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SHIP TRAFFIC IN THE SVALBARD AREA AND SAFETY ISSUES

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ABSTRACT

Intensity of marine transport in the Arctic is rather low; but it has clear tendency for increasing. At the same time, consequences of marine accidents can be significant for vulnerable environment and for human beings in harsh High North conditions. Ship traffic in the Svalbard area is uniquely large for such high latitude. There are no other places in the world where cruise liners with almost 4000 tourists on board run up to 80^{O}N.

There are vessels of 4 main groups in the Svalbard area: tourist, cargo, research and fishing vessels. Naturally the first prevails in number of people on board, and the last dominates by number of vessels. Ship traffic has great seasonal variation for all groups. For example, the number of fishing vessels changes from 10-20 in January-May to 30-40 in June-August, and again to 50-60 vessels in September-December. 1-2 research vessels operate year round, and 5-8 vessels come from July-September.

Located in the heart of the Arctic, Longyearbyen (the main Svalbard town) plays a key role in safety preparedness for the whole Atlantic Arctic.

The main challenges for navigation here are logistics and large distances, sea ice, and inadequate charts. The main challenges for search and rescue (SAR) in addition are remoteness, lack of human resources and hypothermia.

Fortunately, there were not so many ship accidents in the area (2-3 per year), and of these, groundings dominate. Being captured by ice is specific to Svalbard. Among large accidents are the cruise liners *Maxim Gorkiy* (holed by ice at 60 NM west of Svalbard, 1989) and the *Heanseatic* (grounded in Murchinsonfjorden, 1997), when 575 and 145 passengers (respectively) and large part of the crews had been safely evacuated and ships were recovered. Analysis of ship traffic patterns, previous accidents and SAR features is given in the article.

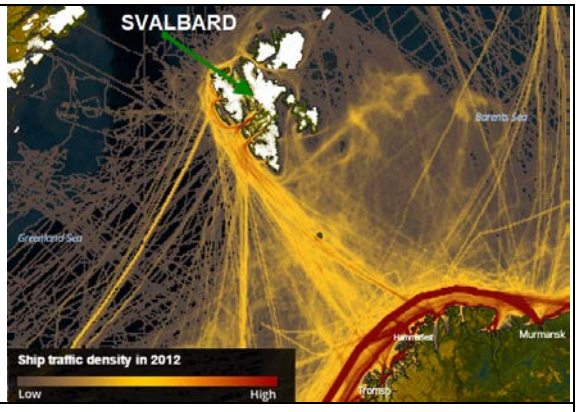
INTRODUCTION

Svalbard is the northern-most archipelago with life settlements and growing permanent population. It has a key role for investigation and exploration of the Arctic, shipping in the high north area, and possible search and rescue operations. The group of islands range from 74° to 81° north latitude, and from 10° to 35° east longitude. The largest island is Spitsbergen, followed by Nordaustlanded and Edgeøya. Svalbard is surrounded by Greenland, Norway, the Barents Sea and the Arctic Ocean. The West Spitsbergen Current (a branch of the Warm North Atlantic Current) heats the western side of Archipelago, while the cold East Spitsbergen Current brings ice from the Arctic Ocean. Svalbard is the place where

cold polar air from the north and mild, meets wet sea air from the south, creating strong winds, and changeable and weather.

Coal mining, fishery, tourism and science/education are the main activities on the archipelago. They provide the reasons for marine transport and determine the type of vessels needed, as well as ship traffic patterns. Ship traffic density is rather low compared to that near mainland Norway and has large seasonal variation, but the pattern is quite stable from year to year (Figure 1).

1A



1B

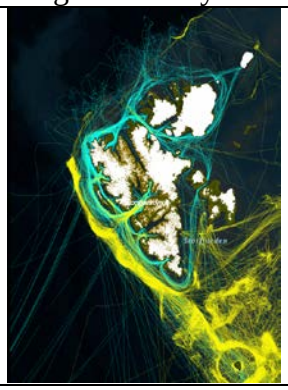
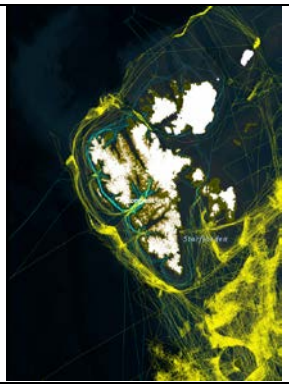
Figure 1. Location of Svalbard (1A) and ship traffic density (1B) from in 2012 (WWF, 2015).

SHIP TRAFFIC PATTERNS

There are 4 main groups of vessels in the Svalbard area: tourist, cargo, research and fishing vessels. Naturally, the first prevails in number of people on board, and the last dominates by number of vessels.

Vardø Trafikksentral (VTS) is the information unit of the Norwegian Coastal Administration (NCA), collecting data about traffic in the Svalbard zone throughout the year, using the AIS system. The special online service ArkGIS (Arctic Geographical Information System - http://arkgis.org/) is a free and interactive mapping platform that combines and integrates existing data about the environment and human activity in the Arctic. ArkGIS has been used to make an image of ship traffic in Svalbard area (Figure 2).

Information about amount of ships and inter year variation in 2013 is presented in the report (Multiconsult, 2014). Special requirement for pilot assistance and Pilot Exemption Certificate (PEC) are presented in (DNV, 2010).

Spring	Summer	Autumn	Winter
Passenger-blue lines; Fishing vessels – yellow lines			
			

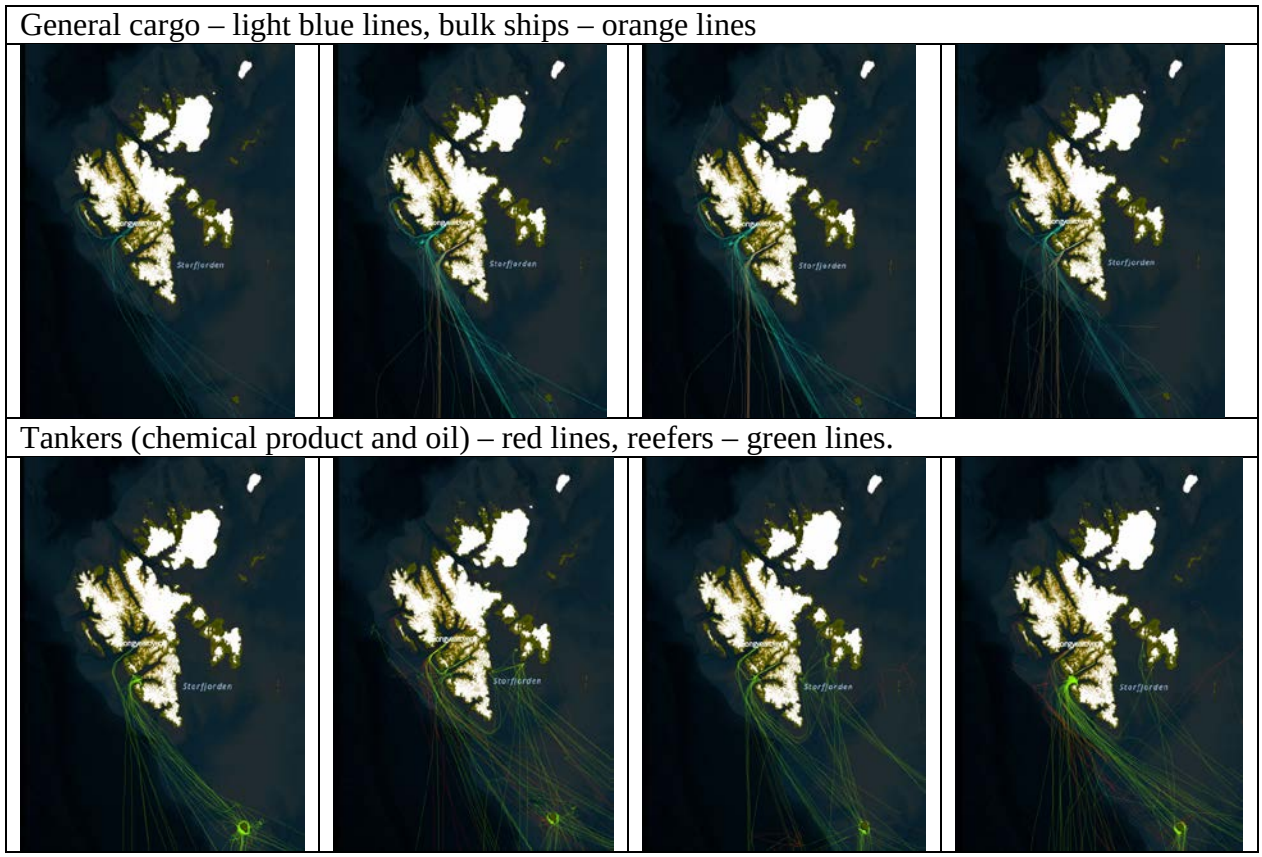


Figure 2. Ship traffic lines for different seasons and types of vessels

Tourism

The main season for cruise ships on Svalbard is from June to September.
The traffic is divided into three segments: A) Overseas cruises, B) Expedition cruise vessels, and C) Day trip ships (Figure 3).

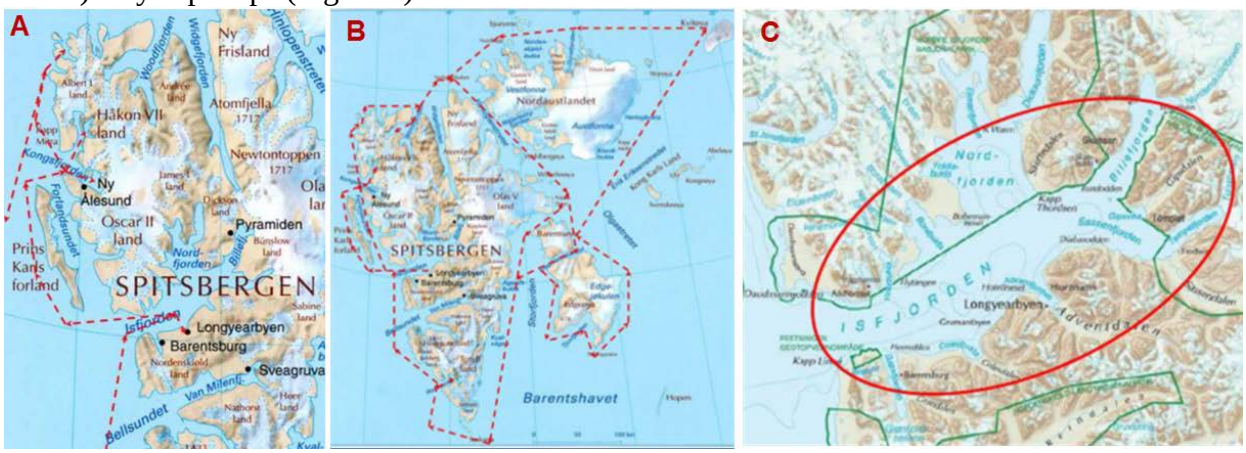


Figure 3. Area of operations for A) Overseas cruises, B) Expedition cruise vessels, and C) Day trip ships in Svalbard area (Kystverket, 2007)

Overseas cruises normally consist of larger vessels (with a length between 100 and 300 meters), where Svalbard is one of the destinations on the cruise. These ships take up to 3,800 passengers. AIS data and information on the operational pattern for cruise vessels indicates that vessels primarily visit a select few and relatively narrow locations. The most visited

places are Magdalena Fjord, Ny-Ålesund and Longyearbyen. The policies suggested by the NCA imply that these vessels will be covered by the pilot requirements for Svalbard. Vessels of more than 150 meters or with more than 500 passengers will not be able to get a Pilot Exemption Certificate (PEC).

Expedition coastal cruises go around the archipelago and have Longyearbyen as a starting point. Expedition cruises are performed with small and medium-sized passenger ships (size varies from about 40 to 120 meters) that take 12-300 passengers. They make trips of varying length, a typical duration is 3 - 14 days and operate all around Svalbard (see Figure 3B).

Passengers land in many locations. The vessels normally do not go to the shore, but must set out smaller boats for tourists to come ashore. Expedition Cruise vessels with a length of 50 meters or a passenger capacity of over 12 will be covered by the pilot requirements according to criteria set by the NCA. NCA expects that most skippers on expedition cruise vessels are eligible for a PEC.

The last segment is **day trip ships** in the Isfjord (Ice Fjord) based in Longyearbyen. They make day cruises from Longyearbyen to Isfjord with landings in Barentsburg, Pyramiden, and occasionally some other places in the Isfjord area, performed with small vessels up to 40 meters and 90 passengers. They will most likely be exempt for polar pilot requirements and PEC.

Sailing boats / yachts. Between 50 and 100 private yachts have visited Svalbard in the summer period every year in recent years. These vessels are below the vessel limits covered by polar pilot requirements

Tourist season starts in May with about 2 ships. In July-August there are 15 to 30 ships, in September - around 10, and 2-4 ships at the end of the season until October. The numbers of arrivals to Longyearbyen Port (Table 1) show a large variation from year to year, but increasing in general (total amount).

Table 1. Tourist traffic in Longyearbyen Port (Multiconsult, 2014)

Ship type	2000	2002	2004	2006	2008	2010	2013	2014
Oversea cruise ship	23	29	32	40	49	52	49	49
Expedition ship	9	259	257	439	117	126	190	154
Day tour					250	258	251	184
Yachts	46	57	85	71	74	130	68	83
Total	78	345	374	550	550	566	558	570

The Norwegian Government wants to facilitate for further development of the tourist industry as an important basis for settlement and business in Longyearbyen. At the same time, it is a goal that Svalbard shall be one of the world's best-managed wilderness areas, and the best preserved High Arctic travel destination in the world. The challenge in the coming years will be to manage the industry in a manner that safeguards the high environmental goals of Svalbard.

Cruise traffic around Svalbard has increased in recent years, but the number of tourists who visit Svalbard is still relatively low compared to many other areas. Traffic to Longyearbyen represents less than one percent of the total tourism on the North-Calotte (Evenset and Christensen, 2011).

The trend for overseas cruise ships is that there are fewer ships, but they increase in size and number of passengers. Furthermore, another trend is season extension, i.e. that the season starts earlier and ends later. A heavy oil ban on ships from 2015 can cause challenges for overseas cruises. The challenge is to keep Svalbard as a still attractive port of call, while

facilitating the development of attractive tourism products on land, as well as experiences and activities that enhance the economic impact of cruise traffic.

Expedition cruises have a long history at Svalbard and most likely will continue the same procedure and volume. There have been between 8-10 thousand passengers annually over the past five years.

Day trips consist of sightseeing to Longyearbyen and are performed today by two companies with very similar products and prices. They are quite popular and probably will increase in volume.

Cargo

Cargo ships run on fixed routes to and from Svalbard. The vessels are 80-150 meters in length and call to Svea, Barentsburg, Longyearbyen and Ny Ålesund. There are two ships in regular service and 5-6 other dry bulk ships with random arrivals of about 15 to 20 trips a year combined.

The vessels are expected to be subject to polar pilot requirements. Frequent visits suggest that most of the vessels are expected to be eligible for Pilot Exemption Certificates (PECs).

There is also a freezer vessel of about 100-150 meters, receiving fish from Russian trawlers operating in the fjords west of Svalbard and around Bjørnøya (Bear Island). There are 2-4 such boats operating throughout most of the year in these waters. There are about 25-35 calls by ships carrying coal from Svea from July to December. The size of ships is 50-150 meters. 2-3 bulk carriers also call to Barentsburg and Longyearbyen during the autumn months.

In addition, there are tankers supplying fishing vessels, cruise ships, Svea, Longyearbyen, Barentsburg and Ny Ålesund with fuel. These boats are from 90-150 meters long and operate in the Svalbard zone from April to December. There are about 10 of these vessels throughout the year.

Fishing

VTS shows that fishing in the Svalbard zone goes throughout the year and around the archipelago, with a peak from August to December. Typical vessel size is between 25 and 60 meters. Fishing takes place mainly in the cod and shrimp areas south and west of Svalbard. The fishing vessels usually do not visit Longyearbyen. Trawlers, going far north, follow fish and shrimps, and occasionally are caught by ice and need icebreaker assistance almost every other year. Since 2003, the number of port calls from fishing boats to Longyearbyen ranged between 15 and 30 per year. Fishing vessels have accounted for over 60% of events in the waters around Svalbard since 1981. Fishing vessels over the vessel limits will be subject to polar pilot requirements. The NCA expects that most fishing vessels will be eligible for PEC.

The number of fishing vessels changes from 10-20 in January-May to 30-40 in June-August, and again to 50-60 vessels in September-December.

Research and monitoring activity

This category includes educational and research vessels, Navy and Coast Guard vessels, and vessels belonging to the Svalbard Governor. Navy and Coast Guard vessels are exempt from the polar pilot requirements. All other vessels over the vessel limits will be subject to polar pilot requirements. The majority of these vessels are expected to be eligible for PEC.

1-2 research vessels operate year round, and 5-8 vessels come from July-September.

In the period from June to October there are about 2-4 seismic vessels working at Bjørnøya and South/South-East of Svalbard. Longyearbyen Port records additional traffic to and from the activity in East Greenland since 2009. This has been seismic vessels, icebreakers and vessels with supply and support functions.

The trend for research, monitoring and search and rescue (SAR) activity is an increased amount of ships and arrivals. Locating in the heart of the Arctic, the main Svalbard town of Longyearbyen plays a key role in SAR preparedness for the whole Western Sector of the Arctic. Future inevitable expansion of industrial activity to the North requires scientific activity in Svalbard area even now and will continue in the nearest years.

PREVIOUS SHIP ACCIDENTS

Fortunately, there were not so many ship accidents in the area (2-3 per year), and of these, groundings dominate. Being captured by ice is specific to Svalbard. Trawlers, going far north for fish/shrimps, are caught by ice and need icebreaker assistance. Fortunately as well, there were no oil spills in 2014 (there are usually 2-3 per year).

In 2014, DNV GL prepared 2 reports (DNV GL, 2014a, DNV GL, 2014b) to find out the risk of contamination due to shipping accidents in Svalbard and Jan Mayen. Passenger vessels have accounted for most of the ship accidents since 1998, and 14 of these cases involved questions regarding groundings. There have been 48 ship accidents overall during that period, with fishing vessels ranking second among those most frequently involved. The reports, however, show that fishing vessels are expected to be responsible for the most accidents, as they make up more than two-thirds of shipping traffic. Tugboats, research, and search and rescue vessels comprise 11 percent of the traffic, while passenger ships account for eight percent. However, accidents involving overseas cruise ships are projected to have the greatest impact, as such ships carry larger amounts of fuel than other ships in the area.

The previous DNV report (DNV, 2010) showed the same proportion, analysing the other period (1981-2008). Among 76 incidents recorded during that period, fishing vessels account for 64% of the registered events, while cruise ships account for 10%, research and other supply vessels account for 9%, and cargo accounts for 4%. Groundings prevail (48%), while collisions make 18% (13 of 14 recorded collisions involved fishing vessels), fire/explosion cause 9%, and other accidents account for 25%, including is capsizing by ice, which is specific to Svalbard. Trawlers, going far north for fish/shrimps, are caught by ice and need icebreaker assistance almost every other year.

Here are the most typical accidents (see Figure 4 for location and Table 2 for picture). We will not touch classic accidents like the shipwreck of the sailboat *Forland* (1958) between Nordaustlandet and Barentsøya (Barents Island). The vessel crashed into ice and sank. Such accidents are quite unusual nowadays because ships became much better, polar navigation regulations do not allow to enter into the ice water, and ice conditions are much easier. Our examples are quite possible and they are rather instructive for future development, improvement of safety systems, and preparedness.

Figure 4. Locations and photos of accidents.1 *Maxim Gorgkiy*, 2 *Hanseatic*, 3 *Aleksey Maryshev*, 4. *Remøy*, 5 *Petrozavodsk*. Photo taken from 1(Hovden, 2012), 2 (Ministry of Justice and the Police, 1999), 3 (Amundsen, 2008), 4 (Stav, 2009), 5 (Molde, 2011)

1. Cruise ship Maxim Gorkiy. 1989. Greenland Sea, near Svalbard/Spitsbergen

Last year was the 25th anniversary of the instructive accident of the luxe cruise ship *Maxim Gorkiy*. Recalling these events becomes a vivid illustration to the question of safety of sea tourism in harsh Arctic conditions.

At around midnight of 19 June 1989, the *Maxim Gorkiy* hit an ice floe while she carried mostly German tourists from Iceland to Spitsbergen fjord and begun to sink rapidly (Hovden, 2012). It happened in the Greenland Sea, 60 nm (111 km) west of Spitsbergen. All passengers and a third of the crew abandoned ship. The situation was quite dramatic while they were waiting for the help on the ice floes and life boats, surrounded by drifting ice. The Norwegian coast guard vessel *Senja* arrived on the scene some three hours later, when the *Maxim Gorkiy* was already partially submerged. The passengers were evacuated from the lifeboats and ice floes by helicopters and the *Senja*, taken to Svalbard and later flown back to Germany. Meanwhile the crew of the *Senja* had managed to stop the *Maxim Gorkiy*'s sinking, by which time her bow had already sunk down to the level of the main deck. Divers from the *Senja* found two large gashes, 30 inches by 8 feet (76x 244 cm) and 2 inches by 19 feet (5x 579 cm). On 21 June, the *Maxim Gorkiy* was towed to Svalbard, where quick repairs were made to make her watertight enough to survive a return to Germany for repairs.

The reported cause of the accident was the captain's decision to cross an ice field while keeping significant speed, being under the impression he was to deal with soft ice. The captain was not experienced in Arctic navigation.

2. Cruise ship Hanseatic. 1997. Murchinsonfjorden

On a Sunday morning, 13 July 1997, the cruise ship *Hanseatic* (Germany), was stuck in Murchinson fjorden in the Hinlopen Strait, a passage between the Spitsbergen and Nordaustlandet islands (210 km from Longyearbyen). There were 145 passengers and 115 crew.

It ran aground while bringing tourists to the islands. The captain tried to approach land at risky distance to show walruses to the tourists. All passengers were evacuated to the land by life boat and further to Longyearbyen by the coastal guard ship *Tromsø*. The *Hanseatic* was grounded for 4 days while the *K/V Nordkapp* took fuel from the *Hanseatic* (to make the ship lighter and to avoid spills) and helped to extricate the ship.

The reported cause of the accident was navigation mistakes, although the captain was very experienced in Arctic navigation.

3. Expedition ship Aleksey Maryshev. 2007. Hornsund

On 8 August 2009, the Russian tourist boat *Aleksey Maryshev* went near a calving glacier in Hornsund. There were 23 British tourists on board. During calving, the boat violently lurched and ice and seawater were thrown over those who were on board. Eight of the tourists were injured, and six who were rather seriously injured were sent to the University Hospital of North Norway for medical care. The Tourist boat was chartered by Oceanwide Expeditions and lay 32 to 36 feet away when the glacier calved.

The reported cause of the accident was a navigation mistake, as the captain approached the glacier too closely.

4. Prawn trawler Remøy. 2009. Moffen Island

On 15 January 2009, the Norwegian trawler *Remøy* had been captured by ice between Moffen Island and Mosselhalvøya, and developed a problem with propeller wings. K/V Svalbard had to fight her way through densely packed, 1 meter thick ice to bring out the trawler. While waiting for help, the trawler was tightened and drifted with the ice to Mosselhalvøya (Stav, 2009).

K/V Svalbard had to struggle several times into very densely pack ice to get through to the trawler. Heavy snow on the ice caused much friction against the boat. Luckily, the trawler had not received other injuries while it stood firm in the ice.

5. Cargo vessel (refrigerator) Petrozavodsk. 2009. Bear Island

On the foggy morning of 11 May 2009, the Russian vessel *Petrozavodsk* ran aground, right in the middle of the breeding area of large colonies of sea birds at the south point of Bjørnøya. The crew had been evacuated by Norwegian helicopter and delivered to Hammerfest. Four Russian fishing vessels, Norwegian K/V *Svalbard* and 2 helicopters participated in the rescue operation. There were no large leakages, but dead and injured seabirds were found in the water around the vessel. The birds had probably been soiled by diesel or oil that had leaked from the damaged ship. (Pettersen, 2009)

In the summer of 2009 the rest of the fuel, Freon and other chemicals had been removed from the vessel by the "Titan Salvage" expedition. The Norwegian Coastal Administration had plans to remove the shipwreck, but in the summer of 2010, the vessel was broken into two parts by waves. The bow had been separated from the rest of the ship and it made the removing operation very complicated. The shipwreck is still on a nesting cliff.

The reported cause of the accident was a navigation mistake related to fog conditions, made while the captain and first mate were drunk.

PREPAREDNESS FOR ACCIDENTS

Responsibility

Located in the heart of the Arctic, the main Svalbard town of Longyearbyen plays a key role in SAR preparedness for the whole Western sector of the Arctic. The increase of activities in the High North makes this role more important and demands international collaborations. The Svalbard governor, as a head of police and local authority, is responsible for SAR service in the limit of the 12-mile zone and coordinates this service. Outside this limit, the governor can help with available resources. The governor's employees work in close cooperation with Longyearbyen Hospital, Coast Guard, Red Cross and fire service.

Actual resources in 2014

Significant improvement in SAR preparedness has been made in 2014. Since April 2014, two large Super Puma rescue helicopters are stationed on the islands where there had been one before. One of the helicopters has a 1-hour emergency time, so it should be in in any place inside the 140 nautical mile zone from Longyearbyen with a 5-man crew and eventual medical or other rescue personal within one hour. It can take 20 men on board. The second helicopter has a 2-hour emergency time. Lufttransport AS delivers helicopter service from 1 April 2014. There are 9 fuel depots on Svalbard, Bjørnøya, and Hopen for refueling, which significantly increases the reachable area. The brand new 88-meter long, 1B ice-class rescue vessel *Polarsyssel* will insure SAR operation in the area from September 2014 during about 6 months per year. *Polarsyssel* has state-of-the-art technology, enabling it to engage in rescue and emergency situations under extreme Arctic conditions. Coast Guard vessels operating in Svalbard area (ice resistant Nordkapp class ships or the icebreaker K/V *Svalbard*) can be used for SAR, fire service, and elimination of oil spills.

Hypothermia is the main concern in the event of large disasters in very remote places of the Arctic. As it is difficult to evacuate many people in distress, Longyearbyen Red Cross creates emergency kits for 8 persons, which allowed even inexperienced people to keep warm for a long time. 30 such kits, dropped by station in the Longyearbyen plane DORNIER 228-202K can protect 240 persons, the amount exceeding the content of the average transpolar plane or adventure cruiser.

Svalbard in general is very well equipped, but has very limited human resources. It is not possible to constantly have a crew for large-scale SAR in a small town such as Longyearbyen. In the worst cases (due to seasonal migration) there could be about 20 persons highly qualified in SAR. But in case of emergency, the number can rise to 100-200 due to Red Cross and to calling in students from the University Center in Svalbard (they all pass a safety course with first aid) and other skilled volunteers. Ironically enough, highly qualified volunteers usually leave Svalbard for vacation in summer time (there are only a few presented as a shift), when ship traffic is most intensive and the possibility of accidents is high. Those living in Longyearbyen society are very intelligent and enthusiastic, hardened and cohesive in harsh environments.

Testing. Svalbard exercise in November 2014

The largest emergency rescue exercises ever in the archipelago took place on Svalbard as a part of the Norwegian Health Directorate yearly practice. 86 students at The University Center in Svalbard and Longyearbyen citizens volunteered to be "victims". 160 people

participated in rescue operation and more than 600 had been involved in support roles. Hundreds of participants, with more than 20 agencies, including the governor of Svalbard, Longyearbyen Red Cross, hospitals in Longyearbyen and Tromsø, Norwegian Armed Forces and the Swedish Health Directorate, were part of the exercise. In addition to the rescue itself, an entire virtual community of relatives seeking their loved ones, national and foreign media organizations, and government briefings was created – and often intentionally exhibited the flaws and errors likely to occur in the chaos of a real disaster. The Norwegian Prime Minister Erna Solberg and other top officials visited Svalbard on Sunday and Monday to get a preview of the drill from participating agencies.

The Norwegian Coast Guard's K/V *Svalbard* icebreaker posed as the M/S *Amanda* cruise ship. Deadly explosion during cruise "happened" in Adolfbukta (Billefjorden) near Brucebyen at 5:00 a.m., and a mayday call had been sent and received in Bodø. Polar night, -20^{o} C temperature, and strong wind made a lot of challenges for rescue team and volunteers, playing the roles of badly injured, dead, slightly wounded or "just frozen." "The governor of Svalbard has initiated a rescue after notification of a fire on a boat on Svalbard," an alert posted on the governor's "official" website (ovelsesvalbard.wordpress.com) declared shortly after the "incident" at 5:15 a.m. There were 2 policemen, 1 doctor and 1 nurse on shift at that time. All available resources had been collected and brought into action according to the ordinary plan that exists for such occasion. Help was requested from local officials, as well the Norwegian military and Swedish health officials, but the latter two in particular would take considerable time to arrive.

The first helicopter came for the place at 6.12, and the second 6:32. The last "victim" was evacuated at about 1 p.m.

The exercise has shown that Longyearbyen rescue system is well prepared for accidents of such scale.

CONCLUSION

Ship traffic in Svalbard area has strong seasonal variation and low intensity in contrast to mainland Norway, but it has clear tendency to grow. It is very important to analyse previous experience and to improve preparedness to accidents. Among possible unwanted events, accidents with cruise ships, and possible oil spills are discussed as being the most dangerous. Accidents with cargo ships and tankers, then, are very unlikely. Fishing vessels are the most numerous and the most risky, as they go far north to catch fish and shrimps, so accidents are possible. These vessels are generally very well prepared and usually cope with difficulties themselves.

In the nearest future (the next 15 years), all experts expect an increase in passenger traffic and the extension of the cruise season as tourism offerings are developed. Oil exploration around Spitsbergen is unlikely until about 2030 at the earliest. There is considerable uncertainty about coal mining development.

Changes in ice conditions will be followed by an increase in fishing vessel traffic in the coming years. Research activity is expected to slightly increase. There is the possibility of Svalbard becoming a hub for increased shipping traffic between Asia and Europe, but it is not the most probable outcome.

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