
# Ship to Ship Transfers as an integrated solution for Arctic Shipping exemplified by a recent case of LNG Ship to Ship Transfer in Northern Norway

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 The data in the presentation slides is the estimation calculated by Tschudi Shipping

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# Why Ship to Ship transfers?

- Draft, beam, length, height restrictions
- Need for Ice class
- Need for special equipment (fall pipe vessels, cranes, ramps, barges…)
- Economy of scale – bigger vessel into small
- Projects – no infrastructure - no time or budget to build a pier
- Projects – no infrastructure – actually building a port as we go
- Domestic flag requirements / cabotage issues
- Environmental/regulatory requirements

# Ship to Ship Transfer is not a new invention

# 100 years ago

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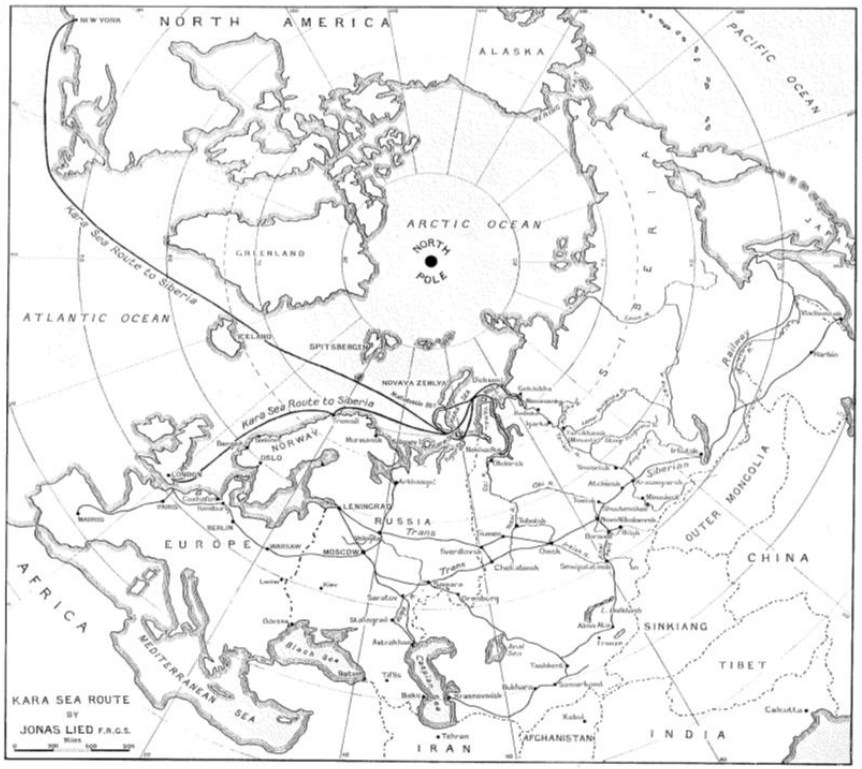
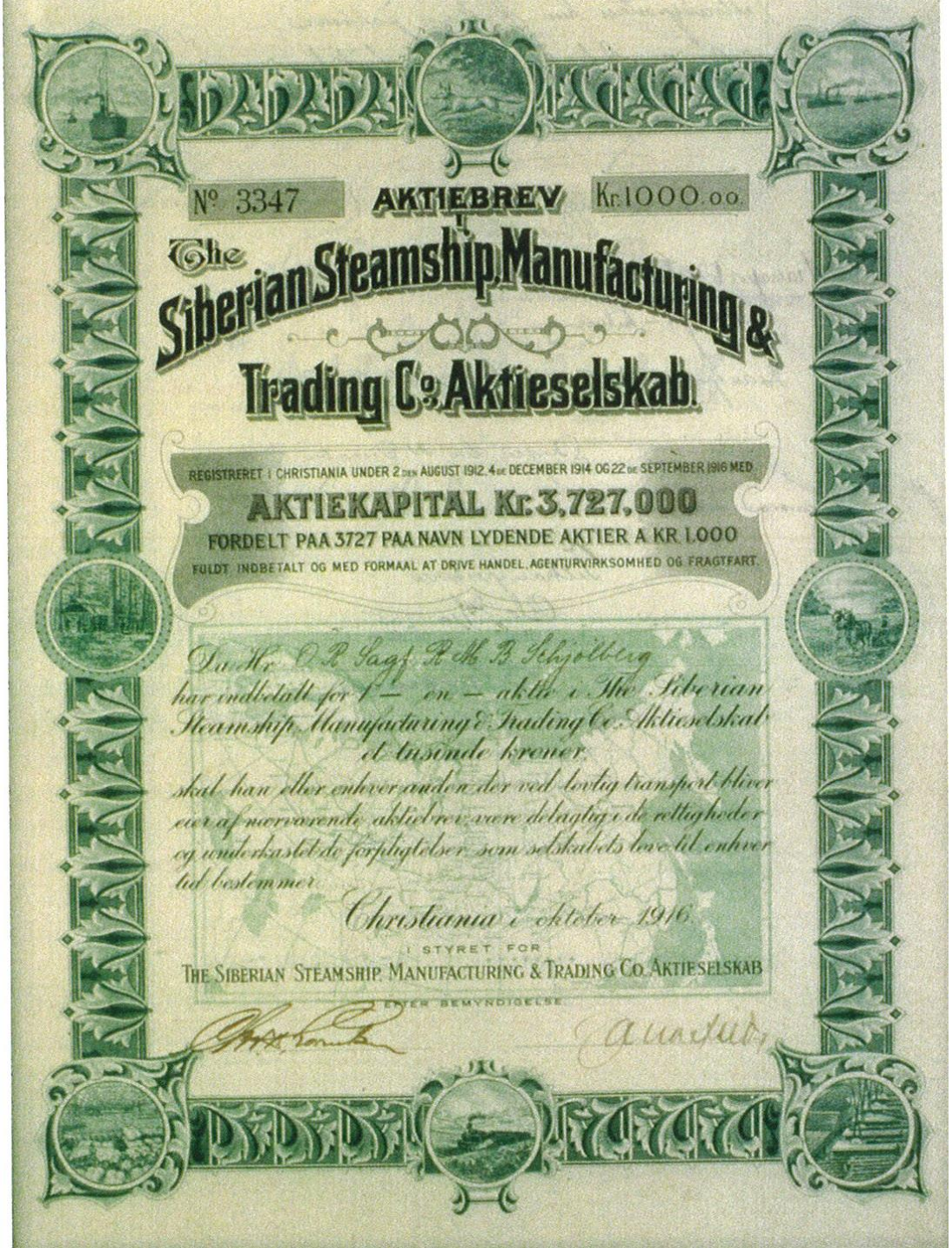
ARCTIC TRANSIT

Jonas Lied was an international businessman and founder of The Siberian Steamship, Manufacturing and Trading Company.

He was also the Norwegian honorary consul in Siberia 1914-1918.

The business idea of The Siberian Steamship, Manufacturing and Trading Company was to open up a trade route between Western-Europe and Central-Asia via the Barents Sea, the Kara Sea and the rivers Yenisei and Ob.



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Lied changed to Russian citizenship during 1914 in order to be able to own and operate river vessels in Russia.
(Cabotage was an issue also then.)

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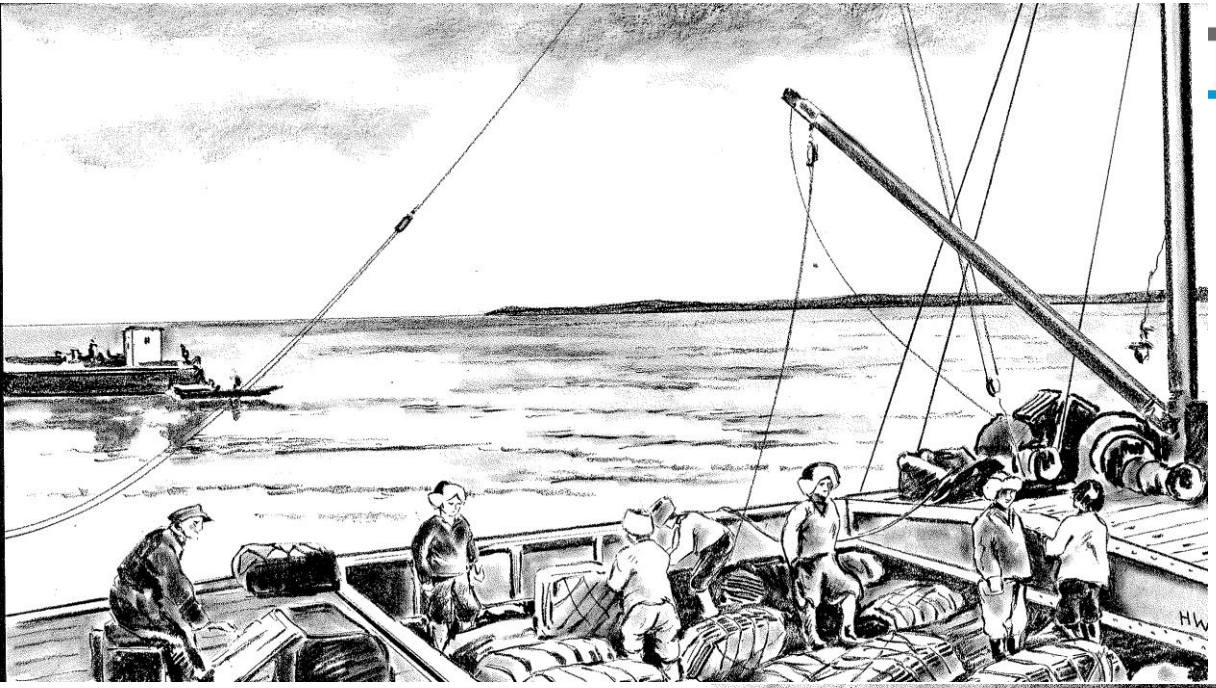

**Jonas Lied' own sketches from his operation**

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ARCTIC TRANSIT

# Ship to Ship transfers are still important for Arctic Cargoes:

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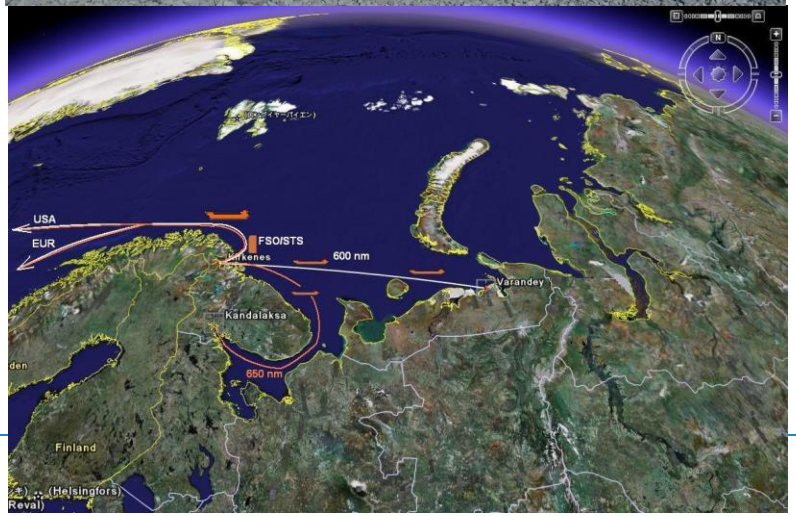
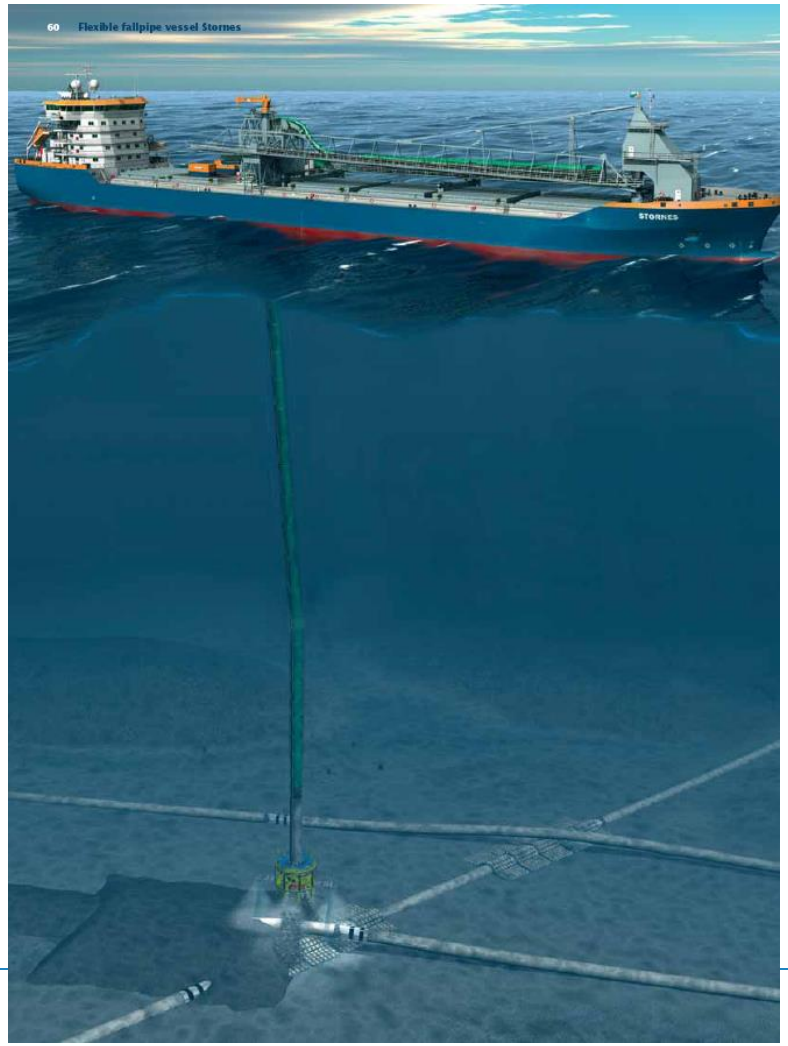
# Using conventional vessels to feed specialized vessels
# Loading aggregates in Kirkenes for Badaraskay Bay-



# Transshipment of project cargoes from Busan bound for Tobolsk, Siberia alongside the Tschudi pier in Kirkenes

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Transshipping in the Arctic for a non Arctic final destination

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# Gazprom Amur GPP Project

## Not Arctic, but same challenges and a good illustration of what can be done

## Scope of work

The Linde Group chose German heavy lift expert Combi Lift as its logistics partner for oversized and heavy lift cargo for the Linde Amur GPP Project. The entire scope involves transporting over 176,000 freight tonnes of cargo, including 12 columns weighing 900 tonnes each.




Combi Lift

# Gazprom Amur GPP Project

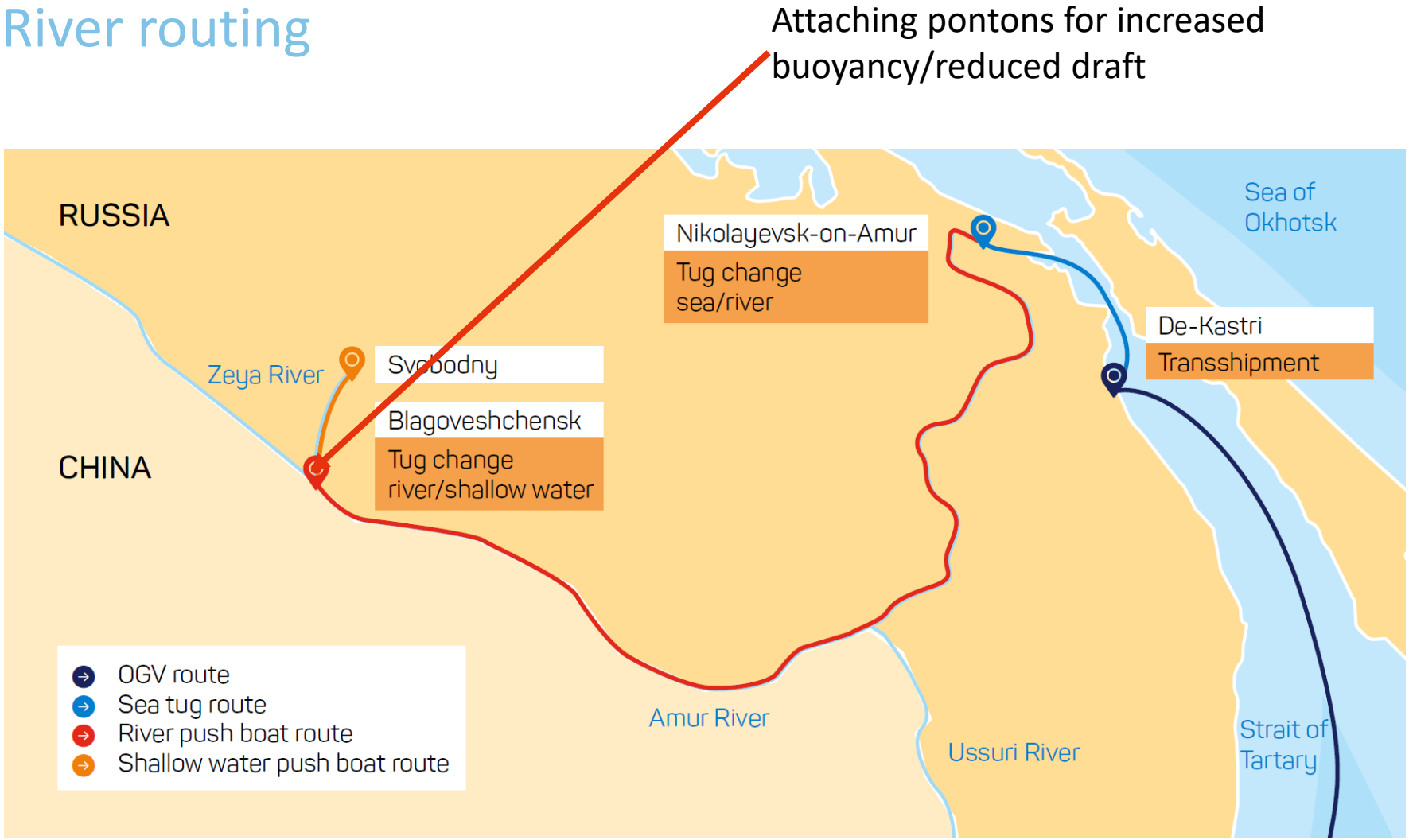
## Routing




Combi Lift

# Gazprom Amur GPP Project

## River routing



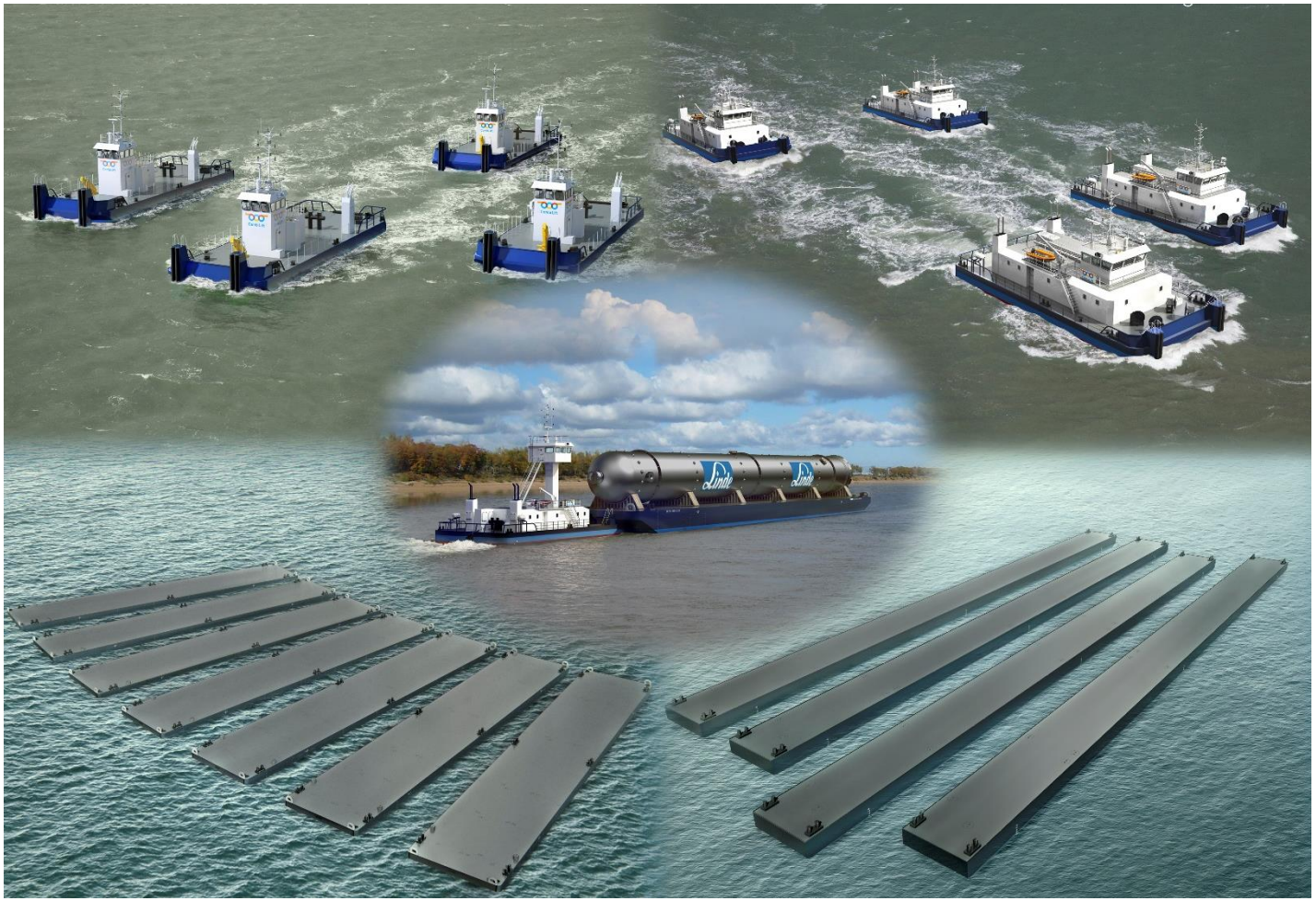



Combi Lift

# The CL Amur Fleet

## Side floater system

## We congratulate Harren & Partners / Combi Lift on a creative solution with a smart and entrepreneurial  transshipment solution.



# Then to oil & gas
# Ship to ShipTransfers

# Tschudi Arctic Transit

## Key Highlights

- Impeccable safety and efficiency record from oil, condensate and LNG transshipment operations in Arctic waters.
- Several locations in Honningsvåg, (North Cape) with the possibility of 3 parallel STS operations.
- One location in Kirkenes, Bøkfjorden for condensate and LNG and one for LNG only in Korsfjorden
- Oil, gas and shipping service cooperation agreement with the Municipality of Nordkapp (Honningsvåg).
- Several strong local footholds in Northern Norway: Skjervøy, Honningsvåg and Kirkenes.
- Offers services of approved and well qualified mooring masters. Provides necessary emergency preparation equipment, hoses, fenders and tug services during oil transshipment operations.

www.tschudigroup.com

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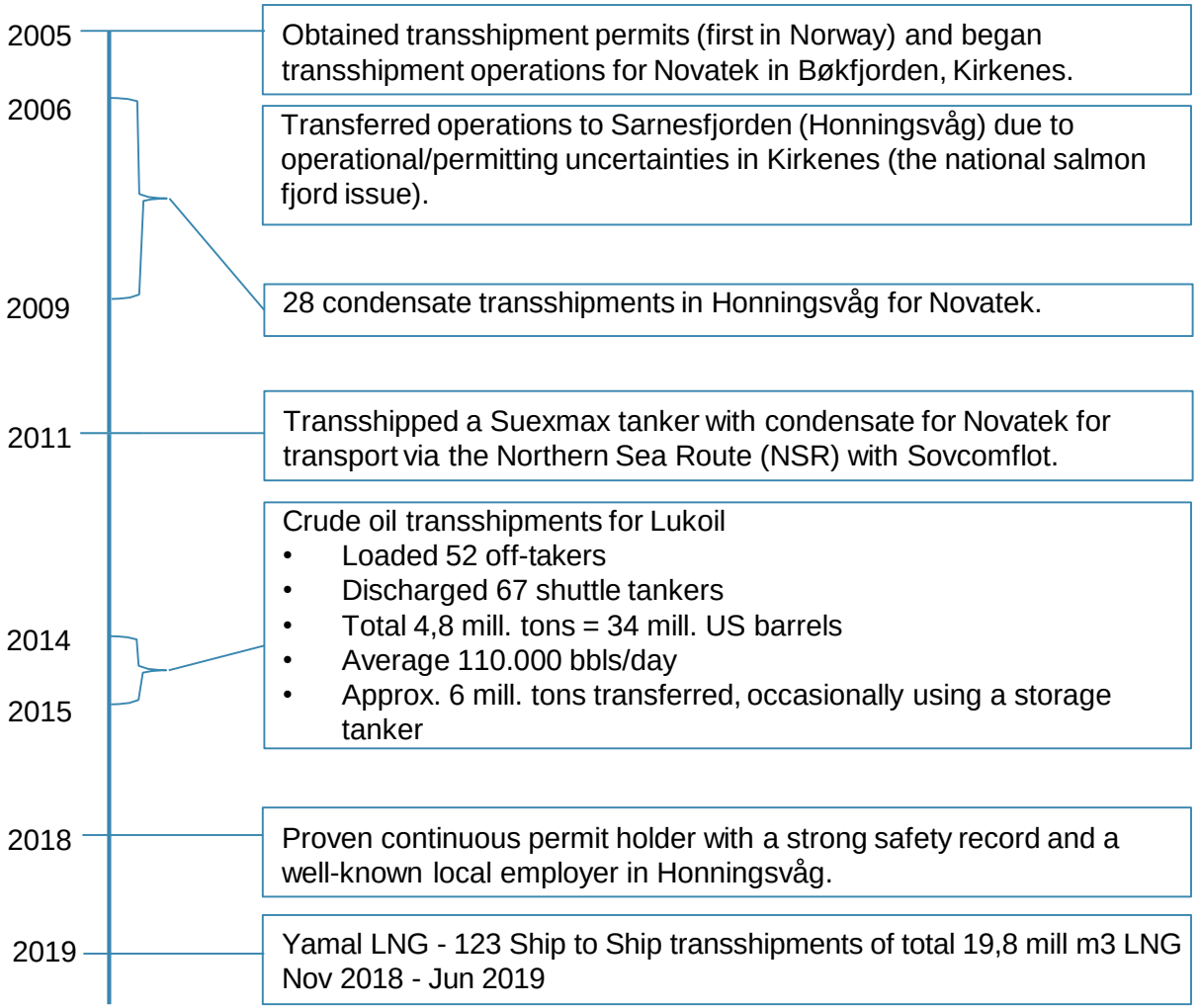
# Tschudi Arctic Transit

## Highlights: the longest transshipment experience in Northern Norway



# The Challenges
# - up to 23 operations per month
# - time for getting organized
# - time needed for permits
# - time for delivery

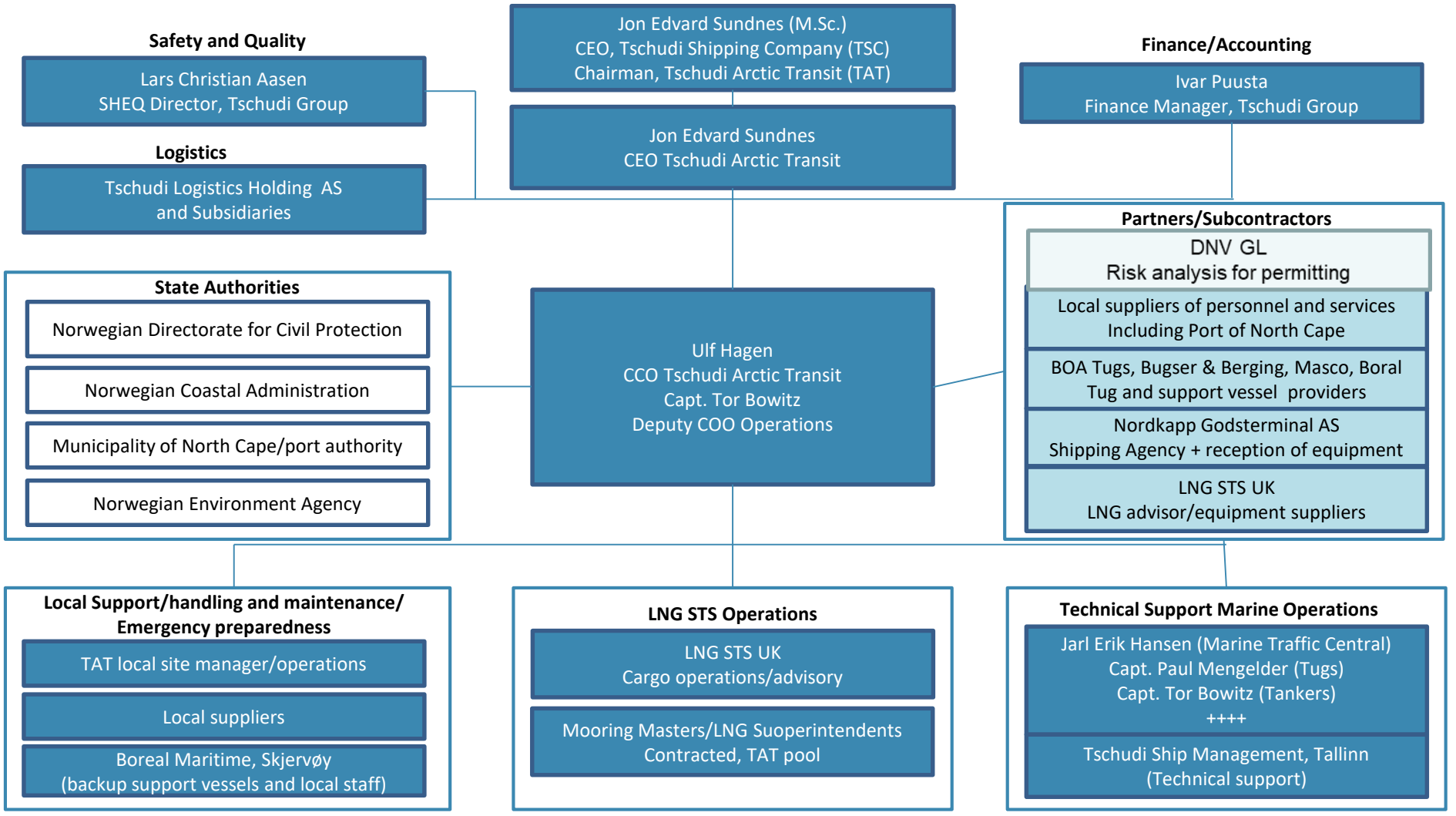
- 72 hours per operation - 30 days – 10 operations per location
- 2 STS positions were not enough
- We needed three STS positions close to each orders
- We needed to have three full sets of equipment including fenders
- Permits take time
- You don’t find all the people needed on short notice
- Tugs needed to be chartered and mobilized
- Delivery time for equipment was 4 months,5 months and 6 months
- The fenders needed to be 4.5 meter minimum because of bending radius of hoses. This was not in stock and many fenders were sold in front of us before we had go ahead.
- Temperature criteria for equipment and a need for an ice free location

# Our approach

- When we were invited to tender we established a project team defining the project parameters
- We worked closely with DNV-GL for risk analyses
- We worked closely with, and not against, Norwegian Authorities when applying for the required permits.
- The permits and the operating parameters related to these reflected our Hazardous operation analyses, the Norwegian legislation and the experiences gained through previous operations with other Hydrocarbons
- The project was well founded in the whole Tschudi Group organization including CEO and Chairman/Owner
- The Tschudi Group CEO full time in the project to secure timely and proper execution
- We sourced our best internal resources for project execution as needed
- We hired the most reputable external consultants and sub contractors when needed (Teekay Marine/LNG STS, DnV GL, Boa, Bugser & Berging)
- We buy locally when possible
- A task with very stringent quality and safety requirements considered impossible to deliver on time, was actually delivered on time because of full commitment from the whole Tschudi Group Team and supporters
- This commitment is well founded in our Group and build on 135 years of treating employees with respect and offering opportunities. The strong and loyal Tschudi Team is our absolutely biggest asset

# Tschudi Arctic Transit

## Drawing on all Tschudi Group Resources and Associates

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# Honningsvåg Location

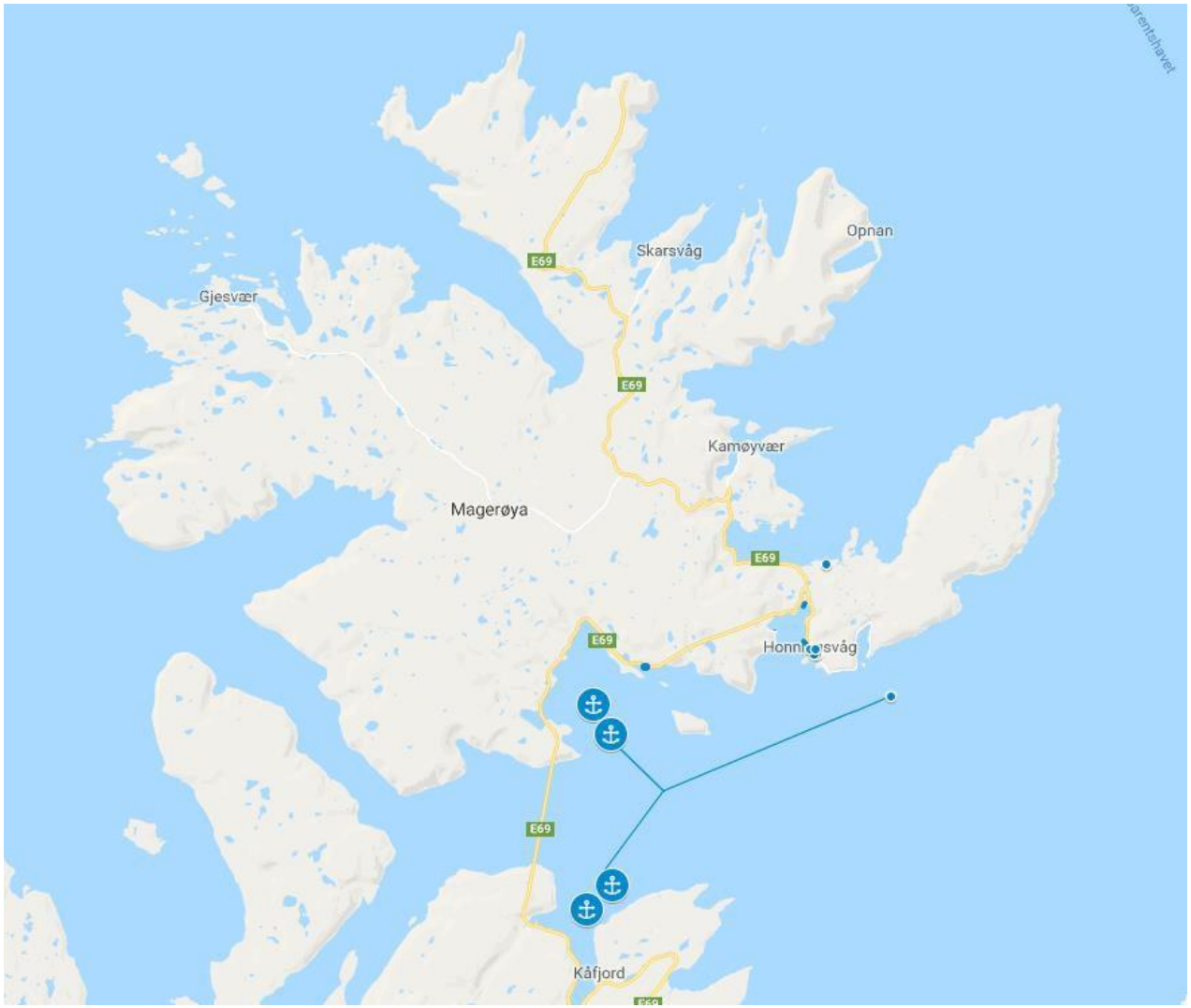

**Tschudi Arctic Transit**

- 4 Ship-to-Ship (STS) transhipment positions are designated in Honningsvåg, enabling three parallel operations.
- Tschudi was responsible for acquiring and complying with the necessary permits, owning STS equipment, chartering tugs, hiring LNG STS expertise (Teekay).

**Project Parameters**

- 2 transhipments in the month of November, escalating to 14 in December and up to 23 January-June.

# Honningsvåg Location



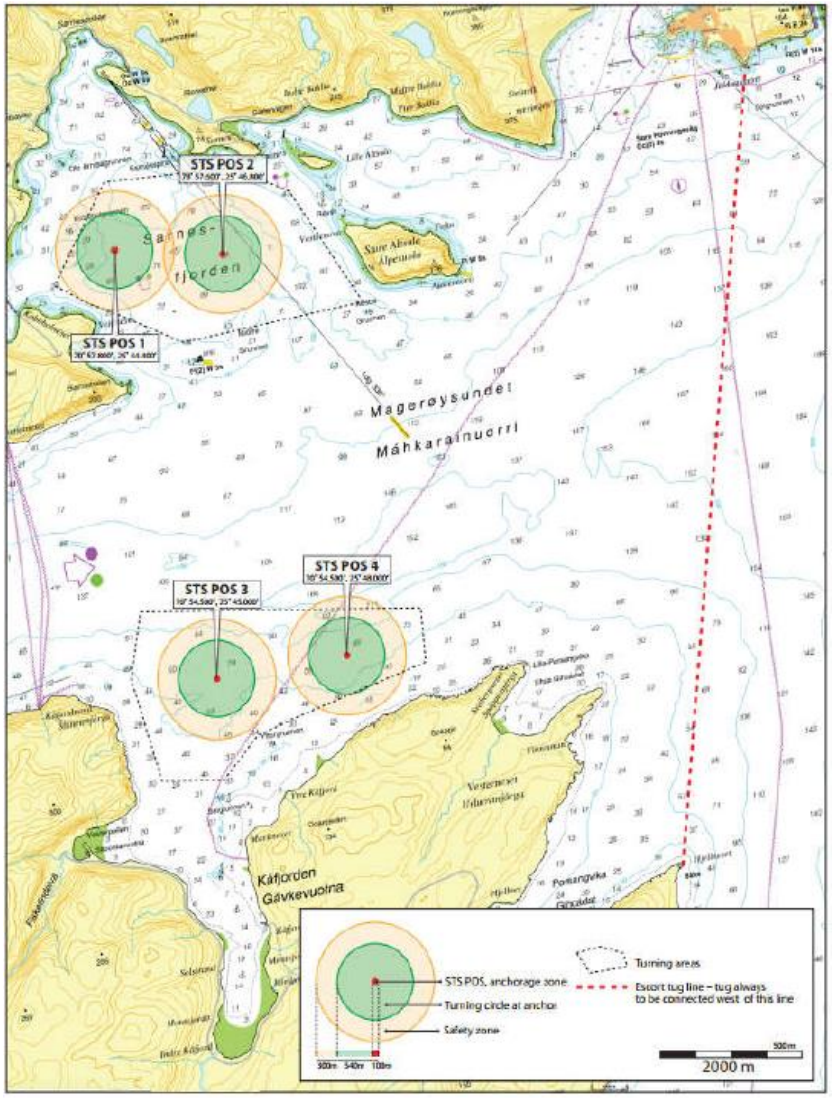
# Honningsvåg Location

**Sarnesfjorden**

STS positions 1 and 2

**Ytre Kåfjord**

STS positions 3 and 4



# Main Challenges prior to start up:

- Permits – 3 Directorates, plus local authorities and the port
- Informing, involving and training local personnel including emergency personnel, pilots, port personnel, sub contractors
- Time available, no contract signature before permits
- We could not commit personnel, sub contractors or equipment before we had a contract
- We needed to have all site and operation specific manuals prepared
- Manuals should reflect an organizational structure that had to be established
- Delivery times' for equipment – long lead items
- Logistics – all had to be shipped, trucked or flown in
- Getting qualified personnel and getting them on site in time
- We needed to tie up and mobilize 4 tugs and one support vessel (AHTS) prior to starting

# The Permits, their conditions and the follow up by the authorities

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## The Coastal Directorate

- Locations, anchor holding, distance to shore, other marine traffic,
- **Weather criteria for anchoring, mooring, break off of operation to stand by, parting and abandoning the area**
- Requirements for tugs – sufficient capacity and number, also for an emergency
- Pilots – interaction with vessels, agent and our operations department
- Emergency preparedness, regional stand by vessel
- Surveillance by the overall marine traffic control (VTR – Vardø)
- Public hearing with 4 weeks response time

## The Environmental Directorate

- Environmental impact – Reviewed and considered to have lower environmental risk than oil and condensate
- Pollution to air
- Acceptance of no oil booms during operation to avoid containment of LNG
- Regular reporting

# The Permits, their conditions and the follow up by the authorities

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## The Directorate for Civil Protection

- Regulating explosion hazards
- We arranged a work shop to establish input for quantitative risk analyses (DnV-GL as advisors)
- Requirements for operations, routines, self assessment and quality control
- Vetting of onshore and off shore operations including equipment functionality and maintenance
- Regular reporting

## Regional and local permits

- The county – having its own environmental agency
- The municipality – all within the general plan and regulated use of the area
- Communication with local users including fisheries and fish farming
- Cleaning the area for fishing gear prior to operations
- Making a preliminary port for tugs and support vessels using a barge provided by TAT
- Marking fairways and access routes for tugs and support vessels
- Part of the emergency preparedness

# We needed 3 LNG STS sets, Each 4+2 10 inch hoses from Klaw/Gutteling

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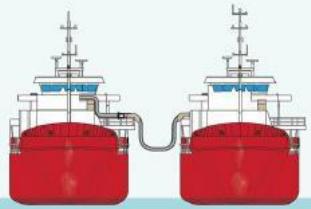
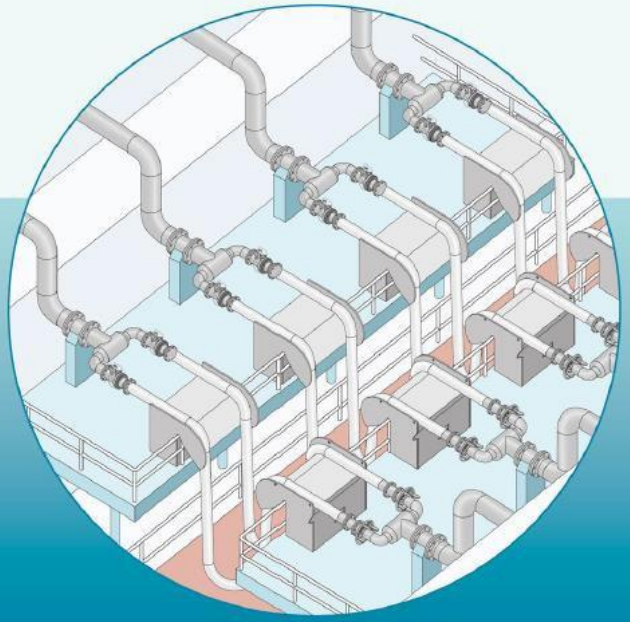


## LNG Ship-to-Ship

**Ship-to-Ship offshore transfer systems for LNGC to FSRU**



**KLAW LNG is the world leader in safe LNG transfer systems.**

**Hundreds of LNG commercial transfers are safely and efficiently conducted every year using KLAW LNG technology.**

The care and diligence demonstrated in both the design of the system and the commissioning of KLAW LNG is what helps to protect the reputation of not just the LNG Ship Owner and Operator but also the reputation of the LNG sector as a whole.

**Efficient transfer of LNG**

KLAW LNG systems provide the most advanced and reliable technology available to safely minimise your hose transfer times and maximise return.

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# The Components

TSCHUDI

## **LNG** Ship-to-Ship system components

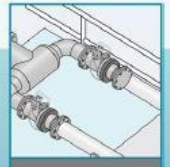

SIL 2 Compliant PLC System


ESD Integration

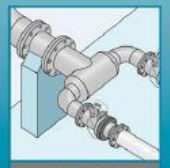

Emergency Release Coupling


HPU


Vessel Separation Detection


'Y' Piece Reducer


Hose Saddle & Fall Arrest System


QC/DC & Isolating Flange


Hose

ERC

**Emergency Release Coupling**

The KLAW LNG ERC provides an identified parting point within the transfer system.

In a controlled release, the valves within the ERC will close; providing 100% fail-safe closure of both halves.

The ERC will then separate. This relieves stress on the transfer system therefore protecting assets, the environment and personnel.

### Minimising risk of spill

KLAW LNG transfer systems minimise the risk of LNG spillage by shutting down flow of LNG when an emergency occurs during transfer. The KLAW LNG safety system will maintain the integrity of the closed system and keeping the medium within the transfer system means you maintain control over the event.

KLAW LNG systems help protect assets such as ships, hoses and equipment. Risk of injury to personnel in the immediate area is minimized and risk of contamination to others and the environment is also greatly reduced.

### Reducing risk in LNG management and transfer

KLAW LNG transfer systems offer solutions to a particular segment of the overall process of offshore LNG processing and management. This is the transfer system used during LNG Ship-to-Ship, Ship-to-Shore and Bunkering operations.

Protection against risk requires a continuing process of risk assessment and risk management and it is this process that is integral to the design of KLAW LNG systems.

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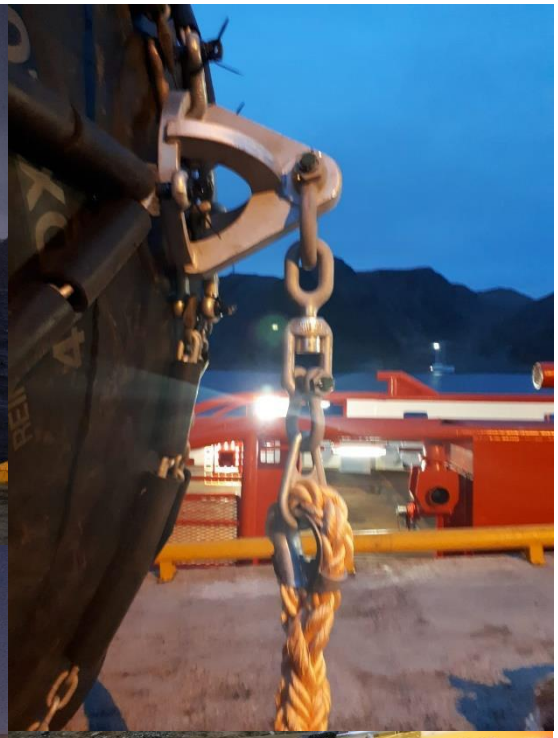
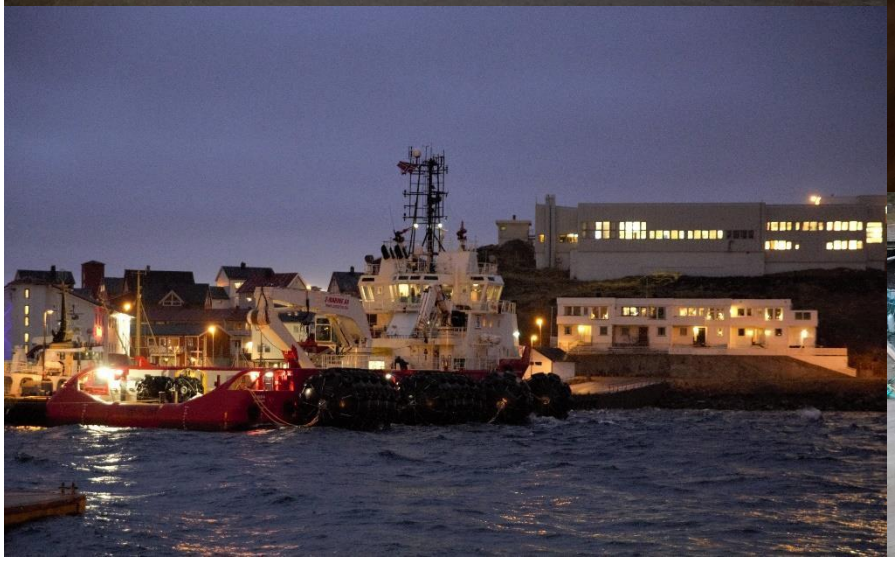
**We managed to source**
**10 Jumbo Fenders: 4.5 m x 9m - 3 sets of 3 plus one spare**
First set delivered just in time for preparation for first operation

# 4 tugs, 1 AHTS + 1 stand by/guard vessel – all ready on short notice

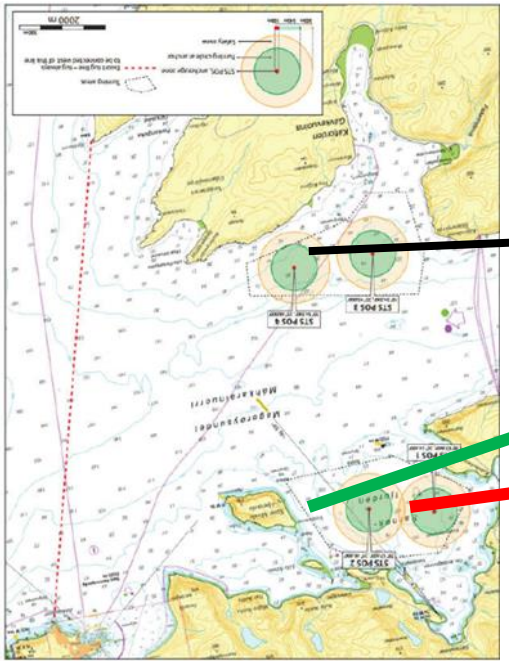


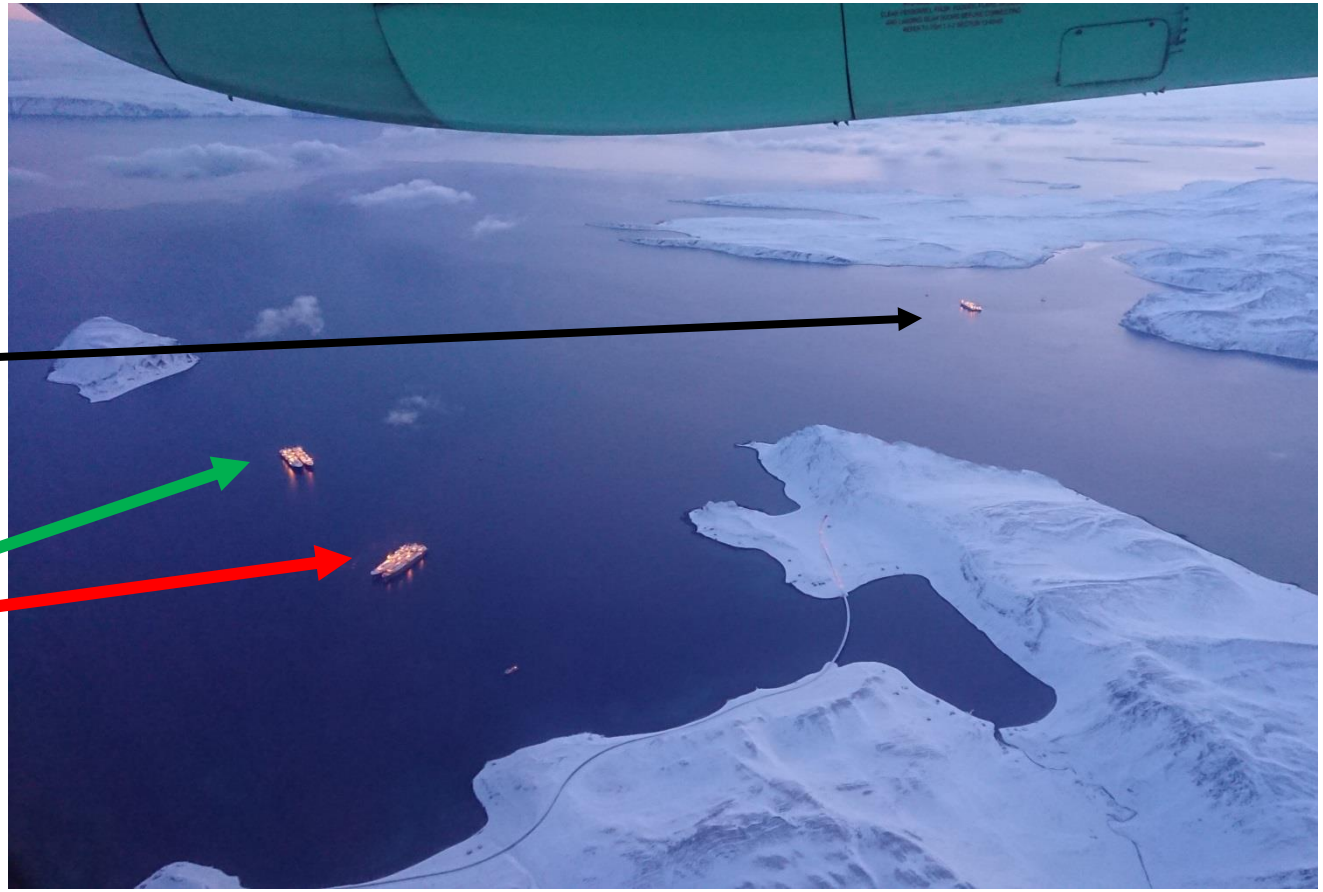


# We started with a rented equipment
# 8 inch – flown in from Houston –
# trucked from Holland
# First operation ultimo November 2018

# In December we got the first new KLAW 10 inch set – ready for first tandem operation

**Early January we got the second 10 inch KLAW set.**
We were ready for the LNG world's first LNG STS hat trick – and it happened in the Arctic.





**The rented 8 inch equipment was replaced by the third 10 inch equipment early February 2019 – we were the at full capacity with about 1,5 – 2 billion Billions USD value of LNG tankers «floating around» in the fjord**

# Time is of essence
# Operating in the Arctic during Winter, you must use the weather windows as efficiently as possible.

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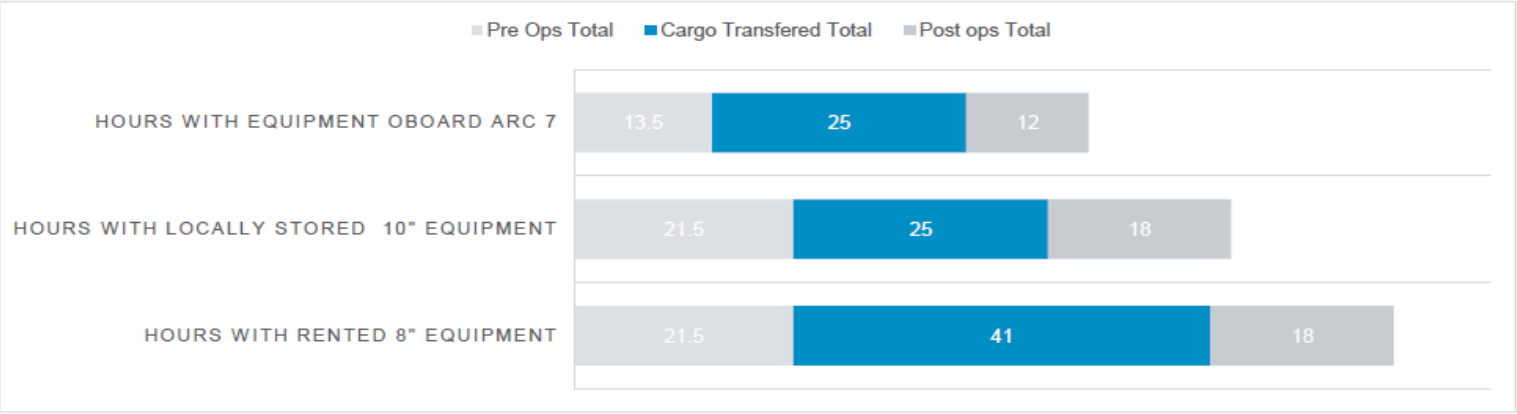
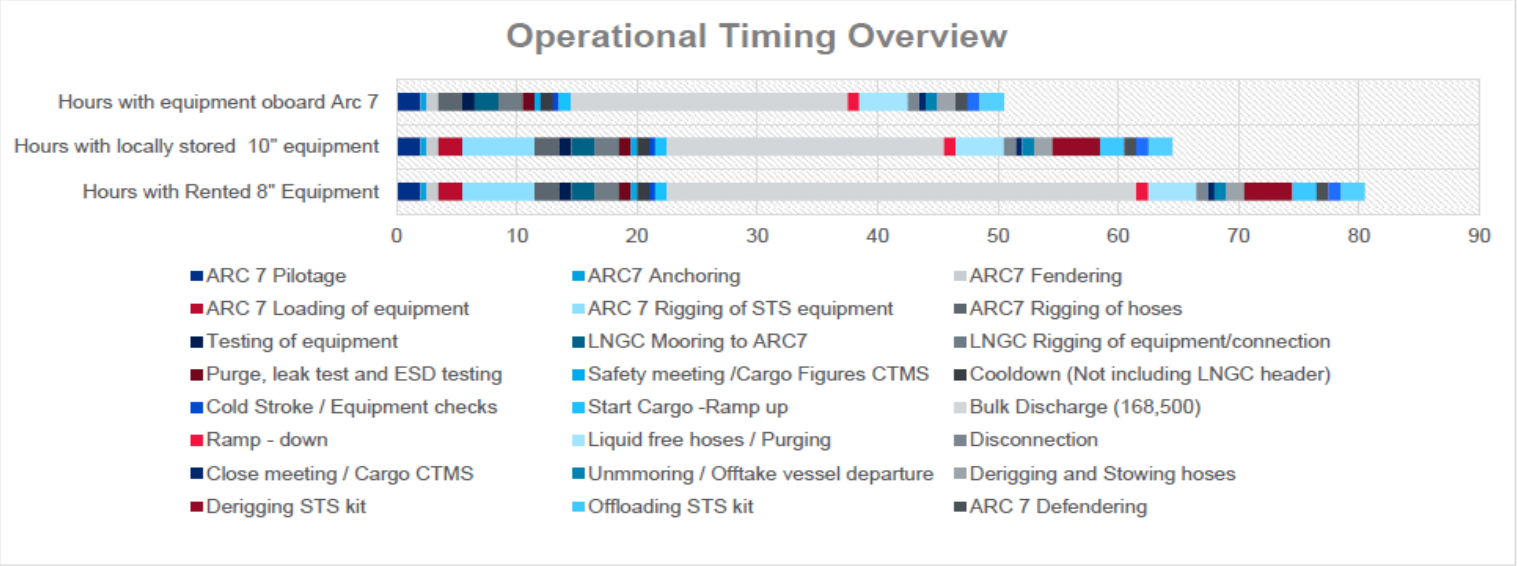
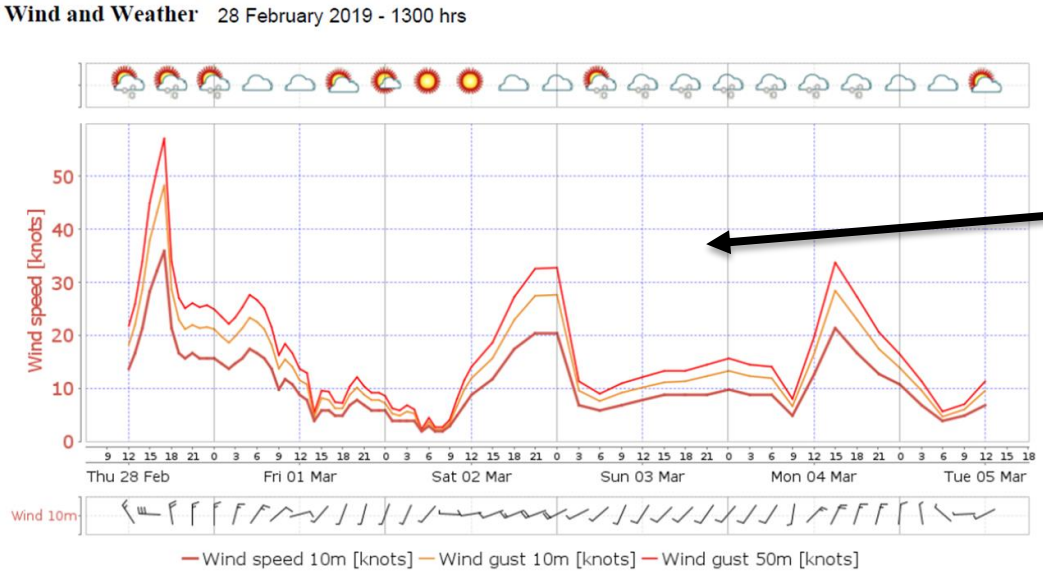
LNG STS

**Equipment Optimization Overview for Novatek**



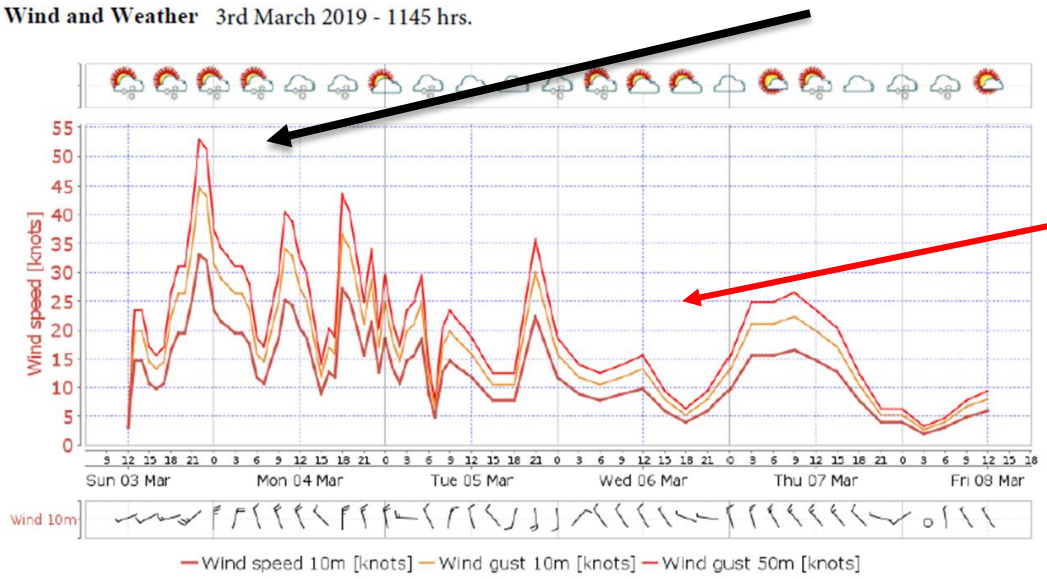



28th February it looked like a lazy weak ahead of us

**But:**

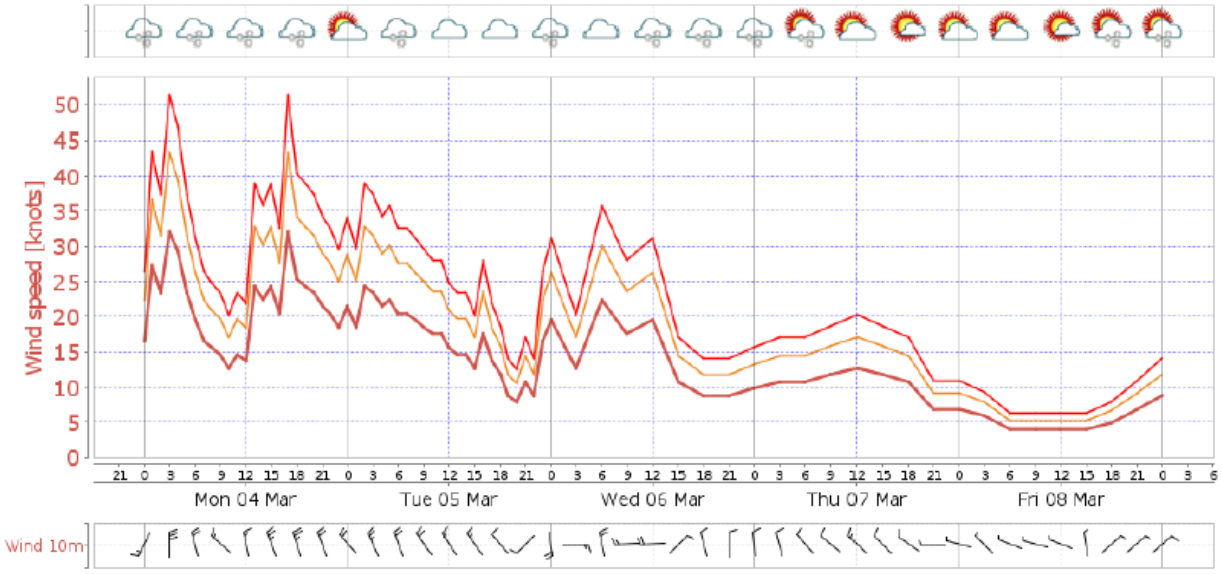
4 days later on 3rd March

That was not fully true

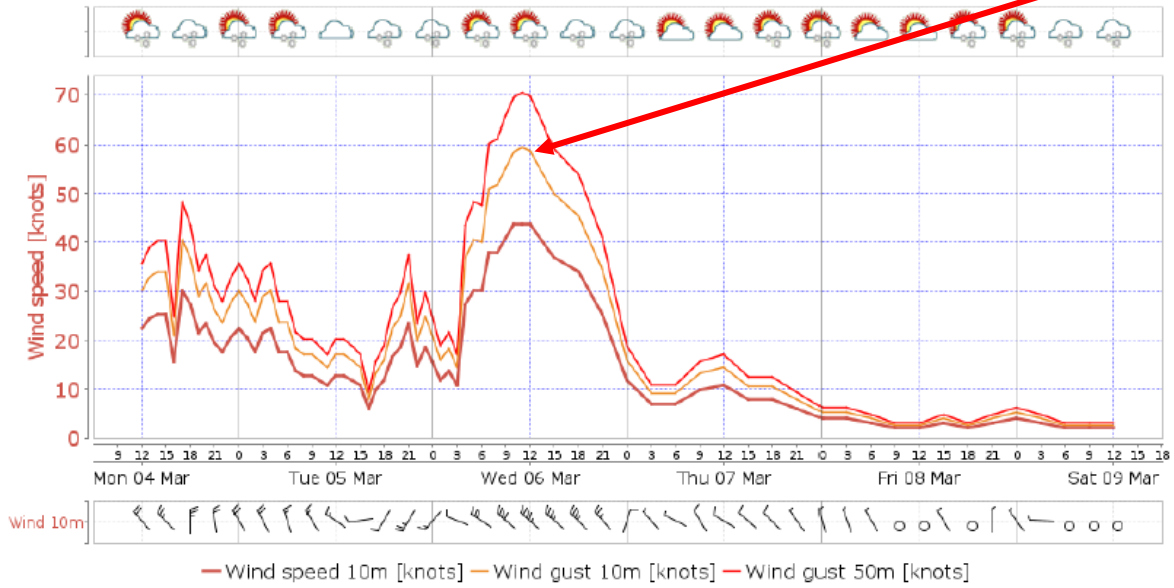



Also please keep this value in mind till the next slide

**Wind and Weather** 4th March 2019 - 00.39 hrs

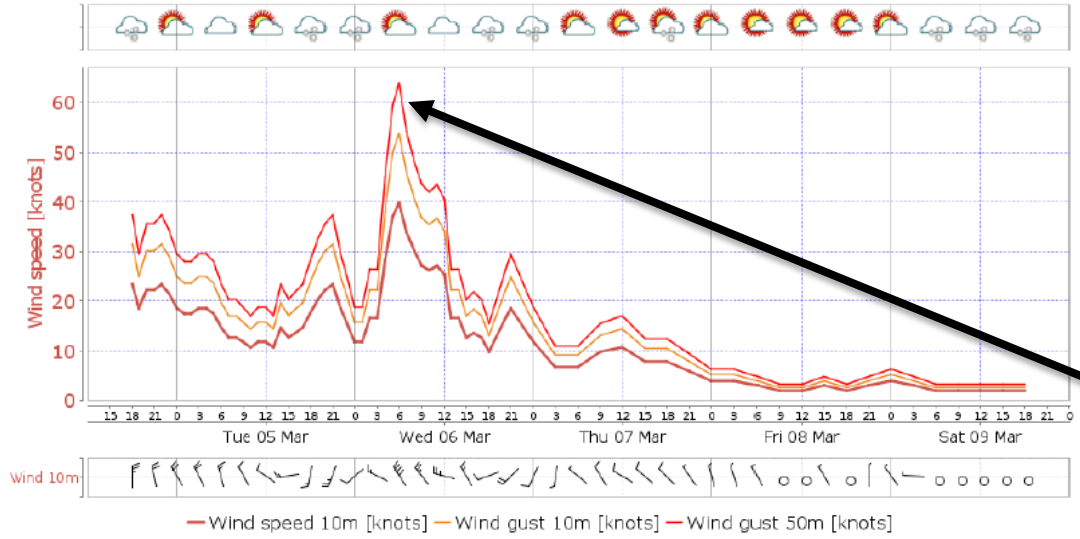



**Wind and Weather** 4th March 2019 - 1311 hrs.



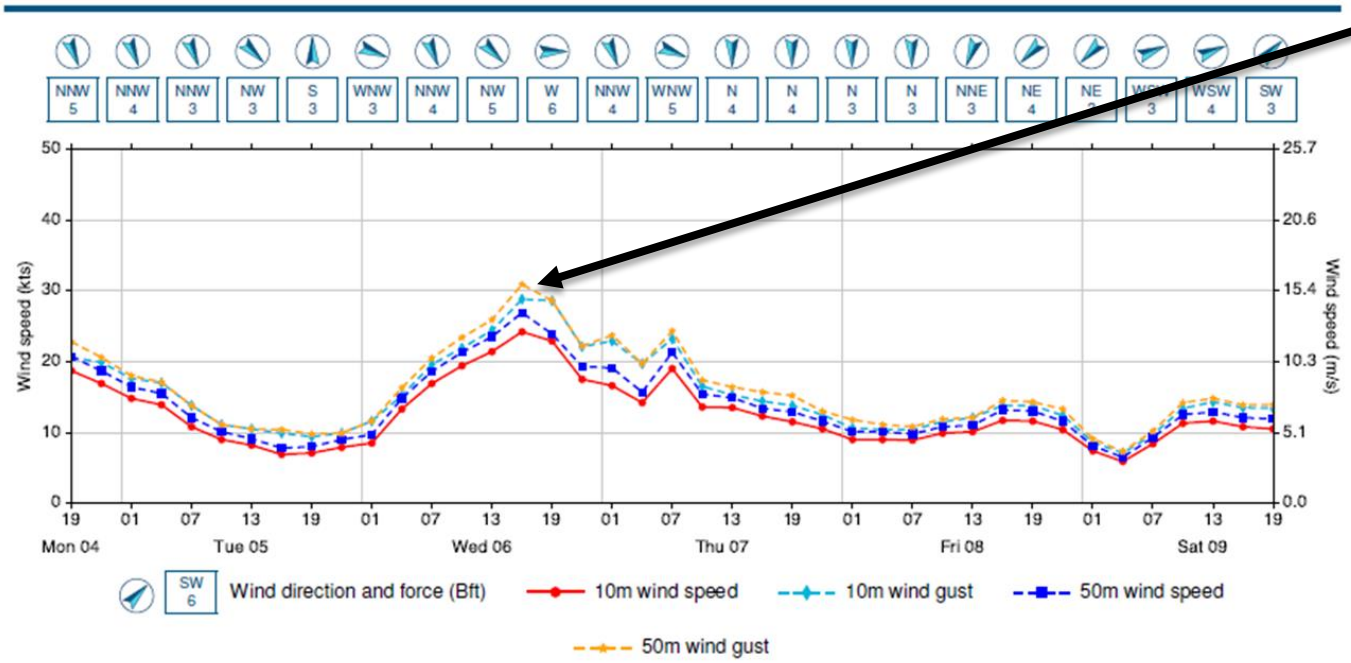

This was much away from the forecast on the 3rd March

**Wind and Weather** 4th March 2019 - 1836 hrs




We always used two independent forecasts plus consulting a third on occasions. These did not always give the same picture.

One forecast clearly outside and one within parameters

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# Some Challenges during operations:

- Establishing a big enough pool of qualified personnel
- Establishing a good rotation and getting the teams on site in time
- Pilot «check out» on site and ARC 7s – including simulator training as the number of operations increased
- Rest hours, travel time and holidays – not only with us but also with subcontractors and pilots
- Delivery times' for spares
- Spares and Personnel Logistics
- Back-up of personnel and equipment to avoid delays
- Assistant superintendents from shore for rigging to off load vessel crews
- Very intensive use of the Equipment in cold and moist climate
- Weather, weather forecasts, weather windows
- Documentation and traceability

# TAT processes

**Planning**

- Preliminary Planning
- Weather
- ETA messages
- STS crew plan
- Tug movements
- Vessel movements
- Irregularities
- Emergency preparedness

**Execution**

- Monitor operations
- Adjust plan
- Preparedness
- Irregularities
- Emergency exercises

**Evaluation/ reporting**

- Ops. Track sheet to client
- Incidents/Non Conformities
- Tug`s consumption
- Work/Rest hours
- Personnel planning
- Telephone conference

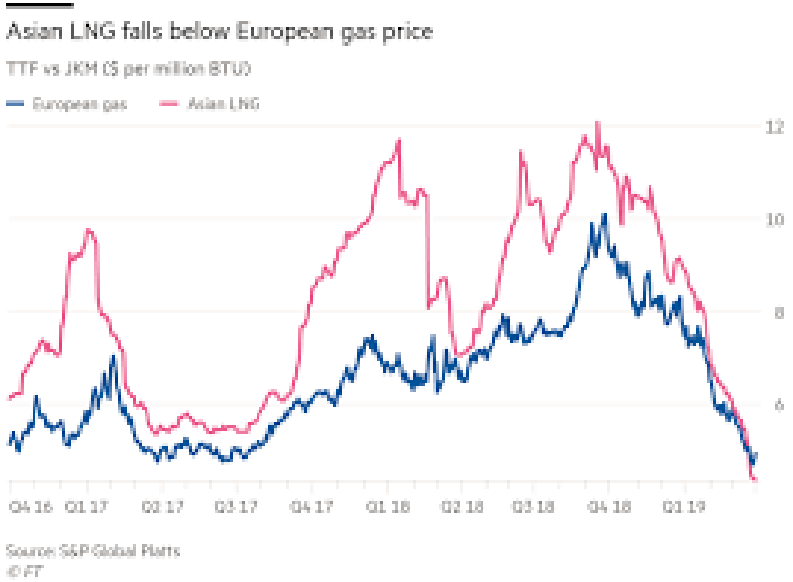
**Corrections/ Improvement**

- Debrief/Evaluation
- Analysis of incidents/Non conformities
- Maintenance
- Training
- Exercises
- Continuous dialogue

**LNG STS cooperation**

# LNG Prices and estimate of the values handled?

(TAT's own rough calculation only and not verified)




1 Cu.M. LNG = 600 Cu.M Gas (methane 82-95%)

1Cu.M. Gas = 35,918 BTU
(British Thermal Unit)

1 Cu.M. LNG = 21.1Mill.BTU

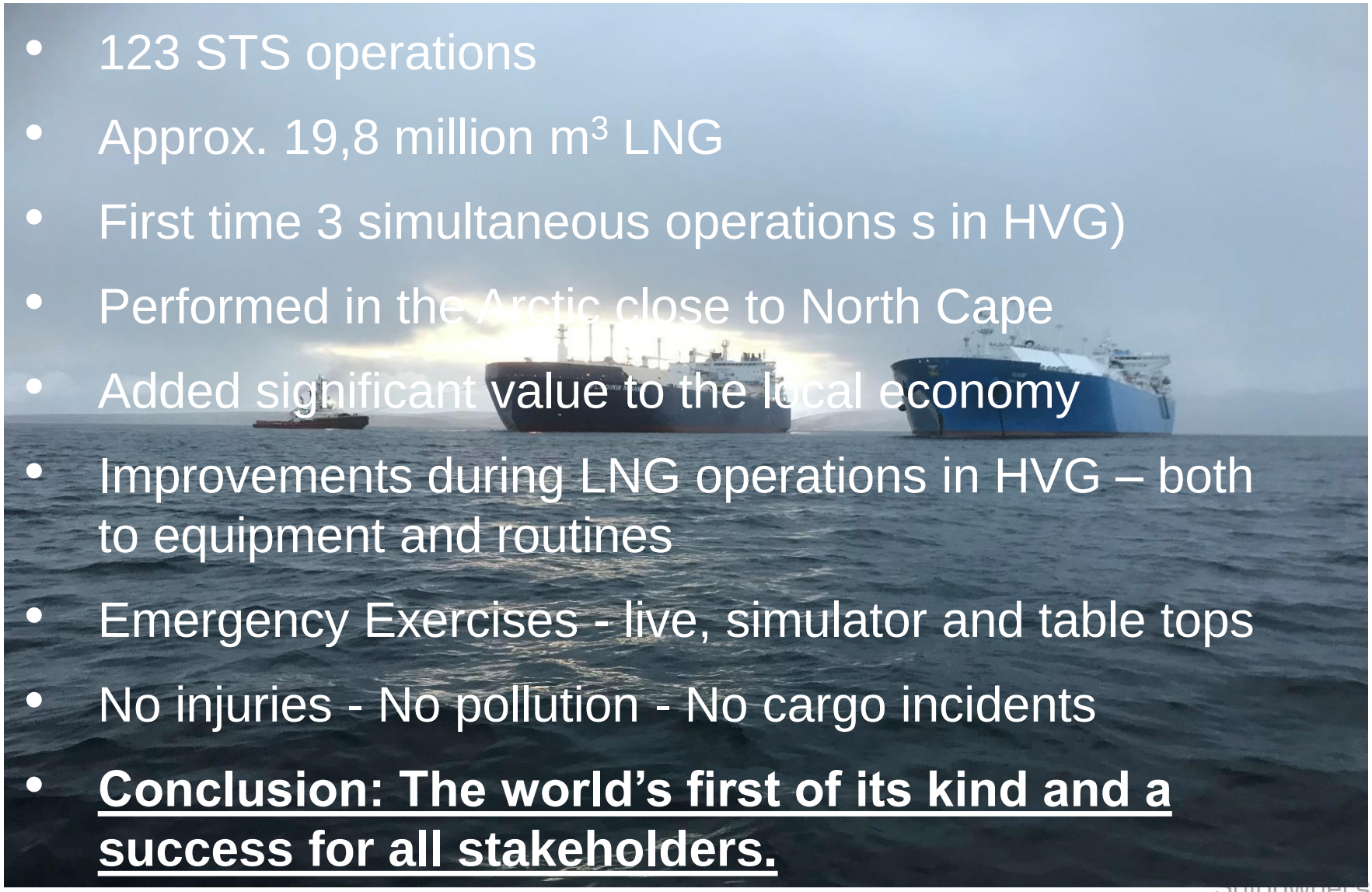
160.000 Cu.M.LNG= 3,379 Billion BTU

The estimated gross value of one cargo at USD 10/BTU: USD 33.8 Million
The estimated gross value of one cargo at USD 5/BTU: USD 16.9 Million

The estimated value of 123 cargoes (19,8 mill Cu.M. at USD 7.5/ BTU (average): **USD 3.1 billion.**

TAT's own very rough estimate is that doing STS in Honningsvåg compared to sailing directly to a Continental North European port increased the shipping capacity of the ARC 7s with about 50%. (I.e. USD 1 billion extra sales during 2018/2019 ice season?)

# Status for 2018/ 2019 season



- 123 STS operations
- Approx. 19,8 million $m^3$ LNG
- First time 3 simultaneous operations s in HVG)
- Performed in the Arctic close to North Cape
- Added significant value to the local economy
- Improvements during LNG operations in HVG – both to equipment and routines
- Emergency Exercises - live, simulator and table tops
- No injuries - No pollution - No cargo incidents
- **Conclusion: The world's first of its kind and a success for all stakeholders.**