COMMENTARY

Review and Analysis of Blockage of Suez Canal Region Due to Giant Container Ship

AUTHORS

Irfan Ahmed Khan
Department of Marine Engineering Technology, Texas A&M University at Galveston

Syed Rahman
Electrical and Computer Engineering Department, Texas A&M University

ABSTRACT

Navigation through narrow waterways always requires expertise and help from local authorities to facilitate safer and faster navigation. The recent Suez Canal blockage by the ultra-large container ship *Ever Given* running aground has resulted in a temporary halt and extended delay in goods transportation. Blockage of such a critical waterway has raised major concerns about the risk involved in navigation. This commentary attempts to analyze the background and chain of events leading up to the blocking of the Suez Canal. In this process, the issues related to navigation and following up salvage efforts are analyzed to identify the critical areas of improvement. Based on these identifications, suggestions for future improvement of navigation and better preparedness to optimize the salvage efforts have been identified. These suggestions include digitalization, prediction-based navigation capabilities, development of tugboats and associated tools, and so forth.

Keywords: ultra-container cargo ships, Suez Canal, *Ever Given*, digitalization, cyber-secured system

Importance of Suez Canal and Global Impact

History

Suez Canal is one of the most significant manmade waterways connecting the Red Sea and the Mediterranean Sea (Schøyen & Bråthen, 2011). This manmade canal is 120 miles long, 205 m wide, and 24 m deep. It took 10 years of construction and was officially inaugurated in 1869 under the Ottoman Empire. It was operational under the Egyptian government and European shareholders until it was nationalized in 1956 by the Egyptian president. A new East-side channel was added in 2016 for berthing and unberthing of vessels from the terminals (BBC, 2021; Huber, 2013).

Significance and Global Impact

The Suez Canal provides the shortest sea link connecting Asia to Europe. For example, traveling from China to the United Kingdom through the Suez Canal requires 21 days for navigation (distance of 10,224 nautical miles). Comparatively, the same destination traveled around the Cape of Good Hope would require 28 days of navigation, as they have to cover 13,454 nautical miles (Youtube Sky News, 2021). Taking this longer route would cost about $400K per vessel. International Chamber of Shipping (ICS) estimates about $3 billion worth of goods pass through the Suez Canal daily. In 2020, almost 18,500 ships have passed through the Suez Canal, controlling almost 12% of the global market share. Approximately, 10% of the global refined petroleum products are shipped through this manmade waterway. Due to this, any political tension in this region increases global crude oil rates (CNBC, 2021; ICS-Shipping, 2021).

Golden Class Container Ship *Ever Given*

Specifications of *Ever Given*

Ever Given is a golden class built in 2018 by Japan-based Imabari Shipbuilding, and Taiwan-based Evergreen Marine Corporation operates it. With a length of 400 m and a width of 59 m, this ship has the distinction of being one of the longest ships. This ship is capable of carrying 21,124 twenty-foot equivalent unit (TEU) containers. It has a gross tonnage of 220,940 tonnes (American Bureau of Shipping, 2021).

This container ship employs a low-speed, 11-cylinder–based two-stroke diesel engine. This engine is rated 59.3 MW, with a top vessel speed of 22.8 knots. It also has four additional diesel generators of approximately 4.5 MW each. For port maneuvering, it has two sets of bow thrusters rated at 2.5 MW (American Bureau of Shipping, 2021).

Blocking of Suez Canal

Difficulty in Suez Canal Navigation

The Suez Canal has a conservative width of 205 m. It supports two ways

of traffic flow, thereby further limiting the available width of the channel for navigation of larger ships. Additionally, this channel also regulates the container ships not to be greater than 400 m long. Longer ships need special permission for passing through the channel. Due to its busy route and limited channel width, navigation through this channel is always stressful and requires navigation expertise (Rusinov et al., 2021). For this purpose, local Suez-based pilots are also provided to help the ship navigators with local knowledge and expertise, resulting in the safe passage of the ships. Passing through this channel generally takes 12–16 hours to transit (Suez Canal, 2021).

Suez Canal Blocking Event

The Japanese-owned *Ever Given* cargo ship navigating from Malaysia to the Netherlands entered the Suez Canal on March 23, 2021. The canal authorities provided two local Suez pilots to help the navigators with safe passage. During this time, the region was experiencing a sandstorm resulting in heavy winds flowing across the Suez Canal. These strong winds reached up to 74 kph. These winds acted on the *Ever Given* containers (acting as a sail) to generate a significant force, which led to erratic steering and uncontrolled sideway navigation. At 7:40 of local Egyptian time (Eastern European Time, GMT+2), the *Ever Given* cargo ship ran aground and turned sideways, with its one side stuck in the ground and another side almost touching the other side of the channel. No damage to the cargo material or crew has been reported. Although parallel channels are available at some other parts of the canal, unfortunately, no parallel path existed across this 984-foot–wide lane, resulting in complete blockage of the Suez Canal, with no option for navigation of any ships from either side.

Global Impact

As previously mentioned, this canal is one of the most significant and busiest sea routes in the world. During its blockage from March 23 to 29, global crude oil prices jumped up by approximately 4%. This occurred due to the delay in the shipping of petroleum products. Additionally, a total of 369 vessels were trapped in the region resulting in further delay of the already COVID-impacted suffering business market (BBC, 2021). In addition to crude oil, other industries such as automobiles, paper, clothing heavily relying on auto parts, and other finished products waited for a week due to the canal blockage. It is estimated that the loss per vessel per day can be in the range of $15,000–$30,000. However, the alternate route around the Cape of Good Hope would still result in higher expense (daily fuel cost estimated to be $30,000) with the additional risk of pirates. Few cases of cargo ships taking the other route also have been observed during the blockade. The decision of choosing an alternative route would be easier for pre-informed ships, compared to the ships stuck right around the Suez Canal region. London-based Lloyd's List approximated that the blockade of the Suez Canal results in a loss of $400 million every single hour (CNBC, 2021).

Potential Reasons for Navigation Failure

Initial investigation has suggested a blackout of the container resulting in the loss of navigation control. However, updates ruled out any mechanical or engine failure as the cause for ship grounding. However, a detailed investigation is ordered to be carried out for the determination of the reasons for this mishap. However, it may take a lot of time for the outcome of the report.

Based on the present data, the major reason for the erratic navigation and grounding of the container ship is attributed to the extreme weather conditions of the region at that time. Heavy winds generated by the sandstorm resulted in the generation of sideward navigation forces and poor visibility of the navigation path resulting in loss of controllability of the container ship (BBC, 2021; CNBC, 2021; USA Today, 2021).

Refloating Plan Sequence and Floating *Ever Given*

After the grounding of the container ship, the following actions were initiated. Initial actions were to dig out the ground sand in which the container ship was stuck. In total, around 30,000 m^3 of sand were removed from the spot. Along with this, 9,000 tons of ballast water has also been pumped out of the vessel. This helps in lightening the container ship. At intermediate stages, multiple tugboats have been employed for getting the ship back to the sea. These boats try to push and pull the container ship so they can be floated (USA Today, 2021).

Salvage companies brought in their dredger ships to remove sand and gravel beneath the seabed. This would help in getting the ship to float. Additionally, more tugboats were employed for pushing and pulling this ultra-large container ship.

Different salvage efforts carried out are summarized in Figures 1 and 2. Along with this, the advent of higher tides would help in accelerating this process, as they increase the average depth of the channel by 18 inches. After continuous efforts of dredgers and tugboats, the cargo ship was finally floated on March 29, 2021. Two dredger boats owned by the Suez Canal Authority (i.e., the 10th of Ramadan and the Mashhour) were instrumental in refloating the ship (USA Today, 2021).

The authorities have also said that the final step would have been to lighten the ship by removing the containers from the *Ever Given* and placing them in some other ships, although this process is extremely costly as huge cranes must be employed for moving these containers, and additional container ships must be brought in to house those containers. Once the *Ever Given* starts floating, these containers must be put back. Fortunately, the ship was floated before using cranes.

Suggestions for Improving Future Navigation and Salvage Efforts in Suez Canal

Although a detailed inquiry has been ordered for determining the exact reasons for the grounding of *Ever Given*, this incident has raised serious concerns about the fragile nature of international shipping heavily relying on expert navigation through narrow waterways. In the last decade, the shipping industry has seen tremendous progress in terms of increasing container ship lengths, an increased container carrying capability, better connectivity, improved shipment tracking, and so forth. However, improvements in related areas such as navigation systems, incorporation of advanced artificial intelligence, predictive navigation capabilities, and so forth are still in the development or incorporation stage (Kumar & Chourasia, 2018). With the incorporation of digitalization and advanced intelligence into the current navigation, capabilities would be greatly enhanced for handling any extreme weather conditions (Baldauf et al., 2018). This would also help in reducing reliance on local navigation experts, generally provided to passing ships for safe passage. Another major concern (although not surfaced in this incident) would be the communication failure of the container ship in case of a cyber-attack. With long voyages almost circling the globe, these container ships require reliable and fast communication, which is critical for a time-bound and safe voyage. Thus, a method to improve this reliable and cyber-robust system must be developed (Hassani et al., 2017; Figure 3).

FIGURE 1

Salvage efforts carried out for refloating the *Ever Given* container ship.

A detailed risk analysis of the entire Suez Canal length would be highly helpful in planning future navigation schemes, well-planned salvage efforts, and critical needs for developing parallel channels to avoid traffic blockage at this crucial waterway. Another aspect to be investigated is to conduct a risk analysis of ultra-large container ships, which could potentially highlight the challenges in navigation and recommendations needed for avoiding this situation in the future (Jeong et al., 2019).

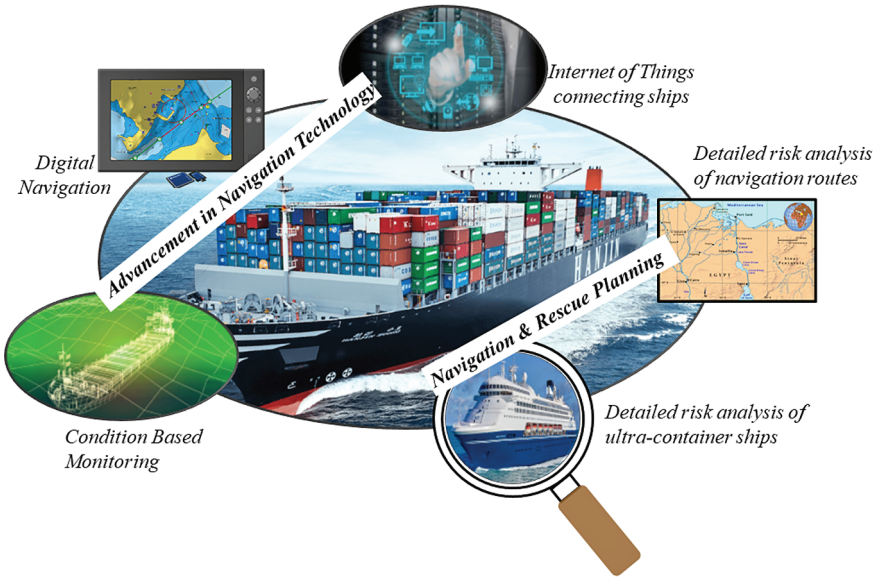
A major area of concern is no improvement in the planning of salvage efforts carried out after the incident, which resulted in a delay, amounting to millions of dollars. This reflects a lack of planning to meet these circumstances from both the Suez Canal authorities and the *Ever Given* crew team. Another concern is to develop stronger tugboats. Although the capabilities and power rating of container ships have increased significantly, there is no improvement in the power

FIGURE 2

Employment of multiple tugboats during high tides helped in refloating the ship.

FIGURE 3

Different areas of improvement to avoid waterway mishaps in the future.



rating of tugboats. This leads to the requirement of bringing in more boats than initially thought of in this Suez Canal incident. One suggestion would be to connect the tugboat in the ultra-large container ships at all times, thereby minimizing the time required for refloating the cargo ship (Jeong et al., 2019; Youtube DW News, 2021).

Conclusion

Blocking of the Suez Canal by the *Ever Given* has highlighted the consequences of reliance on traditional navigation, local experts, and lack of sequencing of salvage efforts. This commentary reviewed the chain of events and followed up refloating efforts that resulted in refloating of the *Ever Given* after blocking global shipping for 6 days, resulting in the loss of billions of dollars. Based on the learnings, the authors suggest two lines of actions that would minimize the possibilities of these events occurring in the future. The first action would be to conduct a risk analysis of both the Suez Canal and ultra-large container ships. This would result in better navigation and improved planning. Another action is to incorporate digitalization and development of a cyber-physical secure system, capable of safer navigation even in case of extreme weather and cyber-attacks, without reliance on external sources.

Corresponding Author:

Irfan Ahmed Khan
Deparment of Marine Engineering Technology,
Texas A&M University at Galveston
P.O. Box 1675, Galveston,
TX 77553
Email: irfankhan@tamu.edu

References

American Bureau of Shipping. 2021. Ever Given details. https://www.eagle.org/portal/#/absrecord/details (accessed 05 April 2021).

Baldauf, M., Kitada, M., Mehdi, R., & Dalaklis, D. 2018, March. E-navigation, digitalization and unmanned ships: challenges for future maritime education and training. In: 12th Annual International Technology, Education and Development Conference (INTED), pp. 9525–30. Barcelona, Spain: IATED. https://doi.org/10.21125/inted.2018.2374.

BBC. 2021. The cost of the Suez Canal blockage. https://www.bbc.com/news/business-56559073 (accessed 05 April 2021).

CNBC. 2021. Suez Canal blockage is delaying an estimated $400 million an hour in goods. https://www.cnbc.com/2021/03/25/suez-canal-blockage-is-delaying-an-estimated-400-million-an-hour-in-goods.html (accessed 05 April 2021).

Hassani, V., Crasta, N., & Pascoal, A.M., 2017, June. Cyber security issues in navigation systems of marine vessels from a control perspective. In: International Conference on Offshore Mechanics and Arctic Engineering, Vol. 57748, pp. 1–6. Trondheim, Norway: American Society of Mechanical Engineers. https://doi.org/10.1115/OMAE2017-61771.

Huber, V. 2013. Channelling Mobilities: Migration and Globalisation in the Suez Canal Region and Beyond, 1869–1914. Cambridge, UK: Cambridge University Press. 365 pp. https://doi.org/10.1017/CBO9781139344159.

ICS-Shipping. 2021. Suez Canal blockage demonstrates just how much global supply chains rely on shipping, says International Chamber of Shipping. https://www.ics-shipping.org/press-release/suez-canal-ever-given-statement/ (accessed 05 April 2021).

Jeong, M.G., Lee, E.B., Lee, M., & Jung, J.Y. 2019. Multi-criteria route planning with risk contour map for smart navigation. Ocean Eng. 172:72–85. https://doi.org/10.1016/j.oceaneng.2018.11.050.

Kumar, A., & Chourasia, A. 2018. Blind navigation system using artificial intelligence. Int Res J Eng Technol. 5(3):601–5.

Rusinov, I., Gavrilova, I., & Sergeev, M. 2021. Features of sea freight through the Suez

Canal. Transp Res Proc. 54:719–25. https://doi.org/10.1016/j.trpro.2021.02.125.

Schøyen, H., & Bråthen, S. 2011. The Northern Sea Route versus the Suez Canal: Cases from bulk shipping. J Transp Geogr. 19(4):977–83. https://doi.org/10.1016/j.jtrangeo.2011.03.003.

Suez Canal. 2021. Suez Canal FAQs. https://www.suezcanal.gov.eg/English/Pages/FAQ.aspx (accessed 05 April 2021).

USA Today. 2021. Ever Given refloated and freed! How did they get the ship out of the Suez Canal? https://www.usatoday.com/in-depth/graphics/2021/03/29/ever-given-refloated-and-freed-how-did-they-get-the-ship-out-of-the-suez-canal/7043678002/ (accessed 05 April 2021).

Youtube DW News. 2021. https://www.youtube.com/watch?v=CKvGKTsAoO4 (accessed 05 April 2021).

Youtube Sky News. 2021. Maritime traffic jam: Ship blocking Suez Canal could take weeks to dislodge. https://www.youtube.com/watch?v=FHnqZlxZcZM&ab_channel=SkyNews (accessed 05 April 2021).