Rice Global E&C Forum International Conference

Norwegian Oil & Gas Field Development solutions for the Arctic

Paris 19th March 2013

Arnt Knudsen
Sr Vice President

KVÆRNER™

Experience from home market; key to Arctic success

- **AGENDA**
- Snapshot of Kvaerner
- The Norwegian oil & gas history
- The arctic challenge
- Possible arctic solutions
- Concrete platform track record

Lun-A Platform at offshore location (Sakhalin-2 Project)
Photo: SEIC (Sakhalin Energy Investment Company)

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Safety – our licence to operate

- Open and transparent reporting
- Continued pro-active focus

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This is Kvaerner

UPSTREAM				DOWNSTREAM & INDUSTRIALS
CONCRETE	JACKETS	NORTH SEA	INTERNATIONAL	E&C AMERICAS
				
				
Global leader in gravity based concrete structures › Concrete substructures	**European leader in steel jackets** › Large steel jackets for oil & gas installations	**Leading EPC contractor to the North Sea market** › Topsides › Floaters › Onshore upstream facilities	**Spearhead for international expansion** › Topsides › Floaters › Onshore upstream facilities	**A leading EPC contractor for the American market** › Power plants › Steel mills
Global	North Sea Intl. markets	North Sea Norway	Global	North America Intl. markets

Kvaerner in brief:

- **Strong HSE mind set**
- **Solid experience**
- **Leading EPC contractor**
- **3 400 employees in 9 countries**
- **Revenues of NOK 11 billion in 2012**
- **Order backlog of NOK 21 billion on 31 Dec 2012**

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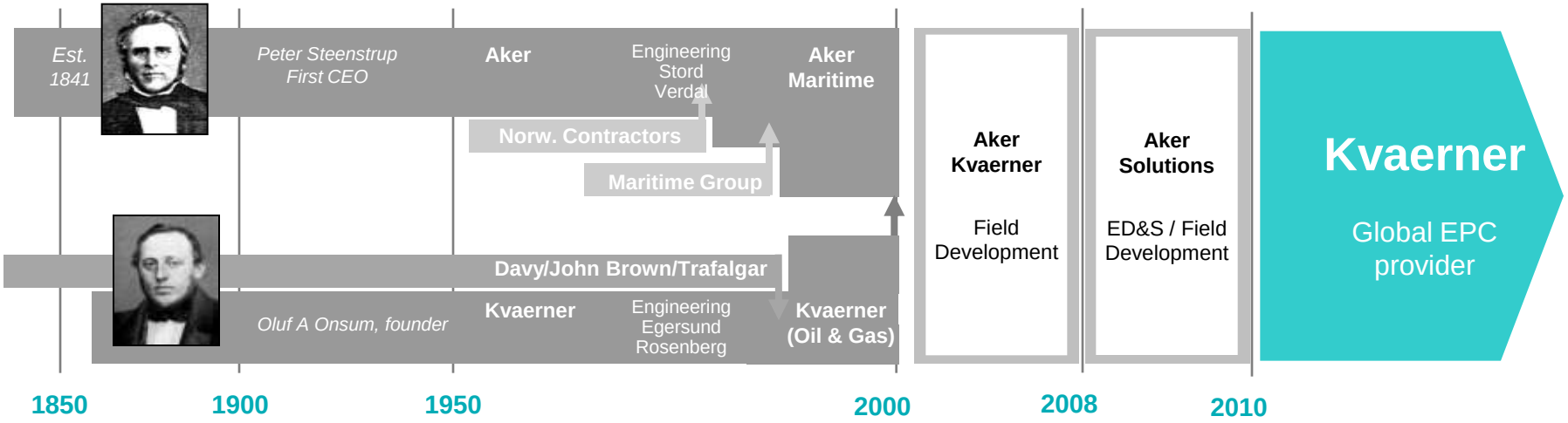
Kvaerner – a strong name with a solid track record



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Specialized EPC company focused on large projects

- Concrete substructures
- Steel jackets and wind jackets
- Topsides
- Floaters
- Onshore upstream facilities
- Onshore downstream facilities
- Power plants
- Steel mills

3 200 employees, operations in 13 countries

AkerSolutions

Engineering, technology, products and service solutions

- Engineering solutions
- Products solutions
  - Umbilicals
  - Subsea
  - Mooring and loading
  - Drilling technologies
  - Process systems
- Field life solutions
  - Maintenance, modifications, operations
  - Well intervention services
  - Oilfield services and marine assets

18 000 employees, operations in 30 countries

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Norway – a great history of industry transformation

from greenfield to fabrication yards	from civil works to GBS fabrication	from ship repair to mechanical outfitting	from ship building to topside fabrication	from design institutes to global engineering houses
				
				

The Arctic dimension

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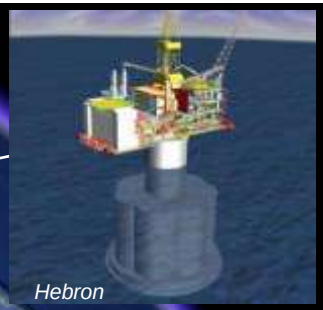
Strong track record delivering to harsh environments


Hibernia

Newfoundland


Hebron


Gjøa


Snøhvit


Transocean Spitsbergen

North Sea

Barents Sea

Kara Sea

Sakhalin


Sakhalin I


Kashagan

Caspian Sea


Sakhalin II

Google earth

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Concrete gravity base structures – a proven Arctic solution

Sakhalin-II project

- Robustness to meet Arctic environment
- Year-round access to drill / maintain wells
- Significant local content
- Minimum maintenance
- Supports large topside weight
- Low lifecycle cost
- Installation independent of heavy lift vessel availability
- Integrated oil storage

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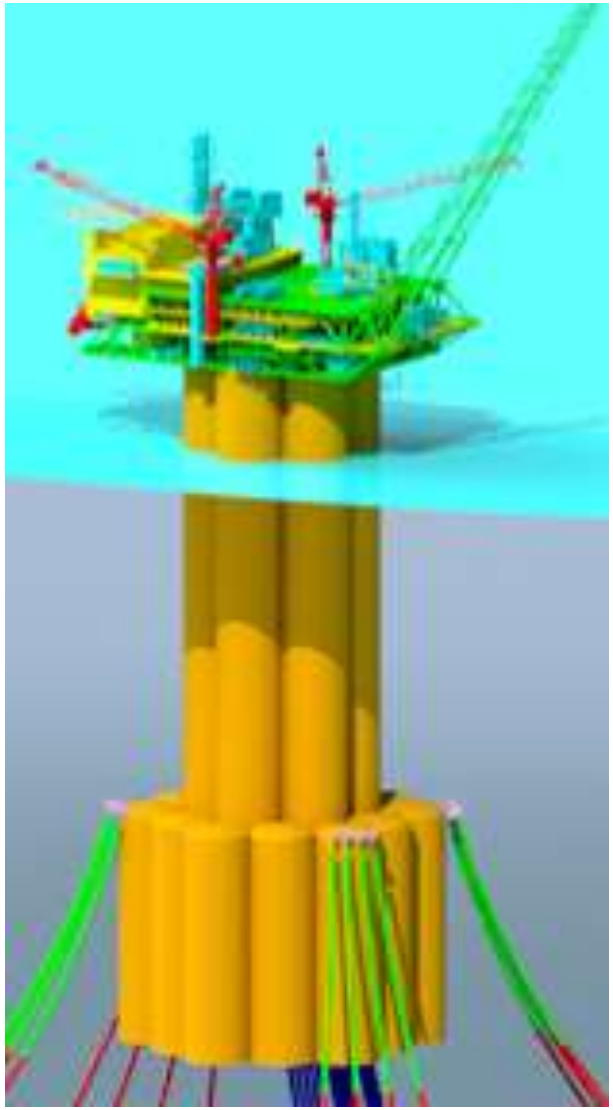
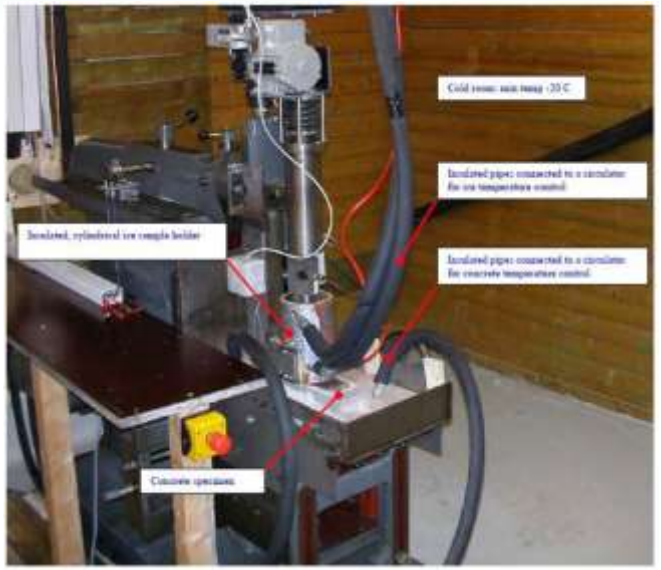
Concrete floater for Arctic – the next step ?



- Robust concrete substructure
- Large topside capacity (50.000 t)
- Oil storage – for “free”
- Ice protection of risers
- Flexible topside delivery model
- Topside integration Norway
- Construction Norway/ NW Russia
- Favourable behaviour in hostile marine environment
- Proven execution model
- Substructure not on critical line

R&D: Design challenges for concrete shafts

- Concrete compressive strength C70/85
  (average strength 100MPa)
- Ice abrasion: able to resist ice caused by drifting ice for several months each year during forty years service life
- High resistance against freeze / thaw
- High durability against sea water



Abrasion on upward breaking ice cone

Ice abrasion testing

Subsea solution will complement fixed structures

Past

Booster station (KBS)

Present

Åsgard subsea compression system

Ormen Lange Pilot

Future

High end: longer step-outs, higher duty, deeper water, higher pressure

System optimisation: modularisation and standardisation

Smaller: compact, simplified, lower duty and lower cost

Example of subsea solution form the Arctic; Aker Solutions gas compression portfolio

Åsgard wet-gas compression system

- 40 km step-out
- Topside VSD
- Water depth 250-325 meters
- 2x11.5 MW subsea compressors
- Production 21 mill Sm3/d

Ormen pilot wet-gas compression system

- 120 km step out (Separate contract)
- Subsea VSDs
- Water depth 1 000 meters
- 2 x 12.5 MW subsea compressors*
- Production 21 mill Sm3/d *

* Pilot has only 1 train

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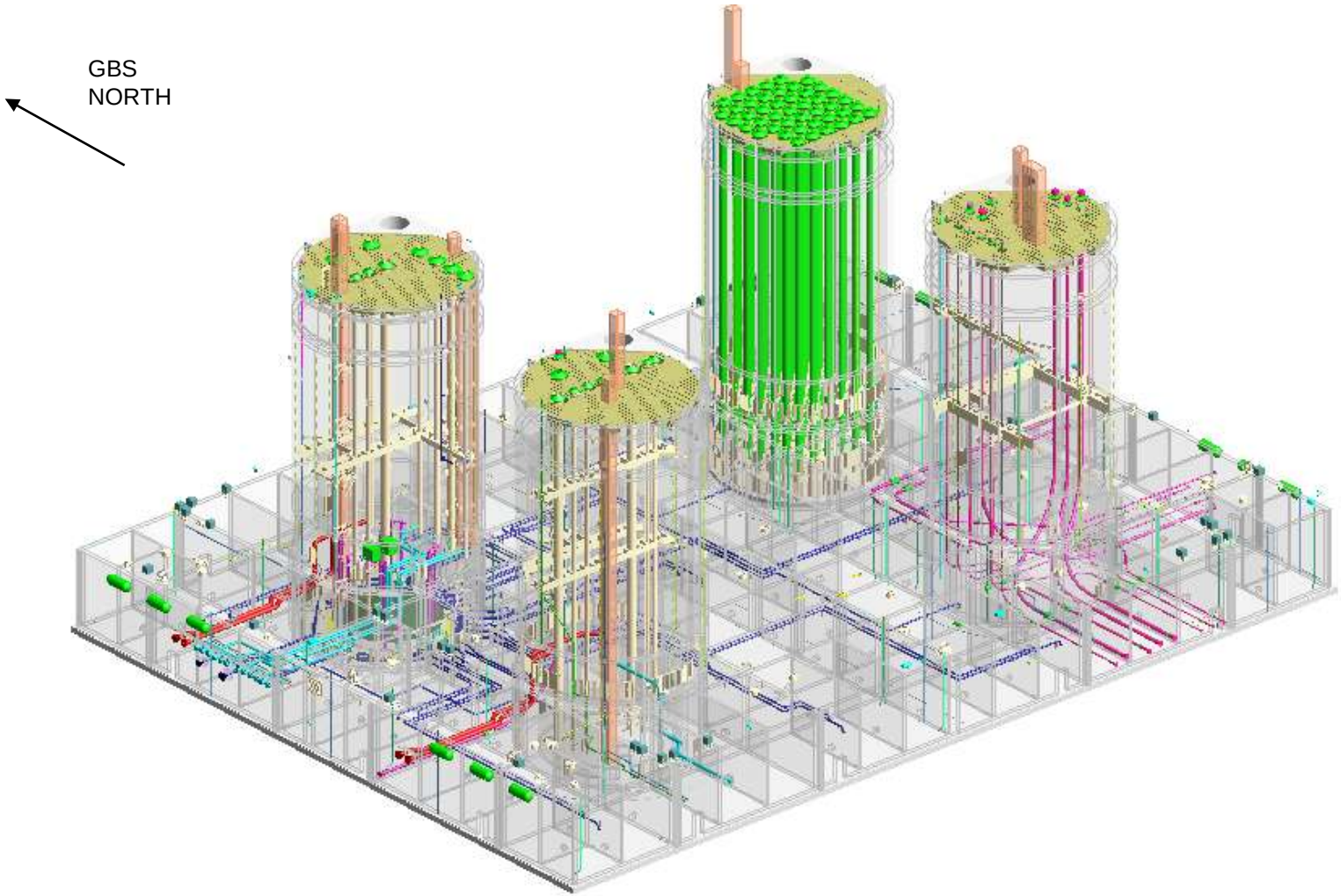
Sakhalin 1 Arkutun-Dagi GBS – 3rd GBS constructed by Kvaerner in Russia

Sakhalin 1 Arkutun-Dagi GBS - mechanical outfitting much more than “concrete”



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Towing in June 2012

Yuzhno-Sakhalinsk

La Peruse (Soya) Strait

Sapporo

Hokkaido

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Picture from Sakhalin II

Kvaerner Arctic GBS experience

GBS projects;

Hibernia (Exxon) , Canada

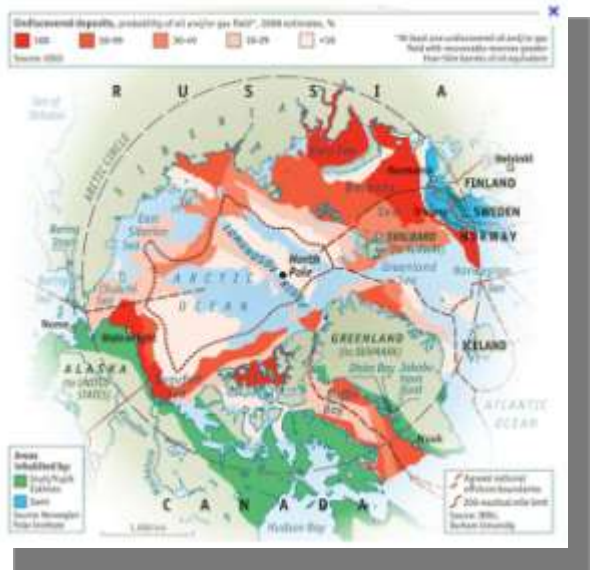
Hebron (Exxon), Canada

2x Sakhalin 2 (SEIC), Russia

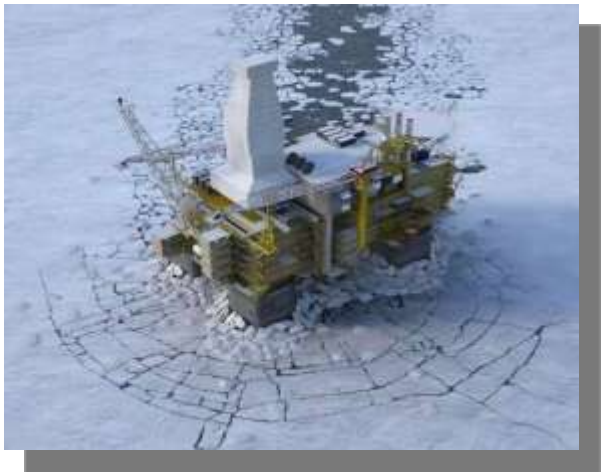
Sakhalin 1 (Exxon), Russia

Numerous studies, Norway, Russia, Canada, Alaska

High potential in the Arctic by estimated reserves



- Estimated yet-to-find reserves of around 400 billion boe
- High end solutions needed



- Design challenges…
  - Extreme temperatures
  - Ice conditions
  - Remoteness
  - Sensitive natural environment

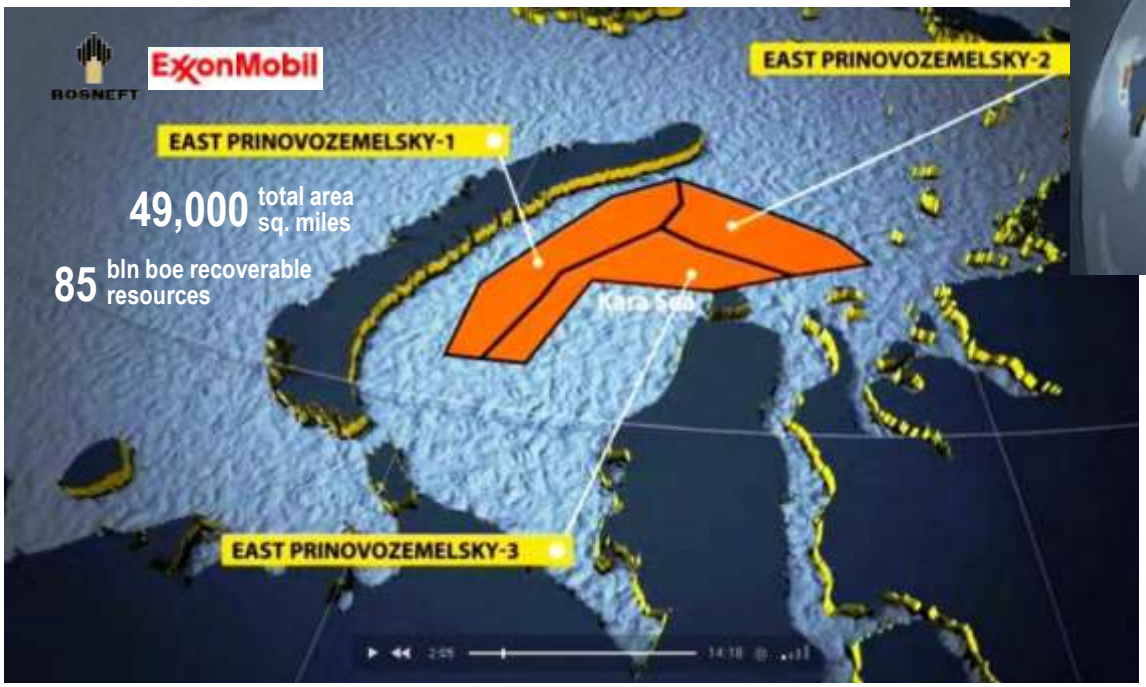
Kara Sea – Vast potential !

Strategic partnership agreements between Rosneft and ExxonMobil

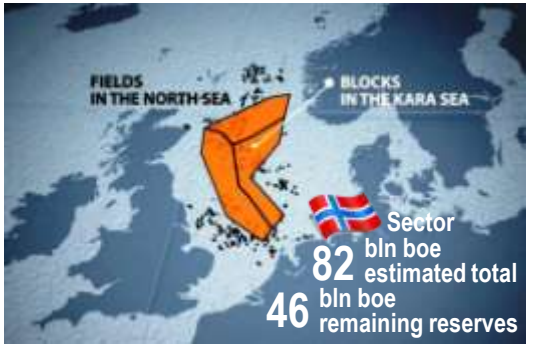
- Includes license blocks in the Kara and Black Seas
- Estimated combined resource base – over 90 bln boe
- Technology transfer and management cooperation
- Establishment of the joint Arctic research centre ($500 mln investment announced)

Blocks licensed to Rosneft / undistributed offshore acreage

The Kara Sea license blocks



Kara Sea vs. North Sea*



All images and data: Rosneft; * Source: Norwegian Petroleum Directorate

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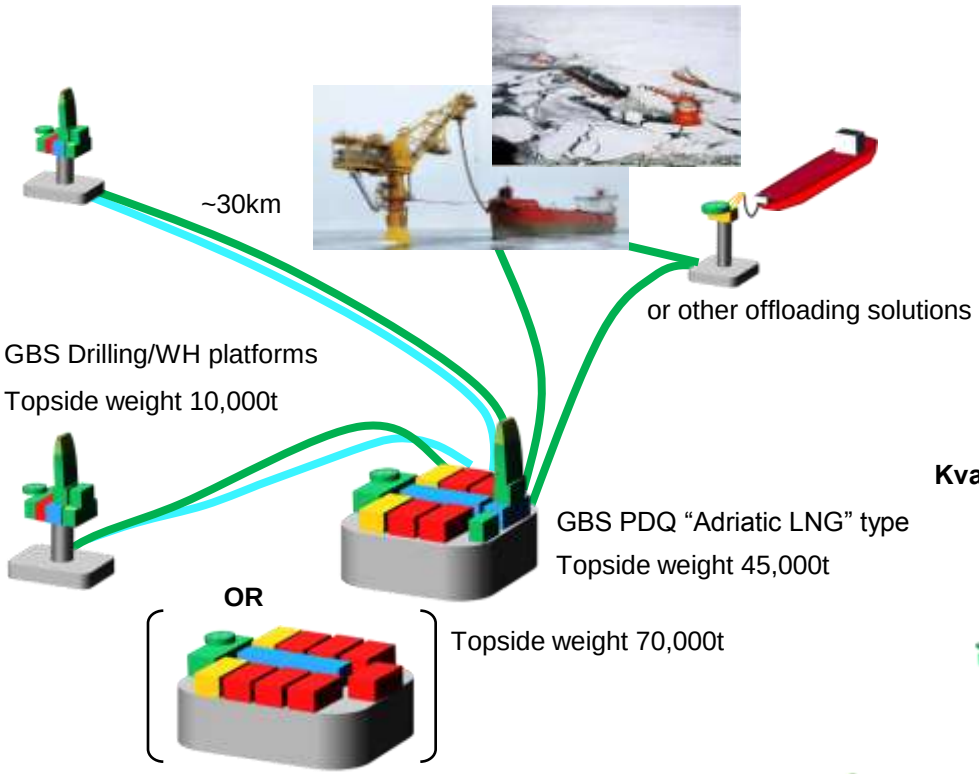
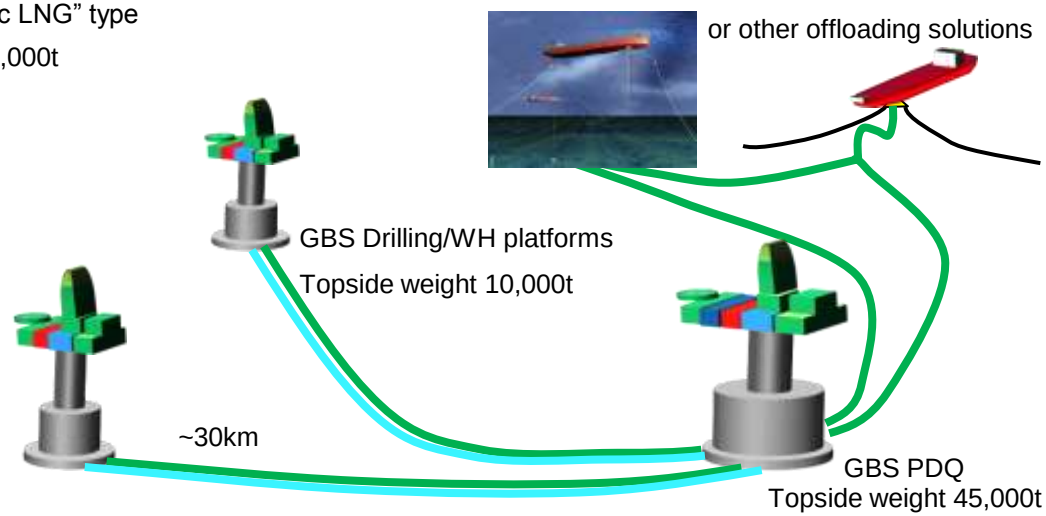
Rosneft;
Possible development scenarios



Kvaerner’s overall development concept. Deep waters [100+ mwd]



First oil targeted before 2020!

Concept design: Rosneft; Kvaerner

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Canada's Beaufort Sea

- Huge Potential – Oil and Gas
- Leases held by Shell, ExxonMobil, Chevron, BP, Statoil, Husky, Imperial Oil, ConocoPhillips
- Harsh Weather
- Transport and infrastructure issues.
- Indigenous and environmental concerns has slowed process of building the Mackenzie
  Valley gas-pipeline
- Shell re-entered area in 2005
  - 2011 won approval to drill 4 wells over 2 years in Beaufort Sea. Drilling started Q3, 2012 after very difficult mobilization and regulatory process.

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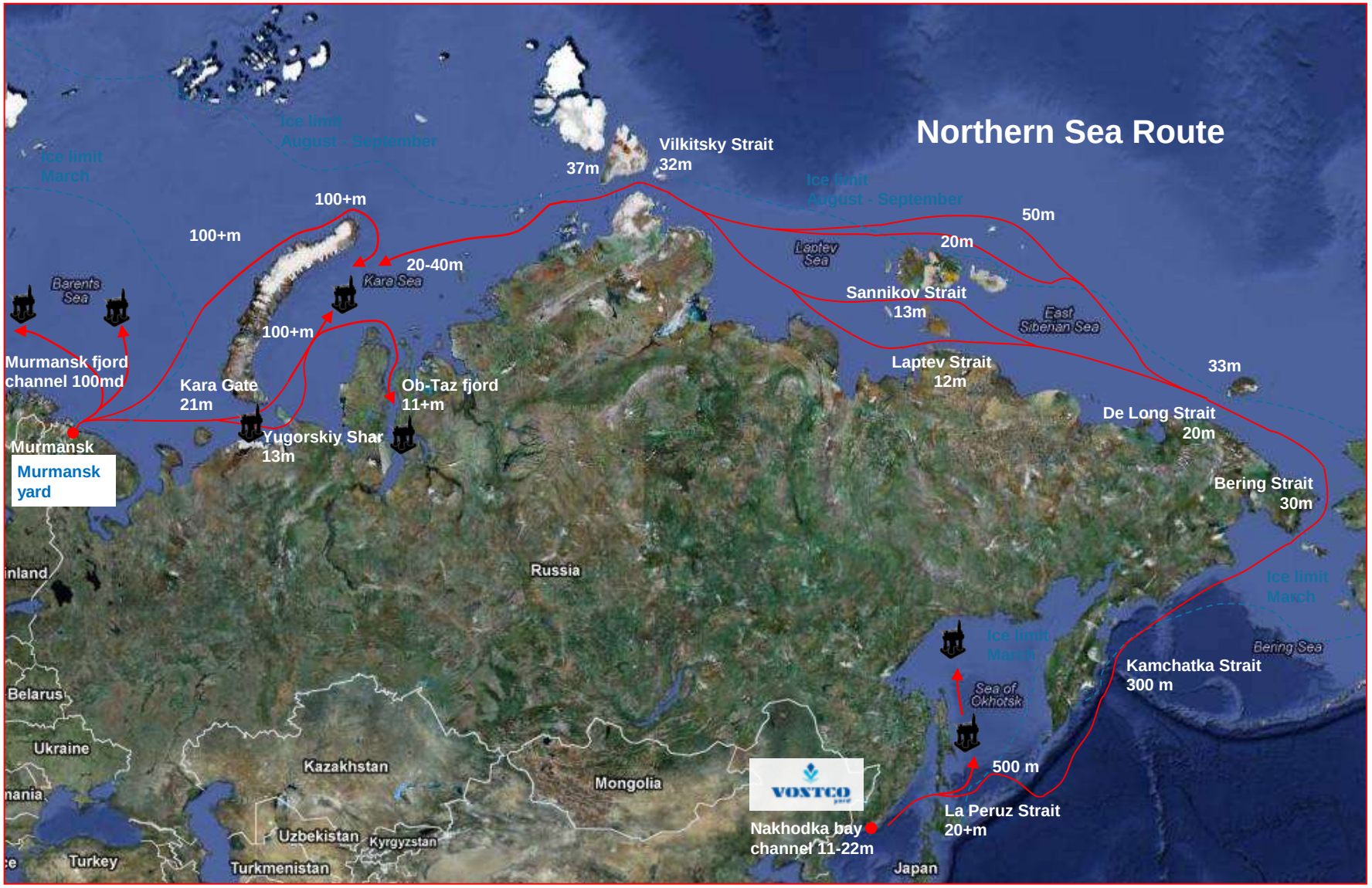
Northern Sea route, new possibilities



Source: Norwegian mapping authority

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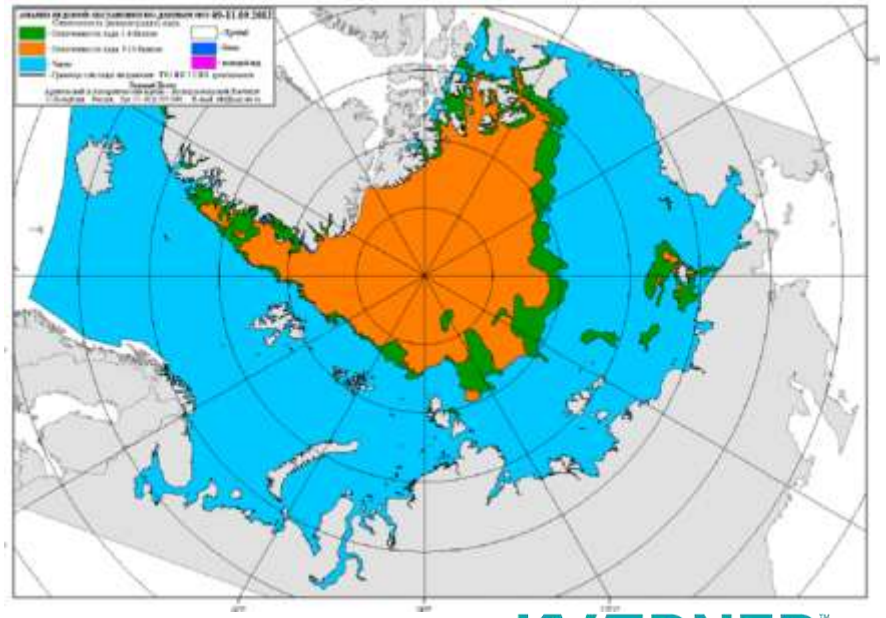
Northern Sea Route
Ob River – LNG Carrier in 2012

The tanker "*Ob River*" transported 66 342 tons (134 738 m³) from Statoil's gas plant in Hammerfest to Tobata in Japan. The vessel spent nine days on NSR from it passed the Kara Gate on November 9 to in entered Cape Dezhnev on November 18.

Gazprom reports that during the first half of the voyage, between the Barents Sea and the Kara Sea, there was not much ice in the waters. For the second half of the Northern Sea Route, from the Vilkitski Strait to the Bering Strait, the carrier headed through only young ice with the thickness reaching maximum 30 centimeters.



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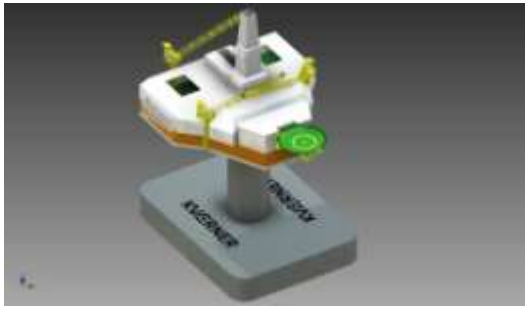
- **Adriatic Re-gas facility**
- Kvaerner; main Contractor
- Towed from Spain in 2008
- Commercial operations from 2009
- (8 GSCMA capacity)

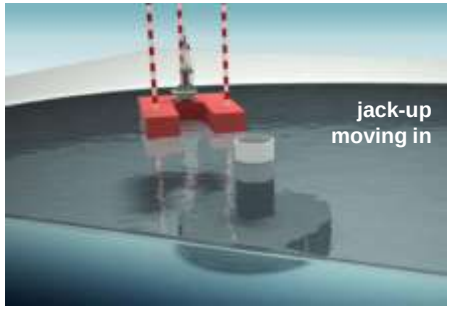
Arctic Oil & Gas concepts studied to date by Kvaerner

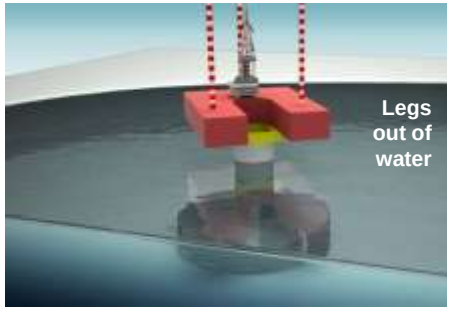
Pechora near-shore LNG concept

“Arctic Driller” concept

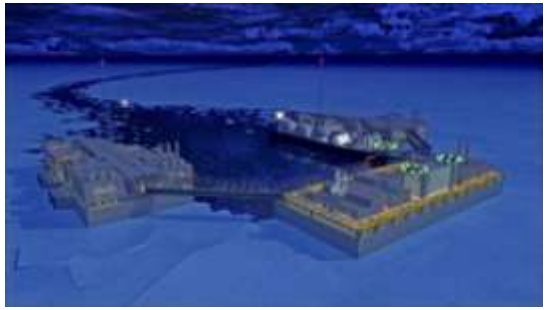


“Arctic Driller” U-shape Jack-up concept

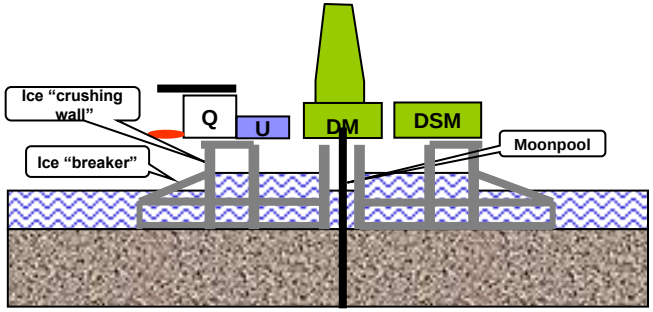




Yamal at-shore LNG concepts



The Beaufort Sea shallow water solution



Concept design: Kvaerner

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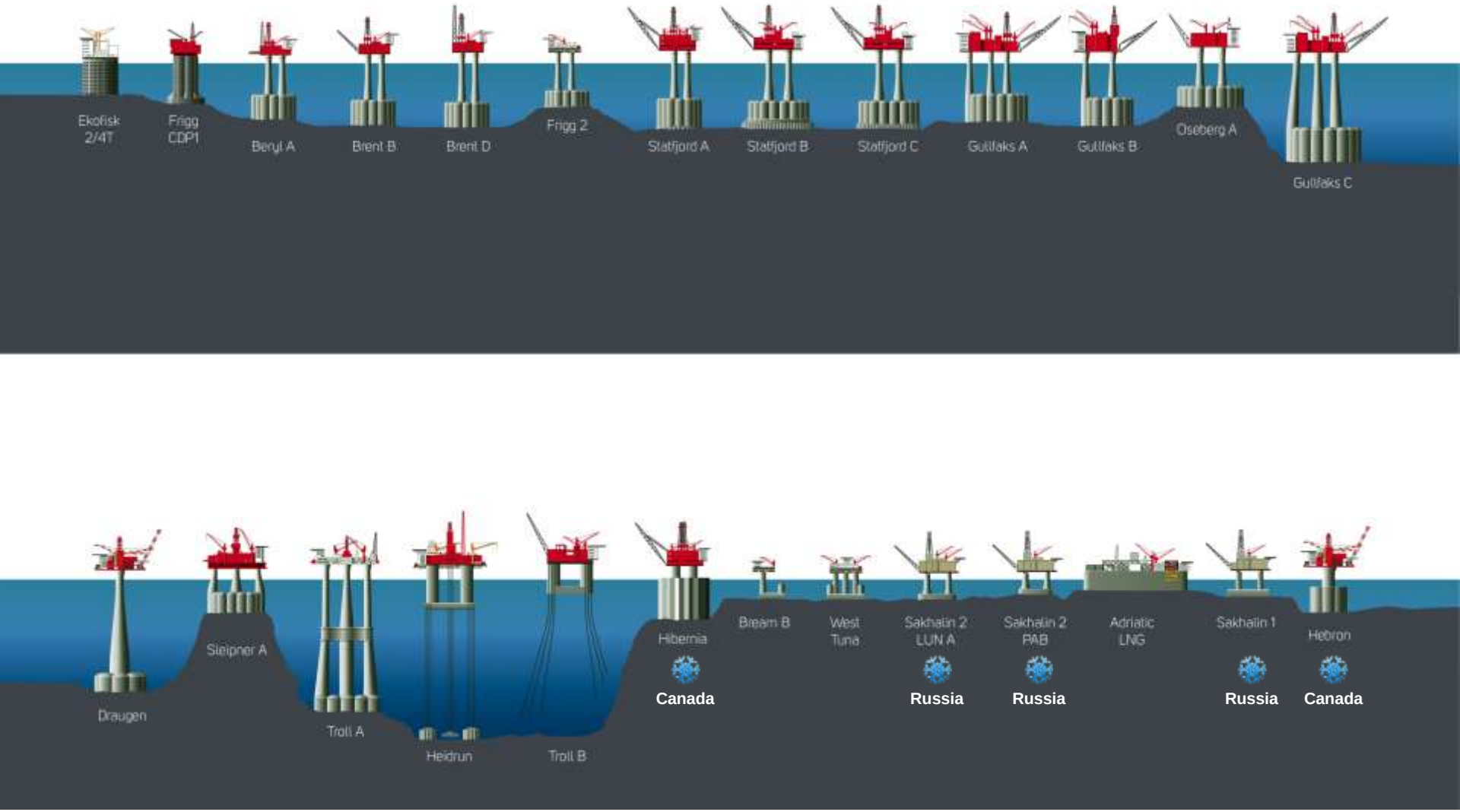
Kvaerner track record
…the path to Arctic experience



Arctic offshore projects

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Kvaerner – vision and mission

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