

Experience of LNG Shipping in the Arctic

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March 5th, 2020 / 15th Arctic Passion Seminar

Today's Agenda

1. **MOL Fleet**
2. **Yamal LNG Project**
3. **Arc7 Ice Breaking LNG Carriers**
4. **Ice Trial of Arc7 LNGC “Vladimir Rusanov”**
5. **Experience of LNGC Operation in the Arctic**



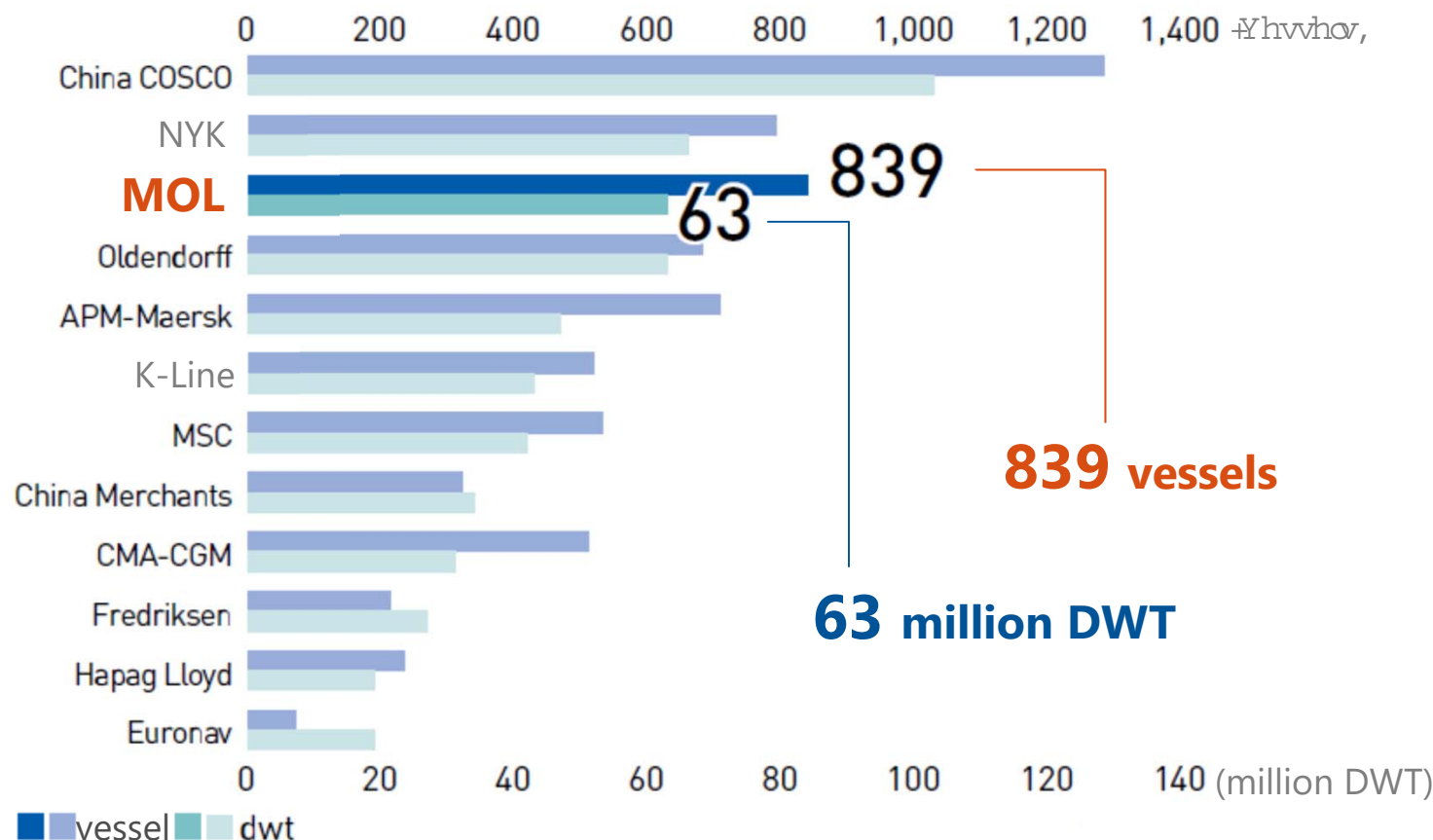
1. MOL Fleet



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Ref) MOL Annual Report 2019

Total Fleet of World Major Shipping Company * as of March 2019



MOL is one of the world biggest Shipping Company operating around 840 vessels in total.

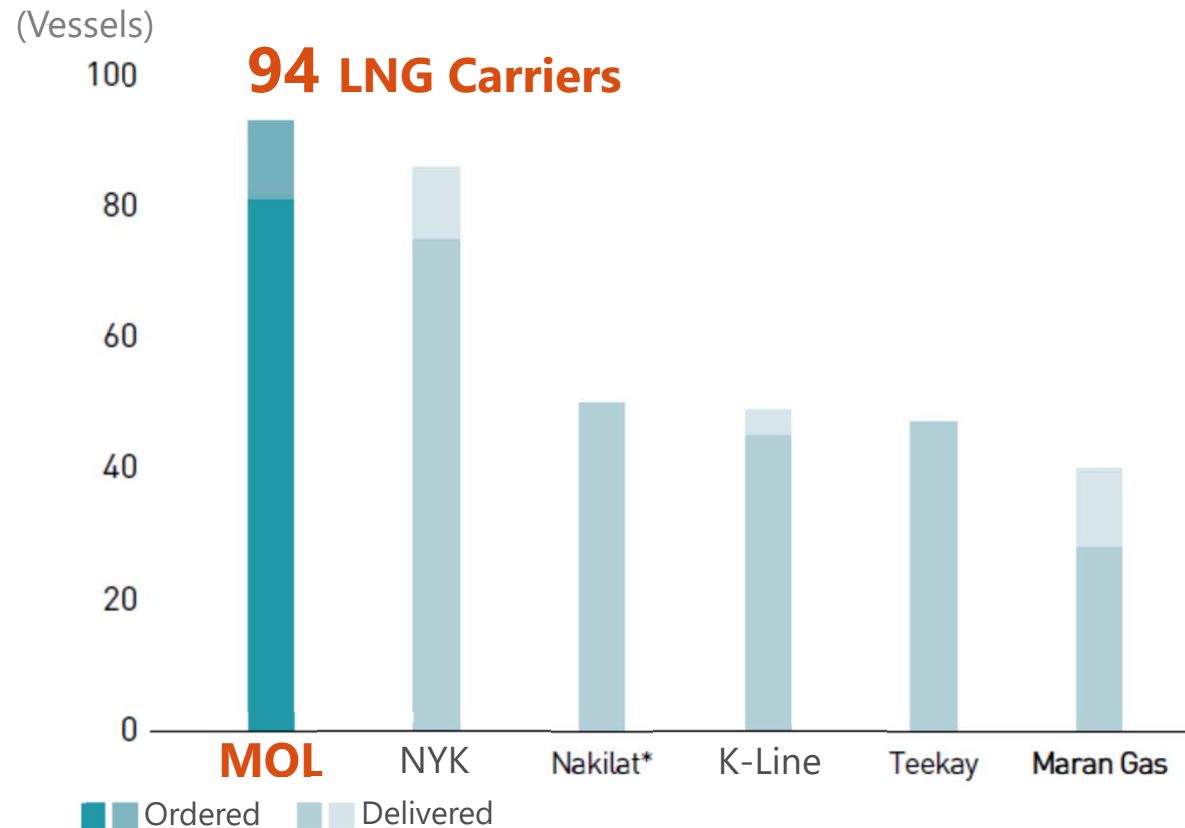


1. MOL Fleet

Ref) MOL Annual Report 2019

LNG Carrier Fleet of Major LNG Carrier Operator

* as of March 2019



MOL has operated LNG carriers since 1983 and kept our position of the world biggest LNGC operator.



2. Yamal LNG Project

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WINTER (mid Nov~June)

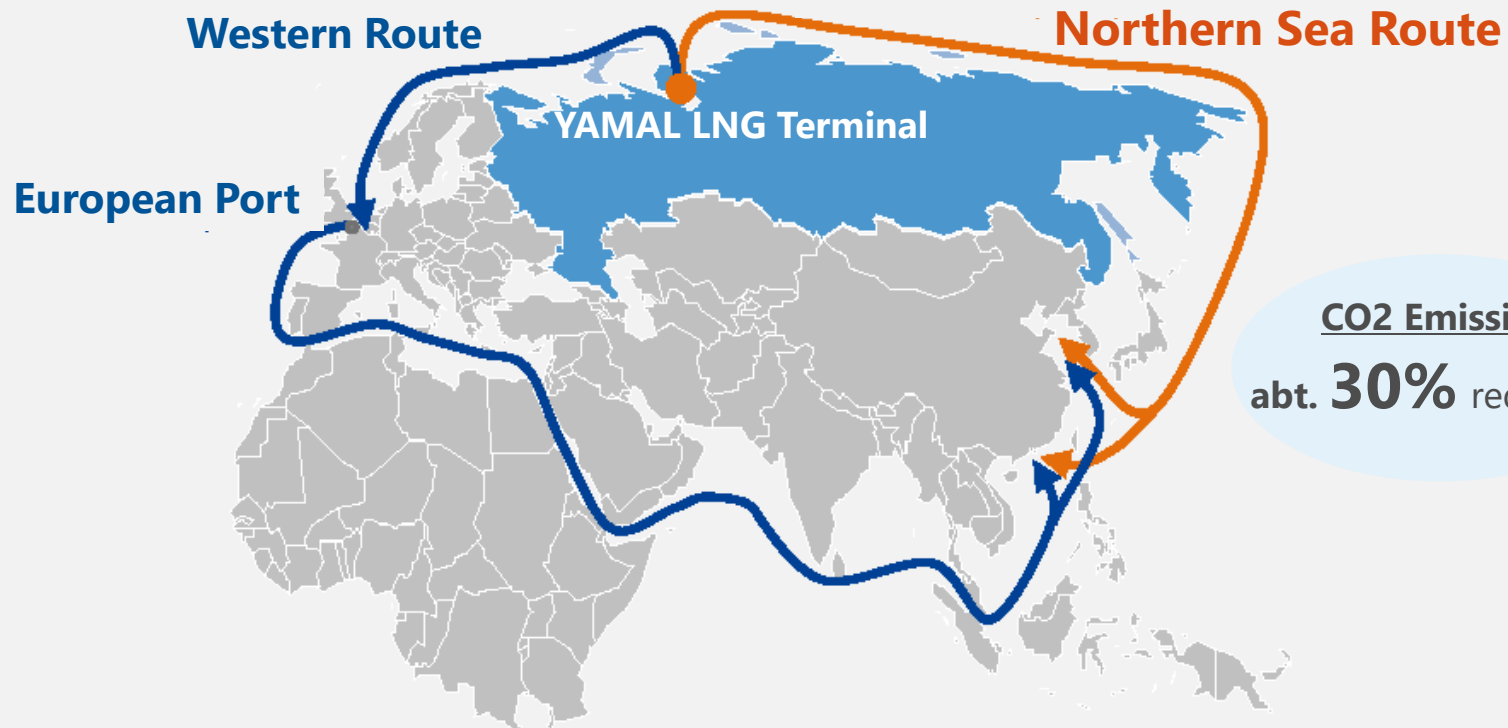
- **ARC7 LNGCs shuttle to Europe**
- **Less Ice-classed LNGCs to Asia**

- ✓ Distance : 13,700 miles
- ✓ One voyage : 40 days @14 knots

SUMMER (July~mid Nov)

- **ARC7 LNGCs to Asia via NSR transit.**
(Northern Sea Route)

- ✓ Distance : 4,900 miles
- ✓ One voyage : 20 days @10 knots



2. Yamal LNG Project

LNG Plant Information

Location	Yamal Peninsula (Russia)
Share Holder	NOVATEC(Russia) 50.1% CNPC(China) 20% TOTAL(France) 20% SilkRoad Fund(China) 9.9%
Production Capacity	16.5 million tons / year (5.5 mtons/year x 3 train)
Plant Start	Train 1 in 2017 Train 2 in 2018 Train 3 in 2018



Yamal LNG Terminal in Sabetta

LNG Transportation

by ARC7 Class Ice-breaking LNGC

Fleet	15 vessels
Size	L 299m x B 50m x D 26.5m
Owner	TEEKAY x 6 vessels DYNAGAS x 5 vessels MOL x 3 vessels SOVCOMFLOT x 1 vessel



Arc7 Ice Breaking LNGCs "Vladimir Rusanov"



3. Arc7 Ice Breaking LNG Carriers



3. Arc7 Ice Breaking LNG Carriers

Outline Specification

Builder	DSME (Korea)
Delivery	2016 ~ 2019
Classification	Class BV & RMRS
Ship Dimension	Loa 299m x B 50m x D 26.5m



Confidential



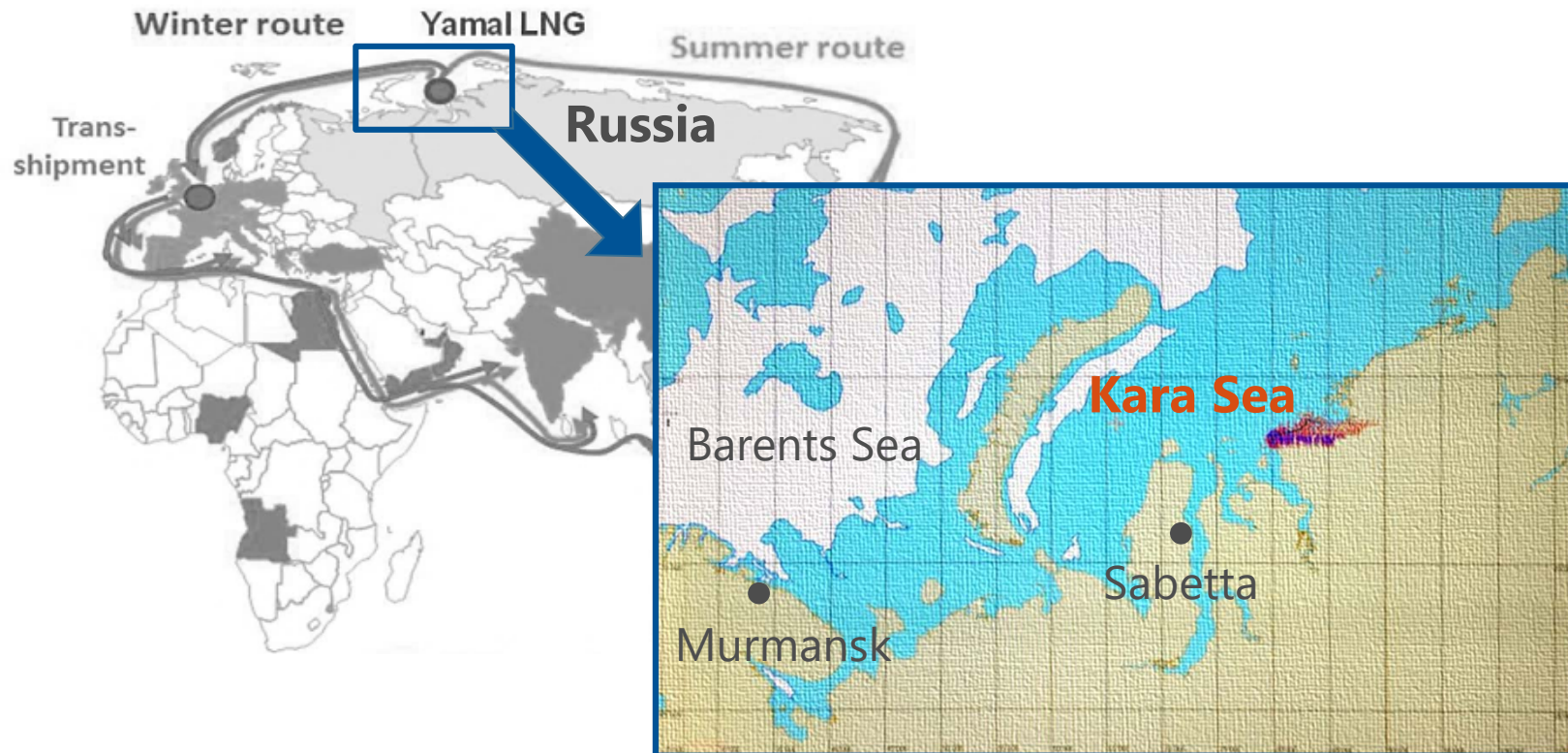


4. Ice Trial of Arc7 LNGC “Vladimir Rusanov”

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Ice Trial Period & Location

- **Trial Period** : 24th February to 11th March , 2018 (16 days)
- **Trial Area** : Kara Sea in Russia



Confidential

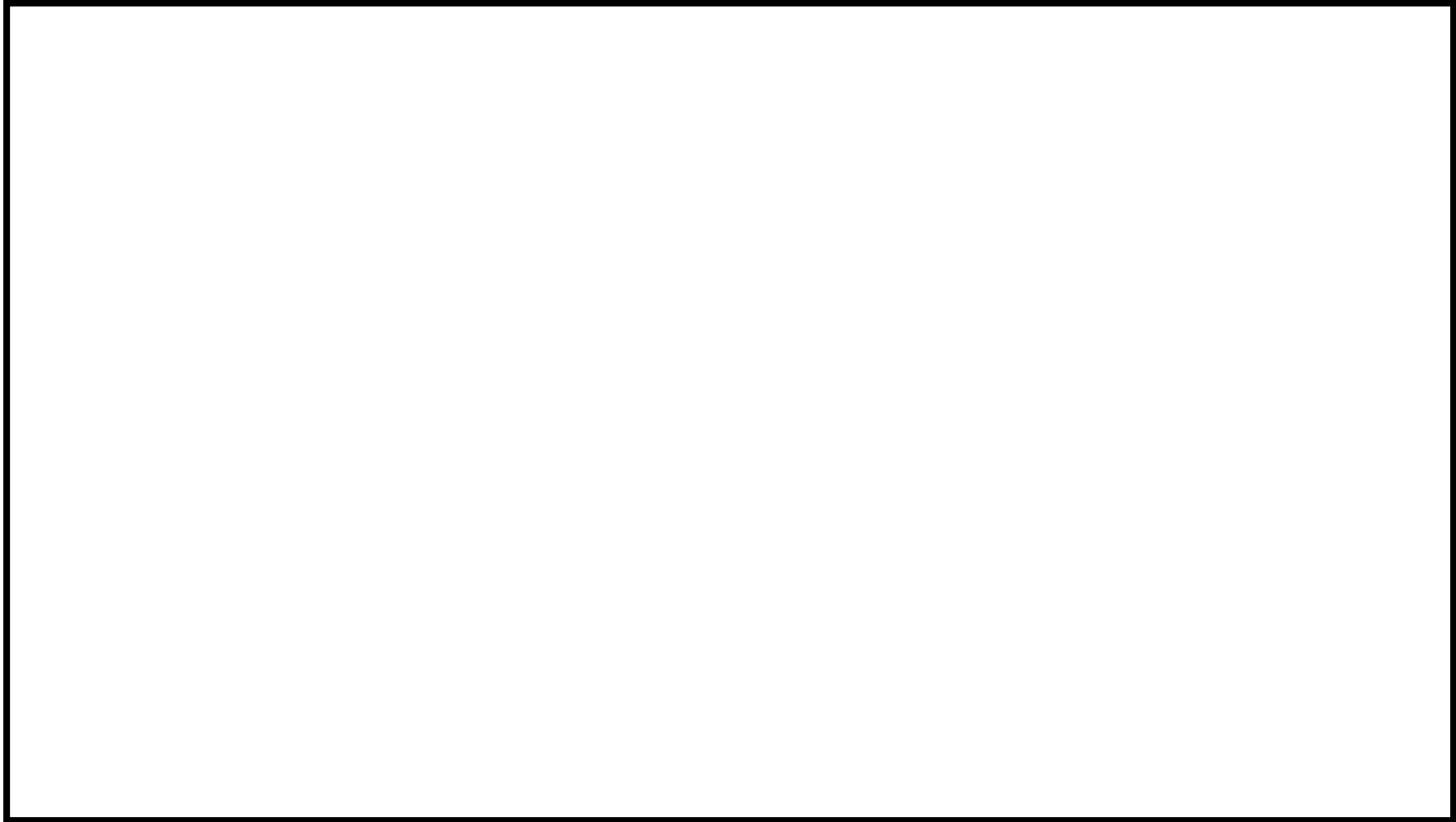


4. Ice Trial of Arc7 LNGC “Vladimir Rusanov”



<https://www.youtube.com/watch?v=mrAfC15QV60>

Movie



5. Experience of LNGC Operation in the Arctic



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MOL- Arc7 Ice Breaking LNG Carrier Fleet

VLADIMIR RUSANOV

*delivered in March 2018,
2 years operation experience*



VLADIMIR VIZE

*delivered in September 2018,
1.5 years operation experience*



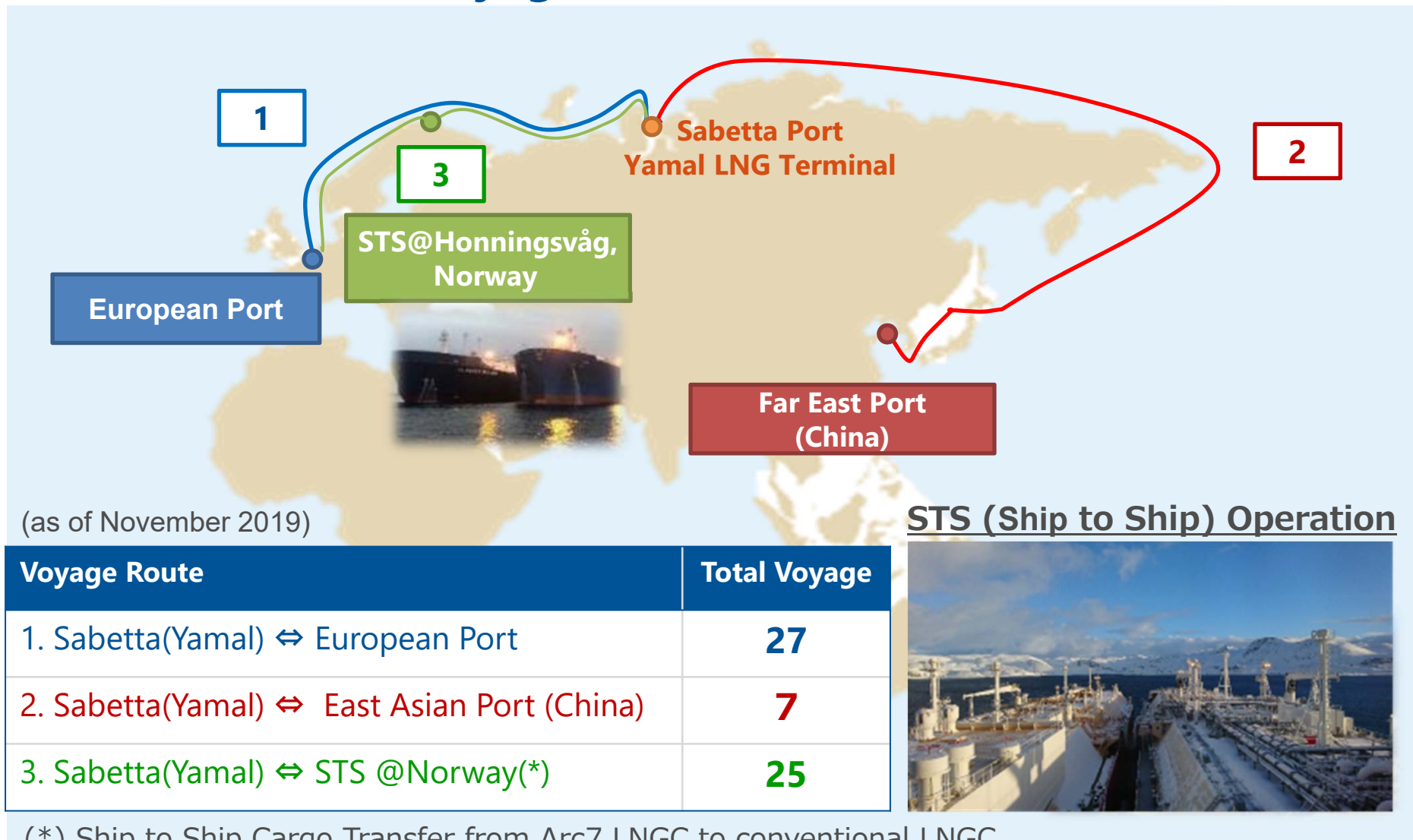
NIKOLAY URVANTSEV

*delivered in July 2019,
0.6 years operation experience*



5. Experience of LNGC Operation in the Arctic

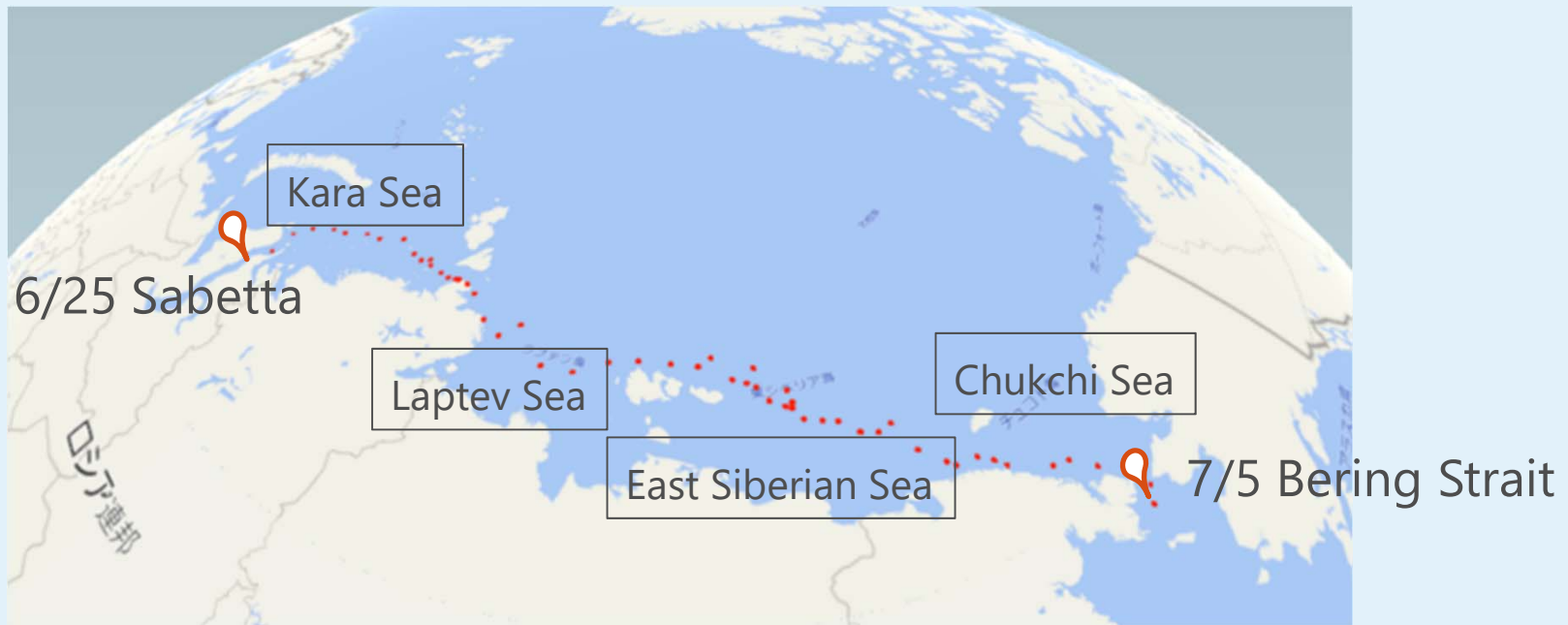
Total Number of Voyage (3 vessels)



(*) Ship to Ship Cargo Transfer from Arc7 LNGC to conventional LNGC.

5. Experience of LNGC Operation in the Arctic

First East-bound Transit of NSR by "Vladimir Rusanov" in June 2018

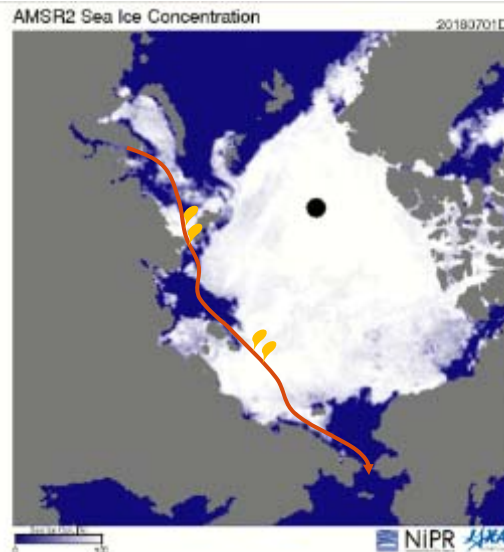


Total 19 days voyage from Sabetta to Far East via NSR
(⇔ abt 35 days by Suez Chanel Route)

6/25	Depart from Sabetta	} 11 days in NSR, Ave Speed 10knot
7/5	Passing through Bering Strait	
7/17	Arrive at Unloading Port in China	} 8 days (except for time adjustment)

5. Experience of LNGC Operation in the Arctic

First East-bound Transit of NSR by "Vladimir Rusanov" in June 2018



① Kara Sea



- open sea or light ice
- Basically using ahead mode but use astern mode twice when vessel stacked in a ridge ice.

② Laptev Sea



- open sea or light ice
- ahead mode operation
- Vessel chose south route considering ice radar and satellite photo.

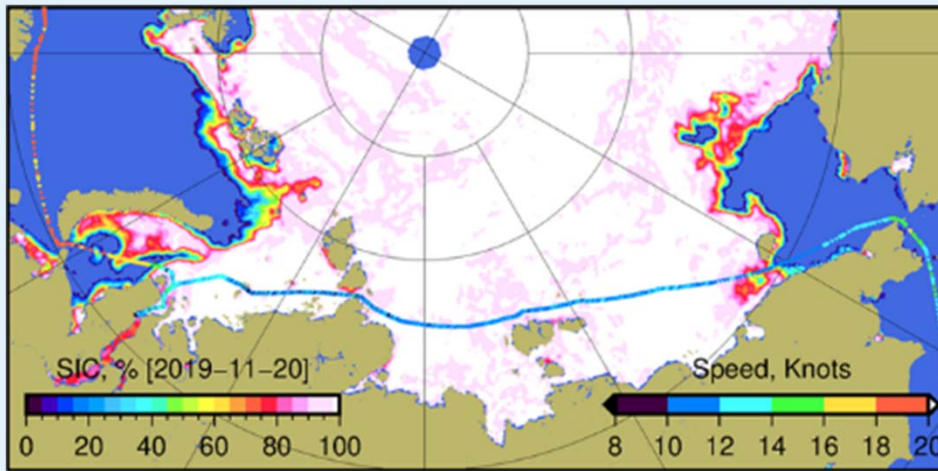
③ East Siberian Sea



- Heavy ice (max. 2m)
- Vessel stacked on the heavy ice twice and use astern mode.

5. Experience of LNGC Operation in the Arctic

West-bound Transit of NSR by “Vladimir Vize” in Nov. 2019



8.5 days in NSR, Ave Speed 11.5 knot

11/16 Passing through **Bering Strait**
11/24 Arrive at **Sabetta**

- 80% Sea Ice Concentration from East Siberian Sea to Kara Sea. Ice thickness seems to be around 0.3~0.8 m.
- Only ahead mode operation.

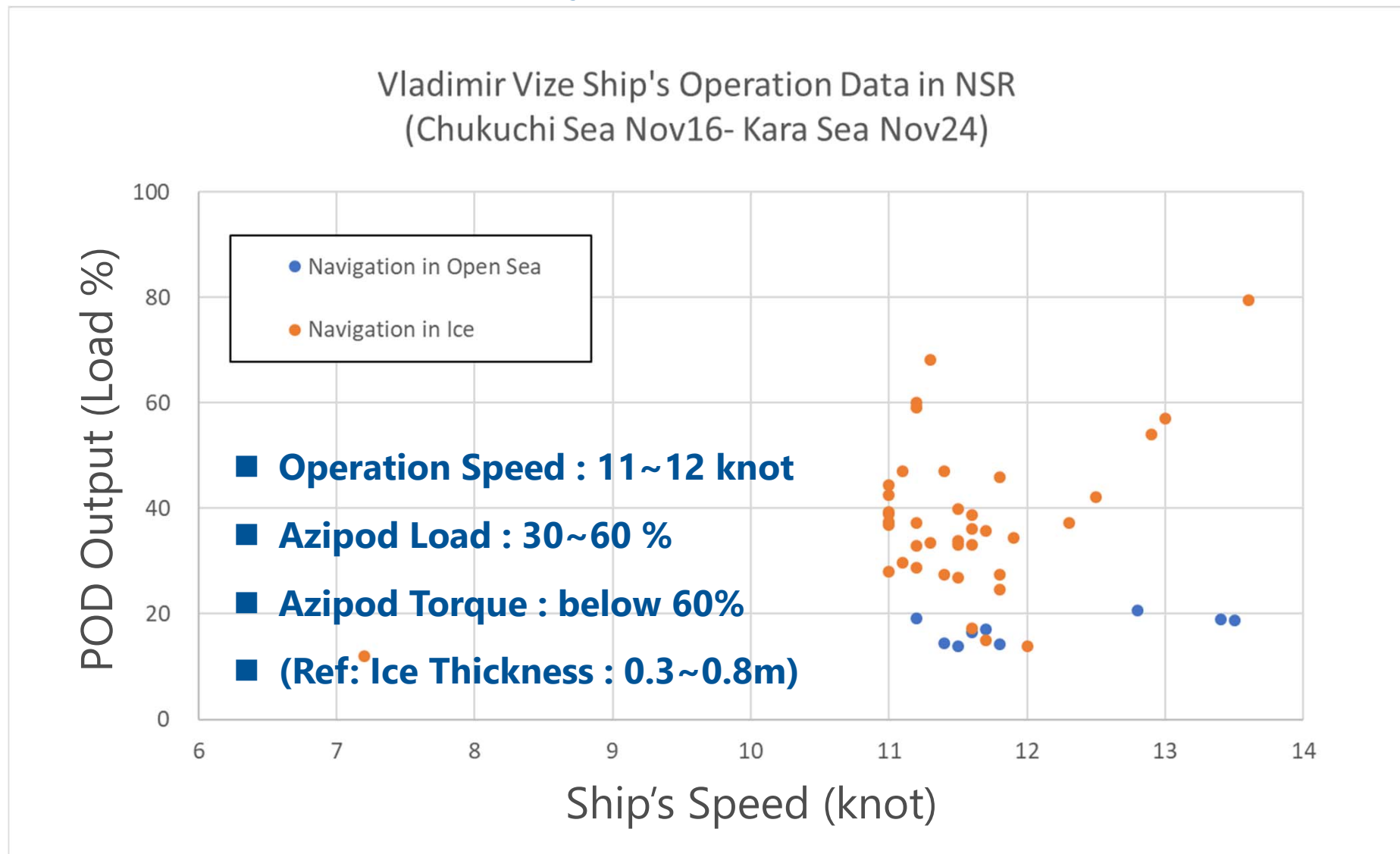
Infrared Camera on Bridge Wing

2019-11-16 / 17:07:48
171:36.861W / 67:33.266N
Chukchi Sea
SOG: 13.1 COG: 334.0 (c) MOL/NMRI, 2020



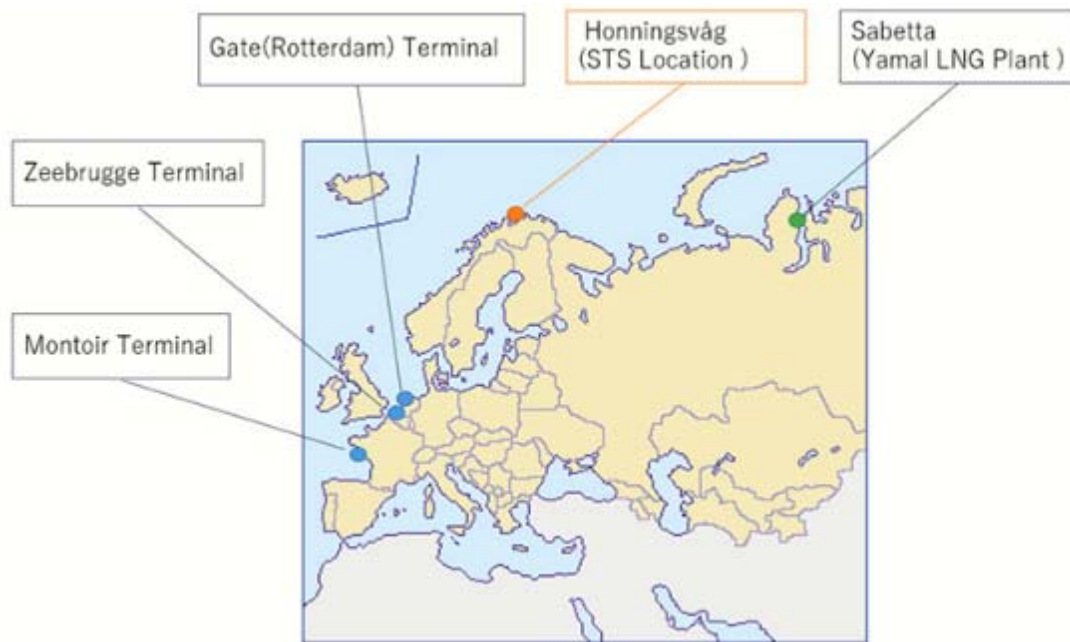
5. Experience of LNGC Operation in the Arctic

West-bound Transit of NSR by “Vladimir Vize” in Nov. 2019



5. Experience of LNGC Operation in the Arctic

First Ship-to-Ship Transfer Operation at Norway in Nov. 2018



- “Vladimir Rusanov” experienced first STS transfer operation of Yamal Arc7 LNGC in Honningsvåg, Norway.
- More than 120 times STS operation in Norway were carried in total by Yamal fleets. (total 15 vessels)



Summary



Summary

- ❑ MOL has been operating Arc7 Ice-Breaking LNG Carriers in the arctic since 2018.
- ❑ Two years experience makes crews get familiar with vessel operation in ice water which contribute to a **safe voyage in the arctic**.
- ❑ MOL contributed to growing in **diversity of LNG trade in the arctic** by east-bound transit of NSR to far east and Ship-to Ship transfer operation.
- ❑ MOL continues to work assiduously to ensure **stable LNG transportation** as well as for **other energy resources and product transportation through the NSR**, where demand is expected to grow in the future.



Thank you for your kind attention !!