



# RMS TITANIC:

THE ACCIDENT, THE INVESTIGATION & COMPARING TO EHS STANDARDS OF TODAY

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In this white paper, Paul Tierney EHS Director at EazySAFE, reviews EHS practices at the White Star Shipping Line. The company who, in April 1912, had one of the most serious accidents ever recorded or written about, with a loss of 1,523 lives. This paper outlines the events surrounding the sinking of the RMS Titanic and an abbreviated version of the subsequent accident investigation undertaken in the US and the UK.

## COMPARING THE EHS STANDARDS AT THE WHITE STAR SHIPPING LINE TO TODAY'S STANDARDS

*As an employer, it is your responsibility to maintain a safe and healthy workplace*

If we look at the history of the White Star Line and the time frame of the accident, the principle of safety, if not health was a foundation of any shipping company, but the implementation of the principle left a lot to be desired.

For 1912, the RMS Titanic was the most sophisticated vessel built, with safety features that no other vessel had before.

Safety features on the RMS Titanic included:

- 5 kilowatt Marconi Wireless Radio (Invented 11 years earlier) - transmitting range 500 miles.
- 4 400 watt electric generators producing 16,000 amps at 100 volts.
- 15 watertight bulkheads, each sealed by electric powered doors, also equipped with electric water sensors and controlled by switches on the bridge. In the event electricity failed, the doors

could be closed manually by pulling a pin and letting gravity close the door.

- 2 bilge keels amidships, 296 feet long that projected 25 inches from the sides of the hull to help prevent a rolling motion at sea.
- Electric lights and heaters in every room (over 10,000 light bulbs).
- 50 telephone switchboard.

### Safe Work Practices

As the RMS Titanic was a brand new ship and one of the largest ships manufactured by any shipping line, it would have been imperative that the new crew were provided with induction training and orientation training to their new workplace.

However, many of the crew joined the ship in Belfast on the morning of its maiden voyage and had little or no more knowledge of the vessel, it's layout, functions and safety features than the passengers who joined the ship. Crew members were continuously getting lost, even without an emergency. Not exactly a safe work practice.

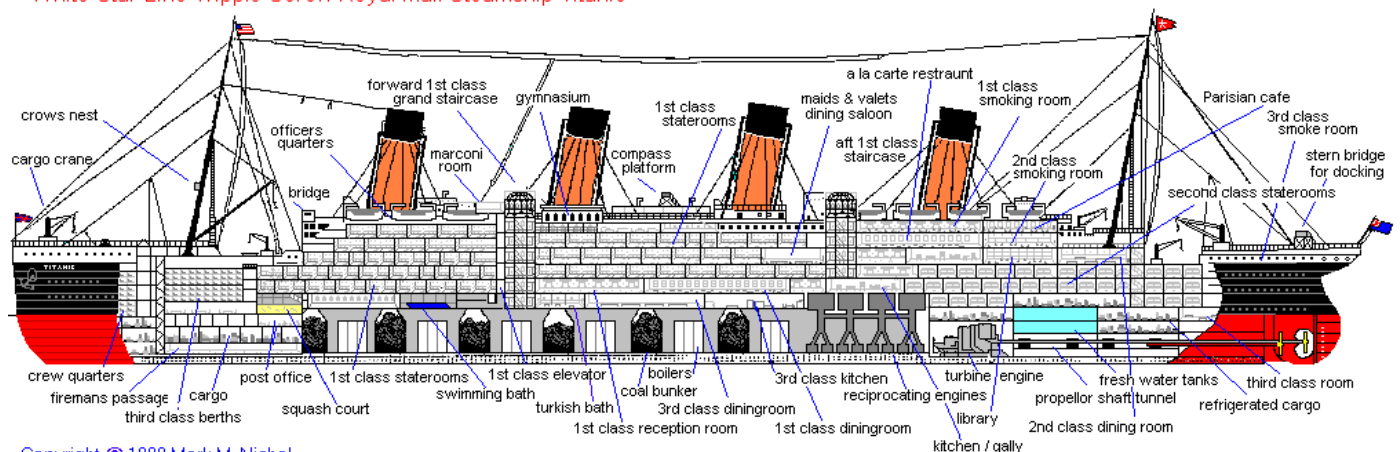
### Health and Safety Statement [Safety Manual]

Recruitment day for the majority of the Titanic's crew involved the loading of the 560 tons of general cargo. Crew members arrived from the Seafarer's Union National Sailors and Firemen Union from Southampton, London, Liverpool and Belfast, Northern Ireland. With the exception of the sign-in log, the new crew of the Titanic were not introduced to any procedural documentation of the new ship. It was not common practice in this era.

### Training

In the shipping business in early 20th century, most

White Star Line Tripple Screw Royal Mail Steamship Titanic



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training in the workplace was completed by the trainee being placed with the competent person and learning by watching and finally doing under supervision. This was referred to as "Sitting with Nellie Training". The problem with this training is that the trainee had a tendency to pick up all the bad habits of the competent person without the years of experience, which in turn increased workplace accidents.

### ***Employee Involvement***

The hierarchical structure of responsibility in the shipping industry in the early 20th century did not allow for any crewmember to bring to the attention of any officer, a complaint or report of a potential problem. He/she would be seen as stepping outside their station and the officer would be unlikely to pay much, if any attention to the issue.

### ***Accident Investigation***

The aim of any accident investigation is to eliminate or at least to severely reduce the risk of future occurrences of similar events and to hopefully learn lessons from them.

Accidents do happen, they seemed to have happened a lot more frequently in the early steam era. There are a lot of reasons beyond carelessness as to why ships came to grief so often. Rocks and reefs were not necessarily accurately charted, and the means of navigation were primitive by today's standards. This may be why paying passengers were willing to forgive the occasional disaster. Maybe they just had a short memory.

The White Star Line had more than its fair share of accidents. In April 1912, the Titanic was lost after an historic iceberg collision. The first White Star ship lost during World War I was Arabic (II), torpedoed off the Old Head of Kinsale Southern Ireland on 19th August 1915 killing 44.

The following November, the last sister ship of the Titanic, HM Hospital Ship Britannic II was lost after striking a mine. She sank in less than 50 minutes with the loss of 21 lives and was the largest vessel sunk in the war. Of the three Olympic class ships, two never completed a commercial voyage.

However, the Titanic's sister ship Olympic, the first of the three to be built, did have a long and successful career and was the only merchant ship in World War I known to have sunk a warship. In 1934, while steaming in a fog, the Olympic accidentally rammed the Nantucket Lightship, sinking it and killing seven of the crew.

Titanic was built in 1911 in Belfast by Harland & Wolff. In 1912, on her maiden voyage she was nudged from her berth by eight tugs, but the wash from her propellers moved a sunken barge 800 metres downstream and the American vessel 'New York' was torn from her moorings, a collision only being avoided by the action of the accompanying tugs.



***Image 3: Titanic at Southampton docks, prior to departure***

She was to sink on her maiden voyage in collision with an iceberg only 90 miles from where the White Star line vessel 'Naronic' had perished nineteen years earlier, again believed to be due to a collision with an iceberg. 1,523 people lost their lives when Titanic sank.

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## **THE RMS TITANIC ACCIDENT**

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### **Saturday 13th April at 10:30**

Captain Smith carried out his daily inspection. During the engine room inspection, Chief Engineer Joseph Bell advised Captain Smith that the fire in Boiler room 6 which had burned for two days had finally been extinguished. The bulkhead, which formed part of the coalbunkers showed some signs of heat damage and a fireman was ordered to rub oil into the damaged areas.

### **Sunday 14th April at 10:30**

Sunday morning in the first-class dining room, Captain Smith presided over Divine Services attended by all classes of passengers and crew.

A lifeboat drill would normally follow this for passengers and crew. For some reason possibly the cold weather, Captain Smith opted not to hold a lifeboat drill that day. He never got another chance to run one. This was very evident when the life boats were launched during the sinking.

#### **Sunday 14th April at 13:40**

On Sunday afternoon the Baltic (a White Star Vessel) reports "large quantities of field ice" about 250 miles ahead of the Titanic. This message was relayed from the Greek Steamer Athonai which had reported passing icebergs and large quantities of field ice at 41 deg 51' N long 49 deg 52' W less than 200 miles ahead of them. Captain Smith passed this message to Bruce Ismay Chairman on the Promenade deck. All these messages were received by 14:00 on Sunday and were passed on to the Captain or his Officers on duty. The last message from the Baltic was passed from Captain Smith to Bruce Ismay.

#### **Sunday April 14th at 18:00**

Captain Smith alters the ship's course slightly to South and West of its normal course, perhaps as a precaution to avoid the ice warned by so many ships. Titanic's course is now South 62 deg West true along the Southwest outward track to the "The Corner" 42deg N 47deg W. where she was to alter course up to 85 deg W true. No order was given to decrease the speed, if anything Titanic's speed was increasing to 22 knots. This was calculated at 75 engine revolutions, the cherub log registered 45 nautical miles every 2 hours which gave the Titanic just under 22 knots of speed. North of this, 250 miles away lay the bergs, growlers and field ice reported by the Cariona.

#### **Sunday 14th April at 19:30**

Phillips and Bride radio operators intercepted 3 messages concerning large icebergs from the Californian indicating that ice is now only 50 miles ahead of the Titanic and the Carpathia. Captain Smith never received the Californian's warnings, because he was in Titanic's first class restaurant at a dinner party hosted by the Windeners.

#### **Sunday 14th April at 21:40**

A heavy ice pack and iceberg warning was received from the Mesaba, Phillips however was preoccupied with private transmissions and the message was overlooked. The warning showed a huge ice field 78 miles long and directly ahead of the Titanic.

#### **Sunday 14th April at 21:45**

The Quartermaster took the sea temperature and it had dropped to ice levels compared with the earlier reading at 6 p.m.

#### **Sunday 14th April at 22:00**

Charles Lightoller is relieved by First Officer William Murdoch who came on deck with a scarf and overcoat, working his arms across his body. He stated it's pretty cold. By this time the thermometer had fallen to 32 deg.

Second Officer Lightoller handed over the course to 1st Officer Murdoch and informed him that the Commander had been on deck and asked to be called if there was anything doubtful.

#### **Sunday 14th April at 23:00**

The Californian wireless operator shut down his set for the night and went to bed. The Californian was not big enough vessel to justify running the wireless set for 24 hours a day. At this point, 24 of the 29 boilers were fired and the Titanic was now running at over 22 knots, the highest speed she had ever achieved.

The night of the 14th was uncommonly clear and dark, moonless but faintly glowing with an incredible sky full of stars. The sea was likewise; unusually calm and flat "like glass" stated many of the survivors. The lack of waves made it more difficult to spot icebergs, since there was no tell-tale white water breaking at the edges of the bergs.

The binoculars normally stowed in the crow's nest were missing on the night of the 14th due to a last minute shift of Officer's assignments and positions. A sailor called David Blair forgot to leave behind a key as the Titanic set off on its maiden voyage. Without it, his shipmates were unable to open a locker in the crow's nest containing a pair of binoculars for the designated lookout.

#### **Sunday 14th April at 23:30**

Lookouts Fredrick Fleet and Reginald Lee noted a slight haze appearing directly ahead.

#### **Sunday 14th April at 23:40**

Fleet in the crow's nest saw a large dark iceberg dead ahead 90 feet/27.43m high half a mile dead ahead and gave the ships bell the three traditional rings indicating an object ahead and also signalled the bridge informing them of the berg ahead.

Sixth Officer James Moody acknowledged the signal stated thank you and relayed the message to the First Officer William Murdoch. He instinctively ordered hard a starboard to the Quartermaster tending the ships wheel, at the same time he telegraphs the engine room to stop all engines, followed by full astern. He also electronically closed the watertight doors.

Titanic slowly begins to veer to port but the distance to the iceberg and the speed of the Titanic proved too much of a problem.

Trials on the Olympic showed it would take 3 minutes 15 seconds to take all the way off from 74 revolutions at full steam, during which time she would travel over 3000 feet or a ½ a nautical mile.

### **Sunday 14th April at 23:40 & 37 seconds**

An underwater spar from the berg scraps and bumps along the starboard side forward. The impact tore 6 thin breaches spread out along a 35 metre (110 feet) section of the hull with a total surface area about of about 1 square metre (12 square feet). The ruptures punctured six watertight compartments and were spread strategically along the riveted seams.

The flooding through the hull started by flooding the coal bunker servicing the number 9 stokehold.

### **Sunday 14th April at 23:55**

15 minutes after the collision, the port office on G deck forward was already flooding. After a quick inspection of the damage by Chief Officer Henry Wide, Fourth Officer Joseph Boxhall and designer Thomas Andrew's Jr., they informed Captain Smith that the Titanic was sinking and that 2,200 people on board were in extreme peril. Captain Smith took the Titanic's position, worked out by Fourth Officer Boxhall as 41 degrees 46 feet North, 50 degrees 14 feet west, approximately 153 km (95 miles) south of the Grand Banks of Newfoundland to the wireless room operator. Handing the paper to Phillips shortly after midnight, he ordered a call for assistance. Phillips taps out the regulation distress signal CQD...MGY...CQD...MGY. The last distress signal keyed by John G. Phillips using a Marconi spark transmitter.

*CQD CQD SOS SOS CQD DE MGY MGY*

- **CQD** – was the common international distress signal.
- **SOS** – was the newer distress signal, only the 4th vessel to use it.
- **DE** – was the international code meaning “from”.
- **MGY** – was the Titanic's call signal.

The position in the CQD message that Cottam received was worked up by Titanic's fourth officer Joseph Boxhall. As it turned out, the position was about 13 miles to the west of the Titanic wreck site which was first discovered 73 years after the tragic

event. But Boxhall's position was not the position sent in the first set of distress messages from Titanic that night. Ten minutes earlier, at 22:25 New York time, Mount Temple's wireless operator John Durrant picked up a CQD from Jack Phillips which he handed to his ship's master Capt. James Henry Moore. The message given to Moore read: Titanic sends C. Q. D. Requires assistance. Position 41° 44' north, longitude 50° 24' west. Come at once, Iceberg.

Capt. Moore prepared to take action. “Before we had laid the course off he received another position, which read 41° 46' north, 50° 14' west; so that was 10 miles farther to the eastward, and it was that position that he laid my course for.”

The position in the first message that Moore received, latitude 41° 44' north, longitude 50° 24' west, was some 7 miles further to the west of the Boxhall CQD location, or little over 20 miles west of the wreck site. This initial position, which is attributed to Capt. Smith, was being sent out by Phillips for almost 10 minutes before Boxhall's revised position was sent out. In addition to the Mount Temple, it was also picked up by other ships in the North Atlantic including La Provence, Frankfurt, and Ypiranga, and by the land station at Cape Race.



**Image 5: RMS Titanic Wreck**

One of the long standing mysteries surrounding Titanic was why were these two CQD positions so far west of the wreck site? How could this have come about?

There has been much speculation over the years since the discovery of the wreck to explain these

positions. Some of these explanations are quite imaginative, almost bordering on the absurd. In 2002, Captain L. Marmaduke Collins suggested that Boxhall's CQD position was correct, but it was the submerged hulk of the Titanic, still holding some buoyancy from trapped air inside, that was carried by strong underwater currents until it came to rest several miles to the east from the CQD position. Capt. Collins also believes Titanic did not strike an iceberg, but instead struck a patch of pack ice. He also believes that the ship later broke in two while on the bottom of the Atlantic from a 7.2 magnitude earthquake centered about 100 miles from the wreck site on November 18, 1929.

More recently, David G. Brown put forth the idea that an undocumented course change took place to avoid ice at 23:30 which put the Titanic on a heading that connected the two CQD positions that were later sent out. He also stated that "misdirections like Boxhall's claim of a late turn at the corner" effectively hid this 23:30 course change from researchers and historians for nearly a century. His article suggested that there was great confusion caused by the way clock adjustments were made on Titanic, confusion that has hidden the true time of the accident from researchers until his paper was published.

Brown also suggested that fourth officer Boxhall may have misunderstood what Captain Smith had done when he was asked to work up Titanic's distress position. According to Brown, Captain Smith sent out a projected position for the ship that marked the beginning of April 15 on Titanic in that initial CQD message. Brown refers to that position as the ship's projected "civil midnight" position, and corresponded to when midnight would occur on clocks that were set back 47 minutes, the expected clock adjustment that was to take place that night.

In Brown's scenario, this planned 47 minute adjustment had not taken place. However, he asserts that clocks used by the crew had gone back 24 minutes, half the total planned adjustment time, well before the accident happened. He then states that the reported time of the accident, 20 minutes to 12, was the time on the clocks used by the crew, and the real time of the accident was 4 minutes past twelve on unadjusted clocks still set for April 14. According to Brown's theory, Boxhall assumed that he was being asked by Captain Smith to simply move the initial CQD position back along the line that the ship was heading following that undocumented course change by 20 minutes of steaming at 22 knots. He even goes so far to suggest that Boxhall either did not compute or did

not use the 7:30 p.m. celestial sights taken earlier by second officer Lightoller and third officer Pitman in working up any of the ship's positions after that time.

#### Interesting Facts:

- To avoid panic the musicians on board were told to play light and cheerful music on deck. They played until the last lifeboat left the ship. None of the musicians survived.
- A millionaire called Benjamin Gugenheim and his servant took off their life vests, put on their tails and sent a message to Gugenheim's wife: "Dressed for a party we go down like gentlemen".
- A few years after the accident it was known that many third class passengers were locked up when the ship started to sink.
- There is contradictory evidence about the degree of physical restraint used to keep Steerage passengers from getting to the lifeboats. In addition to the reports of gates being locked and passageways blocked by armed guards, testimony by at least one steerage passenger indicated there was no such restraint.
- Annie Kelly, an Irish steerage passenger, said that the stewards not only did not wake the steerage passengers with an alarm but told alarmed third class passenger who came up to the deck to go back down as there was no danger.
- Colonel Archibald Gracie testified at the American inquiry that a "mass of humanity" from steerage poured up onto the boat deck only after all the lifeboats had gone.

#### **Sunday 14th April at 23:55**

Ernest Gill donkeyman on the stalled Californian [20 miles from the Titanic] briefly saw the lights of a nearby ship while working on deck.

Monday 15th April between 00:10 and 01:50 several crewmembers of the Leyland liner Californian saw what they thought to be a tramp steamer's lights. Rockets were also observed, but no great concern was applied to them. The radio operator in the Californian was off duty and asleep and did not receive the Titanic's distress signals; many others who did hear were on their way to help but were too far away to reach the vessel before the Titanic sank.

The Californian was only approximately 20 miles away but unaware of the disaster. The nearest other vessels were the Perisian 50 miles away at 22:25 and the Mount Temple also 50 miles away at 22:25 but



at a higher latitude. Both these vessels were west of the Titanic's recorded position and on the other side of the large ice field. To travel south beneath the ice field and then north to the Titanic would be a distance of 70 to 100 miles. Outside of this were the Birma 70 miles at 23.55 and the Frankfort at 140 miles at 22:40 both way south of the wrong side of the ice field. All vessels set underway to assist.

#### **Monday 15th April at 00:30**

Ernest Gill donkeyman while on watch on the Californian saw two rockets from the same direction he had seen the lights earlier on. The Californian was sitting on flat calm near freezing water 18 miles away but with superrefraction may have appeared nearer. Rockets were fired from the Titanic in a random fashion but in order to signify an emergency should have been fired at one minute intervals.

The Carpathia was 58 miles away at 22:45 South east of the Titanic's position, but on the same side of the ice field. She was under the Command by Captain Arthur Rostron and would take over 4 hours to reach the Titanic, which would give her an arrival time of about 03:00. At 00:25 Captain Smith gave the order to start loading the lifeboats with women and children. Second Officer Lightoller and First Officer Murdoch followed this order to the letter.

Supervising the lowering of the lifeboats were Captain Smith and Chief Officer Henry Wilde who at one point assisted in the loading. First Officer William Murdoch, assisted by Fifth Officer Harold Lowe, assumed the task of lowering the starboard lifeboats. The Second Officer Herbert Lightoller took charge of the port side boats assisted by sixth Officer James Moody. The assisting officers changed sides at some point during the launching. Many passengers, sailors, stewards and firemen assisted in the loading and launching of various lifeboats.

#### **Monday 15th April at 00:45**

10 minutes after Captain Smith's order to start loading the lifeboats, the starboard lifeboat No. 7 was safely lowered away with only 28 people, while its capacity was 65. At about this time the first distress signal rocket was fired by Quartermaster George Rowe under the direction of Fourth Officer Joseph Boxhall. These rockets soar 800 feet into the air and explode into 12 brilliant white stars, accompanied by a loud bang. It was undoubtedly one of these distress rockets, which were seen by the crew on duty on board the Californian, unfortunately they did not understand the significance of the rockets thinking they were part of some celebrations. Fourth Officer Joseph Boxhall reported seeing a vessel approach the Titanic's

position in the illumination of the rocket and attempted to contact her via Morse lamp, but she disappeared. It was reported that this mystery ship was the Samson, however according to her logs she was nowhere near the crash site. Other reports stated that she was an illegal fishing vessel, but these were never proven.

#### **Monday 15th April at 01:15**

Water had reached Titanic's name on the bow and she was now listing to port. By this time 7 boats had been launched, but with far fewer occupants than their rated capacity. There were a number of reasons for this, families did not want to be separated, passengers still felt the ship was unsinkable, passengers felt the whole procedure was silly in the dark and cold, passengers were overseeing the filling of boats themselves and were worried about the boats being too crowded, fear of the 65 foot drop from boat deck to the sea, 3rd class passengers would not board without their only belongings.

#### **Monday 15th April at 01:20**

The tilt of the deck grew steeper and the boats then began to fill up with the starboard No. 9 lowered with 56 people aboard out of a capacity of 65. The Titanic had now developed a noticeable list to starboard.

#### **Monday 15th April at 01:30**

Signs of panic had started to appear as port side No. 14 boat was lowered with 60 people including Fifth Officer Harold Lowe on board. Officer Lowe was forced to fire three shots from his side arm along the ship's side to keep a group of unruly passengers from jumping into the already full boat.

#### **Monday 15th April at 01:40**

Wireless distress calls tapped out by operator Phillips reached desperation status with messages such as "We are sinking fast" and "Cannot last much longer". At this point most of the forward boats had been launched and passengers began to move to the stern area. President of the White Star Line John Bruce Ismay leaves the Titanic on collapsible "C" with 39 persons on board, the last starboard boat to be launched. The forward Well deck was now awash with water at this point.

#### **Monday 15th April at 02:00**

The sea was only 10 feet below the Promenade deck with more than 1,500 still on board and just 47 places available in collapsible "D". Second Officer Lightoller instructed the crewmember still on board to lock arms and form a circle around the last boat, permitting only women and children to pass through the circle.

**Monday 15th April at 02:05**

Collapsible "D" was lowered to the sea with 44 people out of a rated capacity of 47. The sea was pouring on to the forward end of "A" deck and Titanic's tilt grew steeper. With all boats lowered, Captain Smith went to the wireless cabin and released Phillips and Bride informing them they had "done their duty". On his return to the bridge, Captain Smith informed the remaining crew members "Its every man for himself" The stern began to lift clear of the water and passengers and crew moved further aft. The lifeboat capacity was 1,200 but in total had 500 empty seats.

**Monday 15th April at 02:17**

Titanic's bow plunged under while passengers and crew gathered in the aft end of the boat deck. Ida and Isidor Straus drowned side by side in the disaster after she refused a place on a lifeboat to remain with her husband. Witnesses stated the couple sat on deck chairs and held hands when they were washed into the sea as the Titanic sank. Mr Straus, 63, was a businessman who owned the Macy's department store in New York. He and his family were returning to America following a holiday in Europe. At first Mrs Straus, 63, joined Mrs Bird in lifeboat eight before getting out to be with her husband, reportedly saying: "We have lived together for many years. Where you go, I go." Her body was never recovered.



*Image 8: Isidor and Ida Straus*

**Monday 15th April at 02:18**

A large roar was heard as the entire movable objects inside the Titanic crash towards the submerged bow. The lights blink once and then they go out. This left Titanic visible to those in the boats and the sea as a black silhouette against the starlit sky. The vessel then split apart on the surface between the 3rd and 4th funnels. The ship achieved a completely perpendicular position for several minutes.

**Monday 15th April at 02:20**

She settled back slightly and slides under the surface heading for the bed of the North Atlantic 13,000 feet below, two and a half hours after hitting the iceberg. She dumped over 1,500 people into the freezing Atlantic. Sea temperature was close to zero, males were more at risk of hypothermia than females due to more body fat. Swimming in very cold water causes increased blood flow and a person loses heat faster.

**Monday 15th April at 03:30**

The Cunard liner Carpathia's rockets were sighted by those people in the lifeboats.

**Monday 15th April at 04:10**

Titanic's No.2 lifeboat was the first to be picked up.

**Monday 15th April at 05:30**

After being advised by the Frankfort of the Titanic's loss, the Californian made for the disaster site 20 miles away and arrived at about 08:30 just as the last boat No.12 was rescued by the Carpathia. Second Officer Charles Lightoller was the last survivor to board the Carpathia. After all the survivors were aboard, the Carpathia's crew cast boats 4, 14, 15, C and D adrift. Seven of the Titanic's boats were attached to Carpathia's davits and 6 more were stowed on the forecastle. The Carpathia took thirteen boats in all to New York.

**Monday 15th April at 08:50**

The Carpathia left the searching for survivors to the other ships, which had arrived in the area and headed for New York. She carried 705 survivors. An estimated 1,203 to 1,523 souls were lost. Figures vary from the various reports. Bruce Ismay sent a message from the Carpathia to the White Star Lines New York's Office as soon as they were within range stating "Deeply regret to advise you Titanic sank this morning after collision with iceberg, resulting in serious loss of life, Full particular's later"

**Thursday, 18th April at 20:00**

It was a cold, dark, rainy evening in New York as the Carpathia made her way to port with the Titanic's 705 survivors on board. She was greeted by up to



"All the News That's Fit to Print."

# The New York Times.

NEW YORK, MONDAY, APRIL 15, ONE-TWENTY-FOUR FIFTH.

ONE COPY **THREE CENTS** ADVANCE.

THE WEATHER.

Forecast: Partly cloudy; temperature, 60 to 65.

## TITANIC SINKS FOUR HOURS AFTER HITTING ICEBERG; 866 RESCUED BY CARPATHIA, PROBABLY 1250 PERISH; ISMA SAFE, MRS. ASTOR MAYBE, NOTED NAMES MISSING

Col. Astor and Bride, Elder Sturges and Wife, and Maj. Butcher.

"RULE OF SEA" FOLLOWED

RENDERED DEADEN FOR ONE HOUR AND FORTY MINUTES TO BE SAFE ON CARPATHIA.

PECKED UP AFTER 8 HOURS

Visited Elder Calk of White Star Office for News of His Father and Lillian Sturges.

FRANKLIN HOSPITAL, ALL DAY

Manager of the Life Insured Trusts was Invaluable Even After His Fall From Tower.

HEAD OF THE LIFE ASSOCIATION

At Head Office, Making Plans for the Ship's Fate.

THE SHIPWRECK

The shipwreck of the Titanic, the largest liner ever built, was a disaster of unprecedented magnitude.

The ship was built to be invulnerable and was equipped with the latest in safety devices.

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The Lost Titanic Being Towed Out of Belfast Harbor.

### PARTIAL LIST OF THE SAVED.

Included: Dr. James, Mrs. Wilson, Mrs. H. B. Smith, and an incomplete name, suggestive of Mrs. Astor.

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CAPT. E. S. SMITH, Captain of the Carpathia.

Biggest Liner Plunges to the Bottom at 2:20 A.M.

RESCUERS THERE TWO LATE

Expected to Pick Up the Two-Ten Thousand Who Were in the Lifeboats.

WOMEN AND CHILDREN FIRST

Considered Carpathia's Mission to Save First the Women.

SEA SEARCH FOR OTHERS

The Carpathia's Mission was to Save the Women and Children.

SEARCHING THERE TWO LATE

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The Carpathia's Mission was to Save the Women and Children.

# RMS TITANIC ACCIDENT INVESTIGATION

These were the findings based on the initial investigations, but based on the eye witness statements given in the U.S. Senate Hearings in April/May 1912, and the British Board of Trade Wreck Commission Hearing in June/July 1912, also the knowledge of Maritime Safe Operations in the avoidance of objects dead ahead, the following findings may be more accurate as to the real fate of the R.M.S. Titanic.

There are serious problems with the suggestion that the Titanic sideswiped its starboard bow on the iceberg while turning left away from the danger. A starboard bow sideswipe collision, while turning left was impossible for a conventional

ship in 1912 as it is today. This is because of the location of the pivot point (located on its centreline roughly one-third aft from the bow). The vessel rotates around this point, when its rudder is put over as was suggested. Because the pivot point is not amidships, but is offset towards the bow, the vessels stern (back) swings a larger arc than the bow. Turning only to the port to avoid a close-aboard object, swings the vessels stern towards that object even though the vessels bow points clear. A side-on impact cannot be avoided. The object in question (iceberg) would then bump and grind along the side of the ship, causing damage along the entire length of the hull from the initial point of impact to the stern.

Ice and metal should have met roughly in the area of the bulkhead between boiler rooms number 5&6. In reality, this is about the location on the hull where damage from the hull ended. It would have continued aft into boiler rooms number 4, 3, 2, & 1 and the two engine rooms. Compartments of boiler room number 5 would have remained undamaged and free of water. Titanic still would have foundered, but stern first. The pattern of damage to be expected during a left turn collision is exactly the opposite of what actually occurred. The left hand turn only scenario would have caused damage to the majority of the 16 primary watertight compartments. The truth is Titanic did not receive ice damage aft of Boiler room number 5, which was approximately below the bridge. This is proof that the Titanic was turning to the port (left) at the time of the accident, turning towards the iceberg. First Officer William Murdoch was 39 years of age, and very experienced at sea, having been transferred from the R.M.S. Olympic, where he served as First Officer. He would have been very aware of the consequences of a turn to starboard only, and he would also be very familiar with the correct manoeuvre for dodging an obstacle dead ahead as would every other experienced mariner.

The correct manoeuvre would have been to first turn the bow away from the object (Port), then the helm is shifted (turned the other way) to starboard to help clear the stern of the object. This manoeuvre would not have caused any ice damage aft of boiler room number 5, which is what occurred. In truth the Titanic's bow was clear of the iceberg (over water) until First Officer Murdoch executed his second turn to starboard back towards the berg to help clear the vessels stern, which would have by now being sliding dangerously close to the berg. The timing of First Officers Murdock's second turn to starboard was critical. He may have started his second turn a little too soon and the bow came a few yards too close to the berg, or

he may not have had sufficient distance between the vessel and the berg to execute the manoeuvre safely. This is one question we will never be in a position to answer. Remember the ice berg was also moving.

The second problem with the original story told to the British Board of Trade Inquiry is the report made by 4th Officer Joseph Boxhall (28 years of age) that 1st Officer Murdoch changed the orders to the two outboard propellers from Ahead Full to Astern Full [Reverse] requesting what is known as a crash stop. This is a violent manoeuvre that can seriously damage the ship's engines, drive shaft and propellers and is used only in the worst emergencies. Reverse thrust from the propellers would have eliminated the ability of the single rudder to steer the vessel. Under full reverse power the ship could not have pivoted to the right and would have begun a sideways slide into the iceberg. An experienced officer such as 1st Officer Murdoch would have been very aware of this.

A command to close the dampers came just prior to impact, when Titanic was perhaps 100 feet from the iceberg. Closing the dampers, on the furnaces was an ordinary precaution to reduce the fires to prevent generating excess steam pressure, while the engineers stopped the engines. Closing the dampers is yet another indication that a crash stop was never performed? Full reverse power would have required as much steam as possible from the boilers. Shutting the dampers would have been the worst possible thing to do during a crash stop. Titanic's engines and associated drive shafts and propeller blades were designed to withstand an instant shift from forward to reverse at harbour speeds only [3-5 knots]. It would be very unusual for them to withstand the strain of instant reversal at 22.5 knots. The consequence of this type of sudden reversal would be a rumbling shudder to convulse through the ship, causing the stern to jump up and down. Many people would have been knocked off their feet, or out of their bunks, resulting in scores of injuries and the possibility of a few people being killed outright as the steel bow collapsed around them. They certainly would not have slept through it as the reports from survivors stated. Since none of the Titanic's survivors described such a memorable event, and because the firebox dampers were ordered shut, the engineers could not have performed a crash stop. They just closed the throttles to the engines to stop them from pushing the vessel forward. Titanic was "shooting" or coasting forward without power when it made contact with the berg.

The final impact with the iceberg was not to the side of the ship as first reported but to the fragile

underbelly, which scraped across an underwater shelf called an “ice-ram”. Most people are aware that the majority of an iceberg lies beneath the water. It therefore appears that the Titanic’s accident was grounding not a collision as thought. Titanic did not run into an iceberg, it ran over it.

Survivors unanimously describe the sound and vibration of a ship running aground. There was no sharp jolt of a ship slamming horizontally into an immovable object. The result of the actual accident was a slight tremble, barely enough to rattle silverware set out for breakfast on the First Class dining saloon. A head on collision with the iceberg would have sent all of Titanic’s 52,310 displacement tons smashing into the ice at a speed of 21/22 knots or 36 feet per second. In a crunch of a head-on impact, the ships speed would have effectively dropped to zero. Everything inside the bow that was not tied down would have continued moving at 22 knots. The theory of multiple impacts along the side does not fit the experiences described by the Survivors. Each impulse and rebound would have whipped sideways beneath the feet of the passengers and crew. This is not the type of impact anyone reported. The universal description of the accident was a rumbling or vibration, not side-to-side motion of the deck.

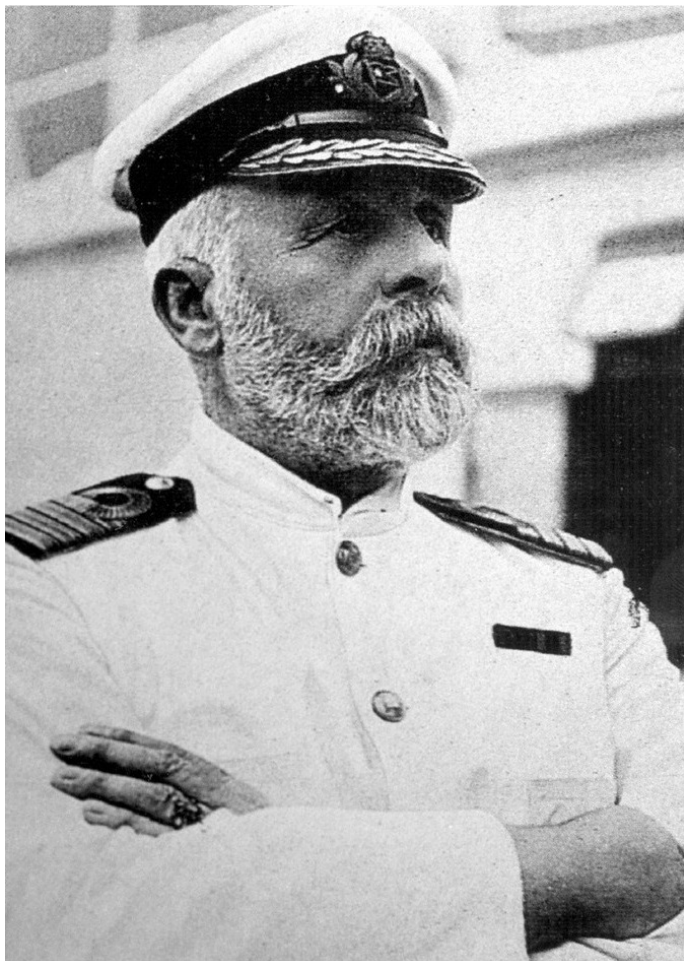
Reference was made to the mini-avalanche of ice from the berg to the forward end of the well deck. This was due to the brushing of the vessel off the top of the berg. The reason for this is that icebergs are notoriously unstable; the upper part extending into the atmosphere melts at a different rate from the underwater portions. The Titanic spent seven seconds grinding across the top of an underwater ice shelf. Due to the additional weight of the ship, the centre of gravity shifted and the berg rolled slightly forward brushing against the upper part of the vessel. Ice above the berg’s waterline can be relatively soft and often crumble upon impact. Crumbling produced the broken pieces of ice littered on the ships forward well deck.

Fatal damage did not necessarily mean sudden death for the Titanic. There is evidence from the ships Chief Engineer that the pumps were successful in slowing the flooding of boiler room number 6 during the first 10 minutes after the accident. Pumping definitely was able to keep even with the inrush of water to boiler room number 5. This is not to suggest that the ship would have floated indefinitely, only that Titanic might have floated as long as there was bunker coal to keep its pumps running. The ship could not founder until boiler room number 6 was lost. This does not appear to have been imminent as late as 11.50 pm thanks to the pumping operation

### **So why did it sink?**

Bruce Ismay [Chairman of the White Star Line] and Captain Smith made assumptions on scanty information based on 4th Officer Boxhall’s visit to the third class births and information about the extent of the damage to the vessel and the ability of the pumps to cope with the flooding. This scanty information was as a result of confusion during the first 10 minutes after the impact and the flooding. Titanic was more seriously damaged than its two commanders assumed, when they started it moving under its own power again. They did not wait the additional 15 minutes, while the man who supervised the building of the ship at Harland & Wolfe, Thomas Andrews Jr., to make a full damage inspection. The instruction was ahead slow for 10 minutes underway for Halifax in Nova Scotia, which was closer than New York. Quartermaster Hitchens was told to steady up on the ships heading of just east of north. Hitchens was kept at the wheel for up to 40 minutes.

Captain Smith left the bridge for the wireless office, which was very unusual for any Captain to leave the command centre of a damaged vessel. The relief Quartermaster Oliver who was on an errand



**Image 11: Captain Edward J. Smith**



taking a note to Chief Engineer Bell would normally do this. The Captain sent a message to the White Star Office in New York, stating that the Titanic had struck an iceberg, that everyone was safe and they were steaming for Halifax. The Virginian reported the message to the White Star Office in Boston via a Canadian ground station. From Boston it went by land telegraph to the Company's New York office. Carpenter Hutchinson rushed into the bridge, only to find Captain Smith had departed for the Marconi room. He had a short conversation with 4th Officer Boxhall, unfortunately the engine room telegraphs were clanging during the conversation and the message that the mailroom was flooding may not have gotten through.

While the Captain was in the Marconi office, Bruce Ismay owner of the White Star Line went to the engine room to confer with Chief Engineer Bell. He was informed the ship was seriously damaged, but was satisfied that the pumps would keep her afloat. The 10-inch pump line was enough to handle water spurting through the two foot of open seam in boiler room number 5. Confidence in the pumps that night was based on their performance during the quiet moments after the accident, prior to steaming again at 11.50pm. Titanic's pumps and bulkheads were a doing a good job of controlling the flooding; basically the ship was floating on its pumps. Ten minutes after the ship got under way for Halifax, the same pumps were being overwhelmed in boiler room number 6. The Titanic's pumps were being swamped by massive amounts of water forced into the ship by its own forward motion. Water surged to 8 feet deep in boiler room number 6 within a few minutes of the engines turning again.

Thomas Andrews Jr., Titanic's builder would have known the situation was precarious from his personal tour of the bow after impact. The fact that the ship started to move again under its own power, before being thoroughly sounded for damage may have been the reason for his re-appearance on the bridge. We can only assume he attempted to convince Captain Smith to stop the engines. While he was on the bridge in discussion with the Captain, 4th Officer Boxhall came up the stairway to announce that the mailroom was fast flooding with water. When Captain Smith, Andrews, Chief Officer Wilde and the carpenter left the bridge to investigate at the stroke of midnight, the Titanic was still steaming ahead slowly under her own power. The inspection by the 4 of the bow area was short, after the Chief Officer spoke to Samuel S Hemming Seaman and Frederick Clench Seaman, they both made reference to air escaping from the

fore pack tank, she is making water as is rushes through. Both seamen reported this to the U.S. Senate Hearing on April 25th 1912. It was obvious to all at this point that the Titanic was sinking. The Captain ordered stop all engines, and at that point Andrews gave the ship an hour to live, she lasted two.



**Image 12: Partially flooded with ice-cold seawater, Titanic's Collapsible Boat D approaches RMS Carpathia at 7:15 am. on 15 April 1912.**

## Lifeboats

1. Perhaps by custom rather than White Star Line policy, lifeboats were the luxury of the First Class. Half the lifeboats, and all of the first six launched, contained only passengers from First Class, plus crew members to do the work.
2. The total capacity of the combined total of lifeboats was rated at 1,178.
3. All of these early launched "First Class" lifeboats were notorious for being launched at less than half capacity. Two of the earliest launched lifeboats, 7 and 1, had more men than women aboard.
4. It did make a difference whether a passenger was on the port or starboard side of the ship, since the crew loading passengers on the port side did refuse to allow men to board.
5. Especially early on, many if not most First and Second Class passengers believed that boarding a lifeboat was not wise or necessary and that the safer option would be to stay aboard the world's largest most luxurious lifeboat, the Titanic itself. Dr. Washington Dodge reported that until the sixth or seventh lifeboat was launched (by which time no Second or Third Class passengers had been put aboard), there was no general awareness that the Titanic would sink. However, evidence is clear that the

chief officers of the Titanic knew before the first lifeboat was launched that the Titanic would sink, but did not take measures to ensure that all boats were adequately filled.

6. Since the total of women (both passengers and crew) and children aboard added up to about half of the total lifeboat capacity, if any planning had been made and guidance given to the crew who were loading passengers, as many men as women and children should have been allowed to board those lifeboats, and without a doubt more men and women would have been saved. However, because of naval traditions, social customs, and the fear and panic present in the emergency, this was not a time for reasoned judgments.
7. Access was an issue. Only First Class passengers were allowed on the First Class deck. Lawrence Beesley, a surviving Second Class passenger, reported that several women in Second Class were turned away when they tried to enter the part of the deck reserved for First Class where half the lifeboats were located. Later, however, First Class passengers found their way to the lifeboats not located on the First Class deck.
8. Although lifeboat 4 picked up six or eight passengers from the water and D hauled in at least one man before they distanced themselves from the ship, the only lifeboat to go back to try to rescue people after the Titanic went under was 14, not a "First Class" lifeboat. It was only able to pick up three or four passengers from the water.

The decision to allow so many lifeboats to be launched at less than half capacity when it was known that the Titanic would sink in a matter of hours rested with Captain Smith. Some have charged it was his indecision, not decision that cost so many lives.

#### **Contributing factors to the Titanic Accident:**

- Vessel steaming too fast in dangerous icy waters.
- Not enough lifeboat space for all passengers and crew.
- Californian radio officer missed the distress signal due to being off duty with the set closed down.
- No lifeboat drills carried out on the Titanic.
- Poor standard of sea trials carried out on the Titanic before her maiden voyage.
- Binoculars were missing from the crow's nest, no additional lookouts at full speed in the dark in

the North Atlantic.

- Ice warning radio messages ignored by the Captain of the Titanic.
- Ice warning radio messages not given priority by the wireless operators and not all sent to the bridge.
- Male family members separated from their spouses and children during the loading of the lifeboats.
- Difficulty in informing 3rd class passengers of the seriousness of the emergency, due to location at both ends of the vessel at lower decks. No direct route to the boat deck in an emergency.
- Lifeboats allowed to be launched with, at times less than half their capacity.
- Lifeboats not returning for people in the icy water when they were only half full.
- Watertight bulkheads did not go up high enough to provide a complete seal and prevent water from flowing over when full.
- The steel and rivets used in the manufacture of the vessel had poor resistance to impact and was brittle due to the ice cold water reacting with the manganese sulphate and excess slag used in the chemical make-up of the steel.
- No defined and written procedures on the duties of the various responsible persons on board the vessel in the event of having to abandoning the vessel in an emergency.
- Moving the vessel under her own power after a collision with the iceberg, before determining if it was safe to do so.
- No person at the White Star Line or at Harland & Wolff ever said the R.M.S Titanic was unsinkable, but the only way to account for the excessive speed in dangerous waters, ignoring ongoing ice warnings, removal of the additional lifeboats so as to prevent clutter on the boat deck, and moving a vessel as damaged as the Titanic would suggest that the Senior Management of White Star Line and the Captain of the Titanic believed some of the popular newspaper fiction or else they were just negligent in their duties and responsibilities.

#### **Identifying Risk Control Measures from Investigation:**

Just over one month after the Titanic struck an iceberg late on April 14, 1912, the U.S. Navy dispatched the cruiser USS Birmingham to begin preliminary ice patrols of the North Atlantic, near

where the wrecked ocean liner lay. By January 1914 an international conference produced the first of several conventions for the Safety of Life at Sea (SOLAS), dictating safety standards for mariners. Included in the 1914 convention was the requirement that ships carry enough lifeboats to accommodate all passengers and crew on board, a precaution that was not taken for the Titanic's voyage.

Those changes, along with the advent of superior technologies for navigation and communication, have made the seas much safer since 1912. As such, it is unlikely that the specific circumstances leading to the sinking of the Titanic will recur. But the ocean remains an unpredictable place, fraught with hazards.

### **Ice patrols from sea and sky**

The first SOLAS convention addressed the proximate cause of the Titanic disaster: the danger of icebergs near the Grand Banks off the Newfoundland coast. The international agreement called for regular ice patrols, funded by a consortium of seafaring nations and carried out by the U.S. Those patrols, which continue today, have kept watch on the icebergs floating over the underwater plateau of the Banks, where transatlantic shipping routes cross the path of icebergs drifting down from Greenland.

### **Outdated Standards and Requirements**

The Titanic only was supplied with enough life boats and life jackets for half of its maximum number of passengers. The Board of Trade had no safety regulations in place for a ship of that size. The only requirement in place was the 1894 Merchant Shipping Act, which required that the number of lifeboats be in direct proportion with the ship's gross tonnage. That rule may have sufficed, but the act only provided calculations for ships up to 10,000 tons, in which 16 life boats were required. Titanic was more than four times that size, some 46,000 tons, and carried only 20 lifeboats.

### **Lack of Training**

The 20 lifeboats were not used to full capacity. At least four lifeboats were filled at 50 percent capacity or less. One lifeboat that could carry 40 people only had 12 passengers. The lifeboat drill that was scheduled to take place the day the Titanic hit the iceberg was cancelled by Captain Edward J. Smith. There is speculation that the training could have impacted the outcome of the

emergency escape, potentially saving more lives.

### **Adequate Tools and Protection**

The ship was short on safety equipment. Some of the officers on the bridge did not have binoculars or search lights. This fact, among many others, may have contributed to the officers only having 37 seconds to react before they hit the iceberg. Each minute gained potentially could have saved hundreds more lives.

### **Emergency Backup**

There was another ship, the Californian, within 20 miles of the Titanic, and its crew saw flares and intercepted emergency response requests. During investigations after the Titanic sinking, a U.S. Senate subcommittee and the British Board of Trade both concluded that the Californian could have rescued some of the 700 people who were left floating in the water for three and a half hours before the Carpathia made it to that location to rescue survivors.

Over the years, people have speculated about why the captain of the Californian decided not to respond to the distress calls. Some say he didn't realise the seriousness of the situation or that there was a miscommunication, while others claim it was negligence. What is clear is that rather than issue the order to respond, the captain of the Californian went to bed. In response to this, vessel emergency response plans were implemented by governing agencies in the United States and the United Kingdom. These plans include, but are not limited to, required training and emergency response from nearby vessels.

### **Agencies Formed and Protocol Set**

The first International Convention for the Safety of Life at Sea (SOLAS) convened Nov. 12, 1913 in response to the Titanic disaster. A treaty was signed by the conference in January 1914, resulting in the formation of the International Ice Patrol. The United States Coast Guard formed the agency to monitor and report on the location of North Atlantic Ocean icebergs that could pose a threat to transatlantic sea traffic.

Lessons have been learned from the 1,500 lives lost on the Titanic. From increased training and appropriate personal protection to standardising requirements for emergency procedures, maritime safety has improved and many lives have been saved.





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