Guidelines for Small Boat Operations in the Vicinity of Ice

(rev May 2016)

Ice is one of the most impressive sights in Polar Regions. First-hand experiences of pack ice, icebergs and tidewater glaciers is something that few visitors will ever forget and can provide a useful mechanism for explaining the driving forces of the unique natural environment of Polar Regions. Ice can also be an important element of wildlife viewing.

However, operating small boats in the vicinity of ice poses potentially serious risks and as such requires skill and alertness on the part of the driver. The following guidelines are intended to provide guidance for drivers and help enable them to make good risk assessments with respect to operating in the vicinity of ice. Every encounter with ice is different making alertness and respect for ice a critical component of being a competent polar small boat operator.

These guidelines are primarily intended for operations with small boats using outboard engines, however similar guidelines should be followed by other small boat operations including for example, kayaks and canoes taking into account the characteristics of each individual operation.

Sea Ice, Pack Ice & Brash Ice

- Pack ice can move very quickly, and can trap small boats.
- When operating amongst sea ice or icebergs, be vigilant to local sea and wind currents. Be alert to ice movement in relation to your operation and how it may affect both boat and shore operations.
- If taking small boats along the edge of the pack ice. Keep the pack ice down wind of your operation and make sure you have a clear exit out at all times.
- Small boats can drive through brash ice at low and controlled speeds. Try to pick a route that avoids large pieces of ice that may damage the boats or get stuck under the keel limiting the boat's ability to maneuver.

Icebergs & Bergy Bits

- Icebergs and bergy bits are unpredictable and dangerous – even grounded bergs. Caution should be used when approaching or doing 'iceberg tours.'
- An iceberg should not be approached closer than two times the height of the berg above water. Even then, caution should be used.
- Remember that a drifting iceberg will have localized currents around it, which may affect your boat's actual course.
- Do not enter an 'ice pool' and avoid driving over an ice foot. While they look very inviting, they are potentially extremely dangerous should the berg roll and either leave the boat high above the water or suck it under the berg.
- Do not drive through an ice tunnel or under any ice as it can collapse. Engine vibrations may affect the stability of the ice. Remember a cubic meter of ice weighs one metric ton and an ice fall near a boat is sufficient to cause real damage, potentially even flipping or sinking a small boat.
- Be aware that grounded icebergs will experience a gravitational change with tidal variation. This makes them more unpredictable to calving or breaking up.
- Leave the engine running to enable a fast exit if needed.
- Do not forget that icebergs extend further underwater than is visible from the surface. If an iceberg breaks up and rolls, ice can appear several 10's of meters (or feet) from the original site of the berg. If you see a berg start to roll: drive away from it as quickly as possible.
- Be aware that a collapsing iceberg can cause a huge breaking wave. Be prepared: if time allows drive away from the wave before turning the boat to face the wave making sure the boat and passengers onboard are prepared to ride a wave out.

Tide water Glaciers[1]

- Tide water glaciers are very unpredictable and calving is a random process. It is impossible to predict precisely when calving may occur, how large a block will be created, or how it will enter the water.
- Using calving cliff height as an estimator for the minimum safe distance is inadequate since the hinge point can lie beneath the waterline. In addition, tide water glaciers can also calve underwater, creating 'torpedos' of ice to appear unexpectedly. There is little or no warning of these events.
- Waves that are created closest to the block, in the so-called splash zone, are very large, unpredictable, and dangerous, particularly for small boats. The minimum safe distance for avoiding direct hits from ice blocks needs to be larger so that vessels are outside of the splash zone.
- Small boats cruising in the vicinity of tide water glaciers should keep ***at least*** 200 meters/600 feet from tide water glaciers to avoid both direct hits and the largest waves. For high activity glaciers this should be increased to 400 meters/1200 feet.
- Try to stay in clear water to both assure good maneuverability and also as floating, rolling ice with waves can be extremely dangerous.
- The 200 meters/600 feet distance should be increased in narrow fjords, in shallow fjords, or locations with ice cliffs higher than 40-50 meters/120-150 feet.
- Keep the engine running and be prepared to move away quickly.
- As waves become grounded, either in shallow water, or on shore, tsunami waves are created (e.g. at Neko Harbour). Small boats should not land on shores near the edge of calving cliff faces, but further around the coastline from the glacier. Even then, implications of tsunami waves should be taken into consideration when securing boats and selecting landing sites.

Range Finders

- It is **strongly recommended** to use Laser Range Finders (LSRs) during small boat operations. Regularly check distances to potentially hazardous features.
- It is recommended that the LSR has a reach of minimum 1000 meters/3000 feet.
- It is recommended to use the LSR for distance assessment training for staff.
- If you do not have range finding equipment on board then request distances from the bridge (who can use their radar to measure your distance from the hazard)

Examples of consequences of ice cliff calving:

http://www.youtube.com/watch?v=HbUIRELqowg.

http://www.youtube.com/watch?v=aDJizpbNZvw

https://www.youtube.com/watch?v=wvcGM6maGGk

[1] These guidelines are based on a report by the Norsk Polar Institute on *'How close should boats come to the fronts of Svalbard's calving glaciers?'*