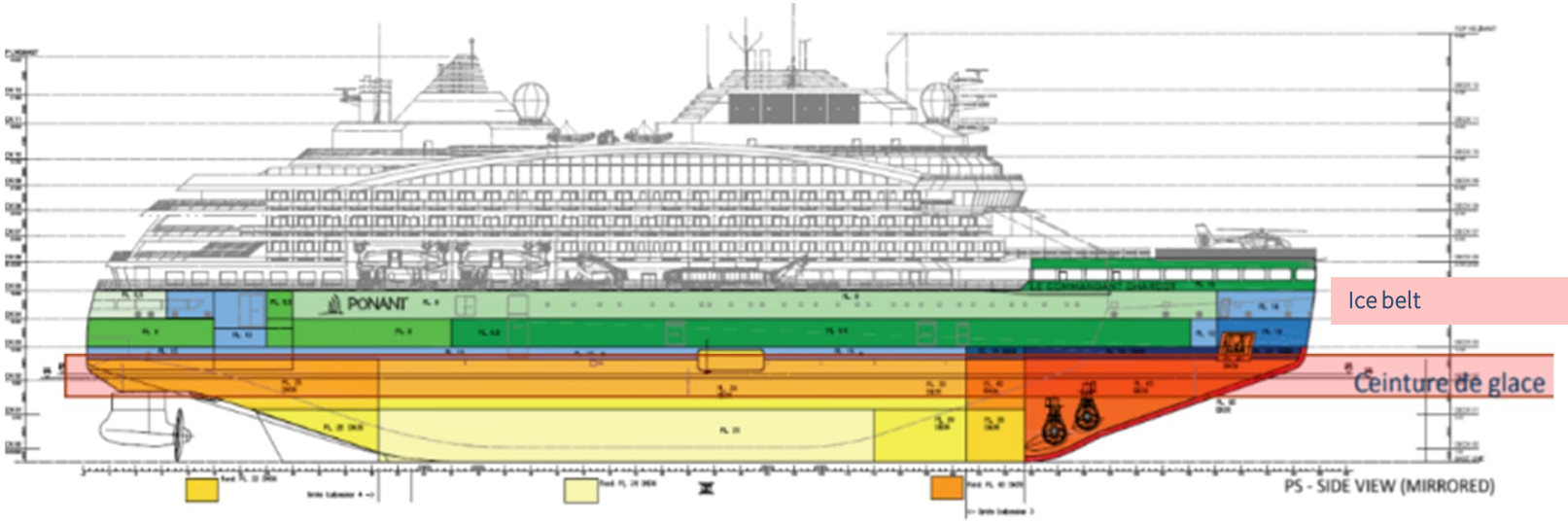
TRANSPOLAR

LE COMMANDANT CHARCOT

Explore to inspire

PONANT

PC2 allowing us to sail safely deeper in the ice / other expedition ships



Capabilities of the vessel

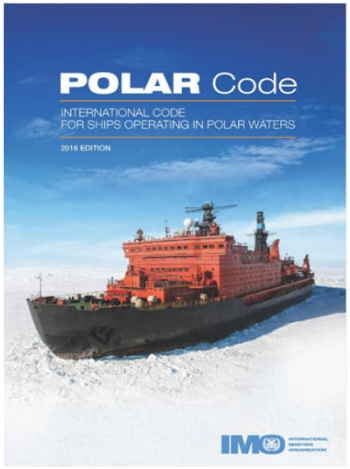
95 % Bow In & 5% Double Acting - According to type of Ice. Glacial ice has to be avoided !

ABB Azipods 2X17 MW

Hull design (by AKER)

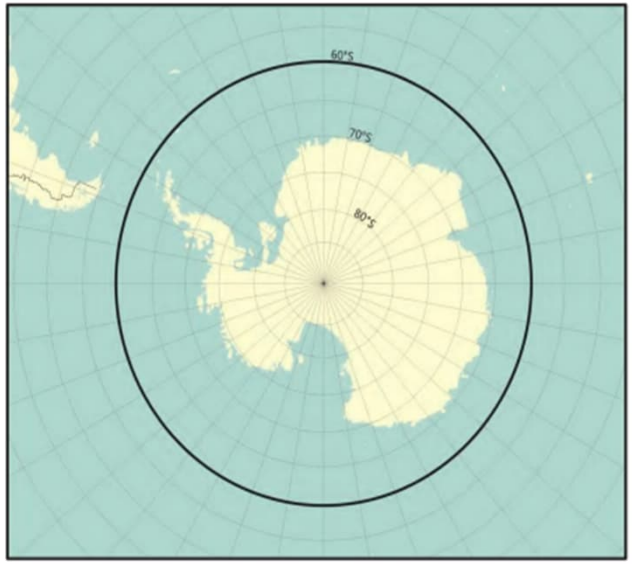
Ice Propellers (5 blades)

Polar experience, training on ice simulator, ABB training & 3 years of experience on board LCC



Bridge Ressource Management / Icebreaker arrangement
Everyone is involve and MUST be able to analyse the ice by Sat imagery

Areas of navigation in Polar Waters & seasonality



ARCTIC

- East Greenland – early spring
- North Pole – summer
- NWP - summer

Trans-Arctic - late summer

- St Laurent River Canada – Winter 2025
- West Greenland – early spring 2025

ANTARCTICA

- Weddell sea
- West peninsula
- Semi-circumnavigation of Antarctica
- Ross sea
- East Of Antarctica coast 2026

AREAS / TYPE OF ICE

ARCTIC

- EAST GREENLAND – EARLY SPRING :

Heavy Sea ice, hummocks and big floe + Snow and inclusion of glacial ice

- NORTH POLE / SVALBARD - SUMMER & LATE SUMMER

Variable Sea ice + glacial ice In Svalbard

- NORTH WEST PASSAGE (Northen route)– SUMMER

Multiyear Sea ice in the northern part of Canada NWT and glacial ice (few)

- TRANSARCTIC – LATE SUMMER

Variable Sea ice – hummocks & big floes - Nilas

ANTARCTICA

- WEST PENINSULA - SUMMER

Variable Sea ice and glacial ice

- WEDDELL SEA – EARLY SUMMER

Sea ice (inclusive on multiyear ice) and glacial ice

- SEMI-CIRCUMNAVIGATION & ROSS SEA – LATE SUMMER

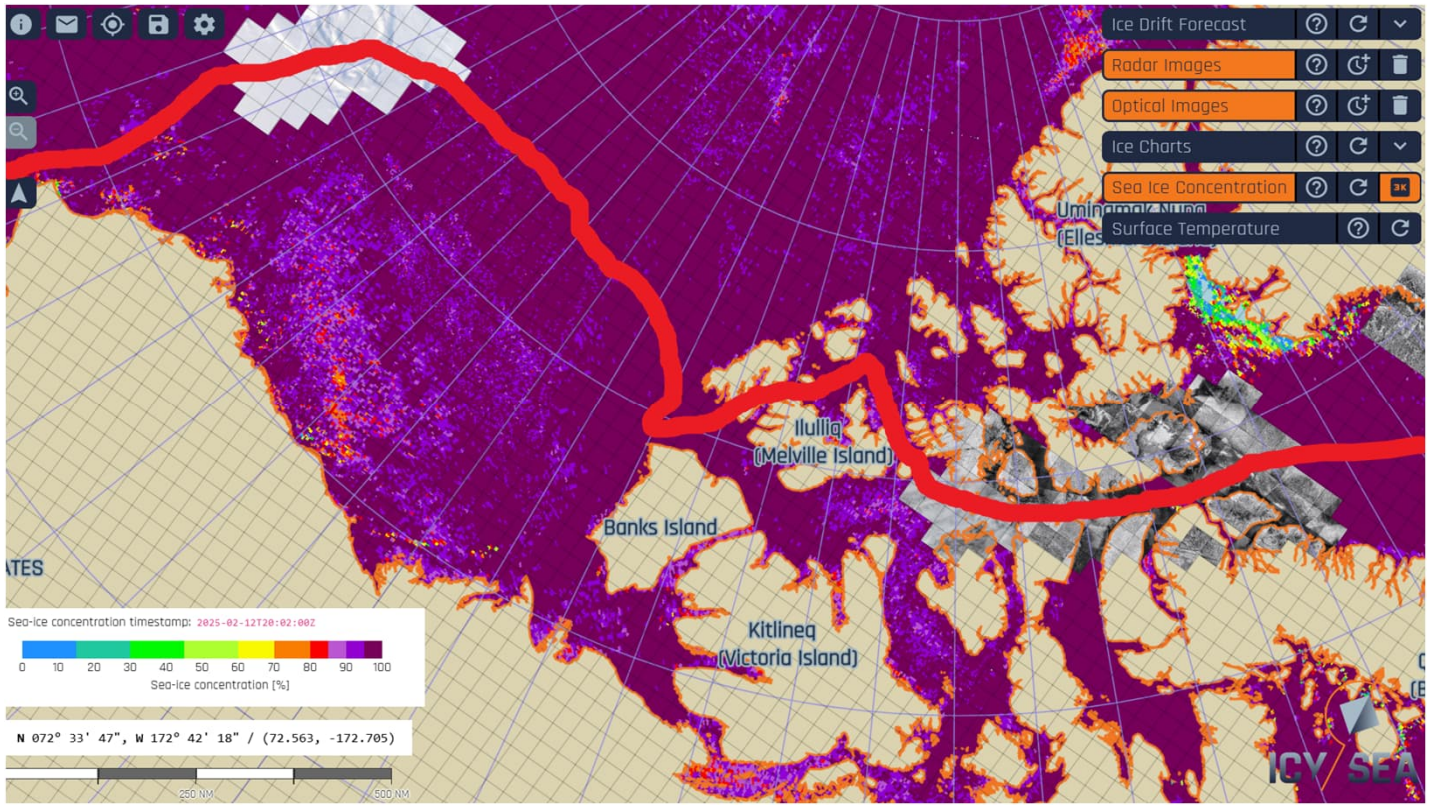
Variable Sea ice and glacial ice

NORTH WEST PASSAGE

By the most Northen route via North of Melville Island & Queen Elisabeth Archipelago

Ice navigation mainly in Beaufort Sea. The ice edge is every year further north.

Drifting Sea ice drifting / Variable floes / 1 to 2 m rrotten/ New ice / Hummocks.



EAST GREENLAND

The most chalenging in early spring ! When LCC is showing her best performances.

Drifting Polar ice agglomerated to fast ice in winter : thick and hard

Multiyear and heavy first year ice drifting to south 0,5/0,8 knts / Big floes up to milles / 1 to 3 m / hummocks

A lot of pressure after a Low (even after 24h) / difficulties of rammings / 5 to 6 DG & Batteries (up to 100 ramming)

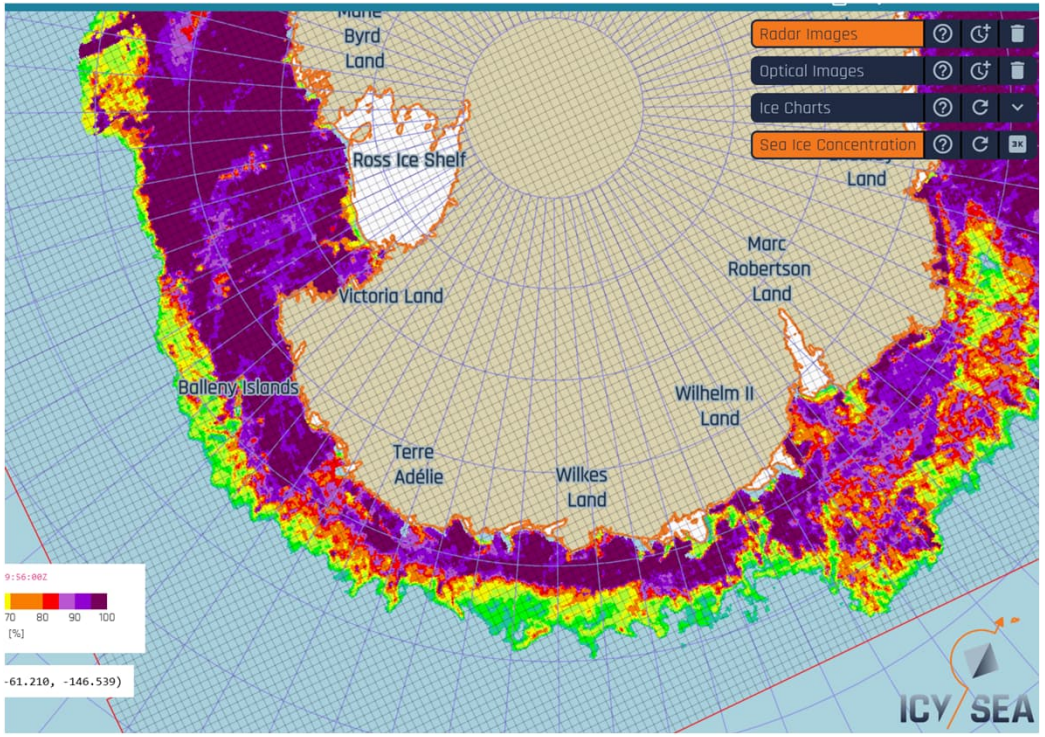
The Pods are suffering…Especially from Astern /Use of Aft bridge if the ramming is too long

Inclusion of glacial ice (icebergs, bergs and growlers).

ANTARCTICA

Semi-circumnavigation by the West / Semi-circumnavigation by the East in 2026

Variable ice conditions / year. Mix sea ice (first year) and glacial ice (Big Tabulars icebergs)



EFFECTIVE NAVIGATION IN THE ICE

ARCTIC

- East Greenland
- North Pole - 4 trips / year
- North West Passage
- Trans-arctic
- Total : about 125 days in ice

ANTARCTICA

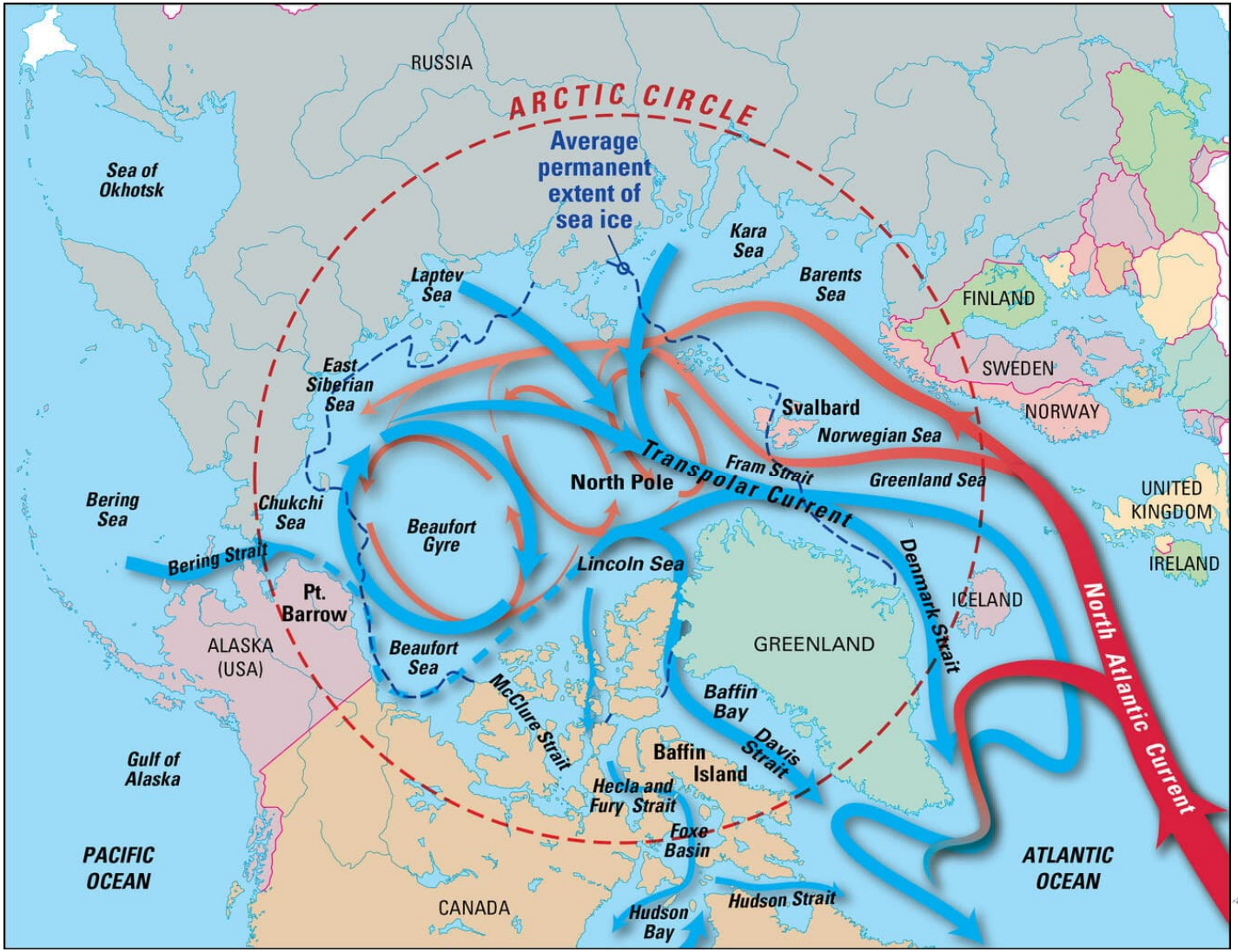
- West peninsula :
- Weddell sea
- Semi- circomnavigation / Ross sea
- Total : 75 days in ice

- ***Every year : about 200 days in all type of ice***

TRANSPOLAR - *Arctic region currents.*

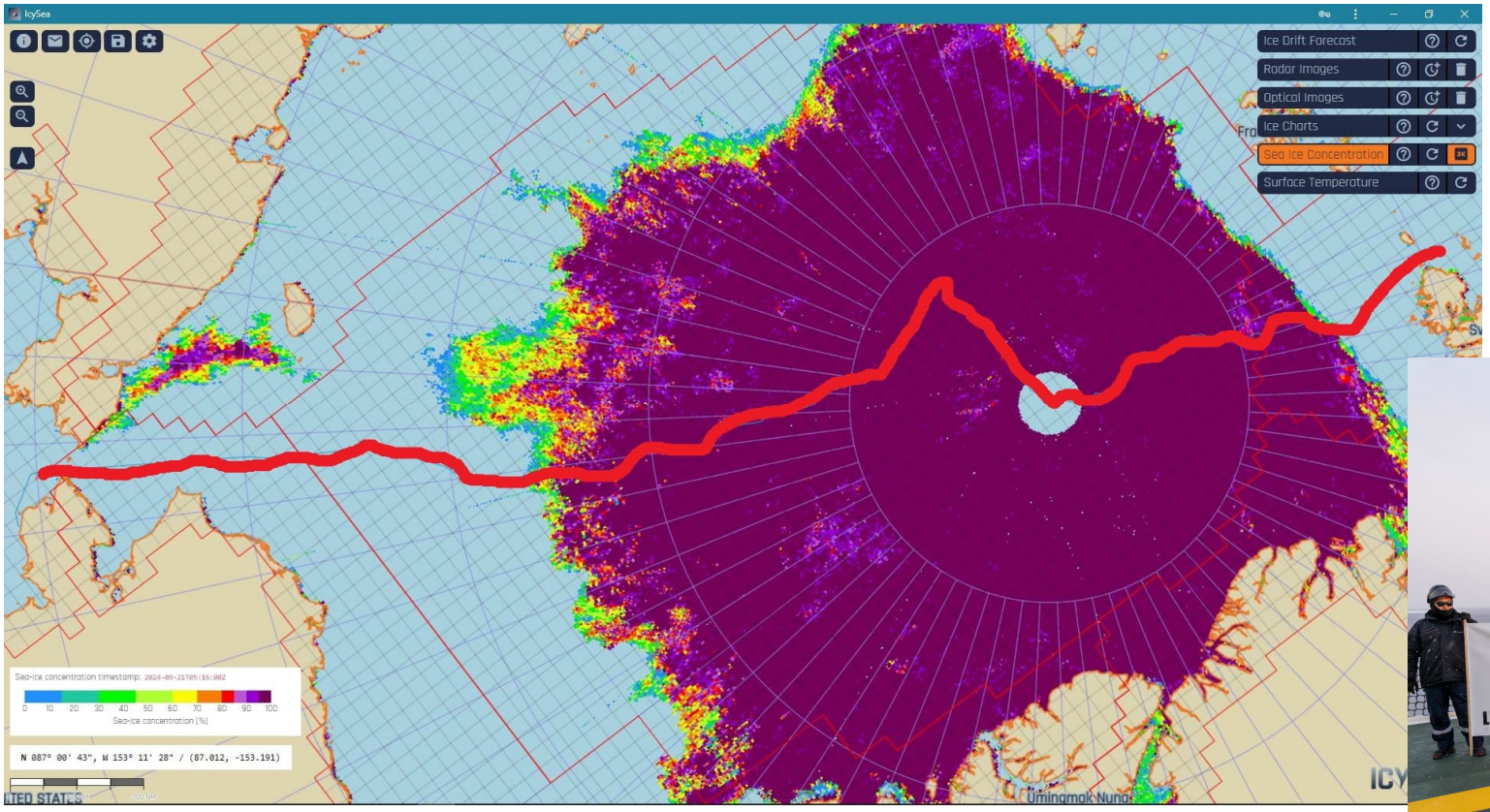
Blue currents are cold, relatively fresh water. Red currents are warm salty water.

The strategy is to avoid the northern part of Canada & Greenland.



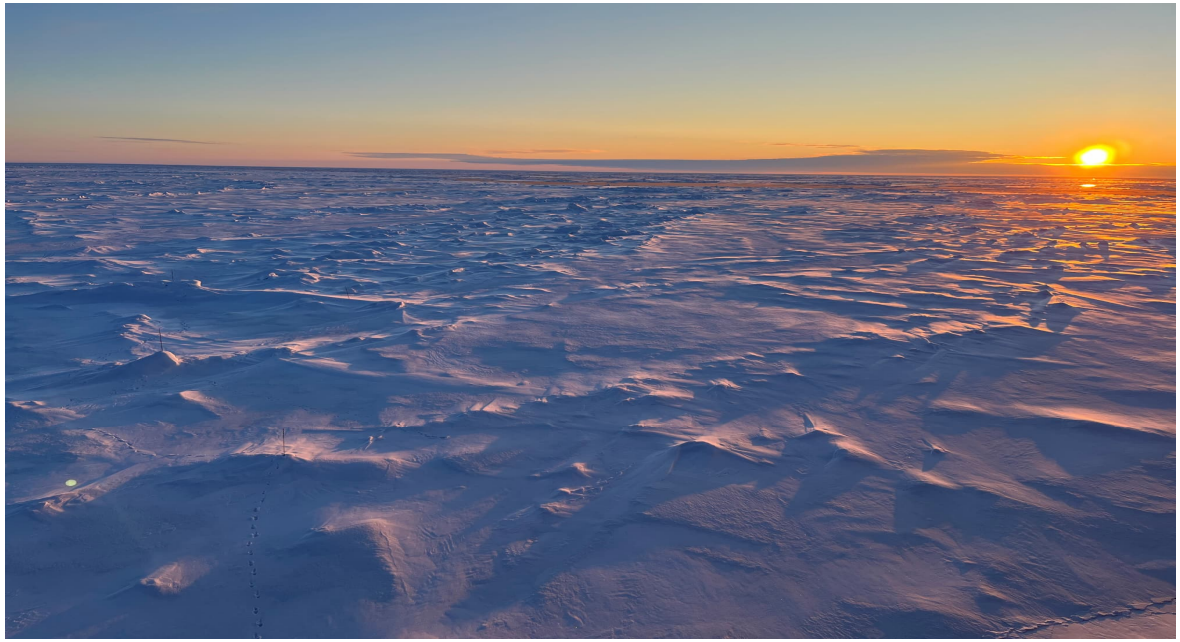
TRANS-ARCTIC or TRANSPOLAR route (TSR)

- The shortest way from Pacific to Atlantic Ocean / First time in the history from Nome to Longyearbyn.
- 3 poles : Inaccessibility, Magnetic, Geographic
- Cruise guided by the science with 22 scientists from various nations (Mission CHARCOT)
- 2/3DG & Batteries / Average speed in the pack ice 7 knts (1700 miles)



ICE REGIME

- Mainly Ice navigation crossing the Arctic Ocean (2000 miles in the ice)
- Drifting sea ice / 1 to 3 m rotten ice (september) / hummocks, variable size of floes with new ice (Nilas) in the leads.
- Avoiding the northern coast of Canada and Greenland (older and thicker).
- Consideration : remoted icy areas. The only vessel capable to rescue us is 50years of V.



ICE ROUTING

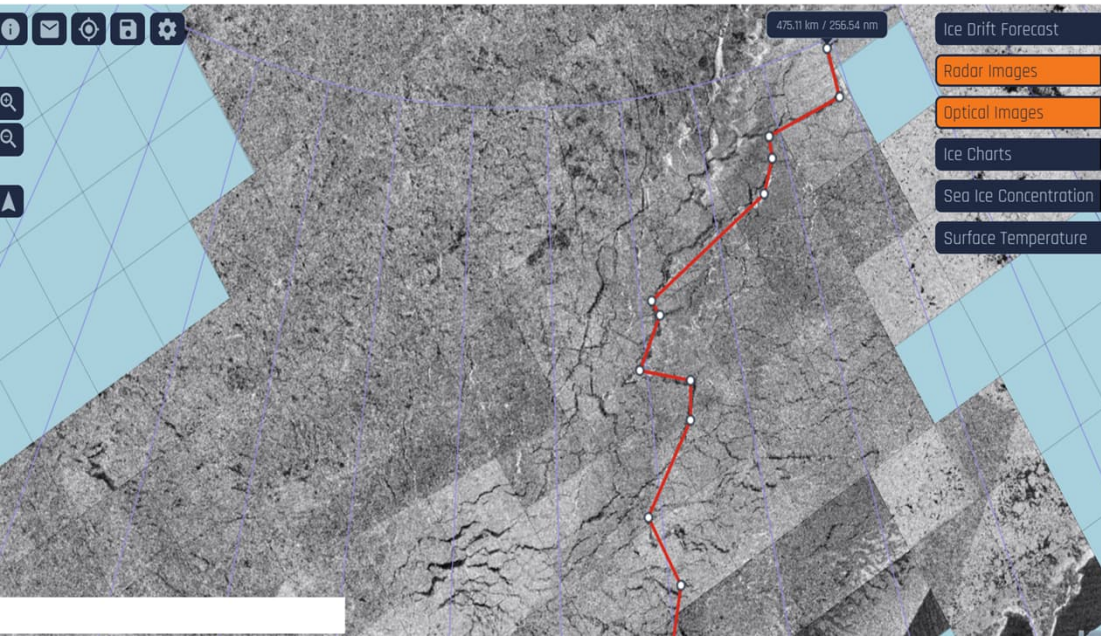
- **<u>Drift noise Icysea</u>** with a lot of improvement and cooperation with Ponant :

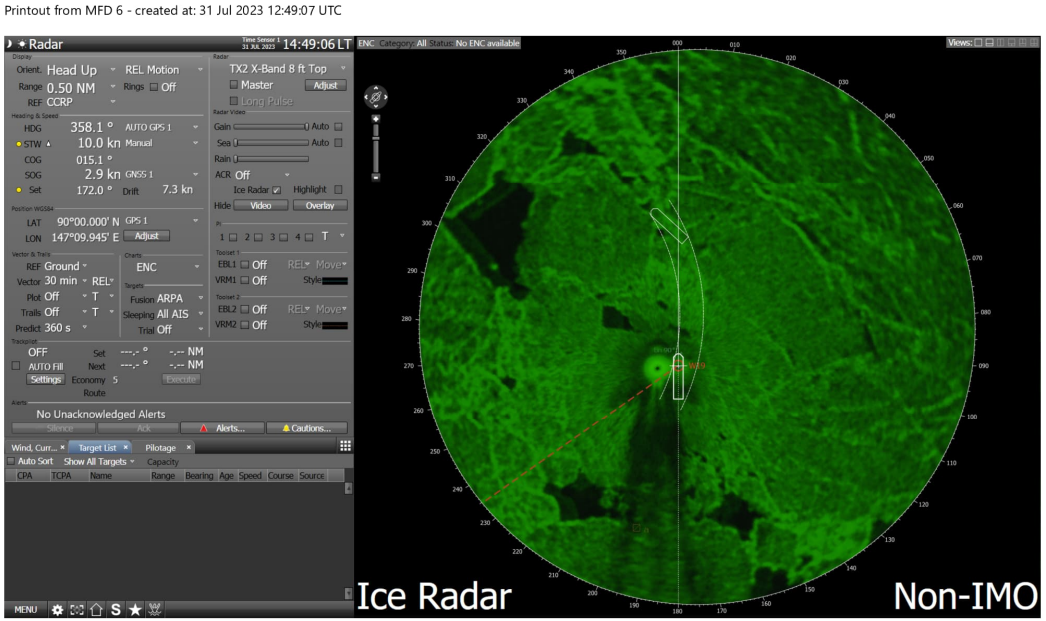
Wider areas – ice charts – Modis & Radar pictures SAR and frequencies– ice concentration (jap model) etc…

Adrena

- Visual comparaison with ice radar (All bridge team well trained and involved). New auto interpolation in progress
- Exportation of the RTZ route from the Icysea to the radar

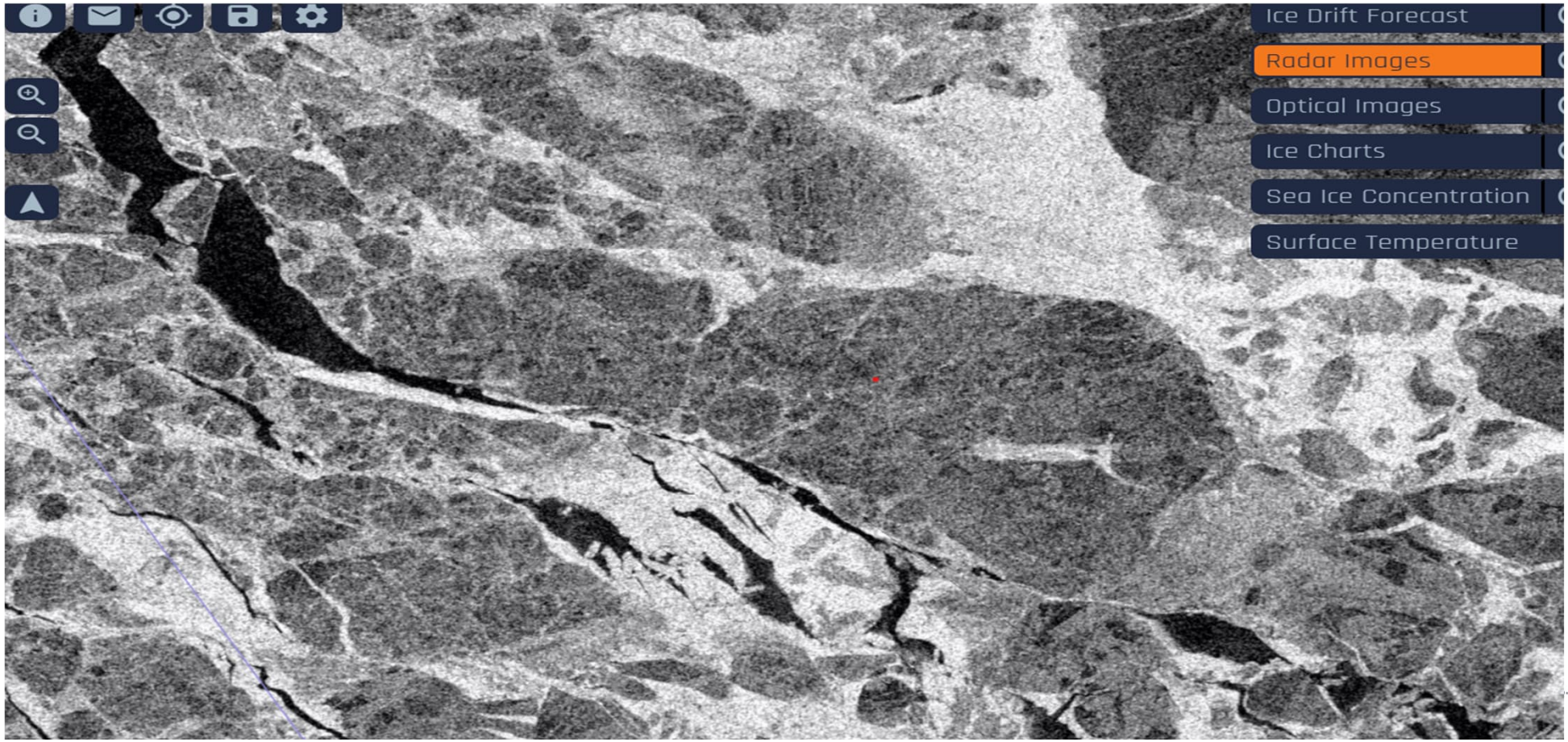
- Helicopter reki (50 milles max)





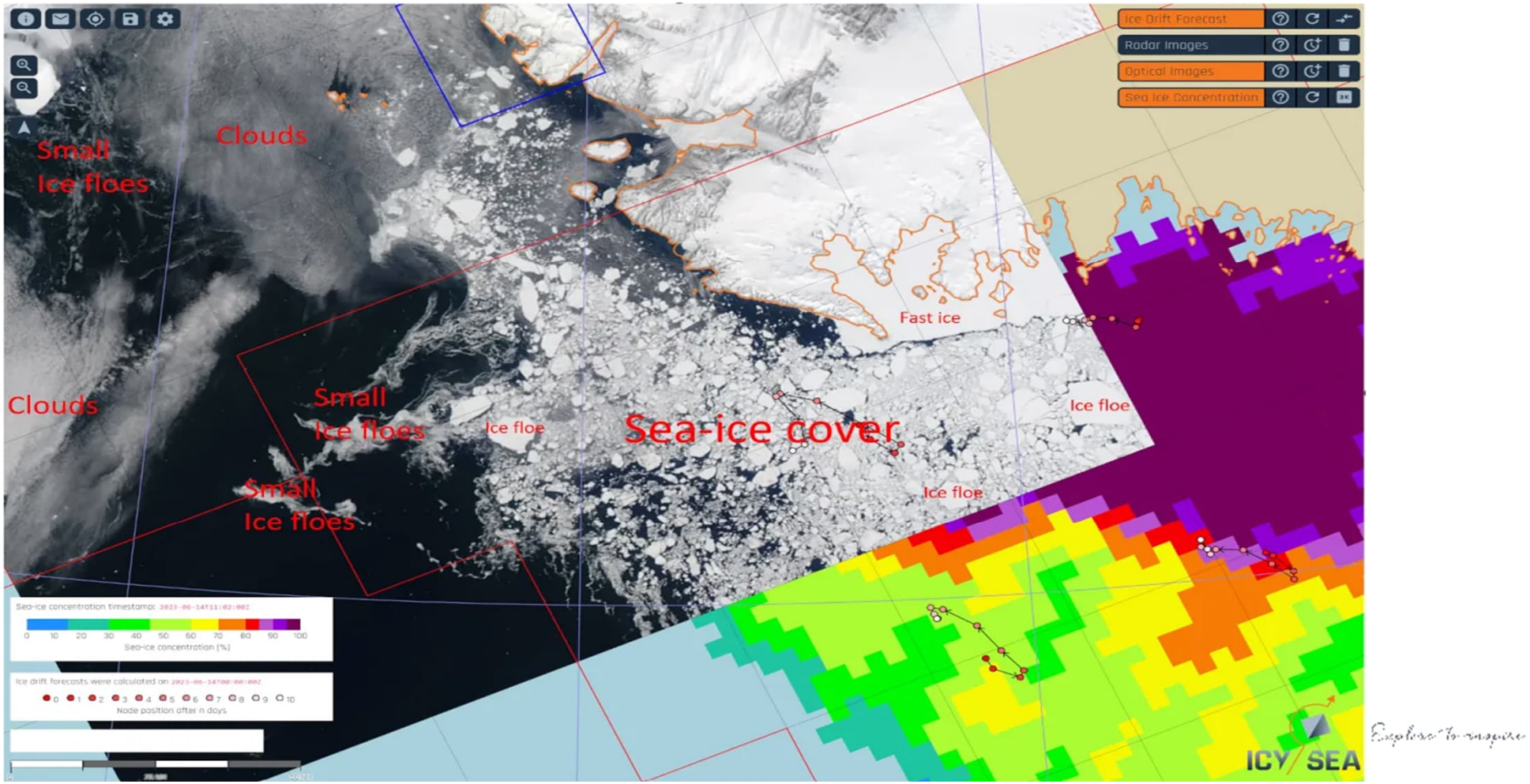
Radar Sat Image SAR

Access to high resolution near-real time synthetic aperture radar (SAR) satellite images. The image will analyze the **ruggedness** of the surface and will not be affected by the clouds. Whatever you see on the radar images: Rough surfaces appear brighter (white) than smooth surfaces (black).
With some experience, you can directly identify sea-ice structures such as individual ice floes or open cracks and ridges.
For high-resolution images, one image pixel is 30 x 30m; for low-resolution images, one image pixel is 300m x 300m.



MODIS Optical Image

The optical image consists of true color satellite images provided by NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) instrument, These images are photographs taken from space and are updated daily. Easy to analyse if the sky is clear

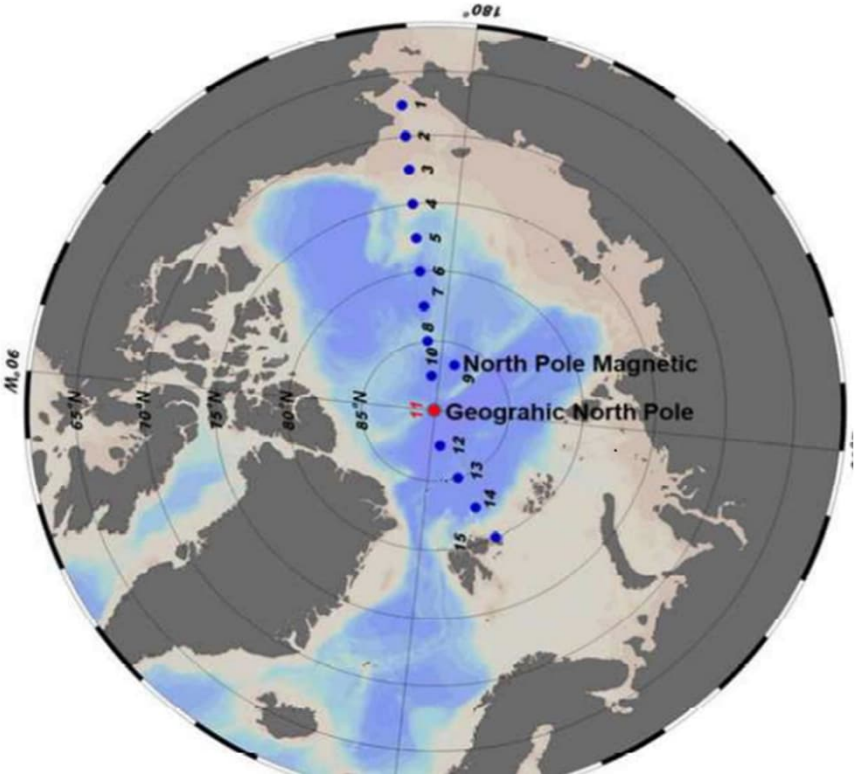


ICE RECKI BY OUR HELICOPTER

- 1 Helicopter H125 – 50 miles range but more according to configuration - 1 pilot + mecanic.
- Tablet with Icysea hold by one Officer in charge (Captain, or First Off etc…) to scout and record the WPs
- Better routing, update & optimizing the Sat analysis, Confort, Save Fuel

SCIENCES

- A platform of opportunities for scientists / Dry & Wet Lab + Rosette.
- Places where No ships can go or in early season.
- About 100 programs in 3 years with 200 researched and 40 Academic/Institutional Partnerships. (2 to 4 scientists per cruise invited by Ponant. Open datas.
- 3 poles : Inaccessibility (not programmed), Magnetic, Geographic
- Transpolar : 22 scientists (Mission CHARCOT) / 14 stations
- SIMs



« A CRUISE GUIDED BY THE SCIENCE »

- Mission « CHARCOT »
- Daily observations by the bridge (Logbook). Ice & wildlife.
- Daily stops for sciences : water samples by Rosette, net from the ship or by zodiac in polynia, ice running (at constant load), ice measurement, nanoplastic etc…

NORTH POLE OF INACCESSIBILITY

Located at 85°48’ N / 176° 09’E

The location of the surface of the Arctic Ocea, which is most distance from land; the most difficult location coast. More remoted than North Pole…1000 km from any land.

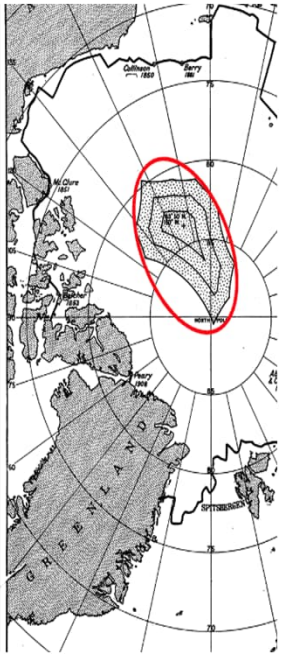
Drift stations and aircraft have come to this pole from the 1950s. It was attained for the first time in the history by LCC on the 12th of Sept 2025

DRAWING ISOCHRONIC LINES FROM THE POSITION OF POLAR SHIPS – EG. PEARY, BERRY AND NANSEN – HE DEFINED THE “POLE OF INACCESSIBILITY”,

DESCRIBING THE POLE AS:

“*THE POINT WITHIN THE ARCTIC REGIONS MOST DIFFICULT TO ACCESS FOR ANY EXPLORER WHO FIRST GOES AS FAR AS HE CAN BY SHIP AND THEN PUSHES FORWARD BY THE USE OF MEN AND DOGS HAULING SLEDGES*”

“*ANY POINT WITHIN IT IS LESS ACCESSIBLE THAN THE NORTH POLE*”



MAGNETIC NORTH POLE

Located at 85°51,2’ N / 139° 28,5’E on 13/09/25. A moving location on earth surface where lines of magnetic force exit. The direction of the magnetic field is vertical. It was first reach by James Ross on 1st June 1831 when it was at 70°.1°N / 96.8°W on land. Since then moving north and give me the idea during the Transpolar to reach it (on the « other side » of the GNP when you sail from Svalbard…). About 50 km per year…

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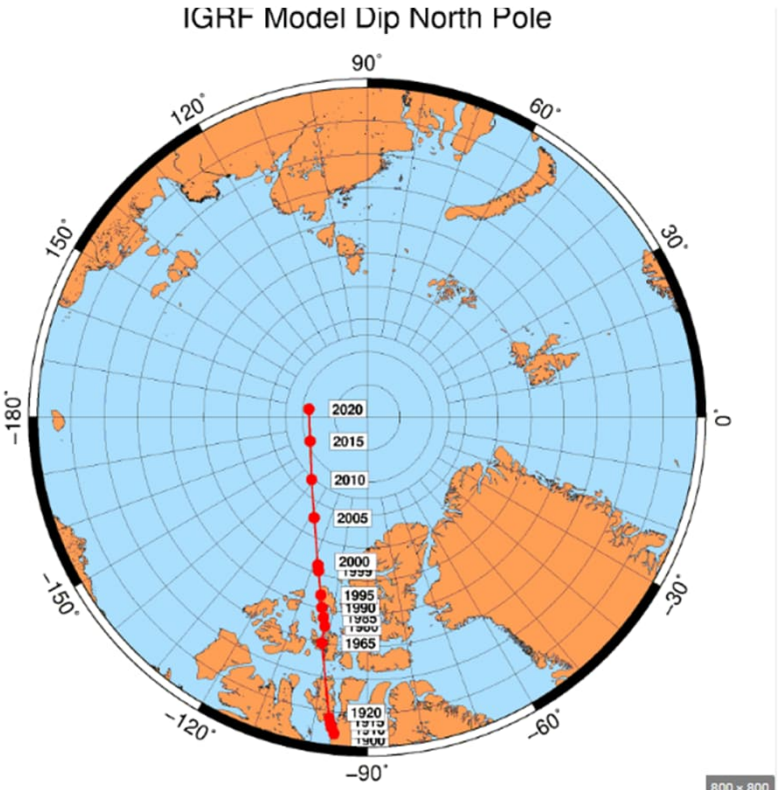
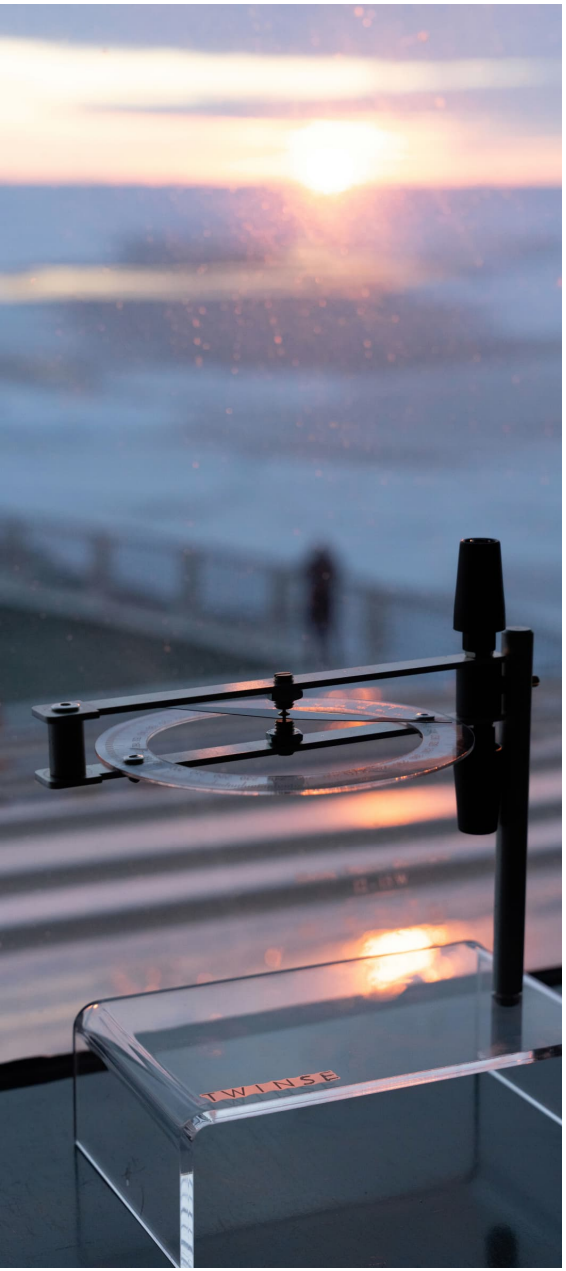
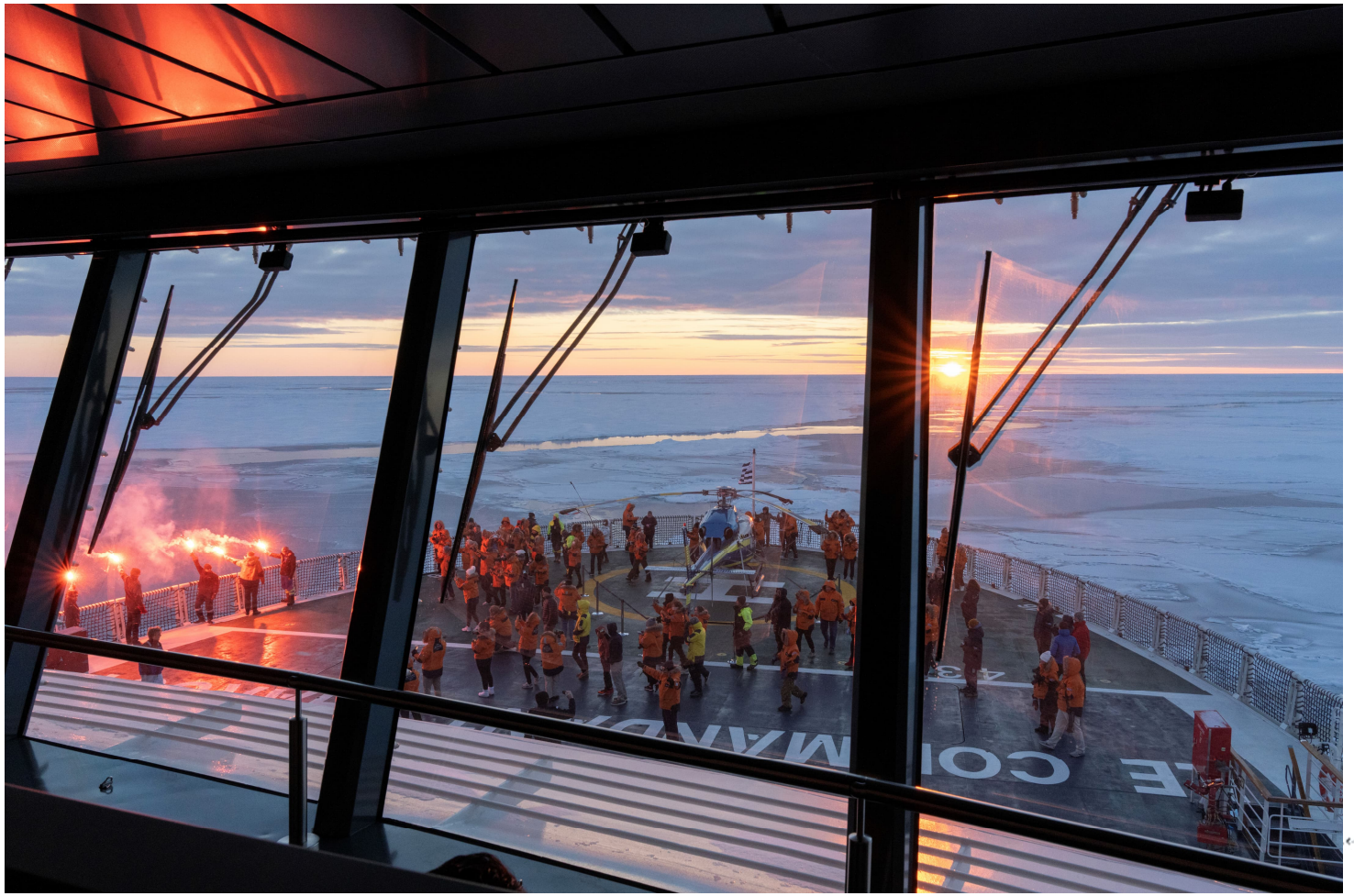




MAGNETIC NORTH POLE

- The location was calculated with scientists and by extrapolation. Experience with James Ross Compass



GEOGRAPHIC NORTH POLE

- Northen axis of rotation of the earth. 690 kms from the nearest land.
- Adrift 48h in a big floe at 0,5 to 0,8 knts generaly toward NE Greenland.
- Observation : thicker ice on mid cruise (around 87°N) instead of North pole itself….
- 13 North Pole voyages since the dryrun in 2021

THREE NORTH POLES

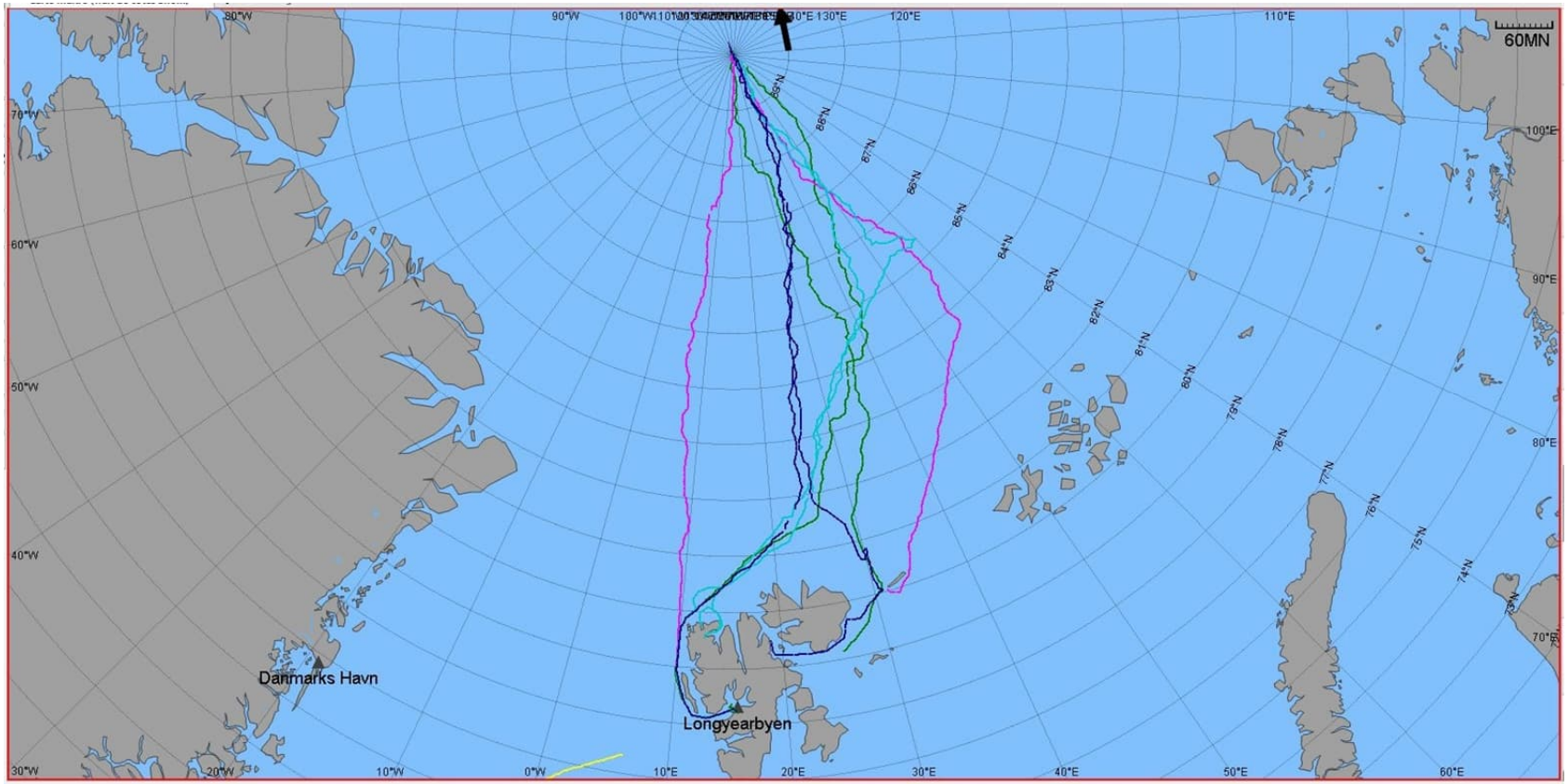
HEADING TO SVALBARD

Routes mainly from the East to avoid pressure at the north of Greenland.

Not much pressure with usually a lot of leads that can be used / Few Rammings / 2 to 3 DG average & Batteries

Smooth North Pole voyages BUT in 2022 early july the conditions were very hard

No glacial ice except in the vicinity of Svalbard.



FEEDBACK

As Captains/ Chief Eng, we are very satisfied with the capabilities of the vessel. Conditions of ice ≥ ice trials.

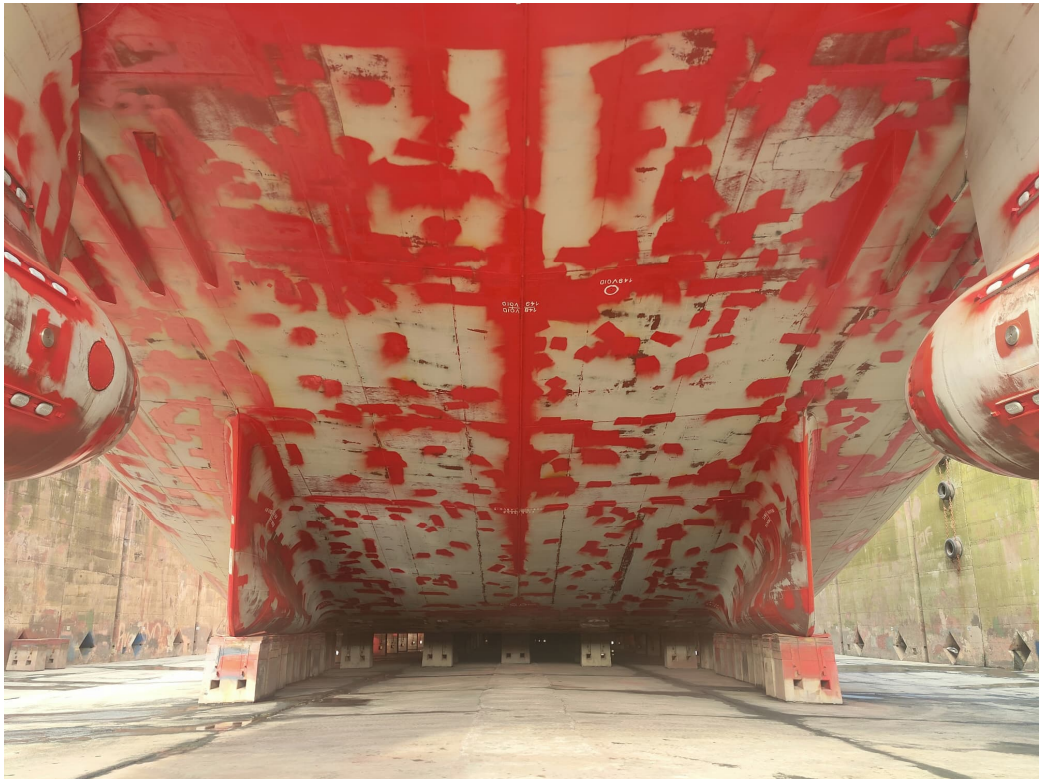
- 200 days / year sailing in the ice . All type of ice and various seasons. NO SHIP is doing the same.
- LCC now become an reference NOT only in the expedition ship industry but also amoung the entire polar maritime industry. (Arctic Shipping SUMMIT) . Identify as Non military in a non military icebrekaer NATO

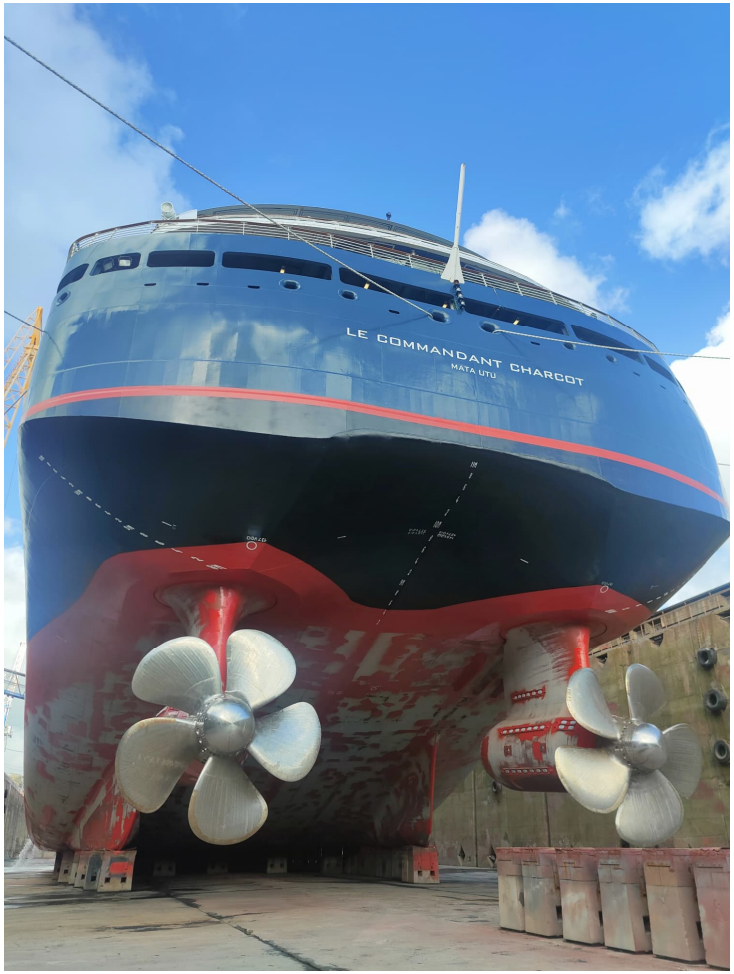
We are identify also as Search & rescue Platform due to our capability. Only 50 years of Victory is more powerfull. Advantage of the Pods : manoeuvrability

- Ice routing : apart from Icysea , we have learnt a lot by the interpretation of the satellite picture. More coverage. It's a paramount importance to analyse it carefully to optimize the options. Bridge team involved in all aspect (Analysis, pods …) .The bridge team become more and more familiarized and expert in driving the Pods / ESS batteries management (load /unload)
- East Greenland in spring time should be a benchmarck for PC2 . It's far the most challenging place. Close to the limit !
- SNOW : thickness of snow especially at the beginning of the season, can lead to a lot of friction (5 to 6 DG) . Power limitation and have to back up. A huge surface of ice/slush/snow remain at the bow (up to 20 ahead).
- ICEBREAKING escort : to North Pole and Antarctica / with « Prince Hakon, ….Attenborough » in Antarctica (Open the channel in double acting)
- SAFETY EQUIPMENT : We had to study how to evacuate on the ice (open water with LB) and to comply with the Polar code . SAREX : North Pole and NWP

DOUBLE ACTING

- Used less than 5% due to not suitable ice condition (Not like Northen route/ Yamal), presence of glacial, vibrations, possible discomfort for suites cabins when ridges.
- Perfect in the level sea ice 1 to 2 m , fast ice when approaching a village in Greenland for i.e oo stop in the ice for activities
- For long ramming (use of aft bridge)
- Inclusion of glacial ice (growlers) … Uncomfortable ramming !






LE COMMANDANT CHARCOT
PONANT