SSPA has developed the Transatlantic IceMaster. The IceMaster is a risk-based decision support tool for the dimensioning and safe delivery of customised services for offshore operations in the Arctic. The expert judgment is an important input and is based on Transatlantic’s unique combination of experience in offshore operations and icebreaking for the Swedish Maritime Authorities. The Transatlantic Ice Council – a forum of associated international ice and icebreaker experts – have also delivered important input to secure decisions leading to reliable acting in the Arctic on a high service level. In addition to the IceMaster and the Ice Council, Transatlantic has also formed an Ice Academy in partnership with Kalmar Maritime Academy with dedicated ice simulator facilities and training programmes.

Based on the demands of the customer and the available resources, IceMaster supports the decision maker in choosing the right options and efficient solutions for Arctic operations. Different activities and tasks have to be conducted, such as anchor handling and icebreaking. The infrastructure in the area imposes constraints, mainly on the supply, but even helicopter support in cases of emergency needs to be taken into account. As the Arctic is a highly sensitive environment, a stringent emergency preparedness is essential. International and national authorities can delimit operations, e.g. the “Jones-Act” or emission limits.

One very complex topic is the environmental conditions on the site. Drifting ice, ice pressure, fast changing winds, among other things, can affect the operations and interrupt drilling processes. As demonstrated in the figure below, the overall planning is very complex and cannot be described in simple models. The IceMaster is, therefore, based on Bayesian networks.

Bayesian Networks
Bayesian networks are well-established within risk analysis for the description of complex systems and operations. They provide flexible input of quantitative and qualitative variables. The links are implemented, modified and understood easily through the graphical presentation even for people not used to risk analysis and mathematical modelling. In the model IceMaster, the most important parameters influencing Arctic offshore operations are modelled, but even ice-free waters are part of the model. The model allows dynamic updates and improvements to the IceMaster can be introduced successively when new experience and increased knowledge are gained.

The Bayesian networks are based on a theorem published by Bayes in the 17th century. Directed acyclic graphs connect different nodes in which these nodes represent a random variable. This variable can have different states. Explained as a simple example, for a given location and a given month in the Beaufort Sea you might know the ice thickness distribution based on statistics. The causal relation in this simple Bayesian network is that the location and the month steer the ice thickness distribution as presented in the figure above.

Risk Based Modelling – “GAIN”
Safety is an important issue in Arctic operations and forms the basis for a successful campaign. Every operator has to assure safe and reliable operations in environmentally sensitive areas.

In addition, every oil or gas company sets certain goals for the campaign, e.g. number of drilled wells for an exploiting operation. These operational objectives can include the fulfilment of the environmental limits as well. By formulating the goals for a whole campaign or parts of it, standards are set and expectations in financial terms are decided on. The IceMaster uses the goals as input to plan operations or to show the probability of succeeding by the so called “Goal Achievement INdex” (GAIN). By setting the requirements for a campaign, the IceMaster can, in this way, help in achieving the optimum solution.

Example of the application of the IceMaster
The outcome of the model gives indications about drill season length and resource optimisation. This can for instance be the number of vessels that are used in the supply of Arctic operations over a period of time. As the environmental conditions differ from month to month, the suggested resources may vary. Synergy effects can be taken into account and costs for an operation can be cut.

A topic that is attracting increased attention is the environmental footprint of a campaign. By estimating the...
IceMaster – a toolbox for the planning of arctic offshore operations

Work to be done, the footprint can be predicted and by applying optimal resource management the environmental impact can be minimised.

Output and use of the IceMaster

The IceMaster will be used as a basic tool for planning of complex operations. It inherits systematic quantification of operations with evaluation of cost-benefit and efficiency of accomplished operations and will help decision makers to project the offshore supply for coming complex operations. With the IceMaster, resource optimisation can be done on the basis of the available support fleet.

Based on the decision, support tool procedures for the whole operation or for difficult parts can be created and updated onshore and settled at company level. The model will be used for training purposes and as a simulation tool for teams and crews before heading for arctic waters. It will be used in situ by the ship masters before performing complex operations to gain awareness of obstructions and barriers during operation and to update the plans to the prevailing conditions.

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