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Polar super seaways? Maritime transport in the Arctic: an analysis of shipowners' intentions ☆

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ABSTRACT

The seasonal melting of sea ice in the Arctic Ocean, which has been confirmed for several summers in a row and is widely documented, has become a hot topic in the media. It is fuelling many speculative scenarios about the purported renewal of a "cold war", or even an actual armed conflict, in the Arctic, for the control of both its natural resources and its sea routes.

The melting sea ice is indeed giving a second wind to projects, abandoned in the 19th century, to find shorter sea routes between Europe and Asia. A look at the map shows the savings in distance that can be achieved with the Arctic routes: for example, a trip between London and Yokohama through the Northwest Passage is 15,700 km and 13,841 km through the Northeast Passage, which is significantly shorter than the route through Suez (21,200 km) or Panama (23,300 km).[2] These findings fuel the idea that these Arctic routes, because they are shorter, are bound to attract abundant through traffic, and consequently will become a major political issue. Amid the media widespread image of a future maritime highway across Arctic seas, even some scientists yield to the popular image and assert, without proof, that Arctic traffic is set to increase rapidly.[3] Beyond the seemingly decisive advantage of Arctic routes, however, there remain many obstacles to navigation (Lasserre, 2010d). In addition, these scenarios for the development of marine traffic in the Arctic remain highly speculative and are not based on an analysis of shipowners' perceptions, which is the goal of this paper.

This article will thus present the results of an empirical survey conducted among shipping companies to determine their interest in developing activities in the Arctic. Besides examining the potential development of shipping in Arctic routes, this research must be replaced in the context of intense competition between shippers, competition that makes both service reliability and costs of transport paramount. In this competition structure, the benefits of established routes between major hubs seems to prevail, so that new routes have difficulty being established.

1. The question of sovereignty over Arctic Passages

Few analysts question the common belief that it is only a matter of time before new sea lanes will be operational in the Arctic. This prospect is at the very heart of the ongoing debate on security in the Canadian Arctic, for it raises the issue of control of such navigation, and therefore of Canadian sovereignty over the Northwest Passage and the Canadian Arctic waters. It is this debate on control of navigation often depicted as bound to experience out-of-hand growth that triggered the Canadian House of Commons to vote a highly debatable resolution, in December 2009, rechristening the Northwest Passage into the *Canadian* Northwest Passage, a move unlikely to attract any sympathy elsewhere in the world, quite the contrary.

The potential opening up of shipping routes through the Northwest Passage, across the Canadian archipelago, as well as along the Northeast Passage, north of Siberia, has raised security concerns as it implies a potential surge in navigation of all sorts of ships (Byers, 2009; Grant, 2010; Lasserre, 2010b). Analysts have speculated about potential threats to the environment should an oil tanker run aground or sink; to military security should terrorists try to infiltrate North America through the back door of a sparsely populated and poorly monitored area; or to human security should a

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[2] Data calculated by the author using Mapinfo GIS software.
[3] For instance, «Because the Northwest Passage is about to become an alternative route to the Panama Canal, the volume of use within the passage will likely exceed 3000 vessels a year», Roston, 2009. The Northwest Passage's Emergence as an International Highway. *Southwestern Journal of International Law*, 15, p. 469.

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passenger ship hit a growler and sink, as happened to the *MS Explorer* in Antarctica in November 2007.[4] The question of sovereignty over the Northwest Passage (claimed as internal waters by Canada) and the Northeast Passage, crossing areas claimed by Russia as internal waters, boils down to who controls shipping along them. But this whole debate assumes there will be more traffic, whereas this is, so far, speculation, at best an educated guess: shipping, if increasing presently, is still far from active in these Arctic waters. To what extent is traffic going to expand in these waters, given the perception of shipping companies?

2. Trends in sea shipping in the Arctic: study protocol

2.1. A topic with little existing research

The initial premise of this study stems from two observations. First, most articles on the geopolitical evolution of the Arctic, particularly in terms of the growth of marine traffic, are based on the hypothesis, which is presented as accepted wisdom, that a shorter route would automatically bring about an explosion in traffic. Second, as a corollary of the first observation, there is a lack of analysis of the shipping sector's perceptions of, and plans to develop, business opportunities on these Arctic sea routes.

Several credible studies have been conducted to determine the potential cost advantages of Arctic transit routes: Guy (2006), Aker Arctic (2006), Borgerson (2008), Somanathan et al. (2009), Mejlænder-Larsen (2009), Verny and Grigentin (2009), Liu and Kronbak (2010) and DNV (2010). Of course, the quality of these simulations is related to the quality of their underlying hypotheses: average transit speed taking account of ice cover, the cost of building and operating a ship, how many rotations a ship can carry out given its average speed; the bunker fuel cost; freight rates etc...

Scott Borgerson states that Arctic transit could enable shipping firms to save 3.5 million $ per transit. Banking on the shorter distances (a fact), he implicitly postulates that average speed will not be an issue and gives no information regarding his sources or his calculation hypotheses. Beyond his enthusiastic forecast, it is thus relevant to remain prudent with his unverifiable argumentation. Aker Arctic calculated a cost 354 $/container for the route northern Iceland–Aleutians along the Northern Sea Route (NSR); when combining this cost with the two transshipments Europe-Iceland and Aleutians-Asia (no data), the study concludes with a marginal but real profitability of the route. Guy set up several scenarios based on variables such as ship chartering, transit time, potential toll fees and insurance; his calculations show that transit across the NWP can be profitable, but only with optimal conditions that are not always guaranteed. Similarly, Mejlænder-Larsen concludes that ice conditions remain too difficult and unpredictable for profitability. Liu and Kronbak stress the fact that the costs induced by polar shipping make transit poorly profitable, except with very expensive fuel cost hypotheses. Verny and Grigentin conclude transit costs are much higher than through Suez. DNV concludes transit can be profitable for the Northern Sea Route only, especially if fuel prices reach the 900 $/t limit (Table 1).

While these scenarios do suggest a potential advantage of Arctic routes in the form of lower business costs, they also show that, contrary to popular belief, this theoretical advantage remains highly uncertain given the investments and special equipment required for Arctic navigation, the variable transit time and the cost of insurance.

Furthermore, these cost analyses, by definition, do not take account of the issues involved in marketing the proposed services. While managing business costs is one dimension of operating a business, it certainly is not the only one. The positioning of the service offering, the nature of the service and its operational constraints are also decisive factors in choosing a route.

To our knowledge, no article has focused on the perceptions of shipowners and ocean carriers, in an attempt to document what these economic actors think of the potential opening of Arctic sea routes.

2.2. Methodology

In the study, 142 shipping companies that directly operate their own ships or charter vessels were surveyed. Companies leasing their ships to carriers (service providers) were excluded since the purpose of the study was to interview companies that make the decisions on which sea routes their ships will take, whether or not they own the vessels involved.

The study was also limited to shipping line operators in the Northern Hemisphere, since the advantage in distance disappears when both the origin and destination are in the Southern Hemisphere. From February 2008 to March 2010, heads and executives of these companies were contacted, first by questionnaire, and then directly by phone. Companies were invited to answer the following questions: "Are you considering developing operations in the Arctic? Why?" A total of 98 answers were compiled.[5]

The relatively small sample did not lend itself to statistical analysis and all quantitative statistical approaches were rejected in favor of a qualitative approach, the only legitimate one, which was used to analyze the data.

3. Results: a lack of enthusiasm for Arctic shipping

The responding firms were broken down according to their home region (Europe, North America or Asia) and sector of activity: container, roll-on roll-off (RoRo),[6] bulk (dry and liquid), general cargo or special project cargo.[7] Companies with a mixed fleet, a common situation, were classified according to their dominant sector of activity. A distinct category was created for fleets consisting of numerous container ships and bulk freighters.[8] Responses to the first question, "Are you considering developing operations in the Arctic?" were divided into three categories: yes, no and maybe (Table 2).

Among the companies expressing an interest in the Arctic, eight are already present on the Arctic shipping market, three in the bulk sector and five in the general cargo sector. These companies are active in servicing local communities as well as mining and hydrocarbon development operations in the Canadian or Russian Arctic. All these companies indicated their intention to expand their service offerings in the Arctic shipping market.

[4] Several navigation accidents took place in the summer 2010 in the Arctic: The tanker *Mokami* ran aground near Pangnirtung on August 12. The cruise ship *Clipper Adventurer* ran aground on August 27 in the Coronation Gulf because of the poor accuracy of nautical maps. The passengers and crew were rescued by a Canadian icebreaker. The ship was refloated only on September 14. *Ships Monthly*, November 2010, p. 8. The fuel tanker *Nanny* also ran aground near Gjoa Haven on September 2. The accident was again reportedly due to an uncharted sand bar.

[5] The list of respondents can be found in Appendix A. These companies operate a total of 8148 ships; firms in the container business accounted for 84.5% of the market share as of September 2010, according to the Alphaliner Top 100 rankings (www.alphaliner.com/top100/index.php), which makes their opinions fairly representative of the container transport sector.

[6] Transport logistics for roll-on roll-off ships are similar to those for container ships—just in time management and tight schedules to meet—prompting us to group them together. Two companies in the sample are mainly involved in the RoRo business.

[7] Companies specializing in oversized and/or super heavy-lift equipment transport. This type of cargo, generally used in construction projects, calls for customized services which, in general, are fairly exempt from scheduling constraints.

[8] When the ratio of bulk ships to container carriers was greater than or equal to 0,6, the company was classified in the mixed (Container and Bulk) category.

Table 1
Summary of studies on cost advantages of transit Arctic routes, 2006–2010.

Study	Aspect studied	Position
Guy (2006)	NWP summer transit	Potential profitability is uncertain given uncertainty on routes and higher costs
Aker Arctic (2006)	Container shuttle service between Iceland and Aleutians	Marginal but real profitability
Borgerson (2008)	Arctic transit in general	Very profitable because of shorter distances
Somanathan et al. (2009)	Transit using the NWP compared with Panama between Asia and the Northeast coast of North America	Present profitability is negative or marginal Could change if fuel costs reach high levels and if ice keeps receding significantly
Mejlænder-Larsen (2009)	Container transit using NSR compared with Suez	Potential profitability but not in the near future
Verny and Grigentin (2009)	Container transit using NSR compared with Suez	NSR is technically feasible Costs are about twice as high on the Northern Sea Route as on the Suez route
Liu and Kronbak (2010)	Container transit using NSR compared with Suez	The NSR is not economically feasible at all if the ice-breaking fee remains at the current level
DNV (2010)	Europe–Asia transit year-round	NWP not profitable Year-round transit not profitable unless very high fuel prices NSR competitive for northern Asian hubs in summertime in 2030

Table 2
Overview of responses according to company's home region and main sector of activity.

	Sector of activity						Total
	Container	RoRo	Container and bulk	Bulk	General Cargo	Special project	
Yes			2	9	5	1	17
No	35	2	5	25	4		71
Maybe	3		1	6			10
Total	38	2	8	40	9	1	98

	Home region			
	Europe	Asia	North America	
Yes	10		7	17
No	32	25	14	71
Maybe	5	3	2	10
Total	47	28	23	98

For all sectors combined, a vast majority of respondents indicated their company's lack of interest in Arctic routes. However, a breakdown of these data by sector of activity immediately highlights the widely different approaches taken by carriers in this respect.

In the general cargo sector, many companies in the sample are already active in the Arctic and this sector seems to be the one with the greatest proportion of companies showing a desire to develop Arctic shipping services. Five companies said that they intend to increase their services, while four showed no interest in doing so. The special project shipper Beluga, based in Bremen (Germany), also responded positively, which makes sense since, in the summer of 2009, it began providing special service to two Siberian communities (Yamburg and Novy Port) to deliver construction goods. The Arctic seemed to be a most unlikely route for special project or heavy lift ships due to their deep draught, poor bridge visibility, high cost of the cargo, high air draught and high exposed superstructure, which could pose higher superstructure icing issues. However, this interest does not rest on potential transits, but on local destinational shipping.

In the bulk sector, responses were generally negative, although six companies were undecided and nine said they were interested.

In the mixed container and bulk sector, responses were also rather negative: five "no" responses against only two "yes" responses.

In the roll-on roll-off and container segments, however, there was no ambiguity: the response was a resounding no.

4. Analysis: a sharp contrast between transit and destination traffic

An examination of the responses received to the second question—"Why are you considering, or not considering, developing operations in the Arctic?"—allows us to comment on their distribution and confirm that the picture thus obtained accurately reflects the strategies of the carriers.[9]

4.1. Arctic routes are likely to remain risky for long

The persistence of risk and uncertainty on these routes is a commonly mentioned factor: problems due to drifting ice or extreme

[9] As agreed, companies will usually not be individually named here to protect the confidentiality of information disclosed during the interviews.

cold; interannual variability in ice extent despite the trend in melting; the scarcity of port facilities and navigation aids, especially on the Canadian side[10]; the inaccuracy of nautical charts,[11] isolation and, as a corollary of all this, the policies of insurers (cited 18 times).

Risks posed by growlers[12] and small icebergs, which are very difficult to detect, force ships to greatly reduce their speed as the possibility of encountering such blocks of ice increases. When that happens, transit times are longer, which reduces the benefits of Arctic transits (mentioned six times). The frequency of small icebergs in Baffin Bay is likely to increase as the Greenland cap shows definite signs of melting (Lasserre, 2010a). Fog, poor visibility and difficult ice conditions are likely to increase the risk of accidents, as testified by the collision of two Russian tankers along the Northeast Passage in July 2010 (Nilsen, 2010).

To meet insurance requirements, businesses wishing to operate these routes must still buy expensive ice-strengthened ships (class 1A at least) well equipped to navigate in these polar areas (de-icing system, two drive shafts, etc.). It is unclear from the interviews whether all companies considering transiting through Arctic routes think ice-strengthened ships are still a necessity, but firms considering destinational traffic are fully aware that a class 1A is a minimum standard. Insurance firms are still bracing with actuarial calculations for Arctic shipping, but it is likely they will be extremely reluctant to insure ships not designed for navigation in potentially iced waters.[13]

Ships must also be temperature-controlled to protect goods from freezing, especially for the container sector (three mentions), and equipped to face icing. Such ships are more expensive to build (capital costs) and operate (less hydrodynamic and heavier, therefore with a higher fuel consumption per km) (cited 13 times). Ragner (2008), DNV (2010) attest to the fact that fuel consumption is less efficient with ice-strengthened ships. The fuel consumption difference may not be as significant as between old and new ships or as between faring at full speed and a more slowly pace (Stopford, 2009; Wijnolst and Wergeland, 2009). However, even if the differential is to the order of a few percents, combined with a much higher investment cost and the fact that the increased steel structure reduces somewhat cargo capacity, in a very competitive business environment, this fuel margin must be relevant for shipping companies (Guy, 2011).

4.2. Reduced costs? A common sense assertion that need be questioned

Cost considerations (potential savings) were of interest to businesses considering using Arctic transit routes between Europe and Asia or between Asia and North America's Eastern Seaboard. Potential savings and/or shorter routes is the main factor set forth by companies interested in transit, not destination traffic, but these are not numerous: only six companies answering "Yes" or "Maybe" have transit in mind. This point is highly significant, since it shows that, contrary to the images widely circulated in the media, many marine carriers are far from being won over by the prospect of significantly less expensive transit opportunities. Furthermore, many of the businesses that considered going to the Arctic or showing an interest in Arctic routes are well aware of their potential difficulties, spontaneously mentioning the need to invest in costly ice-strengthened ships, the inherent risk in Arctic navigation due to drifting ice, the scheduling challenges due to seasonal variations and the scarcity of infrastructures and services in the Arctic region should an accident occur. One company even cited the possibility of the transpolar route becoming navigable over the long term, which would make the routes passing through Arctic straits obsolete.

4.3. The transit segment is not structured to benefit from Arctic routes

- The container shipping industry-like the car shipping industry, which uses roll-on roll-off ships—operates in a just-in-time mode, and this operational constraint is being reinforced as shipping operations are more and more integrated in a broader logistics chain (Terrassier, 1997; Clarkson Research Studies, 2004; Lorange, 2008; Damien, 2008). This industry is therefore not driven by the transport cost per TEU alone, but by other factors such as transit time, marketing advantages of faster delivery, but also the reliability of delivery schedules and the value of markets along the way. Container shipping firms do not merely sell the shipping of goods, but also guarantee on-time delivery according to a fixed schedule. Drifting ice, an increasing number of icebergs and thick fog banks, however, make it difficult to meet these tight schedules. Drifting ice can temporarily block some straits, making them very tricky to navigate, which could cause delays in delivery or perhaps even force the ship to turn around and transit by the Panama Canal, resulting in disastrous delays both in terms of financial penalties and reduced credibility (cited 23 times).
- The ice will reform every winter under polar conditions, which include severe cold, total darkness (the polar night) and complete isolation. Therefore, potential transit routes will not operate during winter, which means that ship owners will have to change their schedules twice a year, a situation that not only is costly but also increases the risk of errors, and hence of delays as well (cited 22 times). Accurately predicting freeze-up and breakup is still very difficult. Since schedules are fixed several weeks in advance, there is a risk of launching summer routes before some straits are ice-free or, inversely, of missing a number of days when navigation is possible (cited eight times).
- Given the costs of operating ice-strengthened ships (as discussed earlier), the possibility of a toll (already in place in the Northeast Passage due to a mandatory escort though Russia) and the significantly higher insurance premiums, one cannot say if the real cost of transiting via Arctic routes would be that attractive (cited ten times).
- Along Arctic routes, there are no intermediate market (stopovers) and no port adequately equipped to receive the containers to be onloaded/offloaded at potential rotations, which reduces the commercial interest of these routes, compared with the multiple loading/unloading opportunities along traditional routes such as Suez or Panama (cited 14 times). This is in line with the literature that underlines the restructuring of the shipping industry along a "main line" of major port hubs (Rotterdam, Felixstowe, Algeciras, Marsaxlokk, Suez, Singapore, Hongkong, Shanghai, Busan, Kobe and Long Beach) from which transhipment is operated to service regional ports (Comtois and rimmer, 2004; Damien, 2008; Renault, 2010).

[10] This lack of infrastructure as a risk factor was underlined by shipping operators during the Polar Shipping Summit in Montreal, May 5–6, 2010. *Nunatsiaq Online*, «Arctic shipping fraught with danger, operators say», May 7, 2011.

[11] In fact, between 1996 and 2009, before the three accidents in the summer 2010, four cruise ships had run aground in the Arctic; in the Antarctic, three strandings, one engine failure and one shipwreck (the M/S *Explorer* on November 23, 2007) have occurred since January 2007.

[12] A growler is a very hard, modestly sized (1–2 m wide) block of multi-year ice that floats barely above the surface. Hitting one at full speed (over 17 knots) could very well sink a ship (Lasserre, 2010d).

[13] Neil Roberts, Senior technical Executive, Lloyd's Market Association, interview with author, London, November 23, 2007; AXA Assurances (Paris), quoted by Verny and Grigentin (2009).

– The container sector is a very competitive market: carriers try to optimize their rotations and write off their ships faster by plying their trade on busy routes with good cargo potential. Consequently, experiments like Arctic routes look more like theoretical options than profitable solutions. The company has not given it much thought (cited 26 times).

4.4. Local traffic is set to be the growth engine of Arctic traffic

Among companies that foresee an increase of business opportunities in the Arctic, and that do consider developing their activities there (answer 'Yes') or at least are thinking about it (answer 'Maybe'), most do not have transit in mind, but rather destination traffic.

Local shipping services, whether involving the delivery of goods to local communities or the servicing of local resource exploitation operations, prompted a significantly higher number of businesses to express a real interest in Arctic shipping. Fifteen businesses cited this rationale for their interest in Arctic shipping, all with an unequivocal "yes." There seems to be a real potential for destinational short sea shipping in the Arctic. The local shipping services market, particularly the servicing of mining and oil and gas operations, seems promising and it is clearly this market niche that is attracting shipowners who have made up their mind about the Arctic market.

– With the extension of the relatively navigable season, local communities are eager to develop shipping as this vital link enables them to greatly reduce the cost of their consumer goods, otherwise delivered mostly by plane.
– Natural resource exploration and exploitation is experiencing a boom cycle, both with the prospect of declining ice cover and increasing world market prices. Although the size of the reserves should not be overestimated, nor the technical difficulties to exploit them be minimized (Offerdal, 2009), the interest of mining and oil firms for the area is certain. Their production will need to be shipped to final markets and their mines serviced (mentioned six times).
– A few ports can be used as gateways to hinterland markets: Churchill for North America, Murmansk and Archangelsk for Russia. Servicing these ports could represent a niche market (mentioned three times).

One interesting point that should be noted, which is consistent with shipowners' motivations, is that in this subgroup, eight out of 15 businesses stated that they favor the Northeast Passage (Northern Sea Route), which has better infrastructures, more local ports to service and more mining and oil and gas operations. Rosatomflot, Russia's state-owned administration of the nuclear icebreakers along the Northern Sea Route, declared that there were four applications to accompany voyages in 2010, but in January 2011 there were already 15 applications (Doyle, 2011).

However, the main drawback of the Arctic bulk shipping market, either for local service or transit traffic, is its small size.

– For local general cargo service, the volumes of goods to be carried are limited and the competition is already very fierce (cited four times).
– Natural resource exploitation creates traffic, but a relatively small number of ships will be enough to service oil and gas deposits for a long time.[14]
– It is also estimated that in 2020, about 20 million tonnes of LNG will be transported from Russian Arctic gas fields to North America. Transportation of such a large volume would nevertheless require only about 20 new ice-class LNG tankers (Wheater, 2007). The market is therefore not a major one for the years to come, although it is growing rapidly (cited nine times).
– Besides, in the bulk segment, whether liquid bulk for oil or gas, or dry bulk for mineral ore, the relatively small market size for the years to come makes it difficult to write off the investment for ice-strengthened ships in a shipping segment where earning are volatile and the investment process risky (Clarkson Research Studies, 2004). As ice-strengthened ships are more costly to operate (they are heavier and less hydrodynamic), using them in warmer waters is financially inefficient. For the cost of a major investment to be fully written off, such as a more expensive to build and operate ice-strengthened ship, the ship must be used in Arctic waters, otherwise there would be little or no hope of a return on the investment. However, the bulk market operates on spot contracts (tramp) rather than regular liner shipping, and regular services (shuttle tankers) are the exception; besides, the ship owner is not the only actor in defining the itinerary (Terrassier, 2001; Lacoste, 2004). Before getting involved in the Arctic niche market, several ship owners would like to have a bit of a financial guarantee—in other words, that they would be able to find shuttle contracts or enough cargo to ship in Arctic waters for a number of years, which is not easy to achieve due to the way this market operates (cited seven times). This kind of long-term relationship can be seen with Frontline's chartered ships to BP, or, in the Arctic, with Fednav and Baffinland Iron Mines (Mary River Project).
– These routes will remain too dangerous—especially when considering the nature of the cargo, potentially very polluting—and therefore too expensive to insure (cited three times).
– Given the evolution of markets and the geography of the operating and consumption areas, trying to develop such routes does not seem worthwhile (cited eight times).

To sum up, an examination of the reasons cited by shipowners for their interest or lack of interest in Arctic sea routes reveals the following basic points in the strategies of shipping companies:

– The container industry is not interested at all in Arctic shipping. The constraints of just-in-time planning, schedule creation and risks are too great, in comparison with what are perceived as relatively modest profits.
– Niche markets, like supply to local communities, offer a high potential for growth, and the companies already involved have the firm intention of expanding their service offerings.
– Reaction from bulk shippers is mixed. Using Arctic transit routes could be a worthwhile strategy, but was cited by few respondents. It is more the possibility of capturing a share of the highly expanding market for servicing mining and oil and gas activities that seems to be attracting shipowners' attention.
– The potential savings in transit time and costs, emphasized widely in the media, do not seem to have won over many companies. Firms either are not interested in Arctic transit routes or play down the advantage of the shorter distances because of the higher capital and insurance costs to be incurred, or the fact that transit time is not much different from other routes

[14] The case of the Mary River iron mine, on Baffin Island, comes to mind with its huge deposits of 365 million tons of ore. To be exploited, it would only require eight ships from the Fednav shipping company (Lasserre, 2010c).

Table 3
Transit Traffic in the Northwest Passage. *Source*: Data compiled by the Canadian Coast Guard, Iqaluit, and provided to the authors.

Vessel type	2005	2006	2007	2008	2009	2010
Icebreaker	2	2	2	1	2	2
Cruise ship or tourist icebreaker	2	2	3	2	3	8
Excursion boat			2	7	10	13
Tugboat		1			2	1
Cargo ship or commercial vessel				1		
Cargo ship, partial transit, local transport service				2	1	2
Research vessel	3	1		1		
Total	7	6	7	14	18	26

Table 4
Total traffic in the Canadian Arctic: number of voyages. *Source*: Data compiled by the Canadian Coast Guard, Iqaluit, and provided to the authors.

	2005	2006	2007	2008	2009	2010
Ships in the Canadian Arctic (number of voyages)	194	196	320	379	311	493
Fishing vessels (number of voyages)	30	33	76	113	83	221
Cargo ships (number of voyages)	119	105	183	200	182	220

Table 5
Ice class fleet: situation and orders, February 2005. *Source*: adapted from Stephen Gordon, "The Ice Class Tanker Market", Clarkson Research, *DNV Seminar*, March 16, 2005.

	Total existing fleet			Ice class orderbook			Orderbook, % of total fleet	
	Number	Million dwt	Average ship dwt	Number	M dwt	Average ship dwt	Number	Million dwt
Ice class 1A and above	262	4.2	16,031	165	11.6	70,303	63%	276.2%
Ice class 1B and below	735	19.3	26,259	69	3.9	56,522	9.4%	20.2%
Total	997	23.5	23,571	234	15.5	66,239		

anyway because of reduced speed. This observation is in line with the review of the literature on cost simulations discussed earlier.

5. Current sea shipping traffic confirms the analysis

The picture obtained from shipowners also appears to be confirmed by the recent increase in marine traffic in the Northwest Passage. In the Northeast Passage (Northern Sea Route), traffic is expanding even more significantly, especially on the western stretch between Murmansk and Dikson, where it consists mainly of ore carriers and tankers serving the Siberian mines and the Varandey oil terminal. Traffic is also recovering on the eastern part of the Northeast Passage, with ice-strengthened ships beginning to carry crude oil or iron ore to Asia from Kirkenes, Murmansk or the Kara Sea.[15] However, it is difficult to obtain access to Russian statistics on this subject. The Canadian Coast Guard collects traffic statistics on the Northwest Passage (Table 3) and the Canadian Arctic (Table 4).

The following conclusions can be drawn from these figures:

- Navigation in the Canadian Arctic has increased, but remains essentially destination rather than transit traffic.
- Especially since 2006, there has been a general upsurge in total traffic in the Canadian Arctic, which reflects an increase not only in fishing activities and tourism, but also in commercial shipping, consisting of service to local communities and natural resource exploitation operations.

Table 6
Number of ice class ships in order or in construction, October 2010. Ship class 1A Super to 1D. *Source:* Lloyd's Shipping Information Database (October 2010).

Type	Number	Dwt
Asphalt tanker	2	9400
Chemical tanker	4	48,300
Crude oil tanker	4	685,300
Combined chemical and oil tanker	26	399,370
Combined LNG and LPG gas carrier	2	25,200
Product tanker	6	307,892
Bulk cement carrier	2	29,646
Bulk carrier	4	149,795
Containership	22	424,943
General cargo	70	780,548
General cargo with container capacity	14	117,700
Research	3	4 450
Seismographic research	1	2 200
Semi-sub HL vessel	7	90,360
Supply	4	17,550
Anchor handling tug/supply	2	6 600
Total	173	3099,254

- Although there has been a real increase in transit traffic through the Northwest Passage, such traffic is still at a very low level: 26 transits in 2010, only three of which were commercial. In contrast, Panama sees 13,000 transits in 2008,[16] Malacca, 70,700 transits in 2007[17] and the Suez Canal, 21,000 in 2008[18].

[15] Let us mention, for instance, Sovcomflot's *SCF Baltica* that delivered crude oil from Murmansk to China; the two Murmansk Shipping Co. oil tankers from Murmansk to Pevek; Nordic Bulk Carrier's *MV Nordic Barents* from Kirkenes (Norway) to China with iron ore. *Barents Observer*, July 14, 2010 ; July 21, 2010, September 2, 2010, September 16, 2010; *Journal de la Marine marchande*, October 13, 2010; *Shipping*, January 2011, p. 5.

[16] Panama Canal Traffic – Fiscal Years 2007 Through 2009, www.pancanal.com/eng/maritime/reports/table01.pdf, accessed November 5, 2010.

[17] Marine Department of Malaysia, www.ialathree.org/iwrap/index.php?title=Malacca_Strait_Traffic_Volume_and_Incident_Rates, accessed February 21, 2011.

[18] Egyptian Maritime Data Bank, *Suez Canal Statistics*, www.emdb.gov.e.g./english/inside_e.aspx?main=suezcanal&level1=totals, accessed November 5, 2010.

Table 7
Ice class ships orders or construction, February 2011. Ship class 1A Super to 1D. Data from shipyards and shipping firms, probably partial. *Source*: data compiled from websites of shipping companies and shipyards; *Ship & Offshore; Fairplay; Ship Technology; Maritime Professional.*

	Number	Zone of operation				
		Arctic	Baltic	Far East	North Atlantic	Other or unknown
Ice class 1A and above	50	28	15	2	1	4
Tanker and LNG	19	6	13			
Bulker	3	3				
Container	5	5				
General cargo	1				1	
Supply, tug, seismic	18	14		2		2
Research	2					2
Ferry	2		2			
Ice class 1B and below	70	1	22	6	20	21
Tanker	28	1	9	4		14
Bulker	38		13	2	19	4
Container	0					
General cargo	0					
Supply, tug, seismic	1				1	
Research	1					1
Ferry	2					2
Total	120	29	37	8	21	25

6. Current trends in shipbuilding are consistent with this picture

Advocates of a bright future for transit traffic in the Arctic point to the explosion of order in shipyards dedicated to ice-class ships.

This picture needs correction now, first as all ordered ships were not ordered for Arctic shipping; and second because the present trend is a decrease in ice-class commercial ships. Besides, most ice strengthened ships built today for Arctic operations are designed for natural resources exploitation, not for the container trade.[19] They are specifically designed to be used in the Arctic since operating them is more expensive, underlining their destinational mission.

At the peak of the 2005 ordering frenzy for ice-class ships, there were 234 vessels to be built – 165 of class 1A and higher; 69 of class 1B or lower. The ice-class fleet at the time comprised 262 ships of class 1A and higher (for 4.2 million dwt) and 735 of class 1B or lower (19.3 M dwt) (Table 5), meaning the orders represented a sharp increase in both the tonnage of the world fleet and a strong renewal towards higher ice-class.

However significant this trend was given the number and size of these new ice-class ships, it must be underlined that not all of them were built for the Arctic. Most of these ships were tankers, few bulk carriers and only one, a container carrier. Much of the interest in large ice-class tankers that prevailed at the time was down, for a large measure, to the emergence of oil loading terminals in the Baltic (Russia, Estonia, Latvia, Lithuania and Poland), as well as hydrocarbon exploration around Sakhalin Island in the Pacific and in the Barents Sea (Gordon, 2005; TankerOperator, 2006; Seaways, 2006; Wheater, 2007).[20] It therefore cannot be inferred from this boom in ice-class tanker construction, that tanker traffic would expand in the Arctic in the same proportion, given that large shares of these new ships were going to sail in the Baltic or in the Northern Pacific.

Besides, ice-class construction has slowed down, a trend noticeable as early as 2006 (Glass, 2006). The Lloyd's Shipping Information database reveals that, in October 2010, there were 173 ice-class ships being built or in order, for a total of 3.1 M dwt (Table 6), a sharp decrease in tonnage from 2005 and consequent decrease in the number of ships. No information was given as to where these ships were set to navigate.

Table 8
Place of construction of ordered ice-class ships, February 2011. *Source*: data compiled from websites of shipping companies and shipyards; *Ship* & *Offshore*; *Fairplay*; *Ship Technology*; *Maritime Professional.*

Country	Number
China	23
Croatia	13
South Korea	12
Japan	10
Bangladesh	10
Russia	9
India	7
Vietnam	7
Germany	6
Finland	6
Romania	6
Turkey	4
Norway	3
Singapore	3
United Arab Emirates	1

A personal investigation in specialized literature and order books from major shipyards and shipping companies sheds light on the geographical destination of several of these orders. Though not exhaustive, this inquiry (Table 7) reveals that, in February 2011, the order books for ice-class ships comprised 120 ice-class ships, of which 47 were tankers, 41 bulkers and 19 involved in the supply of the oil & gas industry, but only five small container ships for Greenland (ordered by Royal Arctic Line for the local market) and no cruise ship.

Among these orders, 29 (24.2%) were directed at the Barents Sea or the Northern Sea Route, but the major zone of activity was again the Baltic, with 37 (30.8%) being built for the area and 21 for the North-western Atlantic (Labrador Sea, Gulf of St.-Lawrence). If the Arctic is taking a significant share of the present ice-class ships orders, it does not represent the majority: there is no explosion of Arctic-plying ships. Besides, again contrary to a common image, Korean shipyards do not take the lion's share of these orders, with only 12 ships out of 120 (Table 8).

[19] Arctic Council, *Arctic Marine Shipping Assessment (AMSA) 2009 Report*, 2009, p. 121.
[20] Also confirmed by Emmanuel Guy, Research Chair in Maritime Transport, Université du Québec at Rimouski, email to the author, March 4, 2011.

7. Conclusion

Arctic seaways provide a definitely shorter route between Europe and Asia than routes through Panama or the Suez. The summer melting of sea ice has fuelled scenarios of an impending explosion in transit traffic through the Northeast and Northwest Passages, as shipowners desperately try to reduce fuel costs and increase their rotations.

However, an analysis of shipowners' intentions, based on a sample of 98 companies, reveals a totally different, and much more restrained, picture. Although marine traffic in the Russian or Canadian Arctic seems to be definitely on the rise, this is far from being an explosion. In addition, although a few voyages in the Northeast Passage have recently attracted a lot of media coverage, the increase is not in transit traffic but rather in destination traffic, the growth being fuelled by vessels servicing local communities and natural resource exploitation activities. The bulk sector remains cautious about Arctic routes, while the container segment is definitely not nurturing interest in these routes.

To sum up, Arctic Passages will not become the new Panama of the 21st century. This empirical evidence from the survey of shipping firms and the analysis of traffic data is in line with traffic scenarios set up by the Arctic Council in its study *Arctic Marine Shipping Assessment 2009 Report*: "Arctic voyages will be overwhelmingly destinational, not trans-Arctic" (Arctic Council, 2009).

Appendix A

Shipping companies that answered the questionnaire.

In italics, shipping companies that were already active in the Arctic in 2010.

Atlantic Container Line	Hacklin	Normed
ACT Marine	Hamburg Süd	*Northern Transportation Company Limited, NTCL*
American President Lines, APL	Hanjin	*Nunavut Eastern Arctic Shipping, NEAS*
Atlas Shipping	Hapag-Lloyd	NYK
Beluga Shipping	Horizon	*Oceanex*
Borchard	Hyundai Merchant Marine, HMM	OOCL
Brostrom Tankers	Iino Kaiun	OSG
BW Gas	J. Lauritzen Bulkers	Pacific International Lines (PIL)
Canada Steamship Lines	J. Lauritzen Tankers	Regional Container Lines (RCL)
Cetragpa SNC – Louis Dreyfus Armateurs	Kawasaki Kisen Kaisha, K Line	Rickmers Linie
Clipper Shipping	Kent Line	Samskip
CMA-CGM	KMTC	Sanko
CMB Compagnie Maritime Belge/ Bocimar	Kyoei Tanker Co.	Sinokor
Cobelfret	Laeisz	Socatra
COSCO	Leonhardt & Blumberg	*Sovcomflot*
Crowley	Linea Messina	Stena Bulk
CSAV	Lundqvist Rederierna	Stinnes Linien
Delmas	Maersk	Swire
Delphis NV	Mann Lines	Teekay
Desgagnés	Maran Tankers Management	Temas
Dole Ocean Cargo Express	Marfret	The Containership Company TCC
Eagle Bulk Shipping	Matson	TORM
Eimskip	Mineralien Schiffahrt Spedition MST	Tsakos
Eletson	MISC Berhard	*Tschudi Shipping*
Euronav	Mitsubishi Ore Transport	Turkon
Evergreen	MSC	US Shipping Partners L.P.
Fednav	*Murmansk Shipping Co.*	UASC
FESCO	*Neste Oil*	Wan Hai
Frontline	Nippon Steel Shipping NSS	*Wijnne Barends*
Gearbulk	Nissan Car Carrier	*Woodward Oil*
General Maritime Corp.	NOL Neptune Orient Lines	Yang Ming
Great White Fleet	Nordana	ZIM
Grimaldi	*Norilsk Nickel MMC*	

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