



America's Largest Maritime Disaster

An Online Continuing Education Course for Engineers

Course Number: ET-2029

Credit: 2 Hours / 2 PDH / 2 CPD

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Americas Largest Maritime Disaster - Sultana

At around 2:00 AM on April 27, 1865, while heading north and 6 miles beyond Memphis Tennessee, three of the four boilers of the large Mississippi riverboat – Sultana, exploded. The Engineer who had been monitoring the boilers that night was Samuel Clemens who suffered severe burns and died later that day after giving his statement to investigators of the incident⁵.



Above is a dramatic but historically inaccurate depiction of the Sultana explosion and fire as published in Harper's weekly (colorized)⁵. The explosion of the boilers had blown away the pilothouse, and one of the two stacks had fallen aft, and the other fell forward crushing many men crowded on the upper deck. The force of the explosion had left a gaping hole from the boiler deck to the upper deck allowing the wooden ship's construction to fall into the now exposed fireboxes rapidly catching fire. The ship's superstructure was completely engulfed in flames within seven minutes.

The Mississippi River in the spring of 1865 was experiencing one of its' worst floods in recorded history. This flooding had caused the banks of the river to be breached by several miles at some points. Rescue ships arrived within an hour of the explosion (roughly 3:00 AM) and rescued many survivors who by that time, had been carried with the river current back south to the vicinity of Memphis. Many of the rescue ships were from Memphis, including a union gunboat, whose crew had heard the victims screams from the river. The Sultana's hulk burned and

drifted for about seven hours, until eventually sinking toward the west bank of the river, near modern-day Marion, Arkansas. The river's strong currents and overflowing banks intensified the efforts of rescuers since many survivors were clinging to treetops, the only visible features of the now highly overrun banks. Rescue vessels could not navigate in the forest of treetops and strong current. This fact contributed to a large number of deaths by hypothermia.

Though the boat had a design capacity of 376 total passengers, it was packed with up to 2,400 persons at the time of the disaster. The boiler explosions, resulting fire and cold Mississippi river water would claim more than 1,700 lives. In terms of lives lost, the Sultana incident remains the largest maritime disaster in U.S. history.

The steamship Sultana was a side-wheel steamship built by the John Litherbury boatyard in Cincinnati, OH. Construction began in 1862, and the ship was launched on Jan. 3, 1863. The ship's registered displacement was 1,720 tons, a length of 260 feet and a beam (width) of 42 feet, four decks and two 34 - foot diameter paddle wheels for propulsion. It was owned by a consortium including Capt(s). Pres Lodwick and Capt. J. Mason, who was the captain at the time of the disaster and did not survive the accident. For two years she ran regular service between St. Louis and points south and was often commissioned to carry troops for the war effort.

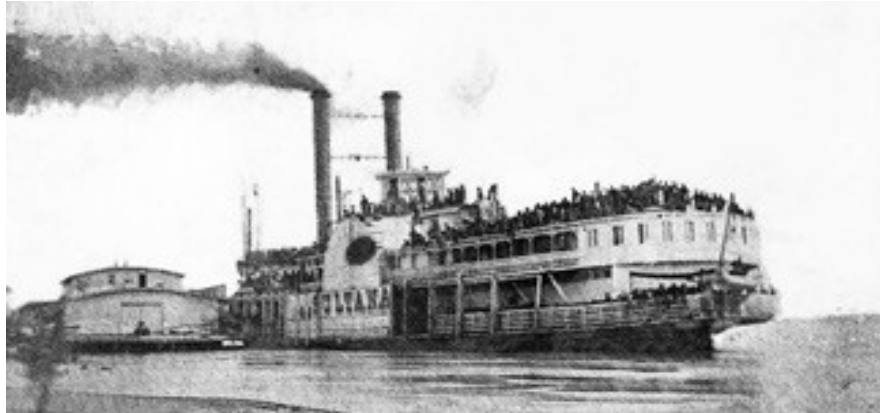
Under the command of Capt. Mason, the Sultana, left St. Louis on April 13, 1865, heading for New Orleans. On the morning of April 15, she was at Cairo, IL when word reached the city that President Abraham Lincoln had been shot. Captain Mason acquired as many of the local Cairo newspapers with the story as he could and headed toward New Orleans to spread the news, knowing that most telegraph communications with the south had been cut off due to the war.

The vast majority of the passengers on the ship, during the impending disaster, were newly released men returning north after surviving from two to twenty-four months of sometimes horrific conditions in Confederate prisoner-of-war camps. These men were eagerly anticipating being reunited with their families and returning to civilian life. On her final journey down the river, when stopped at Vicksburg Mississippi, Captain Mason was approached by Lt. Col. Reuben Hatch, the Chief Quartermaster at Vicksburg. At the time, the U.S. government would pay five dollars per enlisted man and ten dollars per officer to any steamboat Captain who

would take a group north. Hatch had offered Mason a proposition; there were thousands of recently released Union prisoners of war that had been held by the Confederacy at the prison camps near Selma, Alabama and Andersonville, Georgia. These men had been brought to a small parole camp outside of Vicksburg to await release to the north. Hatch suggested that if he could guarantee Mason a full load of about 1,400 men, Mason would agree to give Hatch a kickback. After leaving Vicksburg, the Sultana continued downriver to New Orleans. On April 21, 1865, the Sultana headed back north from New Orleans with about seventy cabin and deck passengers, a crew of 85, some livestock and about 100 tons of sugar. When the ship arrived back at Vicksburg, it took on its promised load of newly paroled prisoners. Although Hatch thought, and had told Captain Mason, that he might get as many as 1,400 released union prisoners, an inaccuracy with the parole camp books and a suspicion of bribery from other steamboat Captains to army officials, caused the union officer in charge of the loading, Captain George Williams, to place every man at the parole camp on board the Sultana, a number he believed to be less than 1,500 men. Although the Sultana had a legal capacity of only 376 persons, by the time she left Vicksburg the evening of April 24, she had been severely overloaded with over 2,000 paroled prisoners and guards in addition to the passengers and crew members. The newly freed men were packed into every available space. Despite reinforcement with temporary columns and brace-work, the decks still visibly sagged under the weight. Though it is not believed that Captain Williams ever stood anything to gain monetarily from this decision, nor had he any knowledge of the deal Mason had made with Hatch, it was this decision, born out of suspicion of widespread corruption that ultimately caused the scale of the disaster in terms of lives lost. In addition to the largest single loss of life in U.S maritime history, it is also one of the highest single day, loss of life incidents among U.S. military personnel.

The Sultana tragedy occurred during a time of overwhelming turbulence and upheaval, very recent events included the assassination of Abraham Lincoln, Lee's surrender and the Civil Wars' end. All of these events took place during April 1865 which nearly caused the story to be lost to history.

This course will examine the factors that led to the boiler explosions through eyewitness accounts, testimony to investigators and at trial as well as a description of boiler technology, knowledge, and assumptions of the time, and what we know to be true today. Some popular alternate theories will be included though most have been rebuked.



Sultana at Helena, Arkansas taking on coal after being overloaded with former POWs at Vicksburg, former prisoners is seen on upper deck.

In the mid - 19th century, boiler explosions were still common, but the causes were not yet known. During these times, one in five riverboats would experience a boiler explosion at some point during their service. By 1865, it was generally accepted by boiler operators and Engineers that most boiler explosions were caused by a low boiler water level⁴. In this theory, an insufficient water level in a boiler would allow a boilerplate exposed to the fire to overheat since it could not transfer its heat to the water. It was assumed that when water then contacted the overheated plate, it would rapidly become steam resulting in excessive pressure within the boiler and causing the boiler to explode. This did not explain many explosions however since they had occurred with the boiler at proper water levels, something that was carefully monitored.

It was realized that a rapid increase in steam generation was taking place within the boiler, but Engineers did not yet understand the tremendous energy stored in a boiler, in what form it was stored, or what was causing the sudden steam generation. Some studies of steam properties

were conducted in the, but the first tables of steam properties were not published until later that century.

Robert Thurston who was the first President of the ASME, published "Steam Boiler Explosions, In Theory, and Practice" in 1887. At that time, steam properties were becoming well understood, and steam equipment had become much more predictable. Two critical steam properties that earlier Engineers and boiler operators did not understand were:

- a) Almost all of the energy stored in a hot boiler containing steam is stored as potential energy in the water.
- b) A sudden drop in pressure causes the water to flash into steam. For example, a drop in pressure from 135 PSIG to zero gauge pressure can produce 15% of the water in the boiler as steam.

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Under standard conditions, water is contained in a boiler at a temperature below its boiling point. If the water will also be at a pressure above atmospheric pressure, the boiling point of the water will also increase. In a pressure water boiler, if there is a leak, the temperature of the water will drop due to a leak, the temperature will decrease. Under this condition, the water will flash into steam and the boiler will become over-pressurized, restoring the boiler to a dangerous condition.

If the leak is small and the boiler is designed to contain the pressure while the water or steam slowly leaks out or the boiler is allowed to cool off, and the boiler pressure slowly drops. If the boiler is incapable of containing the pressure, an increasing amount of water flashes to steam and the original breach in the boiler becomes continuously larger; this process is almost instantaneous⁵. In the case of the Sultana, if the pressure in a boiler dropped too rapidly from a reasonable estimate of 135 PSIG to zero gauge pressure, up to 15% of the water in the boiler (approximately 14 cubic feet) would have turned to steam with an increase in the volume of about 1,600 times⁹. This sudden expansion is what had been causing the