

Case study – Ever Given

Accident Report

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Colophon

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Time lapse

On March the 23rd The Ever Given arrived at the Suez Port at 12:12 AM local time. The Egyptian port is located at the southern boundary of the Suez Canal. At 05:49 AM The Egyptian Tugboat Mosaheb 2 moved towards the Ever Given and delivered two SCA pilots. This indicated that the waiting of the vessel was over and that the journey through the Suez Canal was about to begin. At 06:00 AM the Ever Given started to sail in a convoy with other top-priority vessels, among which Al Nasriyah (Marshall Islands), Galaxy of Hong Kong (Cosco), Denver of the US (Maersk). The Al Nasriyah and the Galaxy of Hong Kong sailed in front of the Ever Given. Denver of the US sailed behind the Ever Given. The first two vessels in the convoy, Al Nasriyah and Galaxy of Hong Kong, were guided by a tugboat. On the contrary, the Ever Given and Denver of the US did not have a tugboat to escort them through the canal. The first ship of the convoy, Al Nasriyah, entered the Suez Canal at 06:51 AM. The Ever Given followed and entered the Suez Canal at 07:18 AM. The speed of the Ever Given had been gradually increasing. At 07:22 AM the vessel passed the 8-6 knot limit which is set by the SCA. The vessel accelerated speed and was travelling 13.7 knots at 07:29 AM. The Ever Given maneuvered towards the west bank of the canal at 07:37 AM, probably due to the winds which gradually pushed the ship towards the east bank. After the maneuver The Ever Given was again sailing parallel with the canal, but the ship was now located close to the edge of the west bank. At 07:40 the stern of the Ever Given moved suddenly westward with the consequence that the bow moved eastward. The only logical navigational option was to turn the ship westward. Nevertheless, the ship ran aground at 07:42 AM. The tugboat Mosaed 2 reached the Ever Given at 07:57 AM and the other tugboats reached the grounded ship after 08:17 AM. However, the efforts of the tugboats did not refloat the Ever Given that day. The blockage started to cause a traffic jam of vessels and a six-day salvage operation endured.

On the 25th of March the Suez Canal authority suspended all traffic in the Suez Canal. On the 27th the authorities plan to free the ship using the tidal movements. After moving 30.000 cubic meters of sand the Ever Given refloated on the 29th at 03:05 PM local time. The salvage operation ended after six days and the vessel sailed to the Great Bitter Lake for inspection. The Ever Given was anchored for almost three months in the Great Bitter Lake, due to liability settlements. Egypt had demanded a \$900 million dollars claim as compensation, which included \$300 million salvage bonus, \$300 million for loss reputation and other costs. According to the UK club, which ensures the shipowner Shoeni Kise for third-party liabilities, the claim was not realistic. The Ever Given was released on the 7th of July, because a formal solution had been agreed with Suez Canal Authority. The details of the agreement have not been presented yet. The vessel continued its voyage to the port of Rotterdam. The ship travelled at a lower speed than during normal conditions, due to the damages. After almost four months after the incident, the Ever Given entered the Port of Rotterdam on the 29th of July the Ever Given.

Figure 1: Map of the Suez Canal



Refloating and damage assessment

The Ever Given was successfully refloated at 4:30 a.m. local time in the morning of 29th of March 2021. The salvage operation started almost immediately from the moment of grounding. 11 harbour tugs from neighboring ports were already deployed. At the location of the grounding, the canal is some 300 meters wide, however the fairway is only 121 meters wide. The Dutch-flagged Alp Guard (IMO: 9398539), and Italy-flagged Carlo Magna (IMO: 934125) were called in to pull and push the ship from three directions. The Alp Guard arrived on Sunday and is capable of pulling 285 metric tons, which is 75% more than the canals' fleet of tugboats. The Carlo Magno joined in on Monday morning. Boskalis's CEO Peter Berdowski told 2,000 tons of water ballast was let into the rear of the vessel, which pushed the stern down and lifted the bow. The salvage company worked out four scenarios for salvage the ship; plan B was to remove more sand; plan C was to start removing containers from deck.

Figure 2: Salvage movements around the Ever Given



Moreover, a cutter suction dredge removed 30,000 metric tons of sand to a depth of 20 meters deep. The salvage operation was done under a constellation of the full moon, which resulted in Spring tide in the early morning of 29th of March. Admiral Osama Rabie and Managing Director of Suez Canal Authority announced that the successful refloating was the “result of push and tow maneuvers which lead to the restoration of 80% of the vessel’s direction: with the stern 102 meters away from the bank of the Canal now instead of 4 meters prior to the refloating”. Towage maneuvers were said to resumed during high tide at 11:30 a.m. Subsequently, the vessel was then towed to the Bitter Lakes waiting for technical inspection.

Hydrodynamics

Ship's dimensions seem to have reached the maximum of 400 meters long. Over the last few years, ships have become wider, not longer. That trend may now have reached its maximum boundaries as well. The hydrodynamics of these wide and long vessels get more complicated in a shallow waterway, like the Suez Canal. The amount of water which is displaced by the ship finds its way under the keel as well as between the ship's hull while sailing in the channel. Due to the wider ships and the already longer existing drafts, the water gets squeezed, which causes the water to speed up and the pressure to drop. This can be explained by the Bernoulli's principle which states that an increase in speed of a fluid occurs simultaneously with a decrease in static pressure.

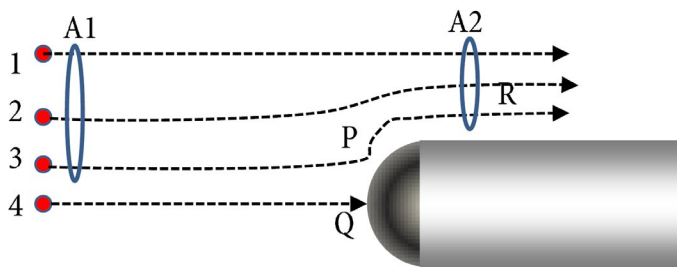


Figure 1: Change of pressure in flows (Groenhuis, *Manoeuvring with seagoing ships*, 2017)

In figure 1 the red dots are the fluid particles in the canal. Particle 3 will slow down in position P, therefore pressure increases. In position R, the available space for particles 1, 2 and 3 will become less (intersection A1 will be reduced to A2). According to the Bernoulli's Principle, the speed of these water particles will accelerate which causes pressure to drop. Particle 4 collides in Q against the ship, meaning speed will be 0.

Applying this principle to the Ever Given in the Suez Canal shows the wider ship was veering from left to right in the channel. While coming closer to the shore, especially on the west side of the channel - just before the incident - the water was squeezed and accelerated between shore and ship and consequentially the pressures dropped between ship and shore. Due to the pressure on the other side, the ship was pushed even closer to the west bank.

The effect of figure 1 is that the ship creates a ship bow wave which was increased due to the higher speed of the vessel, which was around 13 knots. A bow wave creates a higher pressure between ship and shore and therefore a ship will turn away from the shore. The stern wave, which is supposed to counterbalance the bow wave did not exist as all the water was sucked to the propeller, with less water available due to the minimal space between ship and shore. The stern of the ship is then drawn to the shore.

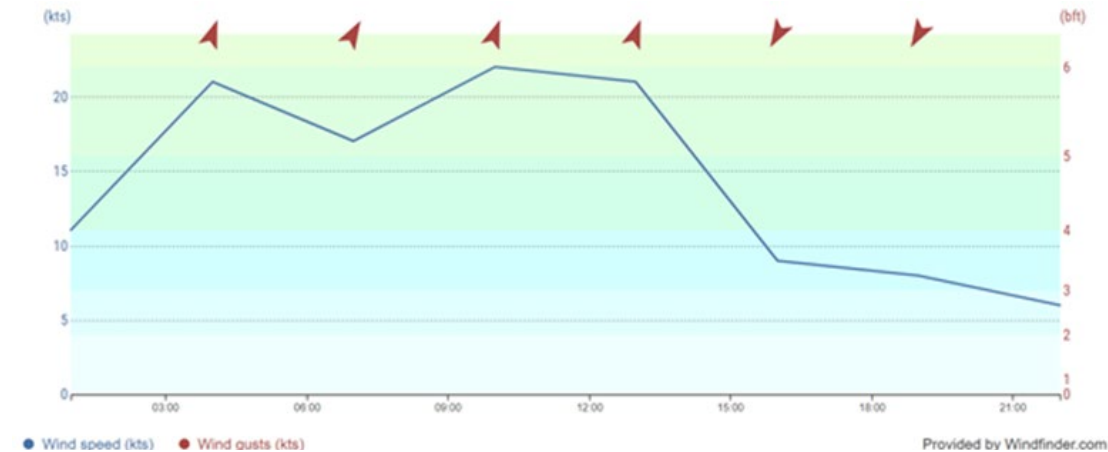
The result: the bow turned to the east (starboard) the stern turned to the west (portside). This could not be corrected with the rudder due to the high speed of the vessel. The ship ran aground onto the east bank of the canal.

Environmental conditions

Weather

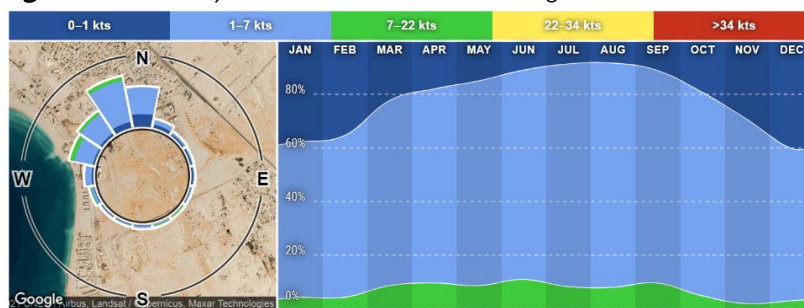
The graphs below on the right show the wind report from a nearby weather station on the day of the accident. Average wind speed at the time of the event shows a wind speed of around 20 knots coming from south-south west direction. Although wind gusts were not reported at this weather station, the Suez Canal Authority commented the day after the grounding on 24th of March, that the accident likely occurred “due to strong winds and a dust storm that impeded visibility” with winds reaching 40 knots per hour”.

Figure 5: Wind reports from Tuesday, March 23, 2021 in Suez



At the moment of the event, the wind was blowing from the south-south-west direction which is uncommon as the dominant wind direction is a northwesterly direction. This has to do with a dust storm. Dust storms are common in this region due to the proximity of the deserts, particularly in Spring “when southerly winds associated with low pressure systems moving across the Mediterranean Sea stir up large amounts of dust and sand. The graph below shows the dominant wind direction coming primarily from the north-north-west.

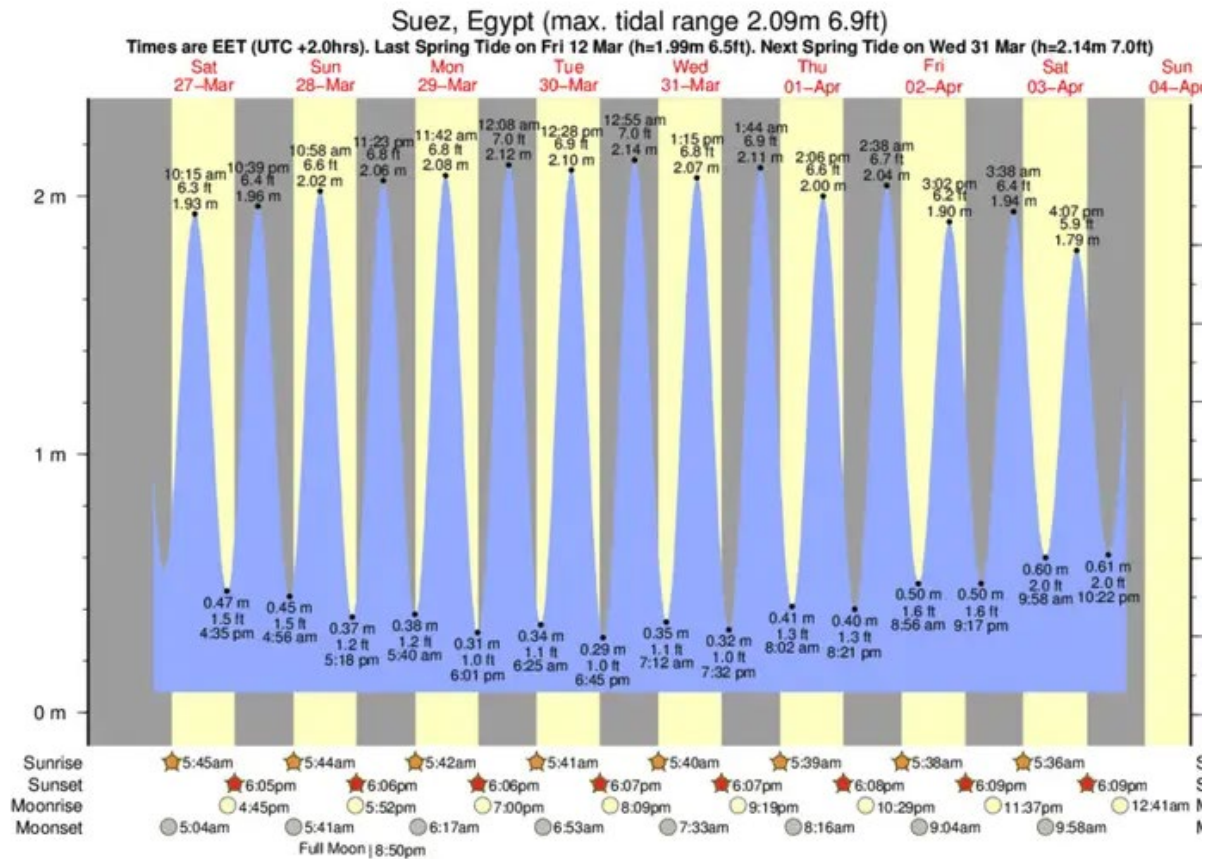
Figure 6: Monthly wind direction and strength distribution in Suez



Spring tide

The salvage of the ship owes a great deal to Mother Nature. It was full moon on Sunday, the following 24 hours offered a crucial time window for the salvage operation. The gravitational pull of the moon and sun and their position relative to the earth results in spring tide. With water levels rising 2 meters. This full moon is also referred to as Supermoon, which is when the moon is within 90% of perigee, its closest approach to Earth. Because of its proximity, gravitational force of the moon is stronger than normal, which leads to higher spring tides.

Figure 7: Suez Canal tides from March 27 – April 4



Source: tide-forecast.com

Suez Canal Information

The Suez Canal opened in 1869 and is 193 km long between Port Said and Suez, no locks. Sailing time approximately 13 to 15 hours. Shorter route from Asia to Europe than the alternative of sailing around the Cape of Good Hope. The Canal was expanded in 2015 to enable ships to transit in both directions simultaneously, but only in part of the waterway. Normally ships go through this part of the canal in convoy. 29 kilometers were added to its original length of 164 kilometers.

The expansion was a US\$ 8.5 billion project and was completed in 2015. In accordance to the Rules of Navigation all vessels entering or leaving the Canal must take pilots on board. The Master (or his representative) must be at the bridge at all times and is held solely responsible for all damage or accidents of whatever kind resulting from the navigation or handling of the vessel [...]. On the pilots' responsibility the Rules of Navigation is clear: "the pilot is not held responsible for any damages sustained during transit owing to these advices".

Suez Canal Authority (SCA) manages, operates, uses, maintains and improves the Suez Canal. SCA was established in 1956 as a public independent authority, reporting to the Prime Minister. The SCA has the exclusive position to keep "in force rules of navigation in the Canal" and has the authority to rule and regulate for "well and orderly" canal.

Ever Given Ship Particulars

The Ever Given is one of the largest container ships in the world with a carrying capacity of 20.000 TEU. The length of the ship is 399.94 meters, and her width is 59 meters. The ship is built by the Imabari Shipbuilding company in 2018 and is owned by Shoei Kisen Kaisha Ltd from Japan. The technical management of the ship is Bernhard Schutte Shipmanagement, based in Germany. The ship is powered by a two-stroke diesel engine with 79.500 horsepower (Mitsui-MAN B&W 11G95ME-C9), which drives a large fixed-pitch propeller and gives a vessel speed of 22,8 knots. In addition, the vessel has 3.400 HP bow thrusters to maneuver through ports and small canals, such as the Suez Canal. See the voyage and shipping particulars for more information.

Crew and vessel management

The Ever Given had 25 Indian crew members onboard. After the grounding of the ship Bernhard Schulte Shipmanagement stated that the crew was safe and that there were no cases of injuries or contamination. When the vessel grounded the whole crew was within the terms of their contracts. The crew could communicate with their families at all times due to full internet access. The vessel was supplied with foods for the next twenty days. The wages of the crew have been fully paid. Minimum safe manning was being maintained at all times. Late April the Suez Canal Authority granted permission for three crew members to be relieved because the contracts would expire. Two other crew members already left the ship due to personal reasons.

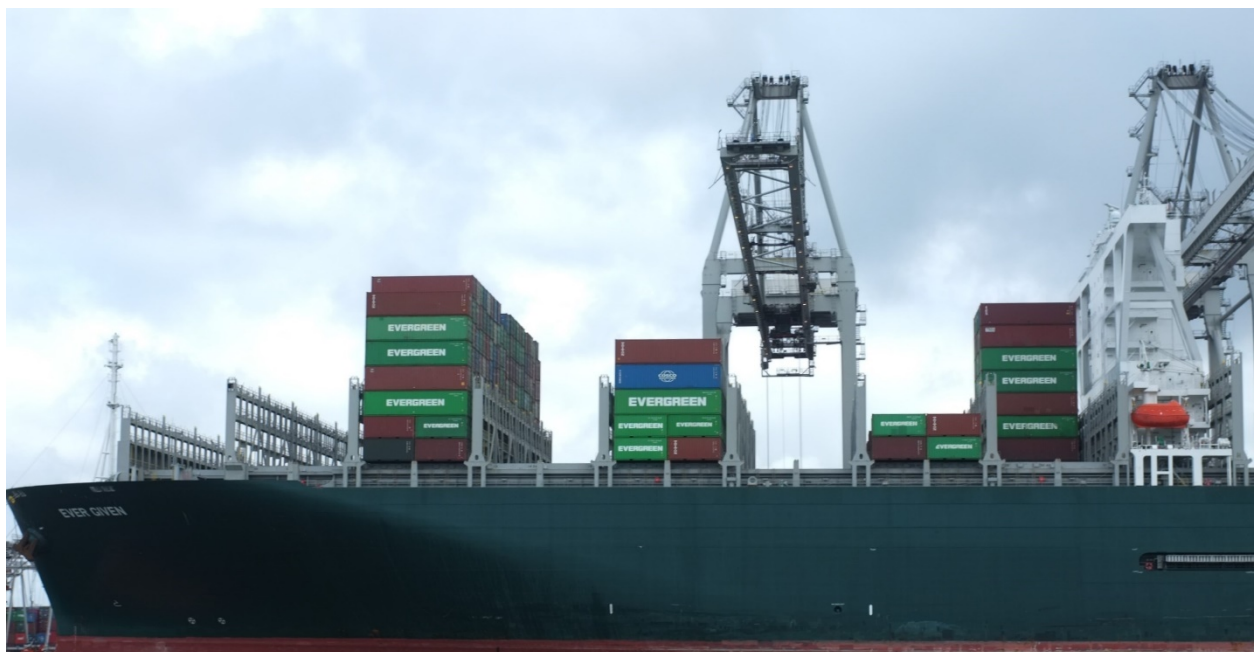
Cargo Owners

On the 20.000 TEU ship there were at least 10.000 laden containers. On a normal container on board, there can be 20 parties who have an interest with the cargo. How the consequences translate for the various parties depends on the contractual arrangements and on applicable legal systems. Liability for damage caused by delay is often excluded by contract. However, this does not apply to damage to the goods. Goods damage can be a consequence of a delay, which is particularly likely for perishable food products. Delay could cause food to degrade or perish, and it could even lead to food safety problems.

If the delay becomes significant, damage can occur in the case of perishable cargo. A carrier cannot go free in this case because it concerns good damage rather than delays damage. However, the carrier is not liable in the even of ‘force majeure’. This may be applicable for cargo on ships other than the Ever Given, i.e. the ships which were queuing up or those that had to circumnavigate Cape of Good Hope.

When damages are suffered, some cargo owners will decide to not collect their cargo when the vessel finally arrives at its final destination under ‘Average Grosse’. Both shipowner and cargo owner carry liability and will therefore have to incur costs. In this scenario, some containers may be dumped or stalled for indefinite time. The first port of call of the Ever Given is Rotterdam, which means that the port of Rotterdam might have to deal with the consequences of uncollected containers.

Reference is made to the Teaching notes of Maritime Law.



Ship and voyage particulars

Table 1: Ship Particulars of the Ever Given

Ship Particulars	
Vessel's name	Ever Given
Flag	Panama
Classification society	American Bureau of Shipping (ABS)
P&I Club	UK P&I
IMO number	9811000
Type	Container ship (20.000 TEU)
Registered owner	Shoei Kisen Kaisha Ltd
Ship Register	Panama Ship Register
Manager(s)	Bernhard Schulte Shipmanagement
Charter party	Evergreen Marine
Year of build	2018
Shipyard	Imabari Shipbuilding
Construction	Steel
Length overall (m)	399.94
Breadth extreme (m)	59
Summer DWT (t)	199692
Gross tonnage	219079
Territorial waters	Lake Mazala, Lake Timsah, Bitter Lakes
Authorized cargo	Containers

Table 2: Voyage particulars and Casualty information of the Ever Given

Voyage particulars	
Port of departure	Tanjung Pelepas
Port of arrival	Rotterdam
Type of voyage	International
Cargo information	Major Hazard (Haz A)
Manning	25
Marine Casualty information	
Date and time	23rd March 2021
Type of marine casualty or incident	Grounding
Salvage company	Boskalis and Dredging Egypt
Location of incident	Suez Canal
Involved port authority	Suez Canal Authority
Place on board	Not applicable
Injuries/fatalities	None
Damage impact	Slight damage on vessel's bow (not enough to take out of service)
Environmental impact	None (no oil leak or something)
Ship operation	On passage
Voyage segment	Pilotage
External & Internal environment	Wind gusts of 40 knots and lack of visibility

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