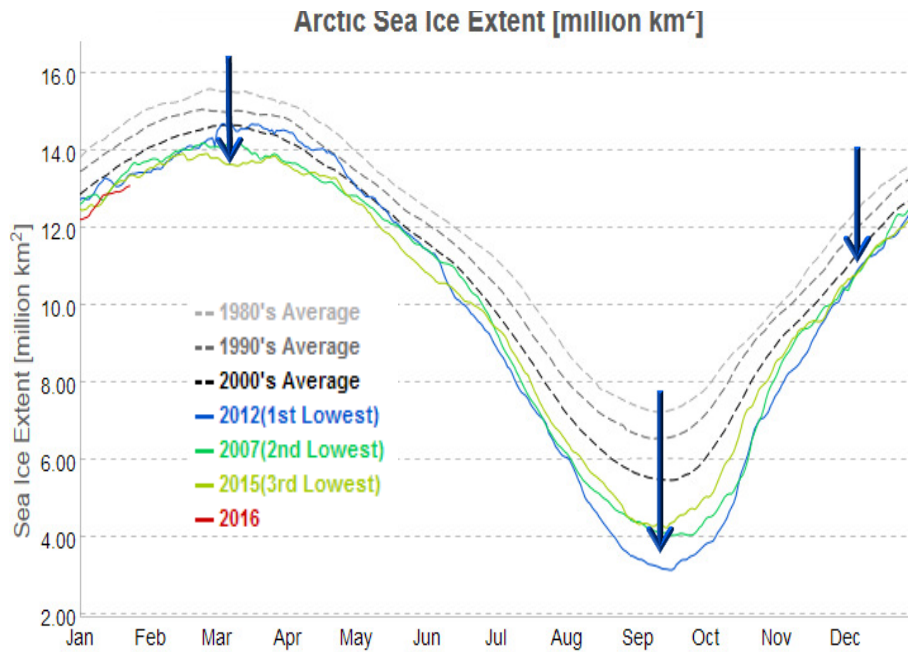


LNG Transportation through Northern Sea Route

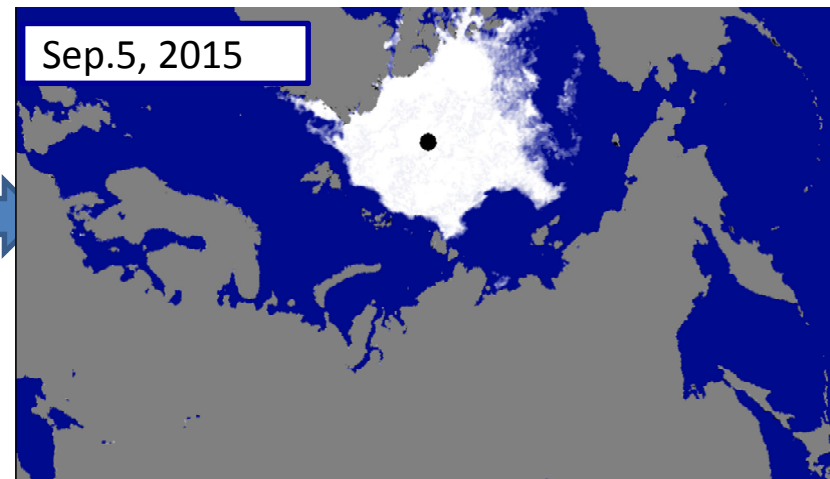
**Hiroyuki Nakano,
General Manager
Offshore & LNG Project Division
Mitsui O.S.K. Lines, Ltd.**



Navigation through Northern Sea Route



- Arctic Sea Ice in Sep 2012 melted to a record low extent. (60% decreased from 1980's average)
- Arctic Sea Ice in 2015 was 40% decreased from 1980's average.
- Decrease trend of Arctic Sea Ice



(Source: IARC-JAXA)

Navigation through Northern Sea Route

- Northern Sea Route was opened by receding Ice



(Source: JAMSTEC)

- Navigation through Northern Sea Route is allowed
 - generally in summer (from July to November)
 - generally with support by icebreakers
 - with permission by Northern Sea Route Administration, Russia



(Icebreaker "Yamal",
Rosatomflot)

Navigation through Northern Sea Route



➤ Traffic Record in Northern Sea Route

Year	Number of Voyages (All Vessels)	Number of Voyages (Cargo Carriers)
2007	2	1
2008	3	2
2009	5	5
2010	13	7
2011	41	32
2012	46	38
2013	71	65
2014	53	43
2015	To be finalized	27

	Eastward	Westward	Total
Bulk Carrier	0	1	1
Tanker	13	14	27
General Cargo	7	8	15
Total	20	23	43

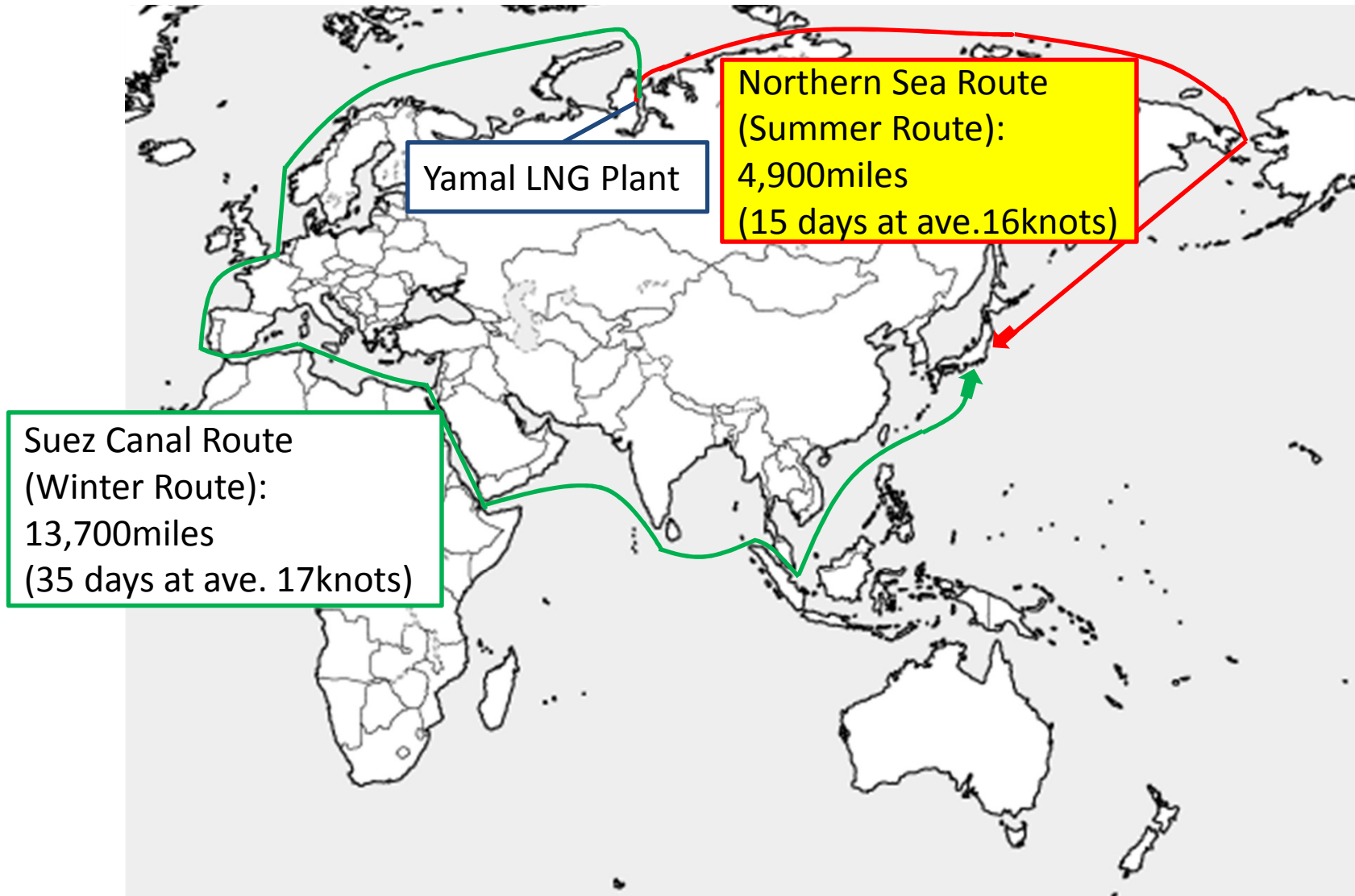
(Source : Northern Sea Route Information Office & Rosatomflot)

Yamal LNG Project

Shareholders	Novatek 60%, Total E&P Yamal 20%, CNODC(CNPC) 20%
Operator	Yamal LNG
FID	December 18, 2013
LNG Production	16.5 MTPA (5.5 MTPA/train x 3)
Export Destination	About 2/3 for Europe, About 1/3 for Asia
Start of LNG Production	Train 1: 2017 Train 2: 2018 Train 3: 2019
EPC contractors	Technip/JGC/Chiyoda



LNG Trade through Northern Sea Route



Profile of New Ice Breaking LNG Carriers

Shipyard	Daewoo Shipbuilding & Marine Engineering Co., Ltd.
Dimensions	Length: 299m, Breadth: 50m
Capacity	172,000 m ³
Cargo Containment	GTT NO96 GW membrane
Propulsion	Dual Fuel Diesel Electric (DFDE)
Ice Class	RMRS ARC7
Ice-break sailing capabilities	Icebreaker bow structure; Aft structure: 3-axis POD propeller Max. ice breaking capacity: ice thickness 2.1m (when going astern)



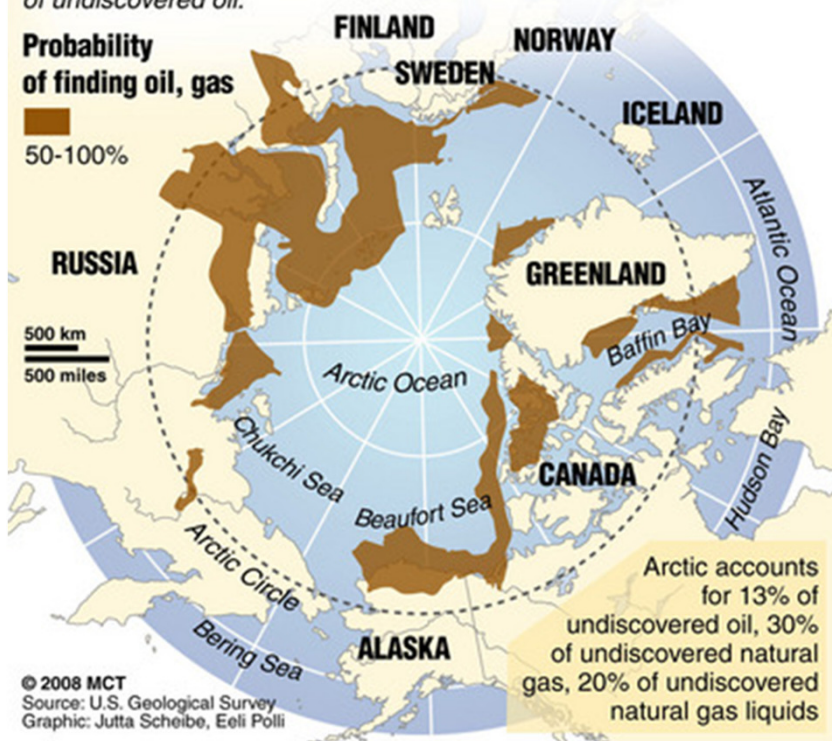
Merit of Northern Sea Route

Oil and gas in the Arctic

Area north of the Arctic Circle has an estimated 90 billion barrels of undiscovered oil.

Probability of finding oil, gas

50-100%



➤ Enable to Access Energy Resources in the Arctic

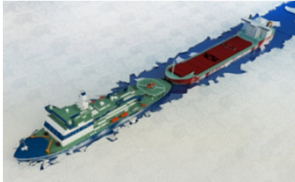
(according to U.S. Geological Survey, 17% of discovered natural gas 30% of undiscovered natural Gas in the Arctic)

➤ Reinforce Energy Security for LNG Importers

(by bypassing Suez canal, Somalian coast, Malacca straits)

➤ Transportation Cost Reduction

The Way Forward: to Enhance Utilization of Northern Sea Route



Increase in Number of Icebreakers/Icebreaking LNG Carriers

- 5 existing nuclear-powered icebreakers in operation by Rosatomflot, Russia
- 3 new nuclear-powered icebreakers to be built in Russia
- 15 icebreaking LNG carriers for Yamal LNG project to be built in Korea



Safe Operation of Vessels in the Arctic

- Development of international safety regulations for operation in the Arctic
- Increase in number of experienced/trained crew



Infrastructure Development

- Development of service facilities along Northern Sea Route
- More accurate navigation charts required (insufficient depth measurement)
- Development of ice forecasting technologies (ice thickness measurement)