Improving Personal and Group Survival Equipment for Ships in Polar Waters

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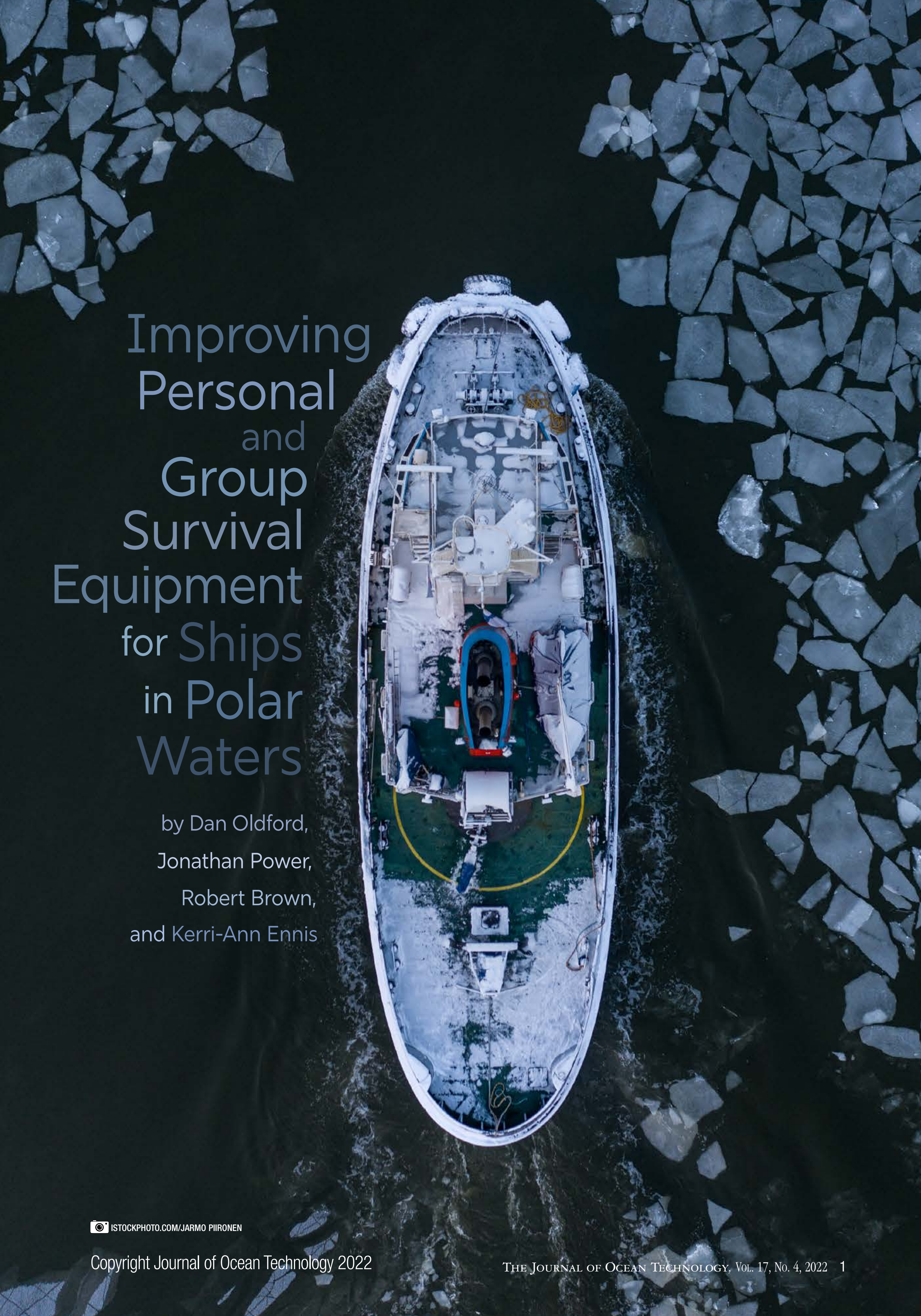

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A Canadian team has created an International Organization for Standardization (ISO) standard that provides practical guidance for operators on how to improve survivability.

The entry into force of the International Maritime Organization's (IMO) International Code for Ships Operating in Polar Waters (the Polar Code) was an important milestone for the shipping industry, but like much global regulation, it remains a work in progress. Many of the important aspects for polar operations are contained within non-mandatory parts of the Polar Code and provided as recommendations rather than requirements.

With maritime operators in polar waters strongly focused on the safety and sustainability of their operations, many stakeholders believe there is a need to turn some of these general recommendations into formal guidance and, in time, perhaps regulations too.

Operational assessment (OA) of a vessel sailing in polar waters centres on a hazard identification process that quantifies risks based on the known sailing area. This ensures that statutory requirements are met.

The OA and the Polar Water Operational Manual (PWOM) are intended to address all aspects of operations, including possible abandonment scenarios a vessel may encounter. The OA is generally based on a review of the intended route and season(s) of operation. With the operational "when and where" identified, the environmental hazards such as ice conditions and polar service temperature can be determined.

Following the review and assessment of the risks the vessel may encounter, risk control measures are developed when the risks are too high. This leads to operational limitations on the Polar Ship Certificate. Subsequent operational assessments serve to ensure that planned operations do not exceed the limitations and that procedures in the PWOM address the anticipated hazards.

The challenge for regulators and statutory bodies alike is to provide guidance that encourages operators to go beyond the lowest common denominator by providing flexible, best practice support for polar marine operations.

When faced with the complexity of polar operations and non-specific regulations, identifying the simplest solution is not always easy, especially for operators unfamiliar with sailing in polar waters. Taking overly complex or unproven options is rarely enough to provide the required risk tolerances that can protect the asset, environment, and crew/passengers. This is particularly true for the survival equipment that ships carry in case of a casualty or evacuation.

The Polar Code only requires personal and group survival kits while the OA identifies a need for additional equipment to enable survival for the maximum expected time of rescue. The language used in the Polar Code around this topic could be seen as loose and weak. Under the Polar Code, the risk assessment by the ship owner or operator includes a decision to specify the number of kits required and equipment carried in them, but makes no mention of the quality or suitability of the equipment for survival in Polar Regions.

It is a problem recognized by polar practitioners and safety experts. To help solve it, in 2020 Transport Canada's Nathalie Godin led a team comprising Jonathan Power of the National Research Council of Canada, Robert Brown and Kerri-Ann Ennis at the Marine Institute of Memorial University of Newfoundland and Labrador with input from the ABS Harsh Environment Technology Centre, also based at Memorial University.

The team set out to analyze how the Polar Code was being implemented in practice and create a feasible framework that could gain industry acceptance. This was done by developing practical and functional

Figure 1: The team focused on the process of maximizing the chances of survival should a crew and/or passengers find themselves on the water in a lifeboat or life-raft or on ice/land.

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requirements for equipment that improves the likelihood of surviving a maritime incident in the Arctic. ABS drafted the first iteration of the current ISO standard and helped to drive the project using the knowledge accumulated by supporting owners with ice operations, survey experience of ships in cold and ice environments, as well as Dan Oldford's personal activities in cold northern climates.

The work was done under the auspices of the ISO, starting just as the COVID-19 pandemic began. Working remotely, the team was able to think through the process of maximizing the chances of survival should a crew/passengers find themselves on the water in a lifeboat or life-raft or on ice/land (Figure 1). This included design guidance to help crew understand what they might need to do to prepare for an incident.

One of the ways that the new standard aims to meet the goals is highlighting the importance of the survival microclimate. This is where sufficient ventilation is provided while ensuring the amount of heat loss from a stationary person is compensable (approximately 55 $W \cdot m^{-2}$ to 65 $W \cdot m^{-2}$) without

Figure 2: The team developed practical and functional requirements for equipment that improves the likelihood of surviving a maritime incident in the Arctic, including suitable protective clothing with sufficient insulation to compensate for heat loss.

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excessive shivering. This can be achieved by ensuring that the person is wearing an adequate amount of protective clothing, providing insulation sufficient to achieve this level of compensable heat loss (Figure 2).

A systems approach can also be taken so that a suitable microclimate can be achieved by using a temporary shelter *together with* insulated clothing. Thus, the ambient air temperature inside the shelter would be greater than the external environment, reducing the amount of insulation survivors would need to wear, even when the only heat source being considered is the occupants of the shelter. The shelter can be in many different forms including the vessel's lifeboats or life-rafts, provided they meet the shelter requirements.

This standard provides a new minimum requirement for personal and group survival kits, based on the team's work to supplement IMO requirements for lifesaving appliances. It also provides information on how to increase the chances of survival for all persons – crew, passengers, and other personnel – by reducing the duration of the search phase to minimize exposure time and increasing the ability of a person to self-rescue.

The new standard offers requirements for selection of appropriate survival equipment while following the Polar Code's philosophy that additional survival equipment is only needed if the ship's existing equipment is inadequate for the intended operation.

We hope and expect that the guidance will move rapidly through the industry acceptance phase, towards adoption into a future revision of the Polar Code. The fact that the guidance has been developed to an ISO standard should make that process more straightforward, further improving the safety of polar shipping.

Dan Oldford is the principal engineer at the ABS Harsh Environment Technology Centre located within Memorial University in St. John's, Newfoundland and Labrador, Canada. He grew up in a small mining town in western Labrador, where he enjoyed many outdoor activities from mountain biking, hiking, camping, snowmobiling, and snowboarding. Mr. Oldford has been working for ABS since 2003, with most of his experience as a senior surveyor in Canada. Surveying in Canada, including the North, he saw, first hand, many problems that ships, rigs, and their operators face in low temperature environments. One of his responsibilities was to ensure that these damages were rectified and the root cause removed to ensure the damage did not reoccur. In 2012, he joined the ABS Harsh Environment Technology Centre, where he is now involved in many projects that utilize his unique skillset and experiences. This includes managing projects to develop new guidance for winterization, further development of the ice class requirements, helping shipping companies comply with the Polar Code, and establishing critical scenarios for icebreaker design specifications.

Dr. Jonathan Power is a research council officer with the National Research Council of Canada (NRC). His primary area of research is in marine safety, focusing on human performance in extreme environments. In addition to his research activities, Dr. Power is a member of the NRC's Research Ethics Board and various standards groups, including Canadian General Standards Board Helicopter Passenger Transportation and Immersion suit systems (CAN/CGSB 65.17-2012); the lead for the Canadian mirror committee for the Working Environments section of ISO/TC 67/SC8 "Arctic Operations"; and a member of the Canadian mirror committee for ISO/TC 8/SC1/WG 1 "Lifesaving Appliances and Arrangements."

Dr. Rob Brown is a research scientist with the School of Maritime Studies, Marine Institute, Memorial University. He is a professional engineer (naval architecture) with a PhD in computing and mathematics from the University of Greenwich in London (understanding human behaviour during passenger ship evacuation). For almost 20 years, Dr. Brown's research has focused on measurement and modelling of human behaviour and equipment performance for emergency situations at sea, in fires, and in the Arctic. He has spent thousands of hours conducting field experiments at sea and in the Arctic, and has contributed to the development of international regulations and standards. Dr. Brown is currently co-supervising four PhD and four master's students.

Kerri-Ann Ennis has been a human factors researcher in marine safety with the Marine Institute's School of Maritime Studies Research Unit since 2010 and holds a master of science in kinesiology from Memorial University of Newfoundland. Prior to joining the research unit, she was the human factors research coordinator with the Small Craft Simulation Project at Memorial University. Ms. Ennis also has practical small craft experience as a past employee of the Canadian Coast Guard-Inshore Rescue Boat Program and experience teaching water safety courses. She has research experience in the areas of maritime safety and survival, human thermal physiology, small craft simulation training, and helicopter underwater escape; and is currently pursuing a PhD at the Marine Institute.