Isle of Man Ship Registry

Casualty Investigation
Report No. CA132

Isle of Man Yacht

"Ice Angel"

Grounding in Polar Waters

07th September 2018

Contents

Foreword

The fundamental purpose of investigating a casualty, an accident or an incident under the Regulations[1] is to determine its circumstances and the cause with the aim of improving the safety of life at sea and the avoidance of accidents in the future.

It is not the purpose to apportion liability, nor, except so far as is necessary to achieve the fundamental purpose, to apportion blame.

Under Section 4 of the Isle of Man Merchant Shipping Act 1985 a person is required to answer an Inspector's questions truthfully. If the contents of this report were subsequently submitted as evidence in court proceedings then this would contradict the principle that a person cannot be required to give evidence against themselves. Therefore, the Isle of Man Ship Registry makes this report available to interested parties on the understanding that it shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

All information provided to an Inspector during the course of an investigation is protected under the Regulations;

"*No statement, declaration or other information from any witness which is provided to an inspector in the course of an investigation shall be revealed or used in any prosecution which may arise in connection with the casualty, accident or incident.*"[1]

All Isle of Man Ship Registry publications can be found on our website: www.iomshipregistry.com

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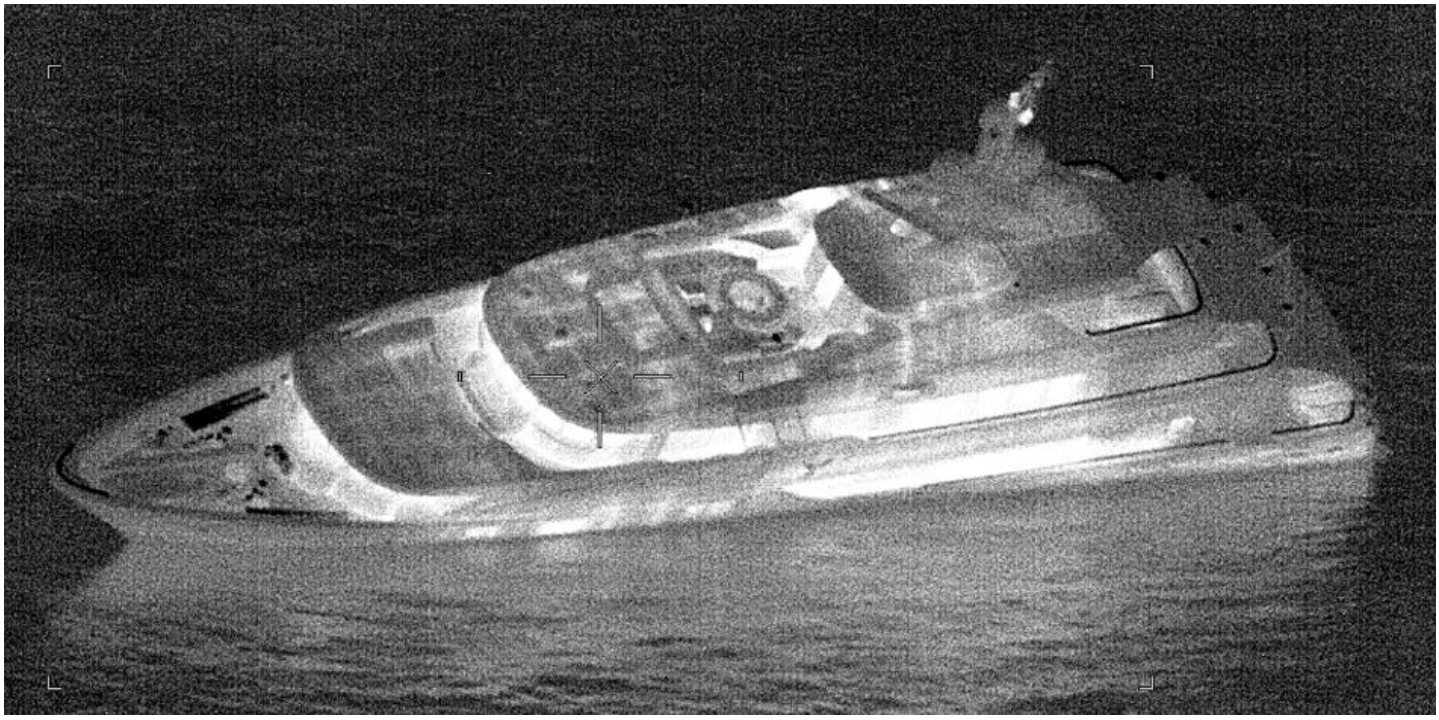
[1] SD815/01 Merchant Shipping (Accident Reporting and Investigation) Regulations

Abbreviations Used in This Report

ºC	Degrees Celsius
DMA	Danish Maritime Authority
ECDIS	Electronic Chart Display and Information System meeting the requirements of SOLAS regulation V/19-2.1.4
ECR	Engine Control Room
ECS	Electronic Chart System
ENC	Electronic Navigation Chart
ER	Engine room
GMDSS	Global Maritime Distress and Safety System
GNSS	Global Navigational Satellite Systems
GPS	Global Positioning System
GT	Gross Tonnage
ICS	International Chamber of Shipping
IMO	International Maritime Organisation
JRCC	Joint Rescue Coordination Centre
Kts	Knots measured in nautical miles per hour
LMT	Local Mean Time
LY3	Large Commercial Yacht Code 3
m, m³, cm	Metres, cubic metres, centimetres
nm	Nautical Miles (1nm=1852 metres)
RIB	Rigid Inflatable Boat
RPM	Revolutions per minute
SD	Statutory Document
SMS	Safety Management System
SOLAS	IMO Convention for Safety of Life At Sea 1974 as amended
STCW	IMO Convention for Standards of Training, Certification and Watchkeeping 1978 as amended
t	Tonnes (where 1t=1000kg)
ºT	Degrees true
UTC	Coordinated Universal Time
VHF	Very High Frequency
WGS	World Geodetic System
WT	Water-tight

Summary



Source: Royal Danish Air Force

Ice Angel – aground on the uncharted rock pinnacle

On the 7th September 2018, the Isle of Man yacht "Ice Angel" departed the anchorage of Nanortalik, southern Greenland, on a day sailing via inland waters to observe and photograph the region. On-board were 15 crew and 4 guests. In the evening prior to departure the master prepared a passage plan for the day sailing on 7th September 2018.

During the day on the 7th September 2018, the voyage proceeded without incident as the yacht sailed along the coast, through inland channels, rounding headlands and drifted in an inlet where the owner and other guests left the yacht for a brief time via small boat in order to take photographs and walk ashore. In the evening the yacht was proceeding at a cruising speed of approximately 14.5kts on its return to Nanortalik anchorage when the yacht grounded on an uncharted sub-marine obstacle, in this case an underwater rock pinnacle.

As a result of the grounding, significant structural damage was caused rendering the yacht unseaworthy. Minor pollution to the marine environment was caused by ruptured fuel oil tanks leaking to sea. No injuries were sustained to any crew or guests on-board.

The report concludes the yacht was at times navigated through waters with no soundings and the yacht grounded at cruising speed on an uncharted underwater rock pinnacle in waters with no soundings considered navigable.

The report also concludes on-board procedural requirements concerning passage planning in the region were not fully observed in compliance the voluntary safety management system. The Polar Waters risk mitigation prepared for voyages in the region was not fully implemented when preparing and executing the passage plan on the 7th September 2018.

Failure to fully appreciate the risks of navigating in a remote area known for poor hydrographic information was evident for the voyage on 7th September 2018 and highlights the importance of a well-planned and well executed voyage plan at a safe speed.

Yacht Particulars

Source: boatinternational.com

Yacht's Name	Ice Angel
Flag	Isle of Man (British)
Port of Registry	Douglas
Type	Yacht
Official No.	740849
IMO No.	9444572
Keel Lay	23/3/2007
Hull Construction	Steel
Call Sign	2BRA3
Length Overall	51.76m
Beam	10.80m
Depth	6.03m
Summer Draught	3.45m
Gross Tonnage	1076
Sailing Speed	Top 18kts / Cruise 15.2kts
Registered Owner	IAT (Malta) Limited
Company	Nigel Burgess Ltd
Classification Society	Bureau Veritas

Voyage Particulars

Departure Port	Nanortalik, Greenland
Arrival Port	Nanortalik, Greenland
Voyage Type	Coastal (day trip)
Cargo Information	Not applicable
Persons On-Board	15 crew, 4 guests (total 19 adults, 0 children)

Casualty Details

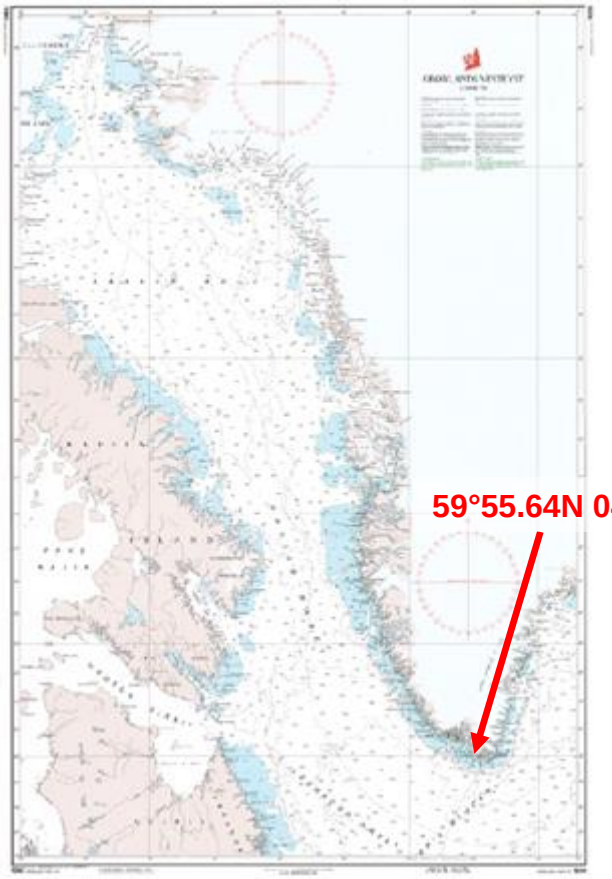
Date / Time	07th September 2018 / 1910LMT (UTC -2hrs)
IMO Classification	Marine Casualty
Location	59°55.64N 044°25.60W, 28nm SE of Nanortalik, southern Greenland.
Vessel Status	underway and making way at approximately 14.5 knots.
Injuries / Fatalities	0 / 0
Pollution	Minor fuel oil pollution of the sea and dock water in Nanortalik.
Yacht damage	• Damaged Keel. • Bow-thruster compartment flooded. • Seawater ingress into accommodation and engine compartment. • Indents and cracks in the hull. • Day tank ruptured allowing fuel oil ingress to the engine room bilge and mixing with sea water. • Stabilizer fins detached or damaged. • Transducer and housing damaged.

1. Narrative of Events

The following is a narrative of the Ice Angel's crew's actions. This narrative is based on interviews and evidence collected on-board the Ice Angel. All times are yacht time (UTC -2 hrs).

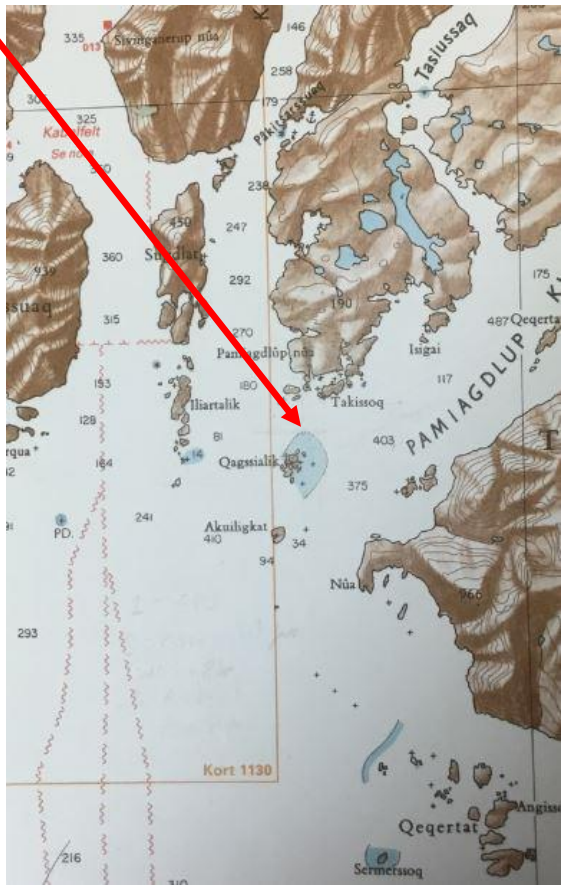
1.1 Location of Casualty

Greenland – Southern Coast



Greenland Chart - 1000 West Coast

Greenland Chart - 1103 Cape Farvel Prince Christian Sund - Frederiksdal Area.



Environmental Factors at time of grounding:
Weather: no precipitation
Temperature: Air 5ºC, Sea 2ºC
Wind: southerly Beaufort Force 2
Visibility: Good (Sunset at 1946)
Current – slack
Tides – 7th September 2018:
LW 1104 – 0.5m
HW 1731 – 2.5m
LW 2356 – 0.4m

8th September 2018:
HW 0552 – 2.1m
LW 1150 – 0.3m

Chart source - Danish Geodata Agency

1.2 Sequence of Events - All times are yacht time (UTC -2hrs)

7th September 2018

In the morning of the day of the incident, the yacht was at anchor in the Nanortalik anchorage area.

Following discussions with the owner on the previous evening, a voyage plan was made for a day cruise to Prince Christian Sund, then planning to return to the Nanortalik anchorage area for the night. The passage plan route was prepared by the master on the paper charts then reviewed by the chief officer in accordance with the passage plan checklist. The waypoints of the route were entered into the Transas ECS.

0900 The yacht weighed anchor and proceeded underway. The intention was to follow the pre-planned route sailing via Torssukatak and Qornoq with occasional stops for the guests to see the glaciers. The yacht was accompanied by a large RIB tender boat which was towed behind the yacht throughout the voyage.

1430 Vessel arrives at Kangerdluk inlet in Prince Christian Sund where the yacht drifted under the supervision of the chief officer at the helm. The yacht's tender boat was launched under the control of a crew member where guests could take photographs and briefly walk ashore.

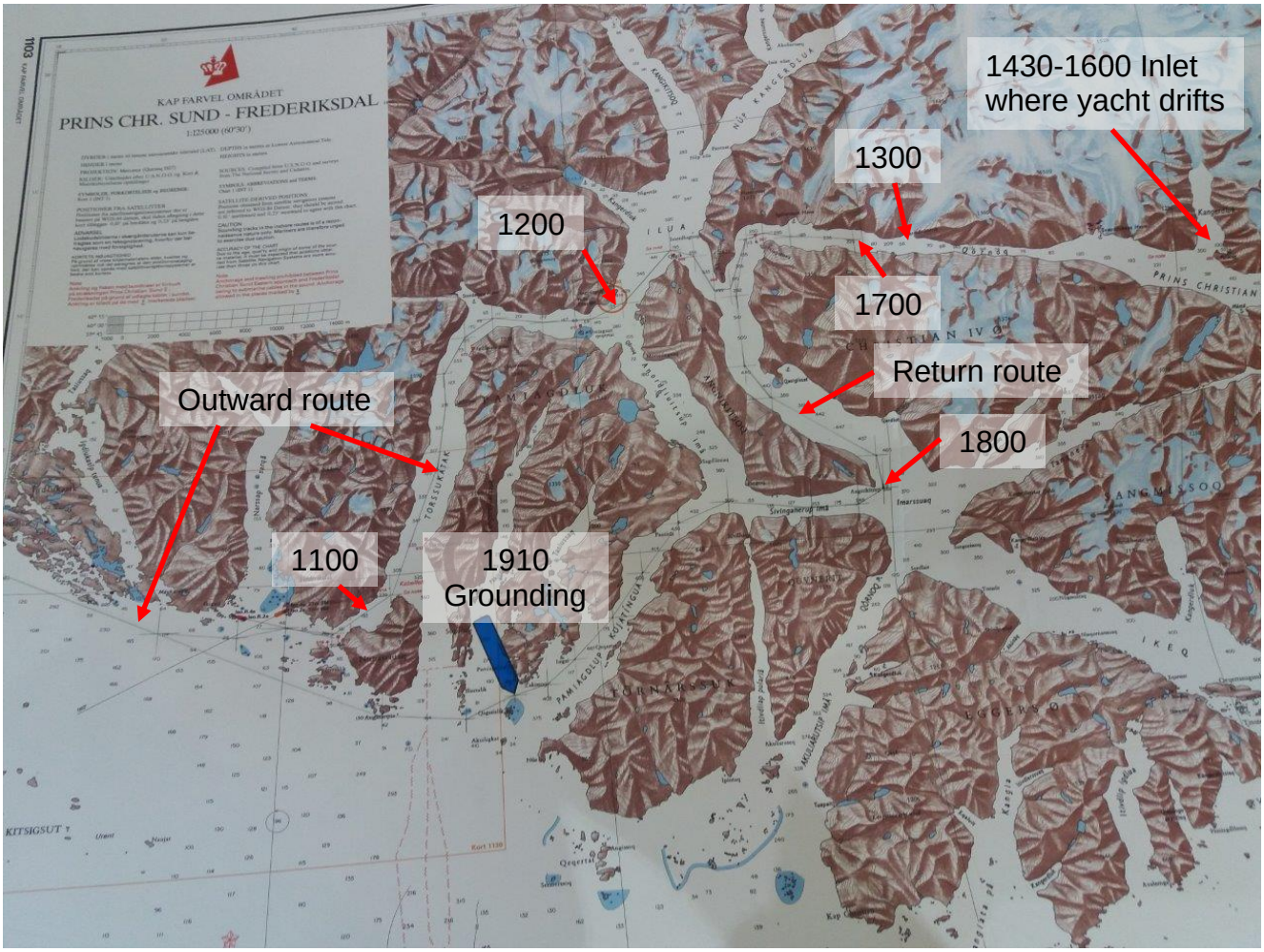
1600 The yacht departed Kangerdluk inlet in Prince Christian Sund with the intention of sailing back to Nanortalik anchorage. The intention was to sail via the pre-planned route to the east of Angnikitsoq and then through Pamiagdlup Kujatingua.

1805 The yacht rounded Angnikitsoq and entered Sivinganerup ima. Present in the wheelhouse were the chief officer at the helm and the master monitoring the route. The chief engineer was on duty in the engine control room.

The yacht was sailing on a course of 248ºT cruising speed approximately 14.5kts after re-entering the planned Transas ECS track after an alteration of course to starboard. The sea state was calm, no wind and good visibility. The depth sounder was showing water depth over 30m, which was in line with expectations derived from the Transas ECS under-keel clearance.

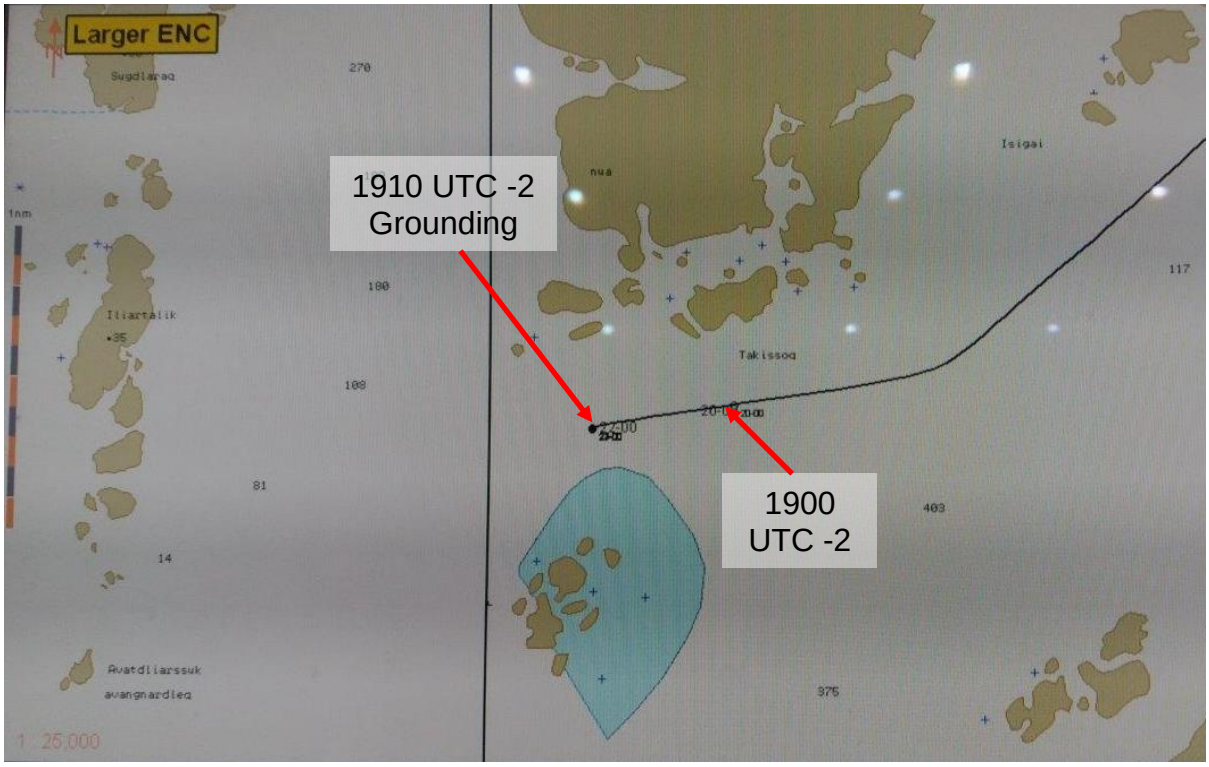
1910 The yacht struck an uncharted rock pinnacle in position 59' 55.638N – 044' 25'.601W at a depth of approximately 2m. The yacht came to an abrupt stop and the crew felt the yacht shuddering and heard "very loud noises" described as banging and scraping. The master stopped the main engines and sounded the general alarm. The yacht quickly listed approximately 15° to port. The master then activated the watertight and fire doors to close from the bridge control panel.

Loose items onboard the yacht were thrown across to the port side causing breakages and damage.



Source: Greenland Chart - 1103 Cape Farvel Area. Prince Christian Sund – Frederiksdal-Danish Geodata Agency

[The chart above also shows the course lines drawn in order to plan the Transas ECS waypoints.]



Source: Transas ECS chart 1103

1920 All crew mustered on the main deck aft muster station and donned immersion suits with exception of the master and the owner on the bridge and chief engineer and 2nd engineer in ECR. The 2nd engineer and 2nd officer were instructed to proceed along the main deck aft then to the sun deck to prepare the two liferafts on the port side.

The master ordered an investigation for damage and water ingress. The bridge alarm system indicated bow thruster and bilge alarms. The chief officer requested permission from the master to go through the forward watertight doors assisted by a deckhand to investigate the bow thruster alarm. On opening the WT door, no water was visible. The bow thruster hatch was opened and only a small quantity of water was visible. The bow thruster hatch was then closed and the chief officer and deckhand proceeded to inspect the dry store room. A small quantity of water was observed in the bilge. The WT doors in crew corridor and bow thruster hatch were left closed and the chief officer and deckhand returned to the main deck aft.

The chief engineer reported a small quantity of water present in the ER bilge and no water in the workshop compartment. A bilge/fire pump was started in an effort to manage the water accumulation in the bilge.

An emergency call was broadcast on VHF CH16 to Aasiaat Radio and a phone call to JRCC Greenland was made to communicate the emergency situation and the yacht's position.

1930 The chief officer proceeded to the swim step in order to reposition the moorings of the RIB tender in tow then went to the wheelhouse with a deckhand to collect the grab bags, including satellite phones, vessel certificates, crew passports, crew documents and logbooks.

1940 The master instructed the chief officer to call JRCC Greenland to communicate the emergency situation and yacht's position. The chief officer then phoned the yacht's local agent to request the possible assistance of local boats and preparations to assist the crew and guests on arrival in Nanortalik.

The master allowed small groups of crew to collect personal items from their cabins.

The RIB tender was secured with one crew member on-board. The master attempted to use the yacht's main engines to manoeuvre off the rocks. The yacht was listing 10°-15° to port. The tide was falling and a small swell caused the yacht to roll gently on the rock. The master attempted full power astern several times attempting to turn the yacht by main engine power, bow thruster and the power of the yacht's RIB tender.

1945 The picture below depicts the list to port and the prevailing weather, sea and light conditions.

2010 With the yacht listing to port the guests and non-essential crew disembarked the yacht to the RIB tender. The tide continued to fall and due to a light swell the yacht continues to roll strike the rocks around the underwater hull amidships.

The master continued his attempts to manoeuvre the yacht off the rock but was not successful.

A phone call was made to JRCC Greenland to update the situation. A call on VHF CH16 was received from Aasiaat Radio concerning Nuuk police's request for information and to inform that Nuuk police were dispatching a patrol boat to assist.

2045 The 2nd Officer and 2nd Engineer launched the two port side liferafts with the painter disconnected so they would not inflate. The crew in RIB tender retrieved the two liferafts.

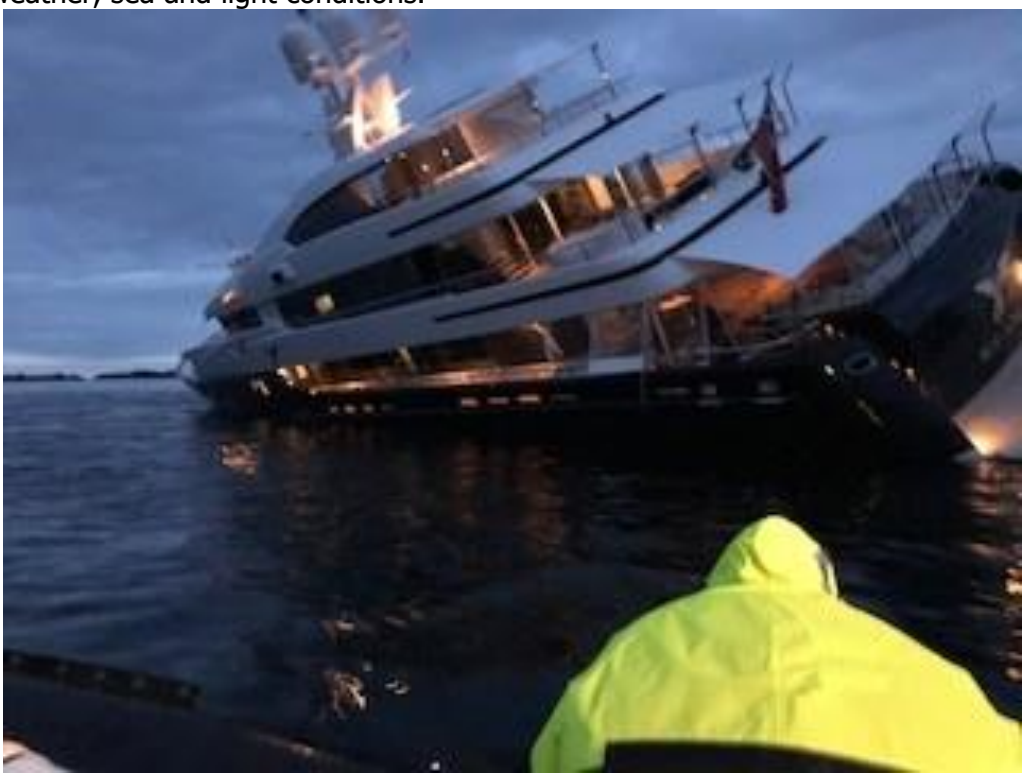
The master requested the port main engine and generators to be turned off (the starboard engine was turned off earlier due insufficient cooling water supply to the engine). The main engine and generator fuel oil supplies were isolated by operating the 'quick-closing' valves. The emergency generator was running at the time.

The chief engineer checked the engine room and workshop compartment; no water was visible. The chief engineer also observed the possibility of one of the stabiliser shafts shearing off and leading to rapid water ingress.

2100 The vessel was listing more than 40° to port and the yacht continued to roll and impact on the rock. All remaining crew on-board including master disembarked the yacht to the RIB tender.

2145 The RIB tender was manoeuvred around the yacht to assess the condition and sound the water depth. At 20m distance from the boat water depths between 27-65m were observed. A small quantity of fuel oil was also observed in the water. The RIB tender with the crew and guests then departed the scene and headed towards Nanortalik, a distance of 29nm.

The picture below depicts the list to port observed by the crew from the RIB tender and the prevailing weather, sea and light conditions.



The master phoned JRCC Greenland to update them on the situation. JRCC Greenland informed the master they had organised an airplane to monitor the area.

The master called the Company using the satellite phone and informed him of the situation. The emergency response team ashore was immediately activated following notification of the incident.

2330 The RIB tender and guests arrived in Nanortalik. All the crew and guests were transferred to a local hotel assisted by the local people. The master called JRCC Greenland to confirm safe arrival of the crew and guests.

8th September 2018

0000 The master appointed 3 local fishermen to go with their boats and assess the yacht. The next high tide was expected to be at 0500 local time.

0204 The master cooperated with the local police while the crew and guests were accommodated in a local hotel.

0300 The master, chief engineer, 2nd Engineer, Chief Officer, 2nd Officer and three deckhands returned to the grounding location on the yacht's RIB tender.

0415 The RIB tender arrived back at the yacht's last know position. The attending fishermen reported the yacht was floating freely and upright since approximately 0405. Light fuel oil could be smelt in the air. The returning crew embarked the yacht via the swim platform. The emergency generator was observed still running. An onboard damage assessment was then carried out which confirmed the following:

- Bow thruster compartment flooded to about 0.5m below the hatch;
- Tank deck dry store flooded to about deck level;
- No leaks in the tank deck engineer's workshop; and
- Engine room flooded with a water-fuel mix to about 1m below deck plates. Flooding was observed in the port generator room and in the vicinity of the port fuel tank.

The engineers started the emergency bilge pump to pump out bow-thruster bilge and dry store bilge. The bow-thruster compartment and lazarette were also pumped out.

The engineers attempted to start the generator sets which failed to start due to the presence of water in the fuel oil.

0545 The police patrol boat arrived at the yacht in order to tow the yacht back to Nanortalik.
The yacht's crew prepared emergency towing lines on the bow and connected them to the patrol boat.

0630 The police patrol boat began to tow the yacht to Nanortalik with the RIB tender connected to the yacht's swim platform in tow.

The deck crew and engineers continued their attempts to manage the leaks in the port generator bilge.

1005 A generator was started using a temporary fuel line. Electrical power was also restored. The main fire pump and bilge pump were tested. During the passage back to Nanortalik the yacht crew continued their attempts to control water ingress and maintain the fuel supply to the generator.

1630 The yacht arrived in Nanortalik where the tow was disconnected and the yacht moored to a pier. The local fire brigade and emergency services were in attendance on the yacht's arrival. An anti-pollution boom was placed around the vessel. The bow thruster and dry store were pumped out. The fuel oil in the engine room was pumped into storage tanks ashore.

The picture below shows the yacht moored alongside in Nanortalik with anti-pollution booms placed around the yacht.

Follow up

- The Danish Maritime Authority attended the yacht for survey and investigation. The yacht was detained on safety grounds being unseaworthy.
- The yacht's classification society completed a structural survey to assess the yacht's seaworthiness. A repair plan was discussed and agreed with the yacht and the Company.
- With the agreement of the DMA, the yacht was transported on a heavy lift ship to a repair yard in the United Kingdom.

1.3 Factual Information

1.3.1 Compliance with Statutory Requirements

The yacht was operating as a pleasure yacht subject to the statutory requirements applicable to pleasure vessels. A pleasure vessel is defined under the Pleasure Vessel Regulations[2].

The yacht was manned in accordance with pleasure vessel manning regulations[3]. All crew certification was found valid.

1.3.2 Voluntary Compliance with the Large Commercial Yacht Code LY3

In excess of the statutory requirements for a pleasure yacht the yacht was being operated voluntarily compliance with the Large Commercial Yacht Code LY3 (LY2 standards ref. LY3/3.3.3.4). The yacht was surveyed and certificated by the yacht's flag State and classification society for the certification stated in LY3 Annex 4.

Having operated as a commercial yacht in the past (until 03rd Dec 2017 and thence operating as a pleasure yacht), the voluntary implementation of an established Safety Management System was considered suitable by the master and Company in achieving enhanced safety measures for operating in polar waters.

The yacht was audited by Nigel Burgess Ltd on 3rd Oct 2017 to confirm continued compliance with the system: 6 non-conformities and 3 observations were raised – none pertaining to navigation equipment or safe navigation.

Last External ISM Audit – Renewal, 23rd June 2017 conducted by an external Isle of Man Ship Registry representative – no non-conformity was raised nor observation noted.

1.3.3 Voluntary Compliance with the Polar Code (LY3/3.2)

In 2018, at the owner's request, a plan was devised to make a voyage through the North-West Passage. The principles of safe navigation and risks identified are contained within the yacht's Polar Water Operational Manual and Polar Waters Risk Assessment prepared by the Company as per the Polar Code requirements. Following satisfactory survey a Polar Ship Certificate was issued by the yacht's classification society on 13th June 2018 for compliance with the Polar Code.

Under the Polar Code, the yacht is a Category C ship, i.e. not ice-strengthened. The limitations stated on the Polar Code certificate are:

"Open waters, not to be operated in low air temperature (ie not less than -10C), Ice conditions – Nilas <10cm / New Ice <10cm / brash ice / bergy water / open water."

Procedural requirements implemented on-board for navigating in polar waters are contained within the yacht's Polar Water Operational Manual. The location where the yacht grounded in southern Greenland is within polar waters are as defined within the Polar Code and within the limitations stated on the Polar Ship Certificate.

[2] SD396/03 Merchant Shipping (Pleasure Vessel) Regulations 2003

[3] SD 2014/0238 Merchant Shipping (Manning and STCW) Regulations 2014 reg 12

2. Comment and Analysis

This section aims to analyse the factors that lead to the grounding.

2.1 Available Hydrographic Information

Greenland Chart 1103 Cape Farvel Area. Prince Christian Sund – Frederiksdal published by the Danish Geodata Agency is the largest scale chart available for the local area where the yacht grounded. The rock where the yacht grounded was not charted on Greenland Chart 1103.

Aside from the information shown on the chart there were no additional documented dangers promulgated to warn mariners either through Notices to Mariners or navigation warnings in the area where the yacht grounded. No navigation warnings, including temporary or preliminary warnings were in force in southern Greenland when the grounding occurred.

KAP FARVEL OMRÅDET

PRINS CHR. SUND - FREDERIKSDAL

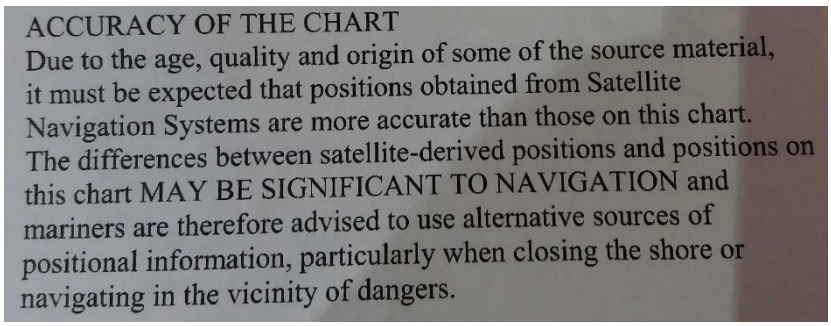
1:125 000 (60°30′)

DYBDER i meter til laveste astronomiske tidevand (LAT). DEPTHS in metres at Lowest Astronomical Tide.
HØJDER i meter HEIGHTS in metres
PROJEKTION: Mercator (Qornoq 1927)
KILDER: Udarbejdet efter U.S.N.O.O. og Kort & Matrikelstyrelsens opmålinger
SOURCES: Compiled from U.S.N.O.O. and surveys from The National Survey and Cadastre.
SYMBOLER, FORKORTELSER og BEGREBER: Kort 1 (INT 1)
SYMBOLS, ABBREVIATIONS and TERMS: Chart 1 (INT 1)
POSITIONER FRA SATELLITTER
Positioner fra satellitnavigationssystemer der er baseret på WGS-84 datum, skal inden aflægning i dette kort tillægges 0,10′ på bredden og 0,23′ på længden.
SATELLITE-DERIVED POSITIONS
Positions obtained from satellite navigation systems are referred to WGS-84 Datum: they should be moved 0,10′ northward and 0,23′ westward to agree with this chart.
ADVARSEL
Lodskudslinierne i skærgårdsruterne kan kun betragtes som en rekognoscering, hvorfor der bør navigeres med forsigtighed.
CAUTION
Sounding tracks in the inshore routes is of a reconnaissance nature only. Mariners are therefore urged to exercise due caution.
KORTETS NØJAGTIGHED
På grund af visse kildematerialers alder, kvalitet og oprindelse må det påregnes at den positionsnøjagtighed, der kan opnås med satellitnavigationssystemer er bedre end kortets.
ACCURACY OF THE CHART
Due to the age, quality and origin of some of the source material, it must be expected that positions obtained from Satellite Navigation Systems are more accurate than those on this chart.
Note
Ankring og fiskeri med bundtrawl er forbudt på strækningen Prins Christian Sund E.-Frederiksdal på grund af udlagte kabler i sundet. Ankring er tilladt på de med ⚓ markerede pladser.
Note
Anchorage and trawling prohibited between Prins Christian Sund Eastern approach and Frederiksdal owing to submarine cables in the sound. Anchorage allowed in the places marked by ⚓
60° 15′
60° 00′
59° 45′
1000 0 2000 4000 6000 8000 10000 12000 14000 m

The chart data for Greenland chart 1103 was compiled in 1927.

As can be seen from the chart legend (left) the legend contains notes and cautions mariners regarding satellite derived positions, sounding tracks and the accuracy of the chart.

Points of note -
- Correction for satellite derived positions.
- "Caution – sounding tracks for inshore routes is of a reconnaissance nature only. Mariners are therefore urged to exercise due caution."
- There is no source diagram on chart 1103.



ACCURACY OF THE CHART
Due to the age, quality and origin of some of the source material, it must be expected that positions obtained from Satellite Navigation Systems are more accurate than those on this chart. The differences between satellite-derived positions and positions on this chart MAY BE SIGNIFICANT TO NAVIGATION and mariners are therefore advised to use alternative sources of positional information, particularly when closing the shore or navigating in the vicinity of dangers.

Danish chart 1103 – chart correction number 424 (shown left) amends the "accuracy of the chart" legend and highlights the significance of satellite derived positions such as GPS compared to the paper chart and recommends alternative position fixing.

2.2 Conducting the Passage – Appraisal, Planning, Execution and Monitoring

The voluntary safety management system on-board prescribed passage plan procedures to be implemented by the yacht's crew – see section 2.4.

Prior to arriving at Nanortalik the crew had sailed the yacht in the polar region as summarised by the master; "*Prior to the grounding the yacht sailed along the west coast of Greenland for about 30 days*

and for about 3,000 miles, crossing icy and unexplored areas. On all these occasions all the precautions have been taken, the speed reduced, the RIB was sent forward to take soundings in the area, passage plan accurately prepared and the use of radars and all the charts systems we have on-board.
During the preparation of the passage plan we have used Paper chart, Transas, MaxSea E-Charts, Navionics E-Charts, View from Google Earth, local touristic information web site, where possible, information from local sailors was requested through the agent. The Towns of Greenland are like islands due to the complete lack of connections between them, and only the local population knows the area around the town apart for the captains of taxis who sail along the coast but who know internal coastal areas not navigable by larger boats, and most of the local fisherman do not speak English."

2.2.1 Appraisal

Consideration of navigational hazards and determination of safe speed was stated in the Polar Water Operational Manual, Polar Risk Assessment and the yacht's passage plan procedure.

The yacht was provided with adequate nautical charts (paper and electronic) and nautical publications. The electronic Transas ECS charts were corrected up-to-date. The paper charts were not corrected up-to-date on-board but the corrections were available for reference. The yacht was equipped with navigation equipment as stated on the voluntary Safety Equipment Certificate Form E issued by the classification society – all equipment was reported to be operating satisfactorily for the passage of 7th September 2018. A high specification RIB tender boat equipped with navigation equipment including an echo sounder and GPS was available for the passage on the 7th September 2018.

The primary means of navigation under the voluntary SMS, i.e. paper charts, were referred to for planning the passage plan waypoints. The waypoints obtained were then programmed into the Transas Navi Sailor system. The investigation noted that some shallow water dangers promulgated by corrections were not applied to the paper chart but were applied to the Transas ECS chart.

The largest scale paper chart for the area of grounding is Danish chart 1103. The largest scale Transas ECS chart for the area of grounding is 1103. Transas ECS chart 1103 contains a warning *"all displayed charts must be used in conjunction with a recognised nautical paper chart of a scale appropriate to the area being navigated. The data on the fully corrected paper chart must always be considered to be more reliable."*

2.2.2 Planning

The passage plan was prepared to the limit indicated in the diagram in section 2.2.3. The passage plan on the 7th September 2018 was prepared for the following (see also annex 2);

Departure Port:	Nanortalik	ETD:	07-Sep-2018	09:00	Average Speed (kts):	13
Arrival Port:	Nanortalik	ETA:	07-Sep-2018	21:30	Distance (nm):	70

The intention was a day sailing through the inland channels at various speeds, at times stopping to view the natural scenery. The expected depth of water was derived from the paper chart at the initial planning phase to obtain the waypoints. The passage plan was prepared with the intended vessel track following the sounding tracks indicated on chart 1103. See Greenland chart 1103 extract in section 1.2 at time 1910.

The soundings on Chart 1103 are of a 'reconnaissance nature' only and thus the 'white areas' of the chart off the sounding track cannot be relied upon to be safe water. Therefore the possibility of unknown sub-marine obstacles in areas where depths are given by a single sounding line must be considered, hence the caution stated on chart 1103. Specific areas of speed reduction/increase were not defined on the passage plan.

Use of the RIB tender boat leading the yacht to determine safe water had been utilised on previous occasions but was not planned for the passage on 7th September 2018. Use of such a boat, for the

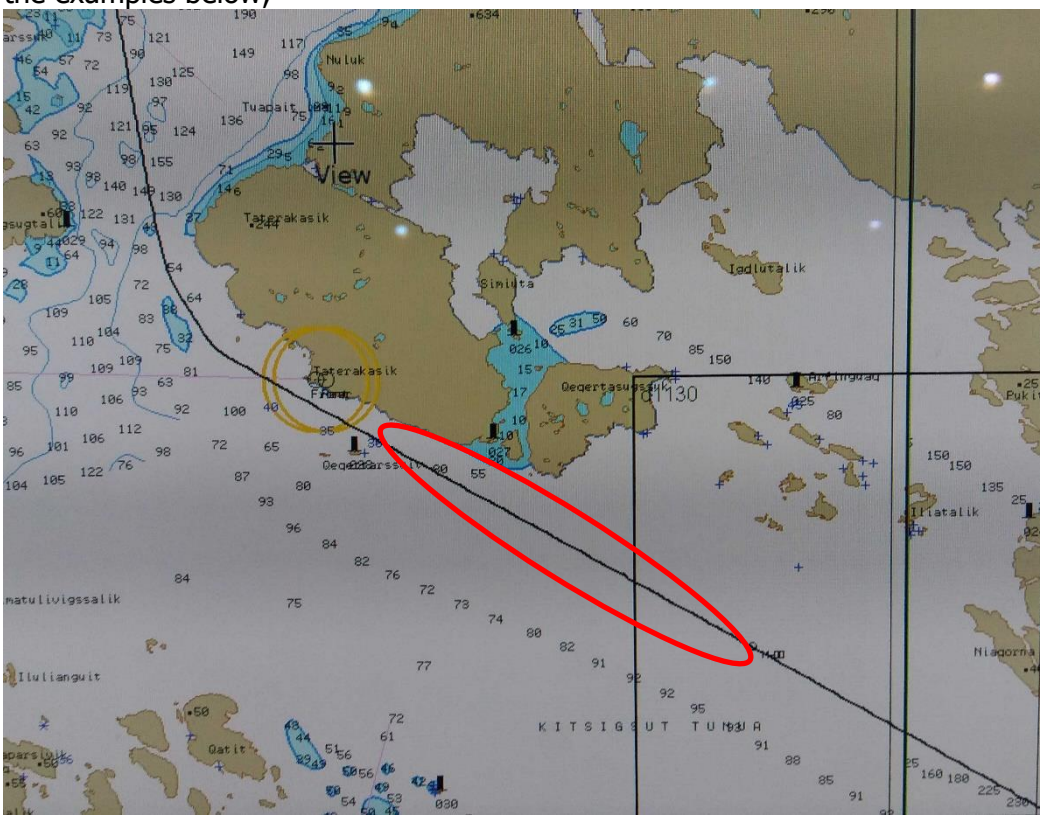
whole passage or part of the passage, will also determine the yacht's speed and distance that can be achieved during the day sailing. The yacht's speed is analysed in section 2.5.

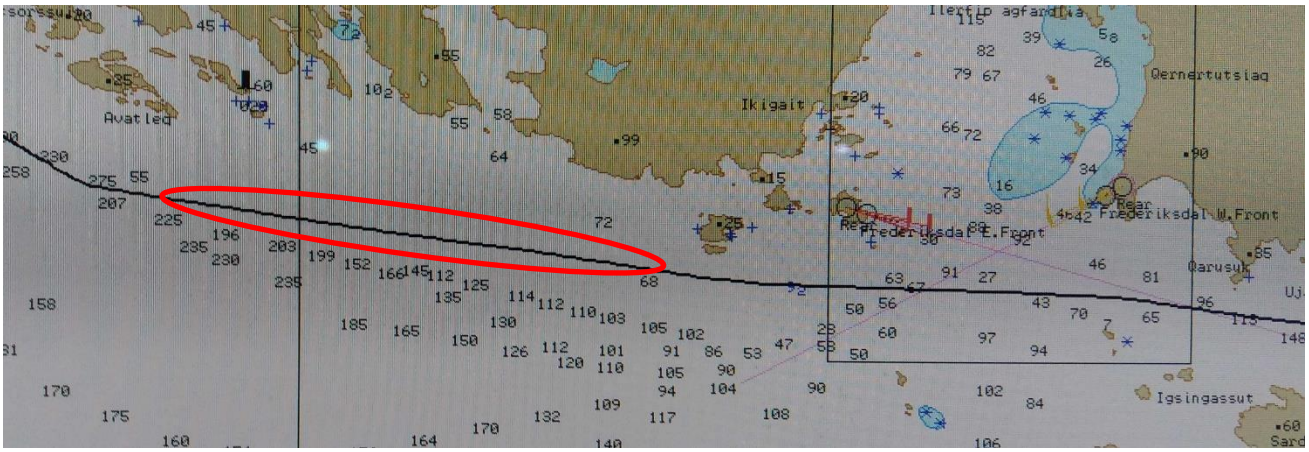
At this stage, effective use of additional information can be utilised to plan the passage. Refer to section 2.3.

2.2.3 Execution

The helmsman followed the planned track on the Transas ECS. Course and speed amendments were also made en-route directed by the master. The RIB tender boat was being towed behind the yacht throughout the passage.

As the yacht was making way, the bridge team at times deviated the yacht off the planned track in order to save time and distance and for sightseeing. The 'white areas' on the paper chart and ENC charts were all considered navigable. The deviations took the yacht through areas of no soundings as indicated in the examples below;



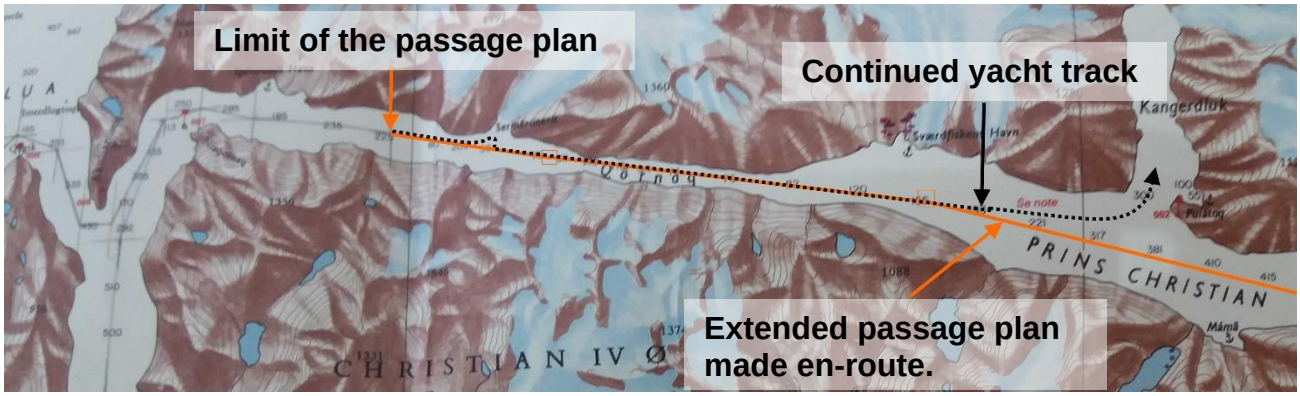


In anticipation of navigating in remote and hostile environments, the Polar Water Operational Manual's emergency response section included the following statement for passage in GMDSS Sea Area A4 where search and rescue capability is limited;

> Sea passages should be planned with abundant caution and absolute aversion to the risks of grounding or stranding. This WILL require a change of mindset from 'normal yacht operations, where groundings are sometimes accepted as a normal operational risk and the price of satisfying an owner's demands to go closer to land or other features.

As the statement above suggests, the acceptance of risk for entertainment is "normal" in well charted areas and the "normal" acceptance of risk must not be applied in the Polar Water region. The off-track deviations indicates a change of 'mindset' was not achieved in this case.

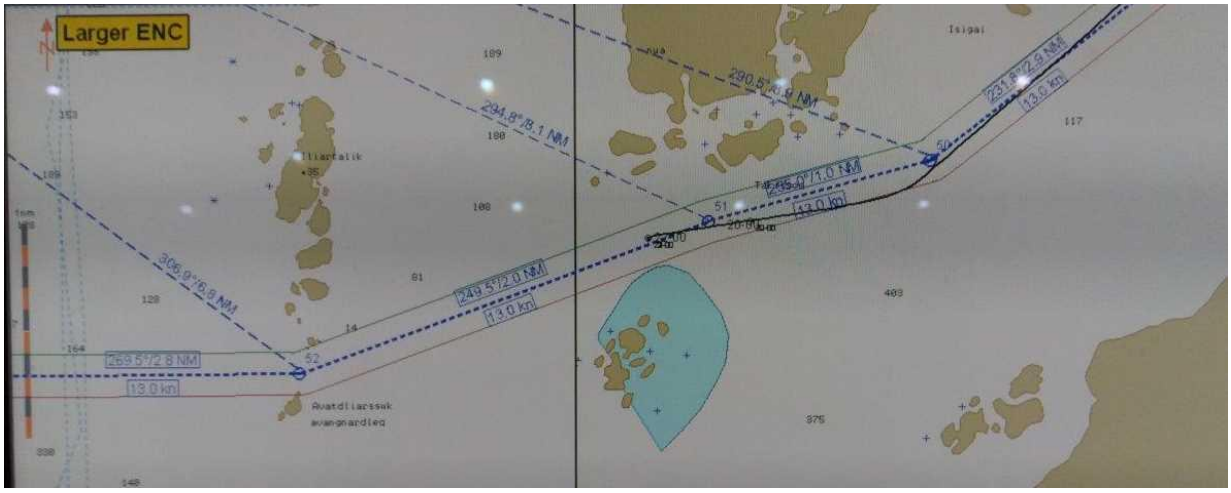
Whilst on passage, the master decided to extend the passage plan further. The additional waypoints were determined from the Transas ECS.



The extended passage plan to the Kangerdluk inlet added approximately 24nm to the planned track and 4 hours to the overall passage including the time taken for the Kangerdluk inlet excursion.

On 7th September 2018 the sunset was at 1946 local time. The yacht departed the Kangerdluk inlet at 1600. This departure time, among other considerations, determined the cruising speed set in order to return to the track sailed in the morning (ie the track sailed prior to 1100) before it got dark.

The yacht grounded in waters with no soundings (between waypoints 51 and 52 shown below) in the vicinity of shallow waters and islands whilst following the planned route displayed on the Transas ECS below as indicated below;



The electronic chart (1103) on the Transas ECS was found corrected up to the latest correction.

A few small ice bergs were observed in the yacht's vicinity during the day and not considered to pose a risk to safe navigation.

2.2.4 Monitoring

Although paper charts were the primary means of navigation prescribed by the onboard SMS, the Transas Navi Sailor 4000 ECS (not to be confused with the type approved Transas 4000 ECDIS) was the main navigation tool when executing the passage plan. The X-Band and S-Band Radars were in use during the passage and cross referenced with the Transas Navi Sailor ECS.

It was preferred to use Navi Sailor ECS in preference to the paper chart as any GPS positions required a position correction in order to plot on paper charts in accordance with the chart legend – see section 2.1.

Position fixing was not verified against the paper charts using terrestrial range and bearing nor was the use of radar parallel indexing utilised.

The Transas ECS Safety Parameters were set to shallow contour 2m, safety contour 30m, safety depth 30m and deep contour 30m. The limited hydrographic data contained on the electronic charts means these alarms have limited functionality due to inadequate depth sounding data.

2.3 Other Sources of Navigation Information

To aid effective passage planning in remote areas with poor hydrography any credible information can be vitally important to enhance safe navigation. Whilst the following sections 2.3.1-2.3.4 are not mandatory for pleasure vessels, and were not utilised for the voyage on 7th September 2018, the information or advice they provide can be useful to masters when planning and executing a voyage in areas with poor hydrography.

2.3.1 Local knowledge

Some dangers may only be known to the local population, especially local fishermen, private boat owners and water taxis. Such information may not be promulgated to warn mariners in the form of ether navigation warnings, sailing directions, chart corrections or buoyage systems.

2.3.2 Local pilotage services

Vessels may voluntarily employ the services of a local pilot. If a Greenland pilot is carried on-board their services include[4]:

- A project management team carry out all mandatory risk assessments and contingency planning according to relevant laws and regulations. Furthermore we liaise with the local SAR authorities ensuring all plans are approved prior to the arrival of your vessel in Greenland;
- Pilots carry out the voyage plan according to best practice and local knowledge, drafting the risk assessment and presenting it to the vessel master before departure;
- 24hrs shore based operations team assist our pilots with the latest weather and ice updates ensuring the safety of your vessel during your operation in Greenland; and
- 2 certified onboard pilots assisting the master and navigators 24HRS during the entire voyage.

Note – Under the Greenland Pilot Act No. 1698 of 11th December 2015, it is only mandatory for passenger ships with more than 250 passengers onboard to use a pilot when sailing within Greenlandic National waters.

[4] Greenland Pilot website (https://gps.gl)

2.3.3 ArcticWeb (https://ArcticWeb.barentswatch.net).
The Danish Maritime Authority (DMA) promotes the use of the ArcticWeb system. ArcticWeb is a joint effort to improve maritime safety in the arctic region. ArcticWeb serves as a single point of access to safety related information, provides streamlined reporting and allows for voluntary co-ordinated voyage through sharing of positions and planned routes.
The sharing of vessel tracks known to be good gives added confidence to mariners when planning their own routes in areas of poor hydrography.

2.3.4 International Maritime Organisation (IMO)
The document NAV 55/INF.6 "Precautions in using navigational charts in Greenland waters" was submitted by Denmark to IMO on 21 May 2009. This document is also referenced on the ArcticWeb system – see section 2.3.3. The document provides information regarding precautions in the use of navigational charts in Greenland waters in terms of inaccuracies in paper charts due to incorrect positioning of the coastline, geographical datum and hydrographic survey.

Masters are urged to refer to NAV 55/INF.6 when passage planning in Greenland waters to highlight precautions in using navigation charts. Precautions stated in various sections of the document include;

- 5…Systematic and completely covering hydrographic surveys have not been carried out in many areas along the coasts of Greenland due to the wide extent of the sea area and the Greenland archipelago. In other words, depth conditions will be unknown or depth data will be of poor quality in large areas. For mariners it is essential to understand the limitations in the source material providing the basis for the production of paper charts and, consequently, the information given in the paper charts must be interpreted with caution.

- 14…Despite the inaccuracies of the paper charts; it is possible for ships to navigate in coastal areas if they use their radar equipment as the primary positioning instrument and rely on terrestrial navigation methods when navigating in Greenland waters.

- 19…GNSS should be used only as a secondary positioning instrument, and if used as such, mariners must beware of the necessary correction between the reference chart datum in the paper charts and the information received from GNSS.

- 21…The lack of survey data or its poor quality is reflected in the charts by, e.g., waters where depths are given only by passages of reconnaissance lines or even as white unsurveyed areas in the chart. 'Source diagrams' are lacking in many of the paper charts available for Greenland waters. The basic lack of IHO compatible survey data for chart production should make ships keep an additional safety distance when passing underwater rocks and obstructions.

["*The source diagram on a paper chart is the traditional method of indicating when and how the survey was conducted to collect the hydrographic data. From this information, the mariner must deduce the degree of confidence to place in charted data.*"] – source www.admiralty.co.uk

- 32… At present ENCs are not available for Greenland coastal navigation, except for a very few exceptions. It is expected that the ENC coverage will be continuously improved, but complete ENC coverage in coastal areas cannot be expected in 2012. In coastal areas, ships will therefore as a general rule have to use paper charts for navigation.

In some areas, depths are only given by sounding tracks from passages of a reconnaissance nature. This is the case for Greenland Chart 1103 as stated on the chart's legend. Paper charts for this region are annotated accordingly in the chart legend highlighting chart inaccuracies such as:
- Incorrect positioning of coastlines in the geographic net;

- Chart datum "Qornoq 1927" is used for some areas, mostly at west Greenland, instead of WGS 84 datum; and
- Source material for chart datum may be unknown and the accuracy may be affected by the age and quality.

2.4 Implementation of the Voluntary Safety Management System

When navigating in polar waters it is prudent for any pleasure vessel to implement enhanced safety measures for the safe operation of the vessel, crew welfare and navigation. The yacht implemented a safety management system as part of the voluntary compliance with LY3.

The SMS procedure for passage planning is shown in Annex 1. Part of the SMS extract shown below includes the following requirements:

1 The appropriate chart of the largest scale is always to be used for passage planning and navigation. All intended courses, course alteration way points and clearing distances should be pre-plotted as far as possible. Emphasis marks should be placed around hazards.

2 An ECDIS may only be used as the primary means of navigation if it is type approved and shown on the SEC Record of Equipment.

3 A system that does not meet the requirements to be classed as ECDIS is an Electronic Chart System(ECS). An ECS may only be used as an aid to navigation. Navigational decisions must never be based solely on the information presented by an ECS.

An inspection of the paper chart folio indicated the following SMS requirements were not complied with:

1. No clearing distances and hazards were marked on the charts;
2. The yacht is not provided with an approved ECDIS system as stated on the Safety Equipment Certificate Form E. The Transas system installed on-board is an ECS; and
3. The Transas ECS was being used as a primary navigation tool and not as an aid. Navigation decisions were based on visual observation and the Transas ECS system.

The passage plan was prepared prior to departure – see Annex 2. The passage plan makes reference to the ICS Bridge Procedures Guide requirements. Among the requirements stated it was noted that the passage plan did not contain all of the largest scale charts nor were there courses, safety contours, depth, parallel indexing, position fixing intervals etc. marked on the primary means of navigation, i.e. the paper charts.

The following items were ticked to confirm completion of the following items on the passage plan (in Annex 2) prior to departure:

1 Are all necessary Charts available and up to date? (please list)
235 / 1001 - 1100 - 1103 - 1113 Greenland Charts - corrections printed and to be applied

2 ✓ Are the above charts corrected up to latest available NtM and are courses marked?

3 ✓ Have the relevant Temporary and PreliminaryNotices and navigation warnings bee checked and marked on the chart?

4 ✓ Have you marked and areas of particular hazard (e.g. shallow waters, expected fishing fleets, poor anchoring, etc.)?

5 ✓ Parallel indexing lines and/or distance and bearing markers, as appropiate?

An investigation of the completed passage plan on-board confirmed:

1. Paper chart corrections were not applied to the chart. Corrections were available on-board for reference.

2. Paper charts were not corrected up to date (Transas ECS was corrected up to date) for the voyage on 7th September 2018 but were available on-board for reference [downloaded and printed from the internet] prior to the voyage. The corrections were not applied to the charts due to "lack of time".

   It was noted that fully chart corrected charts would not have been sufficient to avert the grounding in itself since the rock pinnacle was uncharted.

It was also noted a shallow depth correction of 4.8m and a submerged rock (Danish Correction number 283) 0.7nm east of the yacht's actual track earlier in the day (at approximately 1135) in the Torssukatak channel was not applied to the paper chart but was applied to the Transas ECS chart.

3. No relevant Notice to Mariners was in force for the area and day of sailing.

4. No annotations were marked on the paper charts or Transas ECS. The Polar Water Operational Manual and polar risk assessment both stated "no go areas" be marked on the charts – none were marked.

5. No parallel indexing was planned on the paper charts or ECS charts and transferred to the radar. No bearing and distance markers were planned on the paper charts or ECS for consultation while executing the passage plan.

The passage plan's "Voyage Arrangements" was ticked to confirm pilot arrangements had been considered but was determined not necessary as indicated on the extract:

✓	Have pilots/tugs/berths/agents been arranged?

The passage plan was recorded on the required company passage plan form with a waypoints list from the Transas ECS attached. Other elements of the passage plan were considered by the master including weather reports, tides and currents, stability, ice reports, watchkeeping arrangements, navigational marks and lights. These were examined on-board as part of the investigation and found satisfactory.

Prior to departure, the SMS requires checks to be made on-board in preparation for proceeding to sea. This involves checks concerning the crew and statutory compliance, steering gear checks, pre-departure (deck and engine) equipment checks, checking the draught and closing watertight openings. This was confirmed by an entry in the Official Log Book on the 7th September 2018.

The SMS procedure recommends the inclusion of elements of the ICS Bridge Procedures Guide, section B6, into the departure checks. Most were found incorporated into vessel checklists as applicable to the yacht's operations and equipment with the exception of the pilot checks.

In June 2018 the Company completed a Polar Waters risk assessment and prepared a Polar Water Operational Manual for voluntary compliance with the IMO Polar Code for the intended voyage through the North-West Passage. These were prepared to support the safe execution of the voyage, particularly when navigating near areas of ice. Extensive research went into the preparation of the documents which includes reference to United States, Canadian and International Maritime Organisation sources and requirements. The voyage was eventually unable to be completed due to ice conditions at which point the yacht relocated to western Greenland.

The following are extracts from the Polar Waters risk assessment. Of the factors identified, poor hydrography and lack of proper navigational experience are recorded as unmitigated risks with probable disastrous consequences. Thus, it was anticipated the hydrographic information of the area is poor.

Hazard area		Risk description & consequences	Unmitigated risk	Mitigation	Residual risk
Poor hydrography	7	The quality of hydrographic surveys and the accuracy of navigational charts in some Artic areas is poor to very poor, especially in the eastern parts of the region. Many of the surveys are very old and based on hand lead surveys. There are few reliable sounding contours and these are not reliable enough for use in position fixing. Land mass surveys are now largely based on satellite imagery which means that positions derived from ranges and bearings will be reliable provided the land marks are distinguishable. Positions may be unreliable and show variation from satellite derived positions.	Probable Disastrous	The quality and reliability of hydrographic surveys should be assessed by careful reference to the source data diagram shown on each chart. This will provide navigators with an indication of the age and type of survey for each area being navigated and hence an indication of the reliability that they may place on the hydrographic data presented. Particular care should be taken when navigating in areas where the survey was performed before 1960 because these were unlikely to include full sea floor coverage, or where the survey is based on primitive surveying methods – in particular manual soundings. These considerations should be reflected in the passage plans and the determination of any marked areas safety zones, margins of safety, recommended tracks and 'No Go' areas. The echo sounder should be run continuously to detect signs of approaching shoal water. Charts & NPs will be carried in accordance with USCG and Canadian regulations as prescribed by NP 247(1), Part 1 (4.26)	Remote Major

Points to note regarding the above mitigating factors:

- Chart 1103 has no source diagram thus the reliability of the chart information cannot be determined;
- Particular care was required when using Chart 1103 as the chart survey data dates from 1927; and
- The echo sounder was run continuously.

Navigation					
Lack of polar navigation experience	3	The Master and navigational watchkeepers have no significant experience of navigating in Polar waters. In addition to the risk of damage due to ice there are additional hazards resulting from the unreliability of magnetic and gyro compasses in high latitudes and reduced reliability of satellite derived positions. Navigators should be aware that directions change fast with movement of the observer and the convergence of meridians and excessive longitudinal curvature render the meridians and parallels impracticable for use as navigational references.	Probable Disastrous	Navigational passage plans should take account of the principles set out in IMO Resolution A.999(25) Guidelines on voyage planning for passenger ships operating in remote areas. The detailed voyage and passage plan should include 1 Safe areas and no-go areas; 2 The use of well surveyed marine corridors, if available; 3 Contingency plans for emergencies in the event of limited support being available for assistance in areas remote from SAR facilities. 4 Conditions when it is not safe to enter areas containing ice or icebergs because of darkness, swell, fog and pressure ice; 5 Safe distances from icebergs in conditions of good visibility and safe speed in such areas; and 6 Safe speed in areas where sea ice is present. When using Mercator charts for navigation it should be borne in mind that bearings of objects taken at a considerable distance need to be treated as Great Circles. Arrangements are in hand to provide the Master and navigating officers with special training in polar navigation using an STCW certified online course provided by Seagull. All navigation equipment should be fully operational before the start of the transit. Regular checks should be made to ensure that the equipment remains operational with particular attention to rudder alignment and rudder angle indication, navigation lights and signals, searchlights, Aldis lamps and radars. An accredited Ice Navigtor will be carried while the vessel is navigating in Canadian polar waters in accordance with the	Remote Major
				requirements of Ice Navigation in Canadian Waters Para. 2.6.8 and taking into account the fact that the section of the voyage through Zone 6 will need to be conducted under the AIRSS. The Ice Navigator will embark at Pond Inlet (Zone 13) and disembark shortly before the vessel departs from Canadian arctic waters. Canadian Coast Guard publication ' Ice Navigation in Canadian Waters' should be consulted when planning the passage. http://www.ccg-gcc.gc.ca/folios/00913/docs/ice-navigation-dans-les-galces-eng.pdf	

Points to note regarding the above mitigating factors:

- Ice navigation is not applicable to this case;
- Safe areas and no-go areas were not marked on the chart or Navi Sailor ECS;
- Well surveyed marine corridors are not established in the region to be navigated; and
- The navigation equipment was reported to be fully operational.

2.5 Safety of Navigation

"*No chart is infallible. Each chart is liable to be incomplete, either through imperfections in the survey on which it is based, or subsequent alterations in topography or the seabed. However, in the vicinity of recognized shipping routes, charts can be used with confidence for normal navigation needs. The navigator should be the final judge of the confidence that he can place in the information given, taking into account his particular circumstances, safe and prudent navigation, local piloting guidance and the judicious use of available navigation aids. Ships take the ground when the draft exceeds the depth of the water. The practice of running and observing the echo sounder when near the bank water considerably reduces the possibility of grounding due to navigational error.*"

The Mariner's Handbook NP100 (United Kingdom Hydrographic Office)

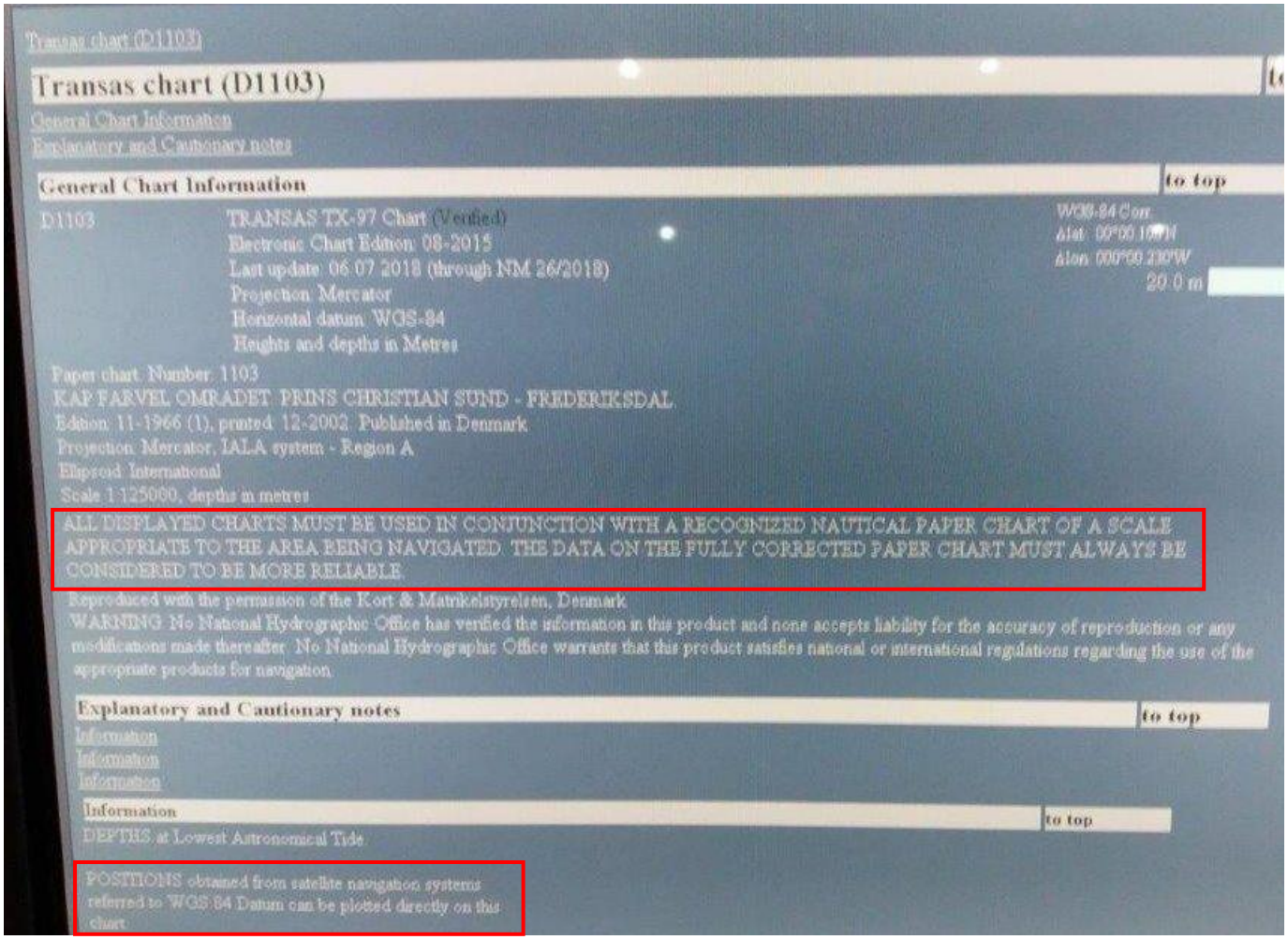
To help determine the confidence in the chart information navigators can refer to the chart's source diagram (paper charts). Chart 1103 has no source diagram and it's survey information is prior to 1960.

Paper Chart 1103's chart legend and the documented 'poor hydrography risk mitigation' highlighted soundings of a reconnaissance nature and areas of 'poor seafloor coverage', i.e. little or no reliable sounding information. The poor hydrographic information constitutes an increased risk that uncharted sub-marine obstacles, i.e. under-water dangers to navigation, may exist. Hence paper Chart 1103 urges mariners to exercise due caution.

When sailing in waters with little or no reliable soundings, establishing how the yacht's position is to be verified, the depth below the keel and an appropriate speed are all important for safe navigation. Effective use of terrestrial navigation, i.e. range and bearings using the charted topography in conjunction with the echo sounder and suitable electronic position fixing means greatly enhances safety of navigation. Over reliance on a single method of position fixing can reduce the safety factor. In this case electronic means was used solely through out the passage without comparison to terrestrial position fixes.

Electronic means provided to verify the yachts position could be achieved in two ways,

- GPS positions plotted on to paper Chart 1103 with a position correction, and
- Navi Sailor ECS where no position correction was required but did stipulate to be used in conjunction with paper Chart 1103 as indicated below:



The difference between using older charts compared to WGS84 datum charts can be summarised;

"*Older surveys are often more accurate in relative terms than in absolute terms, i.e. surveys are positioned accurately in relation with each other, but as a whole may have absolute differences from modern data such as the WGS84 Datum. In these cases, conventional navigation using charted features gives better results than modern techniques such as GPS. Although a navigator may know his position relative to satellites to an accuracy of 10 meters, the shoals in which he may be navigating may only be known to an accuracy of 200 meters or worse.*"

The Mariner's Handbook NP100 (United Kingdom Hydrographic Office)

The warning concerning GPS positions on paper Chart 1103 is emphasised to seafarers in the notes concerning Satellite Derived Positions and Accuracy of the Chart in chart legend - refer to Section 2.1.

The paper chart legend was amended to include the term "MAY BE SIGNIFICANT TO NAVIGATION". This term is used to advise navigators "*to use alternative sources of positional information particularly when closing the shore or navigating in the vicinity of dangers*."

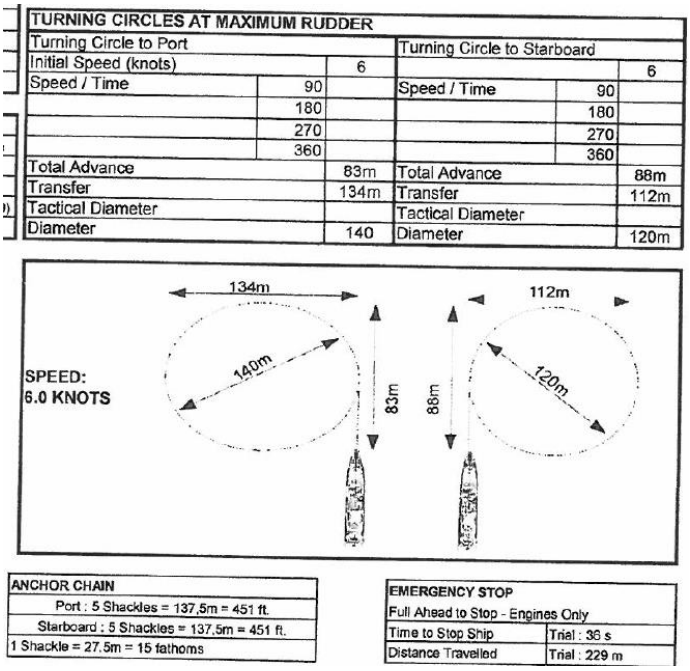
This is where the use of other means of verifying the position such as the Navi Sailor ECS which do not require positional correction, to supplement the other aids to navigation, including range and bearings plotted on the paper chart, are important.

The polar water risk assessment states "*the echo sounder should be run continuously to detect signs of approaching shoal water*". The echo sounder measures the depth of water directly below the keel and not ahead of the yacht. The echo sounder was in operation prior to the grounding. In the case of an underwater rock pinnacle the change of depth of water is almost instantaneous when observing by echo sounder while the yacht is making way. This leaves the navigation officer little or no time to process this information and manoeuvre the yacht clear. This differs from shoaling water where the change in depth may be observed to be more gradual.

Following a change of plan with an unscheduled excursion to the Kangerdluk inlet the yacht began its return trip to Nanortalik anchorage at 1600. 1600 was later than expected when initially planning the voyage to commence the return trip. When departing the inlet cruising speed was set with the hope of returning to the morning's track already sailed before nightfall.

The deployment of the RIB tender boat leading the yacht ahead was utilised on previous occasions but not for the voyage on 7th September 2018. Where the RIB tender boat is deployed to sail ahead of the yacht the master determines the yacht's speed by the ability to stop behind the RIB should the need arise. This speed is then factored into the passage plan for the day's sailing.

The manoeuvring data shown below indicates a stopping distance of 229m (full-ahead to stop engines). It is likely a shorter stopping distance can be achieved by either sailing at a slower speed or by applying full-ahead to full-astern engines but this is not defined in the manoeuvring data.



TURNING CIRCLES AT MAXIMUM RUDDER					
Turning Circle to Port			Turning Circle to Starboard		
Initial Speed (knots)		6			6
Speed / Time	90		Speed / Time	90	
	180			180	
	270			270	
	360			360	
Total Advance		83m	Total Advance		88m
Transfer		134m	Transfer		112m
Tactical Diameter			Tactical Diameter		
Diameter		140	Diameter		120m

ANCHOR CHAIN
Port : 5 Shackles = 137,5m = 451 ft.
Starboard : 5 Shackles = 137,5m = 451 ft.
1 Shackle = 27.5m = 15 fathoms

EMERGENCY STOP	
Full Ahead to Stop - Engines Only	
Time to Stop Ship	Trial : 36 s
Distance Travelled	Trial : 229 m

As shown left the yacht was provided manoeuvring data for a speed of 6 knots.

The yacht was making way at a cruising speed of approximately 14.5 knots when it grounded. At this speed the stopping distances and turning circles is greater than that stated on the manoeuvring data.

The greater the yacht's speed the greater the chance of significant damage to the yacht when striking a sub-marine obstacle.

Therefore, a slower speed in areas of poor hydrography may result in greater opportunity to manoeuvre clear or less damage incurred resulting from a collision.

However, despite the risk assessment mitigation requirement for "particular care", the master believed he was navigating in open water at the time prior to the grounding. The master interpreted there was nothing on the chart to indicate the existence of any dangers to navigation and thus had no reason to believe that he might need to manoeuvre at short notice or in close quarters.

3. Conclusions

In consideration and analysis of the events leading to the grounding on 7th September 2018 the following conclusions are made:

1. The yacht grounded at cruising speed of approximately 14.5kts in waters with little or no sounding information on an uncharted sub-marine obstacle, in this case an underwater rock pinnacle.
2. As a result of the grounding the yacht sustained significant structural damage rendering the yacht unseaworthy and caused minor oil pollution to the marine environment. No injuries were incurred. The yacht crew's response to the emergency situation was effectively managed for which the crew should be praised.
3. The provision of additional equipment, in this case a large RIB tender boat capable of accommodating everyone on-board the yacht equipped portable satellite communications equipment proved extremely useful when abandoning the yacht.
4. The voluntary implementation of LY3 for voyages in Polar Waters, particularly the implementation of a Safety Management System and Polar Code requirements, is above and beyond what is statutorily required of a pleasure vessel. The master and Company should therefore be commended for this initiative. **[2.1]**
5. Chart 1103 warns of inadequate seafloor coverage. No special measures to enhance safety of navigation were included in the passage plan beyond the normal navigation practices and procedures for the passage. "Particular care", as suggested by the risk assessment mitigation, to address the inadequate seafloor coverage was not sufficiently implemented in the passage-plan's planning and execution. **[2.2.2, 2.2.3, 2.4]**
6. With the discrepancies between electronic and terrestrial position fixing effective use of the electronic chart system was made to monitor the yacht's position however the passage plan was not verified against the paper chart which would require terrestrial position fixes. **[2.2.4, 2.5]**
7. When executing the passage plan it was considered safe to sail the yacht at cruising speed off the pre-planned track in waters with few or no sounding information because there were no charted dangers. This was despite warnings of poor hydrography, inaccuracies of the charts and the risk assessment. **[2.2.3, 2.5]**
8. Use of the echo sounder in relation to the yacht's speed proved ineffectual to give advance warning as the yacht approached the rock pinnacle. **[2.5]**
9. Effective use of the RIB tender boat and it's onboard navigation equipment leading the yacht was not considered necessary for the voyage on 7th September 2018 despite being used on previous occasions. Such measures can give early warning of sub-marine obstacles and allow the yacht to take avoiding action. **[2.2.3]**

In examining the implementation of the yacht's voluntary safety management system and Polar Code compliance the following points were noted:

1. The yacht's passage plan procedure and passage plan checklist were not adequately implemented on-board nor did the prepared passage plan take fully into consideration the risk assessment's mitigation factors associated with navigating in polar waters with poor hydrographic information.
2. Elements of the passage plan checklist were marked complete where in fact they had not been addressed.
3. Effective use was not made of the paper charts and the radar's capabilities when executing the passage, e.g. parallel indexing and radar range/bearings.

4. Action Taken

Action taken by Nigel Burgess Ltd:

1. Nigel Burgess Ltd held a captain's seminar giving guidance to highlight the dangers of navigating in remote areas. The information from this seminar is to be circulated around the fleet by means of a revision to the SMS, in particular to include guidance for officers to consider survey/soundings date and quality when passage planning.

2. Nigel Burgess Ltd conducted an investigation into the grounding and prepared a preliminary investigation report where the following conclusions were made:

    1. *In the months and years prior to the incident there is clear evidence that the yacht captain and his officers followed good practices of seamanship and were diligent and professional in their record-keeping;*
    2. *The data shown on the paper charts in use at the time of the incident was derived from surveys and soundings carried out in the 1960s, or earlier;*
    3. *The plotted route passed through a 'blank' area on the chart, mid-way between a headland and a marked rocky shoal. This was assumed to be an area of safe water and that assumption was based on scanty information; and*
    4. *The yacht was travelling through this area at speed of 14.4 Knots during evening twilight. Given the prevailing circumstances this can be considered as an unsafe speed.*

3. The SMS guidance to auditors has been amended and extended as necessary to include a requirement to further verify the yacht's effectiveness in completing the required SMS procedural checks through auditing and practical demonstration on-board.

4. The Safety Management Manual has been amended to include specific reference to the importance of avoiding grounding and advising masters to resist commercial pressures to deviate from the pre-planned track or close the coast.

5. The Safety Management Manual has been amended to include a new requirement to consider local coastal state requirements.

6. The Safety Management Manual has been amended to include new subsection: Special Considerations Relating to Navigation in Polar Waters.

Action taken by the Danish Geodata Agency:

Following the grounding the Danish Geodata Agency promulgated the below chart correction 458 on 28th September 2018 for Danish chart 1103 warning mariners of the rock which caused the grounding.

458	**Pamiagdlup Kujatíngua W**		
1103	Tilføj skær og udvid tilhørende farekurve *Insert rock and adjust associated danger line*	+	59º55,638'N 044º25,601'W

(38/761 2018)

5. Recommendations

Masters are recommended to:

When navigating in remote areas with poor hydrography:

1. Navigate with enhanced vigilance in anticipation there may be unknown/uncharted sub-marine obstacles;
2. Where provided, make effective use of small boats leading ahead using an echo sounder or other suitable means to determine the water depth; and
3. Sail on known 'good' tracks previously made by other yachts and ships.

The Isle of Man Ship Registry is recommended to:

Promote and encourage the need for enhanced safety measures for all pleasure vessels when navigating in polar waters or areas with poor hydrography.

Nigel Burgess Ltd is recommended to:

In view of the actions already taken by Nigel Burgess Ltd no further recommendations are made.

Annex 1 – SMS – Passage Planning Procedure

[redacted]

Safety Management Manual

7A.1 Passage Planning

Account Name: ICE ANGEL
Version : 3

Created by [redacted] on Sunday, February 23, 2014 12:42:33 PM
Last modified by [redacted] on Thursday, December 21, 2017 9:47:29 AM

Passage Planning Requirements

Every sea passage, regardless of duration should be:

1. Planned in advance and in accordance with the principles and factors set out in the latest edition of the ICS Bridge Procedures Guide, Chapter 2.
2. Cover the entire voyage from the departure berth, anchorage or DP station position to the arrival berth, anchorage or DP station position;
3. Recorded using form BY-22

The intended sea passage must comply with any applicable operating limitation. Operating limitations may be stated on the: Certificate of Compliance with the Large Yacht Code (or equivalent), Load Line Certificate, Safety Radio Certificate or Minimum Safe Manning Document (in relation to crew qualifications or complement).

Charts & Publications

To assist in passage planning the following publications must be onboard, up-to-date, and consulted:

- Nautical Charts, of the appropriate scale, relevant to the voyage;
- Temporary and Preliminary (T & P) Notices to Mariners;
- Admiralty List of Lights;
- Admiralty List of Radio Signals;
- Sailing Directions;
- Admiralty Tide Tables;
- Tidal stream atlases;
- IMO Ship's Routing Guide;
- The Mariners Handbook;

In addition to these publications, any relevant local information must be consulted, including NAVTEX messages, pilot's advice, local tidal info, etc.

The appropriate chart of the largest scale is always to be used for passage planning and navigation. All intended courses, course alteration way points and clearing distances should be pre-plotted as far as possible. Emphasis marks should be placed around hazards.

An ECDIS may only be used as the primary means of navigation if it is type approved and shown on the SEC Record of Equipment.

A system that does not meet the requirements to be classed as ECDIS is an Electronic Chart System(ECS). An ECS may only be used as an aid to navigation. Navigational decisions must never be based solely on the information presented by an ECS.

Assessment of Weather Conditions

The Master shall use all available means to assess prevailing and forecast weather conditions before departure and during the passage. Cautious weather routing should be used if there is any doubt about the ability of the vessel to complete the passage without sustaining damage.

Assessment of Fuel, Oil and Water Reserves

The Master and Chief Engineer shall ensure that the vessel has sufficient fuel, lubricating oil and water onboard to complete the intended passage and arrive with an adequate reserve.

Stability

Annex 2 – Yacht's Passage Plan for 7th September 2018 (excluding waypoint list)

PASSAGE PLAN

Vessel Information

Vessel Name:	ICE ANGEL	Captain	[redacted]	Plan prepared by:	[redacted]	Chief Officer	
Departure Port:	Norfolk	ETD:	07-Sep-2018	09:00	Average Speed (kts):	13	
Arrival Port:	Norfolk	ETA:	07-Sep-2018	21:30	Distance (nm):	70	
Is the yacht subject to an operating area limitation?	No - Cat 0, Unlimited			I confirm the intended passage complies with any operating limitations:	[redacted]	Chief Officer	

Draft & Stability

- ✓ Have you checked your departure draft?
- ✓ Have you checked the tides and depths en route?
- ✓ Have you calculated your arrival draft?
- ✓ Have you checked your stability throughout the passage?

Charts & Publications

Have the following up to date publications been consulted?

✓	Sailing Directions	Pages:	Notes: NP12
✓	List of Lights	Pages:	Notes: Digital
✓	List of Radio Signals	Pages:	Notes: Digital
✓	Tide/Current Tables	Pages:	Notes: Digital
	IMO Ships Routing	Pages:	Notes:
	Ocean Passage Guide	Pages:	Notes:

Are all necessary Charts available and up to date? (please list)

235 / 1001 - 1100 - 1103 - 1113 Greenland Charts - corrections printed and to be applied

- ✓ Are the above charts corrected up to latest available NtM and are courses marked?
- ✓ Have the relevant Temporary and PreliminaryNotices and navigation warnings bee checked and marked on the chart?
- ✓ Have you marked and areas of particular hazard (e.g. shallow waters, expected fishing fleets, poor anchoring, etc.)?
- ✓ Parallel indexing lines and/or distance and bearing markers, as appropiate?

Voyage Arrangements

- ✓ Has a list of waypoints for the voyage been attached to this form?
- ✓ Has a weather forecast been obtained / routing been arranged (if applicable)?
- ✓ Have watch keeping arrangements and manning levels for voyage been assessed?
- ✓ Have estimated fuel and water consumption been assessed and are the required quantities available on board with sufficient spare capacities?
- ✓ Are points where the Master must be called marked on the chart?
- ✓ Are points where VTS must be contacted marked on the chart, with relevant info?
- ✓ Have pilots/tugs/berths/agents been arranged?
- ✓ Are you aware of the notice of arrival required by the appropriate authority (e.g. USCG)?
- ✓ Have the MARSEC level of the next port and the areas through which the vessel will transit (both for Flag State and for relevant Port States) been established?

Navigation Equipment

- ✓ Relevant Navtex Stations pre-set ?
- ✓ Relevant Weather Fax Stations pre-set ?
- ✓ AIS / GPS / Electronic Chart Systems and other relevant system programmed with route?

Tidal Information

Port	Date	HW Time	HW Level	LW Time	LW Level	HW Time	HW Level	LW Time	LW Level

Other Relevant Navigational Information

Berth to Berth Principle

- ✓ Has this passage plan been fully prepared from berth to berth in accordance with SMS Section 7A?