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The Eastland Steamer

The *Eastland Steamer* capsized on July 24, 1915, three years after the *Titanic*. The ship was going to take Western Electric Company employees and their friends and family to Michigan City, Indiana for their annual picnic. It was moored on the Chicago River in downtown Chicago. The *Eastland* was one of the newer and more advanced ships that would be taking people from Chicago to Michigan City; therefore, everyone wanted to ride it. It was to be one of the first two ships to leave, at 7:30 in the morning.

At 6:40a.m., people began to board the ships. There were about five thousand people already waiting to board. This number was double the capacity of the *Eastland*. No one had been assigned to a specific ship, so large numbers of people began boarding the *Eastland*. At 6:41a.m. the ship began listing to the starboard (right) side, which was expected due to the large number of people boarding; however, the listing was so bad that it caused the gangplank to rise from the dock. Listing was customary for this ship, but it began immediately and was probably more severe than usual. As time passed and more passengers boarded the ship, the listing became worse. At 6:48a.m., the crew filled two of the port (left) ballast tanks (No. 2 and No. 3) to less than a quarter of their capacity, as instructed by the chief engineer, Joseph Erickson. He did this in an attempt to control the listing, which did help the ship even out and stabilize itself. A few minutes later, the ship began listing to port and Erickson ordered a starboard ballast tank (No. 2) to be partially filled. This again stabilized the ship. Passengers continued to board the

Eastland at a rate of about 50 people per minute. A slight list to the port side returned, but Erickson who could not see the passengers from where he was located on the ship, assumed that a large number of passengers had moved to the starboard side of the ship causing the list. In reality, no large number of people had moved. Erickson emptied the port ballast tanks, but the list continued.

At 7:10a.m., no more passengers were allowed to board the *Eastland*; at that time, the count was said to be 2,500. Several minutes later, the list to port increased between 10 and 15 degrees and an attempt was made to fill ballast tanks number two and three on the starboard side, but they were unable to admit water for unknown reasons. Several minutes later the ship righted itself again, but shortly the list returned and became so severe that water came onto the ship. The angle of list reached 45 degrees and at 7:30a.m., less than an hour after the passengers began boarding, the *Eastland* fell onto its side and panic broke out. Many people were trapped in the lower decks of the ship and were either drowned or crushed by falling debris. Eight hundred forty-one passengers died, just 19.2 feet from the dock and in 23.5 feet of water, a larger number of passengers than died when the *Titanic* sank. Entire families were killed. According to the American Red Cross *Eastland* Disaster Relief, 22 families were wiped out. This was the worst disaster, in terms of loss of life, in the history of Chicago, and it holds the record for the highest number of deaths in a single accident to occur on the Great Lakes.

There were many design flaws that caused the *Eastland* to capsize. According to the *Eastland* Disaster Historical Society, “. . . it really was not a matter of **if** the *Eastland* would capsize, it was simply a matter of **when**. Essentially, it was a disaster waiting to happen” (<http://www.eastlanddisaster.org/causes.htm>). The *Chicago Daily Tribune* printed a letter written by a naval engineer, J. Devereux York, to the government inspectors in Chicago two

years prior to the disaster, August 3, 1913, stating, “You are aware of the condition of the *S.S. Eastland* and unless structural defects are remedied to prevent listing--there may be a serious accident” (Chicago Daily Tribune 1:3). This letter is proof that there were known problems with the *Eastland* that were ignored. The main causes of the disaster were the metacentric height, the ballast system, and lack of communication on the part of management.

The metacentric height is the measure of stability of a ship in the water. A ship with a positive metacentric height has a metacenter above the center of gravity. Positive righting arms are created which cause the ship to right itself. A ship with a negative metacentric height has a metacenter below the center of gravity. Negative righting arms are created which causes the ship to be very unstable and any force acting on the ship will cause it to capsize. A ship with a metacentric height of zero has its metacenter and center of gravity at the same point. No righting arms are created, and the ship will stay at an angle of inclination. If a person stands in the center of a ship with zero metacentric height holding a five-pound weight, the ship will list in the direction the person throws the weight. If a ballast tank is partially filled to steady the ship, the ship will capsize from the slightest touch.

The *Eastland* was designed to have a metacentric height of 18 inches when it was fully loaded. However, 60 feet of length were removed from the center of the ship’s original plans; therefore, reducing the width. Also, another deck was added. These changes lowered the metacentric height of the ship (removing length) and made the ship more top-heavy (extra deck). Also, one of the men involved in designing the steamer thought it was going to be used for freight for which a metacentric height of 18 inches was acceptable. Since the ship was used for passengers, a larger metacentric height (2-4 feet was the standard) should have been used due to the variable weight distribution of a passenger ship. There is a simple way to test and calculate

the metacentric height of a ship, which is normally done to a new ship. However, no inclination tests were done on the *Eastland* to find its metacentric height until after the disaster.

During the first year of the *Eastland's* commission (1903), it had no stability problems. However, near the end of its first year, several changes were made. In order to increase the ship's speed, the Ellis and Eaves system of induced draft was installed; the McCreery system of air-conditioning was added in order to reduce the stiffness on the lower decks. There is no available information on how much weight was added as a result of these changes, but it can be assumed that they lowered the metacentric height of the ship due to the heat exchangers (Ellis and Eaves system), fans (Ellis and Eaves system), and overhead ducts (McCreery system) used for these devices. The added weight caused the ship to hit bottom more often than it had previously; therefore, some of the ship's machinery was relocated to prevent it from being so low in the water and perpetually hitting bottom. All of these changes caused the ship to become top-heavy and have a lower metacentric height. These were the beginning of changes that added to the *Eastland's* already prevalent problems.

As years passed, other changes were made to the *Eastland*. All of the sleeping compartments were removed because they were not being used; later this area was filled with concrete, which added to the weight of the ship and lowered the metacentric height. The added weight was estimated to be about 15 to 20 tons. Also, following the sinking of the *Titanic* and the deaths resulting from a lack of lifeboats, LaFollette's Seaman's Act was signed in March, 1915. This act had several provisions regarding lifeboats, such as how many were required, their size, and the material from which they were built. The *Eastland* added three lifeboats and six life rafts, increasing the weight on the top deck of the ship by 10 to 14 tons. These additions

were made in part, to increase the capacity of the ship. Once again, it lowered the metacentric height and made the ship more top-heavy.

A new chief engineer, Joseph Erickson, was hired for the 1915 season. He was well qualified for the job, having worked on several ships similar to the *Eastland*. However, the ships he had worked on had long metacentric heights. When it was decided to add lifeboats and rafts, it was never discussed with Erickson, and he was unaware that the capacity had been increased. He was not made aware of the fact that all of the changes could possibly cause the metacentric height to become negative during loading. Therefore, he was unaware of the fact that the ship would have to be handled differently; if he had known, he probably would have treated the situation that occurred on the day of the disaster differently. A ship with positive metacentric height is treated quite differently than one with negative metacentric height. The *Eastland* had no problems during the few weeks between the time that all of these changes were made and July 24. The number of people traveling on the ship during this time period was very small (less than 1,000) especially when compared to the 2,500 on July 24. Changes to the *Eastland* caused the metacentric height to become very short which added to the ship's problems. Although the metacentric height was a large cause of the disaster, there were also problems with the ballast system.

Another contributing factor to the disaster were the problems with the ballast tanks. A ballast system consists of a series of large tanks located at the bottom of a ship. This system is used to stabilize the ship by filling and emptying certain tanks. The *Eastland's* ballast system had 12 tanks, two of which were never used. The other 10 tanks were symmetrical on the port and starboard sides of the ship. They were split down the middle by a metal partition, which was connected to the keel, and extended down the entire length of the ship. Each tank had a gridiron

partition to keep the water from moving from side-to-side. The system was set up this way in order to give the water the characteristics of a viscous fluid.

The ballast tanks were connected to the outside water by a pipe, which had a valve and strainer near the end of it and was six to eight feet below the water line. The pipe, located on the port side of the ship, entered the manifold at a downward slope. A manifold is a device with many openings used to channel the water to different tanks. The water was pulled into the pipe by gravity and then went through the manifold and into the desired tank. The tank valves were opened and closed using a detachable wheel that was moved from one valve to the other. The tanks had pipes, which would vent the water out if the tanks were overfilled. Due to the fact that the tanks followed the shape of the hull, they were various sizes.

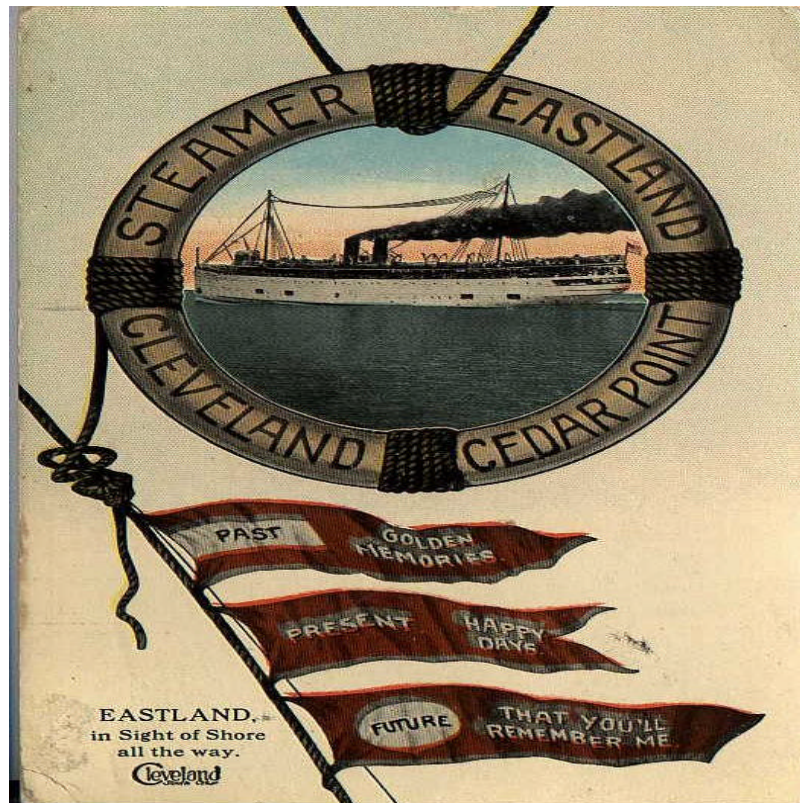
There were no gauges on the ballast system to indicate the amount of water in the tanks. Time was used to measure the amount of water in each tank because it was known that it took 25 minutes to fill one or both of the number three tanks, and 10 to 12 minutes to fill one or both of the number two and number four tanks. This system of measurement was one reason the tanks were emptied before passengers were loaded. It was easier for the engineer if the tanks started out empty than if they started out partially filled; then engineer had no way of knowing how full a partially filled tank was. The water in the tanks could be measured by a dipstick method, but it very often took too long. The opening for the dipstick was simply a hole, which had a covering that was only used when the tank was going to be completely filled. It was easy, therefore, for the tank to overflow and cause water to discharge inside of the hull. As a result, bilge pumps were placed around the hull. Water left the ballast system through the same manifold that it used to enter the tanks and was then pumped out of the starboard side of the ship through a pipe that let it out about three feet above the outside water level. Water could not be taken in and let out at

the same time since the same manifold was used to fill and empty the tanks. Also, water could not be pumped from the tanks on one side of the ship into tanks on the other side. There were many limitations on what this ballast system could do due to its design.

According to Engineering Record, “The handling of the ballast by officers of the boat indicates an entire lack of understanding of the nature and proper uses of water ballast . . .” (221). When Erickson partially filled port tanks number two and three in an effort to right the ship, it was a dangerous action due to the fact that the metacentric height was negative or close to being negative. Since he was not informed that the metacentric height of the ship might be negative or close to it, he did what would have been done on a ship with a positive metacentric height. In doing this, Erickson created a large free-surface effect by putting a very small amount of water into two large tanks. This action affected the stability of the ship because the water acted like a “randomly moving weight several decks above”(Hilton 97). Since the tanks were only partially filled, every movement the ship made caused the water to surge within them.

The ballast system had many problems that may have contributed to the capsizing of the ship. The fact that the same manifold was used to bring water in and let it out, greatly limited what Erickson could do to compensate for the listing. Also, the lack of gauges to accurately measure how much water was in the tanks was a problem. When Erickson tried to fill some of the starboard ballast tanks and they did not actually fill up with water, there was nothing to alert him of this fact. Water sloshing around the hull of the ship after a tank overflowed also contributed to the listing problem. The process used to fill the ballast tanks was very slow because someone had to go from one valve to the next with the detachable wheel to open and close the m. All of these problems with the ballast system plus several other problems lead to the great tragedy that occurred

A combination of the ballast system, the metacentric height, and the failure to communicate with the chief engineer caused the *Eastland* to capsize. The most ironic part in the history of this ship is that it went through many inspections, and passed every time. There were obviously serious problems with this ship, but not one inspector ever found one. The *Eastland* was a disaster waiting to happen and could have been prevented if the signs of the problems had been taken seriously. One naval architect even said that due to its design, the *Eastland* would have to be operated with great care at all times and could not be operated like other ships. There was one postcard that had a picture of the *Eastland* on it and the words printed on it said, “You will remember me.” This ship certainly is remembered, but not for the reason anyone ever dreamed.



“Photos.” Chicago Historical Society. 1998-2001
<<http://www.eastlanddisaster.org/postcards.htm>>

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