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NAVIGATION FEATURES IN THE ARCTIC AND ITS IMPACT ON THE SUEZ CANALREVENUES

Essam EldinYoussef Abdelraouf

Institute of Maritime Upgrading Studies, Head of Quality Assurance unit. Arab Academy for Science, Technology and Maritime Transport (AAST&MT),Alexandria, Egypt

ABSTRACT

Polar navigation is one of the most dangerous trips. The main reason for the increased risk of ice, as well as other unfavorable navigation conditions in high latitudes and northern latitudes, including very low temperatures, ice-covered coasts, which are difficult to distinguish coastal marks, and the inability to cope with the dangers caused by polar nature, And the movement of shipping in the high latitude area is relatively small, and the main reason can be found in the lack of population and the lack of major ports in this area, and the inability to use certain methods because of the ice covering large areas. However, significant changes have occurred in the past few years, and these changes have resulted in a new role in the Polar Regions in terms of the new major routes of commercial vessels, especially in the Arctic, which will save time and expenditure.

These changes have occurred as a result of a number of reasons, including the increased exploitation of mineral resources in Polar Regions, the development of tourism, etc., including the development of new technologies that enable us to use them. All this encourages global warming and the accompanying melting of ice. Specifically, thawing has opened the possibility of using new ship routes, which today represent entirely new challenges for the global shipping industry. And the opening of the Arctic route as an alternative route for the transport of goods between the Far East and Europe. It seems that shipping companies are very likely to use these roads because of the enormous fuel consumption, fuel cost, operating cost, emissions and time of the cruise. This transformation will not only affect the maritime business activity in the Suez Canal but will also affect the Egyptian economy in many respects as the number of vessels passing through the Suez Canal and the Indian Ocean decreases.

KEYWORDS: *Polar Areas, Global Warming, A New Route for Ships, Crew Training.IMO*

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INTRODUCTION

Ice navigation is a specialist area of navigation involving the use of maritime skills to determine and monitor the position of ships in cold waters, where ice is a hazard to the safety of navigation. The presence of sea ice requires a ship to exercise caution, for example by avoiding icebergs, slowly sailing through a lead, or by working with an icebreaker to follow a course through the ice to a destination. Additionally, ships must also deal with the extreme cold of the climate in regions such as the poles; this involves removal of ice accumulation from the ship, as well as protecting the crew from the

elements while working on the deck. Ships and their crews operating in ice will follow established rules of seamanship, as well as complying with national and international regulations such as the Polar Code.

Shipping in the Arctic seas has a long history and its own features. The new era of using Russian Arctic sea routes commercially began in 1920 with so-called Siberian Bread Expedition (Sibirskaya Khlebnaya Ekspediciya), followed by Trade Kara operations (1921-1939) connecting southern Siberia with northern Europe (Belov,1959,1969). In 1932 a Soviet expedition led by O. Y. Schmidt on the icebreaking steamer *Sibiryakov* (master V.I.Voronin) was the first to sail all the way from Arkhangelsk to the Bering Strait in the same summer without wintering en route. After a couple of more trial runs in 1933 and 1934, the Northern Sea Route was officially opened and commercial exploitation began in 1935.

In 1978 a year-round operation on route Murmansk–Dudinka was started to transport the enriched nickel and copper from Norilsk to Murmansk by the sea and then to Monchegorsk enrichment plant. NSR blossomed in 1987 when turnover reached 6.85 ml.t. 16 icebreakers (8 nuclear, 8 diesel) and 380 transport vessels worked in the Arctic (Problemy…, 2006). In 1989 the number of icebreakers reached 18, accompanied by Arctic Lichter *Sevmorput*, 20 ice-class vessels, and 108 freighters.

Borders defined by IMO (International Maritime Organization) are: The Arctic waters are the waters the southern coast from Jan Mayen towards the island ofBjornoya**,** Svalbard all the way to Kanin Nos, and from Kanin Nos it follows the north coast of the Asian continent towards the east and the Bering**.**

NAVIGATION PROBLEMS IN THE HIGHLATITUDES

The navigation in the polar areas can be difficult due to the lack of the vast number of navigation devices. Natural landmarks and costal line may not be shown on the map, or it could be difficult to identify it. Also the occurrence of certain changes under ice conditions.when snow covers the coast and extends for miles towards the sea, even the shore is hard to spot.

Ships navigating in the areas of the Arctic and the Antarctic are exposed to many risks. Cold temperatures in these areas can reduce the effectiveness or even cause the interruption of the function of some components on the board. Search and Rescue (SAR) operations or oil pollution operation can be very complicated and expensive due to the harsh conditions and the distance of the area. Navigation in these areas is a real challenge to mariners due to bad weather conditions, the relative reliability of navigational charts for the polar region, the interference of communication systems and the impact of harsh conditions on other navigational aids.

Not many geodetic measurements have been made in these areas and so the nautical charts for the polar region are less reliable and Precision required for the safety of navigation compared to the charts for other regions. Since not many depth measurements were made in this area, ships that enter the port often send boats ahead to check the depth of the water in front of them. However, the reliability of nautical charts in the Polar Regions improves constantly as new information becomes available.

For the purposes of determining positions, the Sky waves of Loran C are available throughout the Arctic, and ground waves only in some parts of the Arctic. Ground waves and sky waves are not available in Antarctica. Radar is useful, but the interpretation of range in Polar Regions is important for reliable results. Radio direction finder is useful only when radio signals are available. The use of electronics in the Polar Regions is further limited by magnetic storms, which are particularly severe in the auroral zone.

There are difficulties in determining dead-reckoning position in Polar Regions because the reliability of dead reckoning position depends on the availability of the precise measurements of direction and distance, or speed and time measurements. The direction is measured by the compass. The magnetic compass becomes unreliable near the earth magnetic pole and the gyro compass when seeking north becomes unstable near the earth poles.one of the solutions may be the use of directional gyro (and inertial systems) which maintains its own axis in a certain direction, but must be returned at regular intervals, because of the gyroscopic drift.

In Polar Regions, celestial navigation may be of great importance, and sometimes the only way to determine the position, or establish reference direction. When navigators generally avoid observing bodies near the horizon because of the uncertainty of refractive correction. However, although the refractive refraction is uncertain, navigators often have no choice. Near the equinox, the Sun may be the only body available in a few weeks, and it remains close to the horizon. During the polar summer, the Sun is often the only celestial body that is available, in situations when only one celestial body is available, that body is observed in intervalsand measuring distance or speed in the polar region does not represent a problem for airplanes, but it does for ships. When ships navigate in ice-covered waters, the sensor can be negatively affected or damaged by ice.

While that determination of dead reckoning position for ships that navigate in ice-covered waters is problematic, not because of difficulties in measuring the course and speed, but of the fact that one of these two elements cannot be constant for a long time.

TYPES OF MERCHANT SHIPS OPERATING IN POLAR REGIONS

Tankers have a very important role in the transport of crude oil and other forms of liquid cargo in areas such as the Arctic, Russia and several European parts in which is difficult to navigate during the winter period, where the water surfaces are covered with thick layers of ice. All ships that pass through those areas requiring assistance from icebreakers which are going forward and breaking thick layers of ice. This type of assistance from icebreakers requires additional costs for the company because they have to pay for such services.

For this reason, it is important to mention DAS (Double acting ship) and DAT (Double acting tankers) ships that companies are using to reduce their costs while navigating in polar areas. These are types of ships that are specially designed for sailing in the waters covered by thin ice. However, they can change direction and continue to driveastern in heavy ice conditions.

These vessels can operate in areas covered by ice without icebreaker assistance, and also have better performance in open water than ice-breakers.

Therefore, these ships were constructed to break the ice with the stern, and to navigate in open waters with a bow.

In order to avoid additional expenses and to enable ships to navigate in the waters that are covered by thick ice like in Russia, Canada or north Europe, without the assistance of icebreaker, the DAS and DAT ships are being used. DAT tanker can break and navigate in thick ice even without the help of icebreakers. The first such DAT tanker “Tempera” was delivered to the shipping company in 2002.

Double acting tanker navigates in the forward direction as any other ship. However, when it comes to breaking the ice, the ship is moving astern. The aft part of the hull structure is composed of special reinforced double skin with a fatigue

life of around 40 years. with this ship, conventional rudder and propeller were replaced with Azipod system that can achieve speed above 15 knots. Azipod system consists of a high-power electric motor and a fixed pitch propeller that can rotate 360 degrees. Also on these ships, bow thrusters are added to provide excellent maneuverability in narrow channels and harbors. This design allows the DAT to reach speeds of more than 2 knots over the ice sheets thicker than 1mm when they drive astern. Propulsion on these ships is being used to generate streams of water between the hull and ice that lubricates the contact surface and reduces friction hull.

Double acting ships are able to direct the propeller water flow to crush the ice and push it away. In this way, double acting ships navigate through the sea surface covered by ice without icebreaker assistance.

In this kind of ships, all bunker tanks are made of the double hull because the main parts of stern are in contact with ice. The cofferdam and pump room are also protected by a double hull.

EXISTING MARITIME TRAFFIC AND ITS ANALYSIS

Northeast Passage (NEP): connects the Atlantic Ocean and the Pacific Ocean in the north coast of Eurasia, from Murmansk to the Bering Strait. Northern Sea Route (NSR): NSR is known by its Russian name. The difference between NEP and NSR is that NEP includes NSR including Barents sea. during the summer months of 2011 in the Northeast passage (NEP) more than 835000 ton of cargo was transported.

That number can only increase over the next few years, taking into account the annual decline of ice in the Arctic. The northwest passage was the first without ice in 2007. if the global warming effects continue, the Transpolar Sea Route (TSR) could also be opened for the merchant ships in the upcoming decades. The development of the offshore industry in the Arctic will contribute to the improvement of the economic activities and the integration of the arctic economy into the global trade. With global warming, the Trans-Arctic routes could provide new and additional capacity for the growing marine traffic in years to come.

The main barriers for navigation in polar areas are floating ice and icebergs, especially during the warmer season when the ice begins to melt.

Navigating through the Arctic the ships will save on distance, time and fuel. The energetic efficiency would improve while navigating from one port to another.

Savings on the way through the Arctic waterways is up to 40% compared to traditional routes, for example through the Suez Canal. Also smaller distance provides better efficiency in transport so that the ship made multiple trips from one port to another which eventually resulted in higher profits for the shipping company. (Hansen, C., (2016).

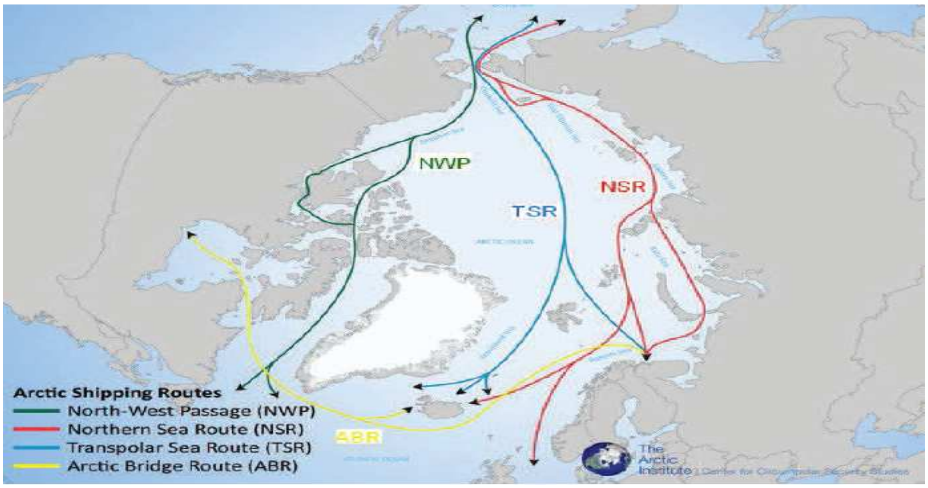

Figure 1: Arctic Shipping Routes [the-future-of-arctic, 2012]

MARITIME LEGISLATION

Present activities that are organized by IMO related to the navigation in Polar Regions can be found in "International Code of Safety for Ships Operating in Polar waters.

The IMO requirements contained in the Conventions and in related codes, guidelines, and recommendations as follows:

SOLAS (International Convention on the Safety of Life at Sea), safety requirements – relate to all ships that are part of "Convention operating in Polar waters". Chapter number V is especially important because it addresses safety requirements of navigation. Regulation V/5 : meteorological services, Regulations V/31 and V/32 Danger messages.

MARPOL(International Convention for the prevention of pollution from ships, 1973. as modified by the protocol of 1978). It covers necessary environmental protection for Antarcticand Arctic. They belong to specially protected areas (Special Areas). Additional MARPOL measures can be found in Chapter 9, Annex I. and they refer to "Carriage of heavy grade oils in the Antarctic area" that entered into force in August 2011.

STCW.(International Convention on Standard of Training, Certification, and Watchkeeping for Seafarers 1978) requirements. Adopted guidelines and recommendations for training and competency of officers and crew members on ships in the Polar Regions. Current recommendations and guidelines are important for the officers and crew members on board so they would have the necessary experience in the polar region. These are also the measures where the masters and officers who operate in the polar region had the necessary training and experience.

Polar Code: The Polar Code is intended to cover the full range of shipping-related matters relevant to navigation in waters surrounding the two poles – ship design, construction, and equipment; operational and training concerns; search and rescue; and, equally important, the protection of the unique environment and eco-systems of the polar regions.

The Polar Code covers the full range of design, construction, equipment, operational, training, search and rescue and environmental protection matters relevant to ships operating in the inhospitable waters surrounding the two poles.

The Polar Code includes mandatory measures covering safety part (part I-A) and pollution prevention (part II-A) and recommendatory provisions for both (parts I-B and II-B).

The chapters in the Code each set out goals and functional requirements, to include those covering ship structure; stability and subdivision; watertight and weathertight integrity; machinery installations; operational safety; fire safety/protection; life-saving appliances and arrangements; safety of navigation; communications; voyage planning; manning and training; prevention of oil pollution; prevention of pollution form from noxious liquid substances from ships; prevention of pollution by sewage from ships; and prevention of pollution by discharge of garbage from ships.

ANALYSIS AND SUBSTANTIATION

Opening of North Pole Route

The North Pole route came to light because of the climate change as several researchers conclude that rising temperatures are causing ice to melt in the northern hemisphere. When the various effects of climate and weather variability and change are introduced into computer models that project atmospheric temperature patterns, the results clearly show that the average temperature in the Arctic region could rise by 3-9 °C over the next hundred years, which is double the increase expected in other parts of the world during the same period. Warming would cause an enormous quantity of ice to melt and it is believed that ice could disappear altogether from large areas of the ocean during the summer months in the coming decades. Extensive melting has already begun, especially in areas of thick perennial ice.

Computer models show that the surface area of ice at the end of summer could contract by 15% to 40% by the year 2050, accompanied by reductions in average thickness of up to 30% in the same period. Indications are that the Arctic Ocean could be relatively free of ice towards the end of the century. Ice will still form during wintertime but it will be a comparatively thin layer and ice-breakers will be able to force a passage through it. Ocean currents will probably cause the ice to drift away from eastern regions of the Arctic Ocean, which would ease sailing conditions (Report of a working group. 2006).

The Northern Sea route along the Arctic coast of Russia is the maritime route that is probably going to be free of ice and would decrease the maritime journey between East Asia and Western Europe from 21,000 km utilizing the Suez Canal to 12,800 km, cutting passing time by 10-15 days and the northwest passage crossing Canada's the Arctic Ocean could be applicable on a constant basis by 2020, extraordinarily decreasing maritime shipping distances. The maritime journey between East Asia and Western Europe would take around 13,600 km utilizing the Northwest Passage, whilst taking 24,000 km utilizing the Panama Canal (Claes, L. R. 2008).

Figure 2: Importance of Suez Canal [Suez Canal Authority. 2013]

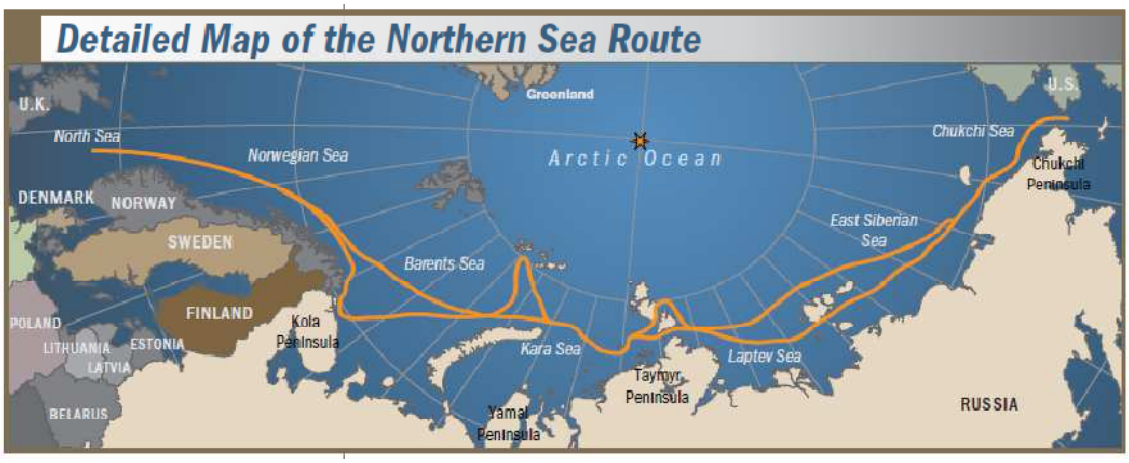

Figure 3: North Pole Route [Claes, L. R. 2008]

IMPACT ON SUEZ CANAL REVENUES

The Suez Canal suffered from a huge decrease in its revenue in the last decade due to the several causes, one of the important causes the shipping lanes through the Arctic Ocean will put the Suez Canal out of business soon, as global warming will make these frigid routes much more accessible than ever imagined by melting an unprecedented amount of sea ice during the late summer.

The comparison between two maritime routes for transporting cargoes from the Far East to Europe. The shortest route to travel from China to Rotterdam is by using the North Pole route which can save up to 13 days. The philosophy applied in the shipping industry is that the reduction in route distance will automatically reduce the total travel time, ultimately reducing the total fuel consumption, bunker fuel cost and vessel operating cost respectively.

From the previous, it can be noticed that the most important reason which affected the Suez Canal revenue and will play a dramatic role in decreasing the Suez Canal revenue in the future is the opening of the North Pole route. The following statistics prove that the number of vessels and the total cargo weight in Suez Canal already decreased over the last few years especially in the summer months which are from June to October.

The total number of vessels passing through the Suez Canal in both directions (South/North-North/South) from June to October in 2015 and 2016 is 7543 vessels in 2015 and 7078 vessels in 2016, It is clear that the total number of vessels passing through the Suez Canal in summer months decreased in 2016 compared with the same months in 2015. This is an expected statistic as the number of vessels passing through the North Pole route increases gradually through the last few years since the opening of this route.(Suez Canal Authority.)

SUGGESTIONS

Our suggestions to counter these threats of the North Pole route as follows:

- There should be a comprehensive development in the policy and management of the Suez Canal.
- The necessity of linking the Suez Canal Authority with the maritime transport sector, when dealing with both the Suez Canal and the Egyptian ports, it is necessary to deal with only one entity that may have advantages to its customers.
- The possibility of benefiting from the potential and contributions of Suez Canal Authority departments and

companies, maximizing revenues and the possibility of renewing the shipbuilding and repair industry in the region as well as its subsidiary industries.

- Maximize the benefit of the Suez Canal area due to its distinguished location. As well as institutional logistics centers and P & O clubs to provide service to ships that may be exposed to accidents while crossing the Suez Canal.
- Finally, there are countries whose primary economy is the maritime economy in terms of shipbuilding and repair. Therefore it is necessary to establish a large maintenance center in the cities covered by the Suez Canal area, shipyard and repair shipyards.

CONCLUSIONS

The safety of ships operating in the harsh, remote and vulnerable polar areas and the protection of the pristine environments around the two poles have always been a matter of concern for IMO and many relevant requirements, provisions, and recommendations have been developed over the years.

Ships navigating in the Polar Regions may be exposed to numerous risks and dangerous. Such areas have not been fully explored and additional data on resources, ice and weather conditions need to be made. Advanced studies and researches in polar areas will be of vital importance for the safety of navigation.

If there is a rise in temperature at the poles, global warming will mostly affect the Arctic where the new routes for ships will be created an alternative to longer routes, such as those that pass through the Panama and Suez Canal. The increase of maritime traffic in these areas will lead to increased exploration and exploitation of hydrocarbon reserves in the Arctic. The main barriers to navigation in Polar Regions may be the lack of reliable weather forecasts, floating ice and icebergs, especially during the warm season when the ice begins to melt. Navigating through the Arctic the ships will shorten their route, save on time and fuel. The energetic efficiency would improve while navigating from one port to another.

After several years of research, it has been discovered that over the past few decades, Arctic sea ice has been significantly reduced, so sea traffic has increased over the past few years across NWP and NEP.

According to further predictions, if the ice continues to melt in the Arctic, the water in that area will be transformed into real navigational waterways. When this scenario is expected is still uncertain and depends on more climate change.

If global warming forecasts are achieved and the amount of ice in the Arctic is reduced, new areas of seismic exploration and oil and gas extraction are expected to be discovered from new sources. On the other hand, it will also be possible to open new navigation routes for navigation of ships that will contribute to increased maritime traffic in these areas.

One can conclude from this research and the figures shown that the opening of the Arctic route may have many advantages for the owners of companies and shipping lines. At present, shipping companies sail in their vessels across the Arctic road in the summer months only. In the near future, due to the impact of global warming, ships will be able to sail the Arctic road throughout the year, which means that the Suez Canal will be its revenue will be greatly affected unexpectedly therefore Early countermeasures must be taken.

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