Implications caused by SARex on the implementation of the IMO polar code on survival at sea

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Abstract. The International Code for Ships Operating in Polar waters goes into effect on 01 January 2018 for all ships. This puts additional strain on vessel owners and operators as they will have to comply with an additional set of requirements. This includes the functional requirement of a minimum of 5 days survival time. The SARex exercise has elaborated on the issue of survival in close cooperation with the different stakeholders associated with the marine industry. Being an objective third party is important when organizing and executing these activities as all of the stakeholders has different agendas and priorities. Developing sustainable solutions is a balancing act, incorporating economic and political aspects as well as technology and requires a mutual common understanding of the mechanism involved.

1. Introduction
The extent of maritime activities taking place in the polar regions is increasing. Much of this activity is related to passenger transfer/cruise ship activity or offshore activity. Traditionally there were no extra requirements for vessels operating in cold climate environments, despite the additional challenges represented. As a result, many operators did not take into account the added risk associated with their cold climate operation.

2. The International Code for Ships Operating in Polar Waters - Regulatory rationale
The International Code for Ships Operating in Polar Waters is also known as the International Maritime Organization (IMO) Polar Code [1], and will go into effect on 01 January 2018 for all ships.

The International Code for Ships Operating in Polar Waters is a functional set of requirements, and utilizes a risk-based approach. It aims to mitigate the additional risks associated with marine activities in Polar waters. Having a risk-based approach induces additional strain on the chain involved in regulating, designing and conducting marine operations in a polar environment, as the risks are to be identified, assessed and mitigated through a holistic approach incorporating all aspects of the system.

Functional requirements are utilized in the offshore oil and gas industry on the Norwegian shelf. The success experienced with in this field can come as a result of a stable and close relationship between major oil operators, employees and authorities. Very few of the current marine regulations are based on a risk-based approach, with the exception of the International Safety Management (ISM) code. The process of assessing and mitigating the risk the identified in the IMO Polar Code requires in depth
knowledge in relevant fields, and the outcome of the assessment is never any better than the knowledge available during the process.

The IMO Polar Code requires additional equipment to be carried, e.g. equipment that enables survival on ice/land and equipment that enables a minimum of 5 days survival time. 5 days have been defined by IMO due to the lack of infrastructure and remoteness present in the polar region. This represents a challenge with regards to the capacity in the rescue craft, and downsizing, operating with a reduced number of passengers, can be a possible solution.

Currently there is no common understanding of the interpretation of the code. As a result, there are variations between flag states and classification societies on how to achieve compliance. For vessel operators/transportation providers the lack of consistency, predictability and transparency represent not only a practical challenge. It also induces an economic risk as downsizing, can be a result of the implementation of the IMO Polar Code. Downsizing or operating with a reduced number of passengers will greatly affect the profit of a marine operation.

3. SARex
An increased activity within the field of expedition cruises is experienced in the Arctic. This increase is expected to persist in the coming years. The tourist industry in areas like Svalbard is already preparing to meet the expected increase in visitors to the area [2].

Much of the focus involves increasing the tourist activities and raising the revenue generated by the visitors. Few questions the safety and the risks involved in these types of activities. Limited understanding of the complex multi-discipline challenge of surviving in a rescue craft in a cold climate environment has troubled the marine industry since the first draft of the IMO Polar Code was released. Our goal has been to investigate and quantify survivability related to a major marine accident in the Arctic/Antarctic, and assess if our results are in line with the global societal expectations and the 5 day requirement as stated in the IMO Polar Code.

To increase the understanding related to the complex multi-discipline challenge of surviving in a rescue craft in an Arctic environment full-scale experiments have been conducted. The project has been called SARex [3] and the objective has been to increase the level of maritime safety through quantification of survivability in relation to Safety of Lives At Sea (SOLAS) approved equipment. The full-scale experiments have been conducted utilizing the Coast Guard vessel KV Svalbard in close cooperation with regulators (Norwegian Maritime Authority, Petroleum Safety Authority, ABS and DNV GL), equipment manufacturers (Norsafe and Viking-Life), in addition to experts within their respective fields (e.g. medical personnel and risk expert).

To fully grasp the concept of survival at sea, following an abandoning ship incident, there is a need for improved understanding of the mechanisms involved. An increased understanding of the mechanism involved, in combination with a functional based rule set, enables sub-suppliers to design their safety systems in a sustainable manner, incorporating not only the functionality required to supply adequate survival, but also at the same time take into account the economic demands enforced by the industry.

The results from our experiments have been communicated to the relevant major stakeholders in the global marine industry, including the Norwegian Government, maritime administrations, IMO, vessel operators/transportation providers and equipment suppliers.

4. The path of regulatory development
Much of the current regulatory regime enforced by IMO [4] has been developed as a result of a retroactive processes preceding a major accident, e.g. the Titanic accident triggered the development of the SOLAS convention.

It is however important to note that the implementation processes taking place in IMO requires extensive time and consensus among the member states. As almost every country in the world is a member state of IMO. Considerable divergence among cultures, financial situation and involvement is experienced among the different members. As a result, common consensus among the member states
can at times be hard to obtain. It is at times experienced that political agendas overrule scientific facts in the voting processes.

As there are many stakeholders and agendas, regulatory development can be regarded as a process of causation, where the process focus on predictable aspects of an uncertain future. We humans have limited control of the future. We retrieve knowledge to handle uncertainties. Both the regulatory goal and the regulatory development path can be unclear, just like economic decision-making. The regulatory development process has strong analogies with the theories described in Saras D. Sarasvathy “Causation and Effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency” [5].

Traditionally full scale experiments or “reduced full scale” experiments, e.g. towing tank experiments, have been utilized in design processes. In cases where the problem is complex and cross-disciplined, where all the individual mechanisms and interactions between the mechanisms have not been properly understood a holistic or “black box” approach can be utilized.

5. Stakeholders

Working with regulatory development within the marine industry on an international level require an in-depth understanding of both the evident and at times hidden agendas of the different stakeholders. The main stakeholders affecting work related to marine safety can be summarized as follows:

- **IMO** – The International Maritime Organization is a special agency under the UN. It has currently 172 member states, usually represented by their maritime administration. IMO is organized through 5 committees, each with several sub-committees. The work associated with life saving appliances is anchored in the legal instrument, the SOLAS Convention, which is administered by the Maritime Safety Committee (MSC).
  
  Many of the decisions made in IMO are based on finding common denominators and reaching a consensus among the member states. This process is time consuming and often involves taking into account political and national interests.

- **National interests** – In Norway the marine industry is governed by the “Norwegian Ministry of Trade, Industry and Fisheries” and the national interests are administered by Norwegian Maritime Authority [6]. The Norwegian Maritime Authority (NMA) is not only administering and enforcing our national requirements, but is also administering our maritime registers (NIS/NOR registers). The vessels registered in our national registers are to comply with our maritime regulations. In most cases, the vessel owners are companies registered in Norway. Due to the income generated by the taxes imposed on the vessel owners, the individual nations strive to have commercially competitive regulations, both within the maritime regime and the taxation scheme.

- **Petroleum Safety Authority (PSA)** – The responsibility of the Petroleum Safety Authority [7] is to ensure an adequate safety level on offshore installations on the Norwegian Shelf. It is administered by the “Ministry of Labor and Social Affairs”, PSA is only concerned with our national interest and no international consensus is required with regards to regulatory development/implementation. PSA has no formal legal connection to the maritime industry (ships/vessels registered under NIS/NOR or any other maritime administrations), unless they are drilling on the Norwegian Shelf. They will however enforce requirements on offshore drilling operators, including their sub-suppliers like offshore supply vessels. Traditionally the requirements enforced by the PSA have been more conservative than the ones enforced by the NMA, addressing weaknesses in maritime regulatory regime.

- **Classification societies** – Classification societies are interpreting the regulations defined by the coastal administrations. In some cases, they act on behalf of the costal administrations. Other times they act as objective third parties. It is however important to note that having vessels registered in a classification society generates income for the society. This mechanism forces the societies to compete against each other in an aggressive marked. As a result, the societies
have to balance the need for conservative interpretation of the regulations with the cost implied on vessel owner/operator to keep a fleet registered under their rules.

- **Vessel owners/operators** - The vessel owners/operators have to cover the cost associated with the regulatory requirements. The owners/operators also have to pay insurance, which again is only valid if the vessel complies with the flag state requirements, typically enforced by class. In general, you are regarded as a responsible owner/operator if you operate in compliance with the flag/port state requirements.

- **Equipment producers** – the equipment producers provide the vessel owners/operators with equipment that enables them regulatory compliance. The safety equipment is usually evaluated on regulatory compliance, price, capacity, weight and volume, where regulatory compliance has to be in place, and where price is the key most important parameter determining the sales volume.

- **Ship officers/crew** – The training of the vessel crew is defined in the IMO STCW convention and their interest are safeguarded through unions, e.g. Norwegian Seafarers' Union [8]. The unions enforce strong interest in the safety of the officers/crew, and have representatives present in IMO.

- **Passengers** – The safety of passengers is safeguarded by no individual organization. Usually their safety is the responsibility of the cruise operator/transportation provider. Their motivation of safeguarding their passengers is the risk of economic implications caused by an incident/accident. It is however important to note that the cruise operator/transportation provider main motivation is to generate a profit, which involves keeping the cost at a minimum level. To stay commercially competitive, they are often forced to keep the cost related to safety equipment at a minimum, but still within the levels defined by the regulatory regime.

6. **Societal perspectives**

In the marine industry the decision processes is seldom “black and white”, and it involves many considerations that interact on the different stakeholders in different ways. This is influenced by culture, economic robustness, global politics and facts. As described in “Technologies of Humility” [9] science only offers part of the picture. It is important to understand that reaching consensus with regards to regulatory development and regulatory interpretation is as much a balancing act, incorporating political, economical and cultural aspects as well as objective scientific data.

There are 3 main stakeholders affecting the design of safety equipment for the maritime industry, the IMO requirements (enforced through the flag state and class rules), the equipment suppliers and the vessel operators. Each party has their own agenda and much of the challenges are associated with finding the right compromise between cost and functionality. The different agendas can be summarized as follows:

- Regulators – ensuring a safety-level that is globally considered acceptable, within the frames defined in IMO and giving their flag state register no commercial dis-advantage.
- Equipment suppliers – supplying equipment that is fulfilling regulatory requirements and at the same time is commercially attractive.
- Vessel operators – providing the safety as required by the regulators at the lowest possible cost.

As defined in Social Construction of Technology (SCOT) [10] there is not just one way or one best way to design an artifact. Development of new technology or utilization of new combinations of existing technology could increase the safety levels considerably. This would reveal many unique opportunities with regards to development of new commercial products. However, the marked will not purchase these products unless they or their functionally is defined as a compulsory requirement in the governing regulations, or the products can be regarded as cost efficient solutions.

A result of the above mechanisms is that increased maritime safety is mainly accomplished through regulatory development and regulatory interpretation. This will later will be followed by development of new products. “Proof” that the current situation is not in line with the global societal expectations
typically initiates regulatory development. This “proof” can be obtained through a major accident, and traditionally the marine regulations are retroactive and major regulator changes has emerged in the wake of major accidents.

“Proof” can also emerge because of scientific documentation. Through the SARex exercises, we have investigated the survivability to be expected if a real accident occurred in an Arctic/Antarctic region. The survivability figures obtained does not meet the global societal expectations or the 5 day requirement as defined by the IMO Polar Code.

As the maritime administrations are responsible for defining the acceptable risk levels associated with maritime activity. It is therefore important that the results from SARex have to be communicated to the maritime administrations, which further will communicate these finding to the international community through the IMO regime.

For the stakeholders represented as regulators, our results have to be incorporated in their organizations. The vessel operators/transportation providers are in general skeptical to findings that will induce additional costs that is to be carried by them. On the contrary to what many expect, the equipment manufacturers have very few opinions on the issue, as they only provide equipment according to regulatory requirements and have no responsibility beyond that with regards to the functionality or survivability provided by their equipment.

The international maritime industry is a complex structure with many stakeholders. Michael Gibson addresses this type issue in “Science new social contract with society” [11] where he states that the price for increased complexity in society is a pervasive uncertainty. The same can be the case in the marine industry where ownership and responsibility can be hard to identify [12].

7. Responsible Research and Innovation Challenges
A responsible research and innovation approach [13] continuously seeks to:

- Anticipate – evaluate the impacts induced by the research activity
- Reflect – reflect on the implications of the results from the research activity
- Engage – opening up for relevant discussions in a broader audience
- Act – utilizing the above processes to influence the direction of the research process.

One way of fulfilling the above principles is that all societal actors are to cooperate and work together to align both expectations and results to societal needs. The SARex project has incorporated representatives from all major stakeholders within the maritime industry. This induces continuously discussions and dialog on the purpose, direction and implications of our findings.

The SARex project and its findings have also been present at several academic conferences, in addition to industry conferences. As the project has broad public interest, the results have also been communicated through media, in addition to several closed industry seminars.

Through our work on communication we have obtained dialog with multiple stakeholders that otherwise would have been difficult.

Among the maritime industry, in addition to all project participants, there is no disagreement on the importance of the issue of survivability on rescue crafts, and further knowledge is required. There is however conflict of interests among the different stakeholders. This is mainly due to the potential cost induced by our findings.

One of the main principles of the regulatory regime imposed by IMO is that there is to be no discrimination among the member states. From a vessel operator/transportation providers point of view this means that all competitors are to compete on “equal grounds”. To our knowledge, there is currently no common consensus with regards to interpretation of the IMO Polar Code. If SARex can contribute to help the global marine industry reach a consensus that would be beneficial for all parties involved, despite the fact that there will be a higher cost associated with the solution. IMO processes are essential to reach this consensus. This takes time and a closure cannot be expected for several years.

There are currently no indications that disruptive effects will reduce the need for cold climate marine activities in the future. However, there might be some unforeseen and unpredicted societal effects of our work. There are many examples where societal impacts and effects have not been adequately considered.
in the early phases of the project [14]. Unforeseen impacts of our work remains speculations. If it turns out that survival along the lines defined in the IMO Polar Code (a minimum of 5 days) is not achievable within the limits of the industry, a combination the following effects are to be expected:

- **IMO will have to reverse the implementation of the Polar Code.** Reversing the implementation of the regulations is extremely difficult. It is a process that will take years and involve high-level political discussions in the IMO.

- **Investment in the expedition cruise industry is dependent on predictability and transparency.** As the Polar Code represents a possible high cost, and potentially a loss of income due to downsizing measures, investments can be regarded as a high risk venture.

- **The nearest vessel in case of a cruise ship incident in the high north is most likely another cruise ship.** With lower economic margins there is to be expected a reduced activity. Fewer vessels will again result in a longer response time. As a result, the passengers on expedition cruises to the high Arctic will expose themselves to an increased risk.

- **The polar states will have to substantially increase their budgets set aside for Search & Rescue capacities to ensure a sustainable Arctic development.**

The societal impacts and effects will most likely not reveal it selves until a major accident occurs, typically involving loss of life. Not only will the accident have to occur, but the accident will also have to be communicated to the public through the public media channels. Based on historical events it is a paradox that lives have to be lost before a major effort is put into regulatory development trying to safeguard lives.

8. **Concluding remarks**

Closure of the challenge related to survival in rescue crafts is achieved when the global marine industry reaches a consensus and perceives the problem as solved. This process will be influenced by not only the objective facts generated by academia, but also political and economic agendas. Science can only indicate that a potential disaster can occur and the effect of the different mechanisms at play.

It is evident that an increasing part of the marine industry is moving its operation into polar regions. Limited activity has been observed with regards to development of infrastructure in the relevant areas. This includes communication, SAR, and oil spill preparedness. This lack of infrastructure put a larger strain and responsibility on the industry which has to mitigate this lack of infrastructure. The costs associated with these mitigation-measures have to be covered by the industry.

As the global maritime industry is a complex and competitive industry where almost every party has a separate agenda. It is highly important that we, as a scientific institution, stay clear of commercial economic opportunities related to this work. Our credibility within the maritime sector is dependent maintaining the status as an objective third-party. The moment we, as a scientific institution, contribute in driving a political process in a direction where our motivation can be linked to our own economic gain; industry, regulators, governments and the IMO will question our credibility. This will terminate our role as a leading knowledge provider for the maritime sector.

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