2 CHALLENGES REGARDING ARCTIC MARITIME EMERGENCY PREPAREDNESS CAPACITIES

The increasing maritime activity in the Arctic necessitates more focus on security risks for people and the environment, and to establish the implications for the emergency preparedness and response systems. A major challenge both for SAR, Oil Spill Response and Violent Action Response is the lack of capacities for surveillance to strengthen the possibilities of a more adequate situation awareness. The gap between actual capacities and realistic needs for immediate availability of resources in unexpected and unwanted situations of crisis or disaster has to do with the harsh climate and long distances in the huge geographical area. But it also has to do with organisational adaptation and well established chains of command between different authorities and between authorities and citizens. The common focus mentioned by most actors is the need of more thorough practices of surveillance in Greenlandic waters to establish a sufficient situation awareness.

5.2.1 Search and Rescue capacity challenges

This was aptly put by the Commander of the Danish Joint Arctic Command (JAC) when he in an interview stated that the armed forces in the Arctic "have been blind" (Kim Jesper Jørgensen in Krog 2018). He stated that the Armed Forces only knew very little about what was going on at the territory of Greenland. But now the Joint Arctic Command is working on establishing an overall picture of the maritime situation in the Greenland waters by utilising satellite surveillance of maritime activity and environmental pollution. This endeavour is partly based on cooperation and information sharing between Canada, Norway, Iceland, the US and Denmark (Krog, 2018).

In Greenlandic waters the authorities have been strongly dependent on captains fulfilling their navigational duties to manually report their destination, course and speed to JAC via the so-called Greenpos system when entering and navigating within Greenland's EEZ. Satellite-based surveliance, therefore, would be an enormous advantage to be able to simultaneously know what is going on and to react fast and adequately in emergency situations. Especially, cruise ships are vulnerable due to their size, number of passengers and crew, and often also lack of navigational experience from Arctic waters. At the same time, they are growing in numbers both absolutely and relatively to the overall number of ships in Greenlandic waters. So, this constitutes an obvious risk and a growing task for the Arctic emergency preparedness systems (Brix, 2018). The worst case scenario would be a large cruise ship in distress in a remote and isolated area on the north or northeast coast of Greenland with thousands of passengers onboard. Hypothetically, the solution to such a risk is a costly expansion of the infrastructure in these remote and isolated areas. Based on a survey among experts on maritime emergency preparedness systems in the Arctic countries, a comprehensive list was established identifying the following key challenges for

Arctic SAR: long distances, severe weather, ice, cold conditions, poor communications network, lack of infrastructure and resource presence (Ikonen, 2017: iv).

5.2.2 Pollution response and capacity challenges

For future surveillance and verifications of oil spill, the resource gap could also be filled with volunteer citizens forming an efficient organisation in local areas obtaining sufficient qualification through education, training and exercises (Forsvarsministeriet 2016: 122).

5.2.3 Violent Action Response and capacity challenges

The lack of considerations on how to respond to the threat of terrorism and other forms of violent action in the Arctic can be explained as a consequence of lacking realism in raising the question, at all. However, thinking ahead of developments might strengthen the future level of preparedness towards an issue that maybe only apparently is hypothetical.

5.3 OPPORTUNITIES AND BENEFITS FROM CROSS-BORDER COOPERATION

A compulsive argument for cross-border cooperation is that some emergency preparedness and response tasks are simply too big for a single country to manage. Danish authorities have characterised the case of the cruise ship *Crystal Serenity* as an example of a situation in which no country has sufficient capacity of its own for an effective maritime rescue of people in distress on that scale (Danish Emergency Management Agency 2018). In the summer of 2016, and again in the summer of 2017, the first cruise ship ever sailed all the way through the Northwest Passage from Vancouver in Canada to Ilulissat in Greenland with around 1.700 passenger and crew onboard. From Ilulissat the cruise ship continued for several hundred kilometres along the west coast of Greenland to Nuuk, and from Nuuk to New York City. The warning by the Danish Emergency Management Agency is crystal clear: “no country has sufficient capacity to launch an effective sea rescue of people on that scale in the Arctic” ((Danish Emergency Management Agency, 2018: 156).

5.3.1 Large-scale incidents

The emergency response capacity in Greenland, therefore, needs not only the resources and capacities to handle smaller SAR operations, but also to handle larger operations. Today, these will not only require Greenlandic SAR and OSR resources and capacities but also assistance from Denmark and probably Canada or/and Iceland, as well, depending on the position and the size of a tourist cruise vessel in distress. Large-scale incidents and mass rescue operations are low-probability and high-consequence events that are in most cases overwhelming and in some cases as the Crystal Serenity even considered impossible to handle for the preparedness and response system of any one country (DEMA 2018). In other words, the very possibility of effective response to such large incidents requires

planning, training and realistic cross-border exercises. Joint courses prepared for Arctic SAR and cross-border cooperation on research to examine innovations and technological developments could improve practical international cooperation (Ikonen 2017).

5.3.2 Multilevel Governance

The Arctic Council initiated the "Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic" (Arctic Council 2013) that was adopted at the Kiruna ministerial meeting as a remedy for strengthening cross-border mutual assistance among the member states that are obliged to maintain a national preparedness and response system and respond to request for assistance from other member states. This still needs to be fully implemented to see how it can work in practice. In the case of Greenland, however, there is an extra governance level between national authorities in Denmark and local authorities in Greenland, which multiply the cooperation and coordination challenges. Especially in the current situation where independence sentiments in Greenland are growing stronger, the coordination is more complicated, and proposals for future capacities and institutions are under more thorough considerations. Still, maritime security and societal safety is important, and so is cross-border cooperation to continue the efforts to establish effective emergency prevention, preparedness and response capacities in the Arctic.

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6 CONCLUSIONS

This report has presented maritime preparedness capacities for Search and Rescue operations, Oil Spill Response and Violent Action Response in Arctic Norway, Russia, Iceland and Greenland. Arctic conditions pose challenges for both equipment and personnel resources. The capacities in the mainland areas and also for the more common small-scale incidents are sufficient and performed with high degree of professionalism. There is, however, a general lack of preparedness resource capacities for the larger incidents. These "black swans" – incidents with potential high impact, which are difficult to foresee – represent a challenge especially the more remote from the populated areas they appear.

The Arctic countries have divided geographic responsibility areas between them. However, they have not declared clear quantitative objectives as to response capacities and response time in the different regions of the Arctic. This is in stark contrast to the demands towards private actors such as the oil and gas companies, where defined risk areas have to be clearified and response time and capacity tested. There is also a lack of systematic analyses as to the risk potential due to change in activity patterns in and between the Arctic countries. The countries could also have more systematic focus on the learning potential from real incidents and exercises with critical analysis of performance. Data for such systematic and independent evaluation is often not available and partly classified within the emergency response agencies.

It is critical to explore the risk patterns and capacity levels for every sea region in the Arctic in order to ensure the proper level of response. It is important to understand the opportunities and the potential for cooperation with other agencies, communities, commercial units and cross-border resources. So far, this potential is to a large degree unexploited.

In uncommon multiple-cause incidents demanding long-term efforts, increased emergency resource capacity beyond regional and national resources is in demand. Cross-border cooperation may be a critical aspect for all types of unwanted incidents. This includes SAR operations, Oil Spill Response and Violent Action Response. In this report, the main institutions that coordinate preparedness capacities are described together with an overview of the available resources. Discussion and critical reflections are presented on challenges, opportunities and benefits from cross-border cooperation.

6.1 SEARCH AND RESCUE CAPACITIES

Country details. SAR capabilities in Greenland, Iceland, Norway and Russia are established to provide emergency preparedness according to a wide range of international, bilateral and national SAR agreements. In terms of cooperation capabilities, the bilateral agreements and interorganizational organizations have provided a platform for increased cooperation.

Taking this into consideration, capabilities for cooperation and coordination are on a very good development path. The state- and municipality-owned resources provide the most substantial and wide-reaching coordination capabilities. The JRCC -Northern Norway has a central position when it comes to Norway's efforts for international SAR cooperation in the Northern regions, and now open up for more systematic research and innovation efforts. However, there is a concern with respect to personnel availability. A report of 2016 by JRCC NN sees a certain risk for their capacities to be overwhelmed in large incidents, hence there is a demand for more capacity. Analytical capacity is also needed to follow up incidents, training and exercise efforts. This is true for most of the emergency response agencies.

The need for systematic knowledge development has increased. The physical availability of resources is low and mobilization times are long in remote regions such as the northern and eastern part of the Barents Sea and the Svalbard region. Commercial operators, in particular passenger- and transport vessel companies as well as the oil- and gas industry, have had to follow regulations and set up independent emergency response services. This includes first line and second line capabilities, which will cooperate and assist during any SAR operation if necessary. Especially the stationary oil- and gas fields usually have rescue helicopters, stand by vessels close to the field, and supply vessels serving as additional SAR capacity.

In Russia, a large number of different actors are involved in emergency response. Information on SAR capacities including the current situation, availability, locations, capabilities and resources and degree of preparedness, is forwarded to SAR relevant institutions at least once a week.

The military is another resource that provides substantial SAR capacity in the form of tow- and rescue vessels and airborne facilities. The Northern fleet in the Murmansk region can provide SAR capacities. In addition, Rosatom fleet consists of 6 icebreaker vessels which may act as "floating" SAR and OSR units. Yet, incidents have shown that in some regions local capacity are most often performing the heavy load of the Search and Rescue operation. Taking into account challenges such as a future increase of traffic and ship ageing and decommissioning, further construction and development of up-to-date rescue capacity is required. Priority should be given to construction of rescue tugboats, supply vessels, and multimission rescue vessels with unlimited navigation area.

In addition, further focus should go to providing more airborne capacity to EMERCOM. Also, there is a need for SAR-coordinators to receive more information on the Air Northern Fleet, which is a unit under the Navy. However, SAR is not their primary function.

In Iceland, SAR operational capability focuses mainly on response to vessel incidents within Iceland's Exclusive Economic Zone. This involves mostly

fishing vessels and cargo ships. Larger incidents would pose great challenges to the SAR system and require international collaboration, particularly in the case of cruise vessels. Multilateral collaboration with authorities from Danmark, Faroe Islands, Norway etc., are essential to successful SAR operations in Iceland. All signs point toward increased Icelandic-Danish maritime security cooperation in the next few years. In addition, Iceland considers establishing an international Rescue and Response Center in Keflavik.

The preparedness system is mainly based on the Icelandic Coast Guard's three patrol vessels and two helicopters on continual standby. An ICG surveillance aircraft frequently participates in financed missions abroad for up to six months a year.

In Greenland, one of the main challenges is the vast area of the SAR responsibility region (SRR) which covers an area of 3 million square km with low satellite coverage, scarce resources and low population density.

The Joint Arctic Command is working on establishing an overall picture of the maritime situation in Greenlandic waters by utilising satellite surveillance of maritime activity and environmental pollution. This endeavour is partly based on cooperation and information sharing between Canada, Norway, Iceland, the US and Denmark (Krog, 2018). The responsibility in Greenland is divided, as some operations are part of Danish jurisdiction and others are part of Greenland's central or local government. Furthermore, both JRCC Greenland and Greenland Police Command Station have responsibility and the capacities to perform SAR mission coordination. They usually need to determine at the start of an operation on who has the best capability on coordinating the efforts. Also, most SAR capacities normally have other main purposes such as security, sovereignty or civilian use. This could potentially increase the mobilization time.

Cooperation on SAR-issues. For all countries in this report, the bilateral agreements and interorganizational agreements have provided a foundation for substantial tacit knowledge and experience. The participation at the Arctic Council with working groups such as EPPR (hosting the SAR and MER Expert Group) facilitate SAR capacity development for all countries. Also, the Arctic Coast Guard Forum represent a platform for further cooperation on operational routines and competence sharing. An increased number of joint education, training and exercises should be considered, for example through expanding the Norwegian-Russian Exercise Barents.

An aspect, which may increase capacity for potential cooperation during SAR is increased understanding of culture differences, shared planning and IT-systems as well as language (both technical language as well as possibility to understand foreign languages).

In addition, private cooperation including oil and gas, cruise industry and other maritime activity increases capacity and should be included in training and exercises.

6.2 OIL SPILL RESPONSE CAPACITIES

Oil Spill Response capacities are coordinated by authorities of different levels within the studied countries, with more resources coming from private companies. In Norway, the response resources are coordinated by entities at three levels – private, municipal and state. Each of the levels coordinate equipment and personnel capacities. Technologies and services are operated by a long and varied list of organizations. Managing oil spill preparedness response capacities is a complex interplay of strategic, tactical and practical considerations and actions. Efforts should be directed towards an assurance of effective interplay and coordination of resources between these organizations, as well as strengthening private–public partnership in oil spill preparedness.

In Russia the authorities in charge of oil spill preparedness capacities include many ministries and organizations from different levels. In spite of the available resources, facilities and vessels at all levels, the existing system of Oil Spill Response cannot be regarded as adequate. More advanced techniques and methods to prevent and respond to emergency situations need to be implemented. Although, Russia is subject to the most extended maritime borders and the continental shelf, there is no federal law which would govern issues of maritime environment pollution prevention. Additional development efforts should be focused on the interaction of the state and the industry.

In Iceland, a more simple coordination system is at hand through the coordination of the Environment Agency of Iceland. The agency is in charge of both land-based and maritime pollution prevention and therefore coordinates action against marine pollution. The Ministry for the Environment and Natural Resources has overall responsibility with regards to pollution prevention, fire prevention and fire brigades. For Iceland, multilateral collaboration is highly important. It could take several days for vessels with sufficient towing capacity to arrive from Norway or from continental Europe. There is however an initiative for increased collaboration between Iceland and Denmark.

In Greenland the capacity for Oil Spill Response is very limited but at the same time of great importance. Effects of oil spills are expected to last longer in the icy waters of Greenland. However, vast areas in combination with limited infrastructure and personnel is a challenge for operations.

In all countries, long distances between potential capacity such as depots, personnel, airports and destinations for collected oil and waste, will be a major challenge. Collected oil must be transported out of the area if it is not dispersed or burned on site. There is a need to develop better methods for separation of oil, ice and water. Mechanical collection and absorption of oil in ice-filled waters is

challenging. Even at low ice coverage, booms and collecting systems have operational limitations. There is a need for product development including initiative for further winter adaptation of existing equipment and technology development for better detecting oil in ice.

6.3 VIOLENT ACTION RESPONSE CAPACITIES

The police is responsible for Violent Action Response during peace times in most countries. In addition, Norway and Russia have a large system of vulnerable maritime installations within offshore oil and gas where the coast and border guards together with the military special forces play a central role in the preparedness system.

International cooperation is also important within security, especially when it comes to intelligence. Close cooperation between different institutions will give an opportunity to exchange experiences and knowledge, and provide the opportunity to proactively launch necessary specialized resources. International joint exercises should be considered between the police and border guard special forces in the region.

6.4 BENEFITS FROM CROSS-BORDER COOPERATION

Cross-border cooperation gives opportunities to assess resources, personnel capabilities and share knowledge and experience. This study analyzed capacity challenges connected to the Arctic operational context, management and organization of the resources within the four countries. These challenges call for stronger cross-border cooperation in border zones offshore and far in the North.

Existing cooperation across borders in the North shows that these enhanced relations provide mutual safeguarding of person traffic, critical installations such as oil platforms, and a mobilization potential for helping out also in areas of policing. Linking coast guards, RCCs and border police are important platforms for enhanced emergency prevention and preparedness cooperation in a challenging area and during challenging times. Collaboration also increasees trust and mutual understanding of each other's capacities.

Cooperation within and between local communities, voluntary groups and industrial capacities is also becoming more crucial when it comes to fast 1st line mobilization, increased competence, and efficient sharing of all available emergency response resources. An example of this we can see on Svalbard with the strong cooperation between the Norwegian and Russian communities.

Management education as well as training and exercises for relevant skills are crucial factors. The cooperation in the Arctic will benefit from a clear understanding of who the leaders are and which personnel in which organization has particular competences to perform the different tasks. This is relevant for all levels of emergency response.

The need for advanced competences in emergency management in the Arctic seas calls for increased frequency and complexity level of joint exercises. Shared exercises – both full scale, functional and table top – improve cooperation as well as understanding of each other's capacities in an actual incident.

Furthermore, analysis capacity is needed to look into weaknesses and gaps. Competence platforms or hubs may facilitate this. Cross-border comparative studies will bring more diverse, and comparative reflections and a better understanding of the different organizations and how they handle critical incidents. Close-knit, cross-border cooperation may bridge many gaps present in the current emergency response system of the Arctic.