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Building Self Supporting Vessels

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Agenda



- » Nordic Yards
- » Northern Sea Route Where are we?
- » A versatile Design Project for a self-supporting NSR vessel

Our Shipyards



TWO SITES IN GERMANY



- » employ a highly qualified team all have at least one skilled worker qualification
- » are equipped with modern, highly automated plants
- » have covered dock halls of a unique size
- » are in an ideal location with direct access to the Baltic Sea

Design



» More than 150 Inhouse Designers from Concept to Detail Design

» Highly skilled, broad knowledge base from almost 1000 ships in 65 years





Strategy Fields Mirror of Global Trends

mobility &

comfort



new geological

insights



new energy

policy

climate

change

References: Arctic Vessel of iceclass 1A or higher

20 x Icebreaking Bulk/MPV Carriers Type ULESC for SU 61 x Icegoing Reefer ships Types POLAR, Kristall, Kristall II (152 x 22 x 8 m) 11 x Icegoing Research Vessels (110 x 17 x 6 m) for SU 2 x Icebreaking Chemical Oil Tanker COT 9 (110 x 17.7 x 8.6 m) for RIGEL 4 x Icebreaking Chemical Oil Tanker COT 11 (124 x 17.7 x 8.4 m) for RIGEL 6 x Icebreaking Chemical Oil Tanker COT 20 (161 x 23 x 8.6 m) for RIGEL 2 x Icebreaking Oil Tanker ARCTIC 17.2 (145 x 22.5 x 8.7 m) for Lukoil 3 x Icebreaking Chemical Tanker ARCTIC COT 17.2 (145 x 22.5 x 8.7 m) Lukoil 4 x Icebreaking MP Containerships for Norilsk Nickel **1 x Icebreaking Tanker for Norilsk Nickel**

115 vessels for ice navigation

References – Arctic Offshore

Ice-Breaking Container / Cargo Ship - ACS 650





»	Ice-breaking capability:	1.5 m
»	Draught (scantling):	10.0 m
»	Depth:	14.2 m
»	Beam:	23.1 m
»	Length overall:	169.0 m

»	Deadweight:	18,000 t
»	Container stowage capacity:	648 TEU
»	Diesel-electric machinery	
»	Service speed:	15.5 kn

References – Arctic Offshore



Ice-Breaking Tanker



The POLAR project (2011-2013)



- ✓ POLAR is abbreviation of Production Operation and Living in Arctic Regions
- Funded by German government (Federal Ministry of Education and Research)
- ✓ POLAR has a financial volume of 20 Mio € and includes <u>14 strategic</u> <u>partners</u>, located in Mecklenburg North West Pomerania
- POLAR is a joint industrial project which aims to develop system solutions for exploitation, storage and transportation of resources in arctic regions



Further POLAR Partners





IMG





L













ILK Dresden



Current Projects

Arctic | Ice







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The Northern Sea Route







Historical travel times show deviations





through NSR during 1940 and 2009





Single Projects







BarentsObserver.com

Cross-border news

Politics Security Business Nature Energy Fish Society Borders

Shipping to double on Northern Sea Route 2012-02-08

KIRKENES. More than 1,5 million tons of goods will be shipped along the Northern Sea Route in 2012, regional authorities in Murmansk say.

While a total of 820,000 tons of goods was shipped along the Northern Sea Route in 2011, the volumes are expected to almost double in 2012, regional minister of Property Relations Yuri Chuykov said at the <u>Kirkenes Conference</u>.

In his presentation at the conference, Minister Chuykov underlined the key importance of the Northern Sea Route. While the goods volumes on the route in 2010 was only 111,000 tons, the volumes will in 2012 increase to more than 1,5 million tons, Chuykov said.



Photo: usinsk.e.ru

Icy oil shipping from Ob Bay 2012-03-15

Gazprom Neft intends to export all oil from the Novoportskoye field through the Northern Sea Route.

In 2011, the number of vessels using the route in 2011 amounted to 34.

Read also: 34 vessel in transit on Northern Sea Route

Several regional industrial initiatives in Murmansk will benefit from the improved shipping conditions on the route. According to Chuykov, the project preparation of the railway line to the western shore of the Kola Bay as well as the planned oil and coal terminals in the area are about to be be completed.

The first objects to be built on the western side of the bay are the new coal terminal, the oil terminal, as well as new residential areas, the regional minister said.

Text: Atle Staalesen

Drivers and Constraints



Oil price development and forecast

Global Oil & Gas & Minerals consumption increase and forecast

Local and Global Governance

Reliability of availability/schedule => <u>Technology</u>

Icebreaking Tankers for Arctic Seas Vol.I-III (1995-2001)



- » Resources, Opportunities
- » Environmental Conditions
- » Ship size evaluation
- » Evaluation of Transport Variants (Direct/Shuttle)
- » Economy / Trafficability Model
- Definition of 4 Designs, Principal Parameters, Classification, Performance Figures (20, 50, 80, 120 T tdw)

R&D project: Icebreaking Tankers Vol.II (1996-1997)

- » COCARC 50 single skeg GL ARC 2
- » Steel Structure Design
- » Definition of 3 Hullforms
- » Tests in open water, level ice and ice floes, forward, backwards
- » Icebreaker assistance
- » Economical models, Transport Analysis, Trafficability Model
- » Consideration of Arctic climate
- » Corrosion protection
- » Machinery

R&D Project: Icebreaking Tankers Vol. III (1998-2001)

- » ARCTIC 63 TwinSkeg / TwinPod
- » Model tests
- » Evaluation of Transport Variants (Direct/Shuttle)
- » Economy
- » Definition of 4 Designs, Principal Parameters, Classification, Performance figures



nord

vards

The ARCDEV Project 1998 Large scale EU-RUS project









State of the Art

Historically ships were mainly escorted by an icebreaker in convoys, at least in winter season, examples are the SA-15 ships, Warnemuende's ULESC vessels, Wismar's **RIGEL** and Lukoil vessels.

Independent year-round services in Kara Sea with ARC7 "Norilsk-Nickel" Class Ships (from 2006)

Further independent year-round services in Pechora Sea with ARC6 "Vasily Dinkov" (from 2008) and "Mikhail Ulyanov" (from 2010) class ships, operated by Sovcomflot











The AMSA report



Arctic Council and its subgroups

Consolidation of ARCOP and other R&D by main stakeholders



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The Mission



1400 TEU + special cargo

7-9 months NSRindependent

Year-round Murmansk – Dudinka

Guiding convoys



Source: Norilsk Nickel

Environmental conditions



Level ice Icebergs Ridges (sometimes grounded) Rubble ice Shallow water Ice pressures Temperatures down to -50 °C Permanent darkness Fog



Source: Mironov et al.: Scheme of location of the ice massifs in the Russian Arctic Seas 1-Novozemelsky, 2-Kara North, 3-Severozemelsky, 4-Taimyrsky, 5-Yansky, 6-Novosibirsky, 7-Ayonsky, 8-Wrangelevsky, 9 Chukchi North

Ice thickness along the routes



	Area	Season								
6.00		Winter-Spring				Summer-Autumn				
Sea			Navi	gation		Navigation				
		S	M	Н	E	S	м	Н	E	
Doronto	North	0,45	0,70	0,90	1,17	0,23	0,35	0,45	0,59	
Darents	South	0,32	0,55	0.72	1,10	Jonge.		Jonesi	:maye.	
Koro	N	0,75	1,25	1,75	2,35	0,38	0,63	0,88	1,18	
Nala	S	0,45	1,00	1,70	2,20	0,23	0,50	0,85	1,10	
Lontov	N	1,00	1,90	2,80	4,00	0,50	0,95	1,40	2,00	
Lapter	S	0,65	1,50	2,25	3,70	0,33	0,75	1,15	1,85	
EastSiborian	N	1,00	1,70	2,40	3,20	0,50	0,35	1,20	1,60	
Castolberian	S	0,60	1,34	1,90	2,95	0,30	0,67	0,95	1,50	
Chuckchee	N	0,85	1,50	2,50	3,75	0,43	0,75	1,25	1,88	
VIIGOROIGE	s	0.50	1,18	2.0	3,45	0,25	0,60	1.00	1,73	

Source: RMRS/AARI

Service areas and conditions for ships of arctic categor
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Category of ice strength- ening	Type of ice navigation	Winter/spring navigation					Summer/autumn navigation					
		The Barents Sea	The Kara Sea ¹	The Laptev Sea	The East Siberian Sea	The Chuckchee Sea	The Barents Sea	The Kara Sea	The Laptev Sea	The East Siberian Sea	The Chuckchee Sea	
		ENHME	ENHME	ENHME	ENHME	ENHME	ENHME	ENHME	ENHME	ENHME	ENHME	
Arc4	IN	+					+ + + +	++	+	+	++	
	IEN	_*++	+		_	*	+ + + +	*+++	++	+ +	_*++	
Arc5	IN	++	+				+ + + +	_ + + +	++	++	++	
	IEN	*+++	*+	+	+	*+	+ + + +	*+++	*+++	*+++	*+++	
Arc6	IN	*+++	+	+	+	+	+ + + +	+ + + +	_ + + +	_ + + +	_ + + +	
	IEN	+ + + +	**++	_**+	_**+	_*++	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	
Arc7	IN	+ + + +	+ +	+	+	++	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	
	IEN	+ + + +	+ + + +	*+++	*+++	*+++	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	
Arc8	IN	+ + + +	+ + + +	_*++	_*++	*+++	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	
	IEN	+ + + +	++++	++++	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	
Arc9	IN	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	
	IEN	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	

Symbols:

IN — independent navigation IEN — icebreaker escorted navigation

+ - operation allowed

- - operation not allowed

* - operation connected with the increased risk of damage

EN — extreme navigation (average periodicity once in ten years)

H, M, E — hard, medium, easy navigation (average periodicity once in three years)

¹For ships with ice category mark Arc7 an independent (IN) year-round navigation in the southwestern part of the Kara Sea, at EN, H, M and E types of navigation.

Ice Class Comparisons: Ice Pressure on Bow Area





Ice Class Comparison: Resulting Weight of idealized Bow Section



Design Criteria



- » Strong, large and versatile Arctic Containership with Icebreaker capabilities
- » Very good open water and sea-keeping performance
- » High reliability through redundant machinery
- » Increased icebreaking performance to 2m level ice
- » Ability to lead a convoy and support operations
- » Winterized to -50 °C

Propulsion

- Highest degree of redundancy (GL RP50)
- » System and room related
- » Twin Azipod configuration due to narrow and shallow passages
- » Fully diesel-electric power and propulsion plant







Main Particulars Nordic AC-IB 1400





Lwl x Bwl x T Icebreaking capability Ice Class Flag 195 x 29 x 9.50 m 2m equivalent level ice RMRS ARC8 Russia

Hull Form Optimisation



- » Icebreaking capability up to 2m level ice
- » Icebreaking in both directions
- » Overcome large ridges either in regular ramming ahead or backwards milling
- » Adequate manoeuvrability
- » Good open water performance
- » Reasonable sea-keeping behaviour

Ice Model Tests @ HSVA



- » Level Ice Tests ahead and astern in 3 ice thicknesses
- » Turning cycle
- » Breaking out
- » Ridges
- » Propeller Ice Interaction





Ice Model Tests @ HSVA





Winterization

- » Exposed steel
- » Navigation equipment
- » Air heads
- » Exposed piping on deck
- » Ballast tank heating
- All ventilation (accommodation and machinery)
- » Passage ways
- » Escape ways
- » Safety equipment
- » Stability and deadweight (icing)
- » Exposed Cabling
- All operational equipment, e.g. cranes (might get a deviating design ambient temperature)





"Making the ship and its crew fit for coping with low temperatures"

Wrap Up





Once in operation the vessel will be the largest and most capable vessel of its kind.

Outlook



Arctic Shipping is on the verge of a significant boom, *provided that*

- » Local and Global Governance is predictable and responsible, but allows exploration and exploitation of natural resources
- » Market prices of O&G and Minerals remain high
- » Industry acts responsible and severe accidents can be prevented
- » Technology advancement

But realize ...

...several specific niches are economically viable even today

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