



**ACCESS**  
Arctic Climate Change  
Economy and Society



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**ACCESS**

**Arctic Climate Change, Economy and Society**

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## **D2.63 – Comparison of transport costs and time for sailing from Kirkenes to Yokohama via Northern Sea Route**

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# Status on Navigation in Arctic

## General Comments

To this date, all commercial transits performed in the Northern Sea Route (NSR) have been assisted by icebreakers authorized to navigate under the state flag of the Russian Federation. Icebreaker assistance is a compulsory action, adopted under “The Northern Sea Route Administration”. All transits are performed 200-500 meters behind an icebreaker, and ship owners have no influence on the selected route, so there are no measureable benefits in using any Ice Route Optimization Systems (IRO).

This action could change in the future, but we believe it will take at least 5-10 years before commercial transits without icebreaker assistance are allowed in the NSR, and most likely even longer.

In other new shipping destinations in the Arctic, we may be able to see changes in the regulations earlier, but not in the same type of ice, e.g. in Arctic Greenland or Baffinland in Canada.

In the below, we have therefore used cost savings without IRO systems.

## Exact Calculations

Our task was to use a trip from Kirkeness to Yokohama, but in order to make it more realistic we have based our calculations on a trip from Murmansk to Jingtang (North China). The route is the same but the distance is about 500 miles shorter, corresponding to approximately 5% difference, but this does not have any impact.

The advantage in using this route is that we can use real data instead of projections.

## Costs and Savings

Before establishing the actual costs and savings for sailing via the Northern Sea Route, it is important to understand that many factors are not just variable, they are highly volatile.

### Vessel's Costs:

The costs can be defined in two ways. A financial way that is used to establish the running costs of the vessels on a daily basis, and a way that establishes the market value for specific vessels at a specific time. The last version is the one that is used by shipping professional as it gives a more correct picture of today – what does the vessel cost today – when we talk about savings in terms of days on the NSR vs Suez, we will use option no 2. Both examples are highlighted below.

### ICEBREAKER COSTS (fee)

The transit service in the NSR is provided by Atomflot, which is a Russian state-owned

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icebreaker company. Costs are calculated in USD/pmt, so in other words you pay for the volume of cargo on board the vessels and not for the actual time or distance. This is a very unusual way of calculating prices. The vessels get other similar services like Pilot or port tug service, and the costs are being calculated in either vessel's size (GRT/NRT) or time. The irony is that if a vessel transits in ballast condition (no cargo on board), the fee is then calculated based on the vessel's max cargo capacity less than 40%.

Today, a bulk carrier pays between USD 4,5 pmt and USD 6 pmt, depending on each company's individual agreement with Atomflot.

So using a price of USD 5.0 per lifted ton cargo for a vessel like Nordic Odyssey, the calculation will be roughly 65.000 mts x USD 5,0 = USD 325.000 for one transit.

Often these transits are performed in convoy, however, no discount is given.

#### OPEX

Operational expenses (OPEX) for the vessel on a daily basis cover: Crew's salary, food, lub oils and insurance for the vessel – these costs are approximately USD 5,500 per day on a bulk carrier.

#### CAPEX

Capital Expenditure (CAPEX) covers the financing of the vessel. This amount varies a lot from vessel to vessel, depending on several factors - was the vessel purchased in a high or low market, and how well is the vessel financed, interest rate and size of the loan? Today a bulk carrier like Nordic Odyssey costs USD 35 million – 8 years ago the same vessel would cost USD 65 million. This big price difference has obviously a big impact on the CAPEX, and we have used USD 35 million for the calculation – this will give a daily CAPEX of about USD 7.500.

#### SAVED DAYS

We have used the actual days saved when sailing from Murmansk via NSR to arriving at the Pilot station in Jingtang compared to the estimated days for the sailing from and to the same ports via the Suez Canal.

The days saved shall be seen as an estimate, because the days will change depending on the season. We see a difference between transits performed in August compared to October and annual ice movement also has an impact.

#### FUEL COSTS

Even though a vessel burns a lot of fuel to each day, shipping is said to be the cleanest way of transporting goods, due to the huge amount cargo per shipment.

A vessel like Nordic Odyssey uses about 33 tons fuel per day – this amount can change from design to design, but the level for such a vessel is between 30-38 tons per day.

Fuel prices are in almost 100% correlation with the oil prices. They are extremely volatile and have changed a lot since we performed our first transit in the NSR in 2010. Back in 2010, the fuel prices were more than double of today's price (from USD 700 pmt to 300 pmt). This

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factor has been the biggest impact when savings are calculated. The difference is more than USD 350.000 for one voyage.

Vessels daily fuel costs:

@ USD 700 pmt it is: USD 23.100/day

@ USD 300 pmt it is: USD 9.900/day

#### MARKET VALUE (COSTS)

In the shipping world we use a different way to calculate savings or extra costs. We use a term called market value. This describes the value that someone is willing to charter the vessel at – the daily rate. This rate is also very volatile and controlled by supply and demand. Today, the daily rate for Nordic Odyssey from Kirkeness to Yokohama via the Suez Canal is USD 10.000, which means that we as owners will only get some of the costs covered:

**USD 10.000 - USD 5.500 (OPEX) - USD 7.500 (CAPEX) = -3.000/Day**

This small calculation shows that vessel's costs (OPEX+CAPEX) have no influence on the market.

If we do the same calculation with the shipping market from 2012, where the market was USD 35.000/day, the calculation looks quite different:

**USD 35.000 (MARKET) - USD 5.500 (OPEX) - USD 7.500 (CAPEX) = 22.000 /Day**

So when we establish savings, the calculation will be:

**Saved days x (Saved Fuel + Market Value)**

In a 2012 calculation it would be:

17,73 Days saved x USD 58.100 (35.000 + 23.100) = USD 1.030.113

Today the same calculation would be:

17,73 Days saved x USD 19.900 (10.000 + 9.900) = USD 352.827

As the above calculations show, fuel and market value have major impact on the savings and can therefore easily influence the shipping volume in the NSR.

Lower market in general reduces the upside for NSR transits, and the last couple of months' heavy fall in oil prices, and thereby in fuel costs, also makes the NSR savings less.

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### Fuel Savings

The fuel cost savings from Murmansk to Jingtang have changed as follows:

Year	Fuel saving in mts	Fuel price pmt in USD	Total fuel savings in USD
2012	600	700	420.000
2015	600	300	180.000

As Table 1 above shows, the reduction in fuel savings has been reduced by USD 240.000 due to the dramatically fall in oil prices. An interesting comparison is that the costs for the icebreaker in the NSR are about USD 300.000 – 350.000.

### Time saved

Table 2 below shows the budgeted and actual time saved when using the NSR instead of the Suez Canal, when the vessel Nordic Odyssey loaded its cargo in Early September 2011. During the years we have seen the most optimal conditions during these periods. Good ice conditions and thereby faster transits and bigger savings. Once again it is important to stress that we would not have seen the same savings in end October where the ice starts to form again. The voyage through the NSR was 17,73 days shorter than via the Suez Canal, which is within the expected for this period. Our best time saving was almost 20 days and worst was close to 11 days.

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Table 2: Time consumption and distances for Nordic Odyssey through NSR vs. Suez Canal

Freight Route	Voyage	Distance (NM)	Distance sailed (NM)	Transit NSR (Days)		Transit Suez (Days) Estimate	Difference NSR / Suez	
				Budget	Actual		Budget / Actual	Budget / Actual
NSR	Hamburg - Murmansk	1566	1566	4,66	4,38			
	Murmansk - Whitney Cove	860	2426					
	Whitney Cove - Uelen	2519	4945		7,38			
	Uelen - Jingtang (Qingdao)	3697	8642					
	<b>Total distance incl. ballast</b>		<b>8642</b>					
	Days in ballast			4,66	4,38			
	Days at sea			25,85	26,76			
	<b>Days at sea incl. ballast</b>			<b>30,51</b>	<b>31,14</b>			
	Sea margin			7	0			
	<b>Total number of days at sea</b>			<b>37,51</b>	<b>31,14</b>			
	Port days			10,99	11,2			
	<b>Total number of days</b>			<b>48,5</b>	<b>42,34</b>			
Suez Canal	Hamburg - Murmansk	1566	1566			4,38		
	Murmansk - Suez Kanal	4895	6461			15,34		
	Suez Kanal - Jingtang (Qingdao)	7390	13851			23,15		
	<b>Total distance incl. ballast</b>		<b>13851</b>			<b>42,87</b>	<b>5209,00</b>	<b>37,61%</b>
	Days in ballast							
	Days at sea					38,49		
	<b>Days at sea incl. ballast</b>					<b>42,87</b>	<b>11,73</b>	<b>27,36%</b>
	Extra days (Suez)					1		
	Sea margin					5		
	<b>Total number of days at sea</b>					<b>48,87</b>	<b>17,73</b>	<b>36,28%</b>
	Port days incl. 1 extra day					11,2		
	<b>Total number of days</b>					<b>60,07</b>	<b>17,73</b>	<b>29,52%</b>

## Actual voyage breakdown basis 2011 voyage

Table 3: Voyage cashflows through NSR and Suez Canal

Statement	Voyage cashflow Nordic Odyssey / NSR		Voyage cashflow Nordic Odyssey / Suez	Difference Nordic Odyssey
	Budget	Actual	Estimate	
Intake in mts	65.000	66.343	66.343	-
Freight rate in USD/MT	47,50	47,50	47,50	
<b>Gross freight income</b>	<b>\$3.087.500</b>	<b>\$3.151.292,50</b>	<b>\$3.151.293</b>	
Commission (5%)	\$154.375	\$157.564,63	\$157.565	
<b>Net freight income</b>	<b>\$2.933.125</b>	<b>\$2.993.727,88</b>	<b>\$2.993.728</b>	<b>-</b>
Number of days	48,50	42,34	60,07	
Number of days at Sea	37,51	31,14	48,87	
Market Value	\$24.500,00	\$24.500,00	\$24.500,00	
Bunker costs	\$866.481,00	\$719.334,00	\$1.128.897,00	409.563,00
Port costs	\$175.000,00	\$155.000,00	\$155.000	-
Ice breaker assistance	\$355.000	\$331.000,00	\$0	331.000,00
Cancel Tolls	\$0	\$0,00	\$185.000	185.000,00
Insurance	\$105.000,00	\$96.000	\$100.000	4.000,00
Market value x days	\$25.000	\$25.000	\$25.000	
<b>Market value Total</b>	<b>\$1.212.500</b>	<b>\$1.058.500</b>	<b>\$1.501.750</b>	<b>443.250,00</b>
<b>Net total income</b>	<b>\$2.933.125</b>	<b>\$2.993.728</b>	<b>\$2.993.728</b>	<b>-</b>
<b>Net Total costs</b>	<b>\$2.713.981</b>	<b>\$2.359.834</b>	<b>\$3.070.647</b>	<b>710.813,00</b>
<b>Voyage result</b>	<b>219.144,00</b>	<b>633.893,88</b>	<b>-76.919,12</b>	<b>710.813,00</b>

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Table 3 above shows the savings as they were in 2011 in a market with high oil prices (bunkers) and a high shipping market (market value). The calculated savings are USD 710.813 for one voyage, compared to the alternative Suez Canal where we have used an estimated result based on 10-20 annual transits in the Suez.

### Actual voyage breakdown basis 2015 voyage

Table 4: Voyage cashflows through NSR and Suez Canal (2015)

Statement	Voyage cashflow Nordic Odyssey / NSR		Voyage cashflow Nordic Odyssey / Suez	Difference Nordic Odyssey
	Budget	Actual	Estimate	
Intake in mts	65.000	66.343	66.343	-
Freight rate in USD/MT	47,50	47,50	47,50	
<b>Gross freight income</b>	\$3.087.500	\$3.151.292,50	\$3.151.293	
Commission (5%)	\$154.375	\$157.564,63	\$157.565	
<b>Net freight income</b>	\$2.933.125	\$2.993.727,88	\$2.993.728	-
Number of days	48,50	42,34	60,07	
Number of days at Sea	37,51	31,14	48,87	
Market Value	\$24.500,00	\$24.500,00	\$24.500,00	
Bunker costs	\$371.349,00	\$308.286,00	\$483.813,00	175.527,00
Port costs	\$175.000,00	\$155.000,00	\$155.000	-
Ice breaker assistance	\$355.000	\$331.000,00	\$0	- 331.000,00
Cancel Tolls	\$0	\$0,00	\$185.000	185.000,00
Insurance	\$105.000,00	\$96.000	\$100.000	4.000,00
Market value x days	\$10.000	\$10.000	\$10.000	
<b>Market value Total</b>	\$485.000	\$423.400	\$600.700	177.300,00
<b>Net total income</b>	\$2.933.125	\$2.993.728	\$2.993.728	-
<b>Net Total costs</b>	\$1.491.349	\$1.313.686	\$1.524.513	210.827,00
<b>Voyage result</b>	1.441.776,00	<b>1.680.041,88</b>	<b>1.469.214,88</b>	<b>210.827,00</b>

Table 4 above shows savings in 2015, where oil prices and shipping market have dropped more than 50% since 2011. The savings are 70% lower than what we experienced in 2011.

## Conclusion

We have seen a dramatic fall in NSR transits during the last 2 years, and especially in 2014, which was a very bad year for NSR traffic.

We can only comment on the development within the Dry Bulk segment, and within this segment there is a very close correlation between the fall in savings and the actual number of transits.

It is still very early to draw any conclusions, as commercial transits in the NSR only has existed in 5 seasons, and traffic has gone from 5 to 67 transits and then down to the official 60 transits again. For NBC the number has gone from 1 to 10 transits and then down to 1 again. There is a saving in using the NSR route, even in today's low markets, but this will not change the major trading patterns for the next 5-10 years.

The main reason is that the season is too short and there are not enough vessels build with sufficient ice class. We will not see a boom in orders for these ice classed vessels as the season is too short to justify the extra costs of building.

Also, the changes in market value and trading patterns have shown and will continue to show an effect in the volume of transits in the NSR.

We believe that most of the new volume in the coming years will be more focused on arctic shipping in general, and mainly cargo in or out of arctic ports and not as much on the transits. New mines in Baffinland, Greenland and Russia will be the driving force in arctic shipping, and in the event of market value changes, and climate changes that allow a longer period, this could result in a change of volume of transits.

If the number of commercial transits should increase in the NSR, a new challenge would be lack of icebreakers. The Russian fleet of icebreakers (see Picture 1 below) capable of NSR transits counts only 5, and with an average age of more than 20 years this could be a serious bottleneck for future expansion in volumes. This issue is further escalated by the increased activities in the Arctic, like the Yamal project, which is a new LGN terminal that will need constantly icebreaker service - meaning this will take away capacity for the commercial transits.

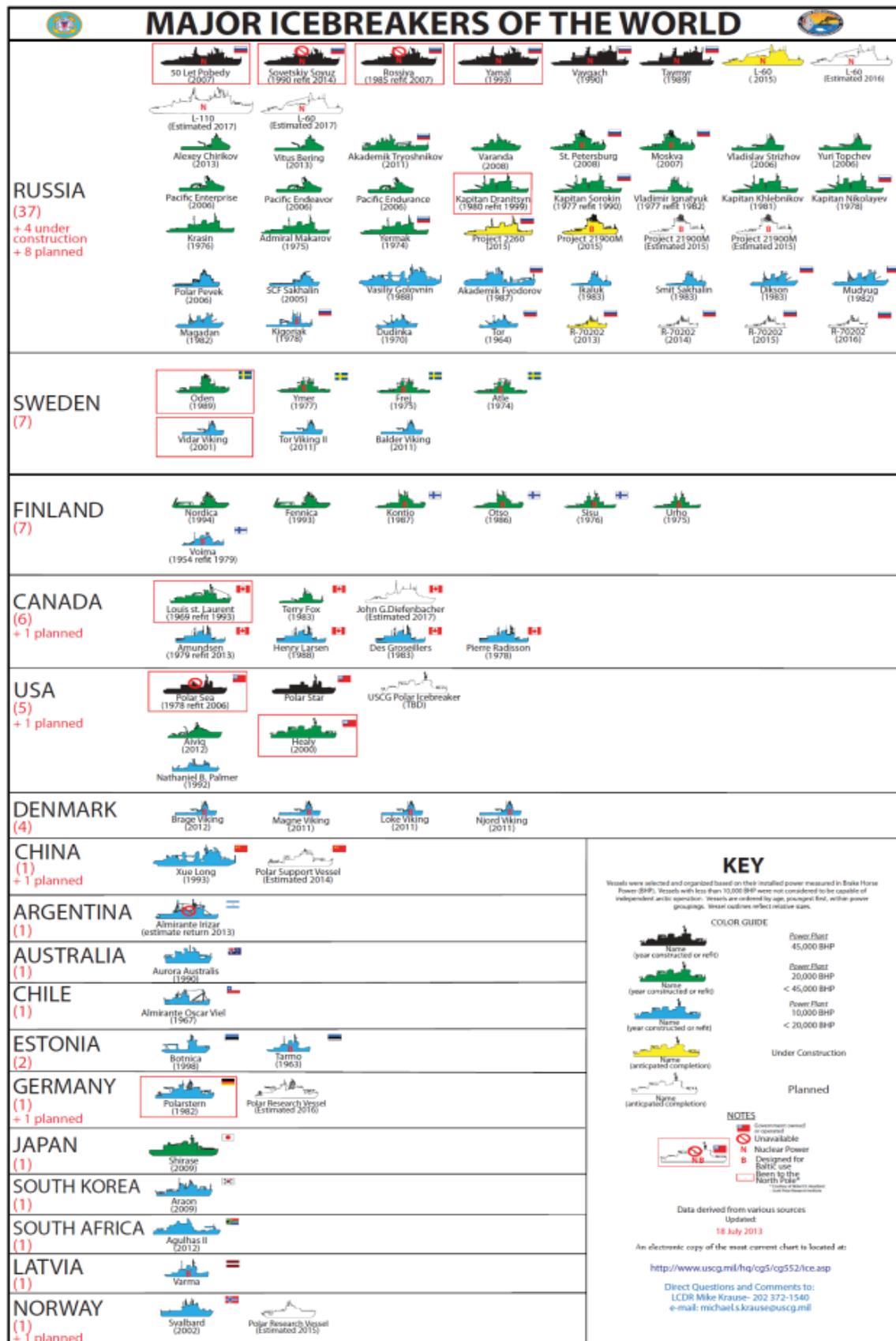
The Russian fleet is not alone with this issue. Canada, Denmark (Greenland), United States and other Arctic states have not upgraded their fleet of icebreakers for many years, due to the warmer winters. So with the increased activity in the Arctic, we see an increased need for icebreaker assistance, and a need to build new ones first.

As the only Arctic state, Russia has ordered up to 4 new icebreakers, but for the time being, the newbuilding project is on standby due to sanctions from the western world, which is a big issue and a potential risk for the continued development in Arctic shipping.

Christian Bonfils, Managing Director  
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Task 2.6.3 Comparison of Transport Costs and Ice Route Optimization

Picture 1



Developed and maintained by USCG Office of Waterways and Ocean Policy (CG-WWM)

## Sources

American Nautical Services [www.amnautical.com](http://www.amnautical.com)

Northern Sea route Information office [www.arctic-liaison.com/nsr\\_nsra](http://www.arctic-liaison.com/nsr_nsra)