Safe cruising in the Polar areas

In November 2007, the sinking of MV *Explorer* in Antarctic shocked the world. She was ice-strengthened, but misjudgement and operational mistakes combined with a low ice class vessel could not match the prevailing ice conditions. Today, an increasing amount of cruise ships are bringing passengers to explore the Polar waters. Few of these vessels are actually designed to operate in Polar areas and to manage the various challenges that these high latitudes present.

In 2007 the sinking of MV Explorer in Antarctic shocked the world. Luckily, all passengers and crew were saved.

The Arctic and Antarctic differ from each other, primarily because of their different geographical locations. Arctic ice is not as mobile as the ice in Antarctic because the Arctic is almost completely surrounded by land forming a semi-enclosed ocean. Therefore, ice ridges pile up more easily and become thicker than in Antarctic. Antarctica, on the other hand, is a land mass surrounded by an ocean. Ice floes can drift more freely and mix with snow, underwater ice, bergy bits and growlers, forming large underwater rams posing great danger to vessels.

"The Arctic and Antarctic are often referred to with only one word and still we are talking about an area, which is bigger than Europe," says sales and marketing director Arto Uuskallio.

Polar Code and Polar Class are not the same

The newly introduced IMO Polar Code will require additional crew training, enhanced operational practices and vessels to fulfil the criteria, which match the conditions in the intended area of operation. The intention of the Polar Code is to improve safety for the passengers, the crew and also the environment.

"However, complying with the Polar Code is not a guarantee that a vessel can manage all kinds of harsh ice conditions and freezing temperatures," Uuskallio says.

A ship intended for Polar areas needs to have the appropriate ice class. The owners, designers and administrators need to select an appropriate ice class to match the requirements for the ship with its intended voyage or service.

"It is important to understand, that the Polar Class focuses on structural integrity," Uuskallio emphasises. "Moving around is a completely different story. What if the vessel is stuck in ice for two weeks because the Captain made an incorrect interpretation of the ice field? What if the wind packed the ice so thick that the vessel cannot go through? Will the systems still work? What to do with waste and wastewater, which cannot be dumped in these fragile areas? Will somebody come to help?

Area, profile, season

Aker Arctic has been designing high ice class vessels for decades. The starting point is always to decide on the operational area, the operational profile and operational season before beginning to design a vessel.

"It is not sensible to order a vessel first and then hope that the circumstances will be favourable," Uuskallio adds.

Once the operational area has been defined the planning can start. If a vessel is only intended to sail nearby ice areas, but not actually designed to break thicker ice, a low ice class vessel can be chosen, as it will be cheaper to build. It can be PC 6 or 7 and use Aker Arctic's new multi-draft bow, which can manage well in light ice and is economical to use in open water transits.

However, a high ice-class vessel, which can manage independently in thicker ice, is more complicated to design, as the design has to be a balance between the open water performance and good icebreaking characteristics. When operating in Arctic or Antarctic waters, the safety aspect is always crucial. Therefore, a good understanding of the ice loads, effective winterisation to keep the cold out and the operation of the ship's systems is essential when designing the vessel. ▶

Crystal Cruises brings passengers to the Northwest Passage for the first time. An icebreaker accompanies the ship during the entire trip for the safety of the passengers.

Ice class is safety
First of all, from a safety point of view, the right ice class needs to be chosen. Secondly, the right performance in ice and open water has to be selected to keep operating costs down.

"Ice class is a guarantee of safety, not a guarantee of performance," Uuskallio points out.

The choices in performance concern how the vessel will manage operations in ice and open water. Operation in difficult ice conditions is of utmost importance, but also involves higher operation costs. When selecting icebreaking capabilities, it is essential to also include open water performance for cost efficiency in long open water transits.

"Our aim is to always find the optimal solution for our customers' needs, which will combine the icebreaking capabilities with hydrodynamics without at any point compromising safety," says Uuskallio.

Winterisation needs
A third area of consideration is winterisation. This means how well all the machinery and equipment can sustain freezing temperatures and how to keep the accommodation and recreational spaces comfortable.

"Winterisation is not something you can add as a warm jacket when you are feeling cold. It has to be part of the design from the beginning. At the same time, it makes the vessel energy efficient," Uuskallio adds.

Winterisation guarantees that the vessel can function in freezing temperatures. If, for some reason something would happen, the big vessel is usually the safest place to stay. Small lifeboats are cold to sit in and help can be days away.

There are different types of cruise ships and passengers. Expedition-cruises usually take more adventurous passengers, who are prepared to manage also uncomfortable situations. Luxury cruises usually carry passengers who like to dress up nicely and admire the scenery from the restaurant window. Nevertheless, safety should not be a question in either case.

That November night in 2007 was fortunate. The seas around MV *Explorer* were calm and there was enough time for the passengers to board the lifeboats and RIBs in the darkness, while their cruise vessel was taking in more and more water. Help came after only a few hours and all the passengers and crew were saved by another vessel. The next time might not be as lucky, so please contact Aker Arctic before starting to plan your Arctic cruise liner, we would be more than happy to assist you in designing a safe cruise ship.

Aker Arctic has designed strong ice vessels for decades. The starting point is always to decide the operational area, the operational profile and operational season before beginning to design a vessel. The concept drawing is for the International Marine Association's annual conference held in 1989 in Helsinki.

The Double-Acting ship concept Aker Arctic has developed can also be used for cruise vessels. The vessel advances bow first in open water or light ice conditions and stern first in heavy ice conditions. The vessel on the right is Norilskiy Nickel, an Arctic container ship designed by Aker Arctic and built by Aker Finnyards in 2006. She has been operating successfully in the Russian Arctic for ten years and does not require icebreaker assistance even in the hardest ice conditions.

Bow ahead

Stern first

Polar Class	Ice descriptions (based on WMO Sea Ice Nomenclature)
PC 1	Year-round operation in all polar waters
PC 2	Year-round operation in moderate multi-year ice conditions
PC 3	Year-round operation in second-year ice, which may include multi- year ice inclusions.
PC 4	Year-round operation in thick first-year ice which may include old ice inclusions
PC 5	Year-round operation in medium first-year ice which may include old ice inclusions
PC 6	Summer/autumn operation in medium first-year ice which may include old ice inclusions
PC 7	Summer/autumn operation in thin first-year ice which may include old ice inclusions

The Polar Class notation is used throughout the Unified Requirements for Polar Class ships to convey the differences between classes with respect to operational capability and strength. It is the responsibility of the Owner to select an appropriate Polar Class. Source www.iacs.org.uk

A safe Arctic/Antarctic cruise ship

Aker Arctic designed an Antarctic cruise ship in 2008, which was planned to be a safe cruise ship for ice conditions. Most other cruise ships sailing to the Arctic and Antarctic are converted passenger ships and actually not designed for the cold and ice.

The Arctic/Antarctic cruise ship was planned for the actual operational conditions: to bring passengers to the Arctic in summer and to Antarctic in winter.

The PC 5 ice class ship was designed as a luxury modern ice-strengthened expedition cruise vessel for one to three weeks of worldwide itineraries with about 200 passengers.

It has a double-acting stern and can break 1 metre thick ice at a speed of two knots.

The bow is optimised for open water operations but allows breaking 0.5 metre thick ice.

It is also equipped with rib boats for expeditions to take passengers to experience the Polar nature.

The vessel was not constructed due to lack of financing, but the design is available to be used as a basis for new, interested parties.

Since 2008, there have been many inventions and innovations. If the ship would be built today, the optimal hull would be the new multi-draft hull concept, which provides excellent open water performance at design draught and good ice performance when the bow is trimmed down. It would also need to be updated to meet the new Polar Code rules.

“Before beginning the process to acquire an Antarctic cruise vessel, the most important thing is to decide what it will be used for," project manager Maximilian Vocke points out. "What is the operational area and what is the operational profile? Does the vessel need to break ice or will it only stay close to ice areas? What ice class does it need to be and what is the icebreaking capability needed?"

We are now working with high interest on real Polar class cruise vessel projects, which could provide the arctic experience for passengers in a safe way.

Multi draft bow benefits ice classed cruise vessels

Aker Arctic has developed a new hull concept, which is optimised for both ice and open water. The bow form is a combination of a bulbous bow and an icebreaking bow. At design draught, the vessel uses the bulbous bow, which is optimal for open water. In ice conditions, the bow is trimmed down and then works like an icebreaking bow.

"This invention is optimal for cruise ships as they have a stable draught," says Tom Mattsson, senior specialist in ice performance at Aker Arctic.

"It offers excellent comfort for passengers with its good seakeeping characteristics. Safety is another essential feature as the vessel can manage to get away from even severe ice conditions on its own by using her excellent icebreaking capability."