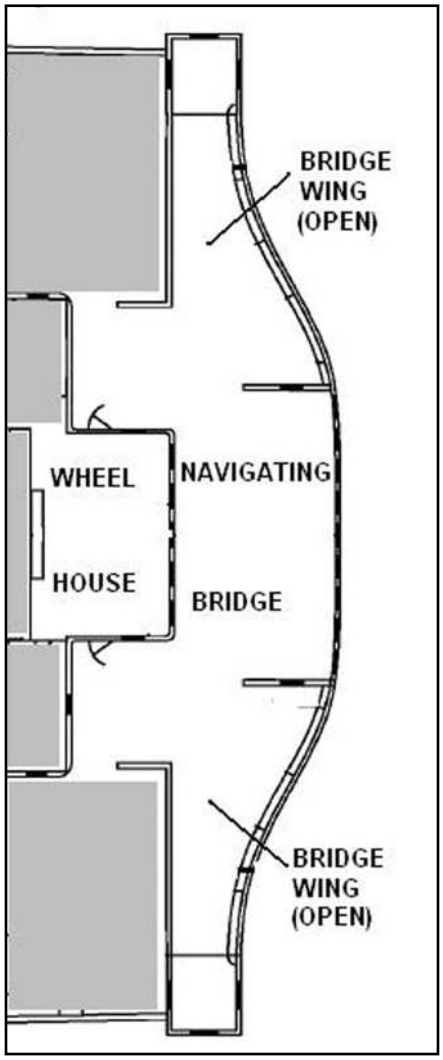
"Iceberg Right Ahead!"

(Originally written as an article for Voyage, the journal of the International Titanic Society, Issue 71, Spring 2010, under the title "A Visit To Titanic's Bridge".)

By Art Braunschweiger

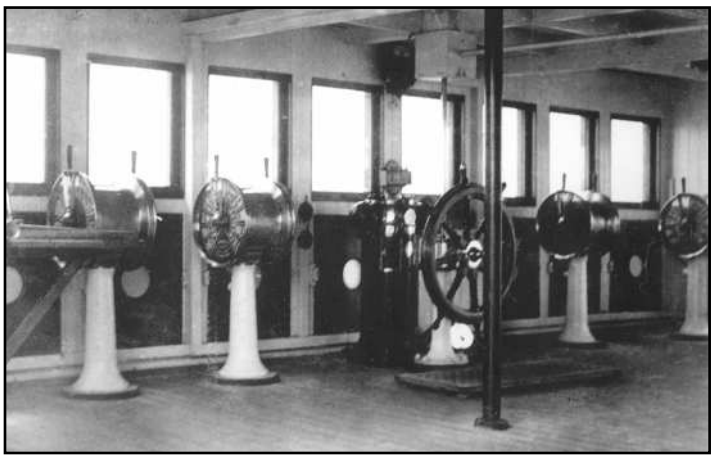
[Author's note: The story of Titanic's *sinking revolves around what took place on the navigation bridge, yet many people are not entirely clear on how it functioned, what the duties of the officers and crew were, and exactly who did what on the night of April 14, 1912. For the reader with no technical or nautical background, this article seeks to paint a clear picture. Through explanations and quoted testimony as to the time line of events, this article will give the reader an understanding of what they would have seen had they been an observer on* Titanic's *bridge that night. (Note: All testimony quoted is from either the U.S. Senate inquiry, referenced by day number in the form "U.S. Day 5", or the British Wreck Commissioner's Inquiry, referenced by line number in the form "B. 10732".)]*

Nearly everyone interested in *Titanic* knows where the bridge was located and its general appearance, at least from the outside. Properly termed the "navigating bridge," it was not the same as the wheelhouse and the two terms are not interchangeable. Since the Wheehouse was located within the bridge structure, reference is sometimes made to the bridge when, technically, it is the wheelhouse that should be referred to. But first, let's look at the bridge itself.[1]



Bridge drawing, modified from General Arrangement plans. (Drawn by Bruce Beveridge; used by permission.)

The bridge, located at the forward end of the boat deck, gave a commanding view over the forward end of the ship. Open bridge wings on either side gave a more unobstructed view and permitted a better view off to either side. Reference to the drawing at left will show that the bridge structure was open on either side so that the crew could readily go in and out, cross through from one side to the other, and communicate between the bridge wings and the bridge itself; the latter was especially important in maneuvering or docking because commands would often have to be relayed from the captain or pilot on one of the bridge wings to an officer inside. In all circumstances, the officer in charge of the bridge needed to be able to see, observe and hear; and quite often he could do that better by stepping outside. For that reason the bridge structure was essentially just a shelter against sun, wind and rain. Whereas today navigation bridges are largely or completely enclosed and impervious to the weather, such was not the case in 1912, when there was no electronic navigation, positioning, communication or collision-avoidance systems. It is easy to forget that in 1912 there was almost-total reliance on the "Mark I eyeball" and its human processor for everything from estimating distance to making a judgment about the course and speed of a vessel ahead. Although *The Shipbuilder* magazine described *Titanic's* bridge as "a veritable forest of instruments",[2] information-gathering and decision-making functions were entirely non-technical: there was no radar, no intership (bridge-to-bridge) radio capabilities and no collision-avoidance systems other than the human brain. It is also worth noting that although some contemporary maritime experts have levied criticism on the way the *Olympic*-class bridge was laid out, it was a tried-and-true Harland & Wolff design that served the White Star Line well for many years.



There are no known photographs of Titanic's *bridge, but it was laid out in manner similar to* Olympic's*, pictured here. (Father Browne photograph, courtesy of Bruce Beveridge)*

Returning to the navigation bridge, arrayed in a line parallel to the windows were the engine-order telegraphs, engine-order relay telegraph, docking telegraph and emergency telegraph (see photograph above). Discussion of *Titanic's* telegraphs is outside the scope of this article and merits an article all its own; fortunately, there is a well-illustrated article online by Bill Sauder on Parks Stephenson's "Marconigraph" website (see reference at the end of this article); his pages will give the reader all he or she desires to know on their layout and operation. It is worth noting here, however, that the main engine-order telegraphs on *Titanic's* bridge – those which told the reciprocating engine room to start, stop, or reverse either of the engines, and what speed was desired – were duplicated such that there were identical telegraphs in the outermost position on either side of the bridge. By positioning them in this manner, it allowed for more direct communication when engine orders were being relayed from either bridge wing, so that orders never had to be called across to the opposite side

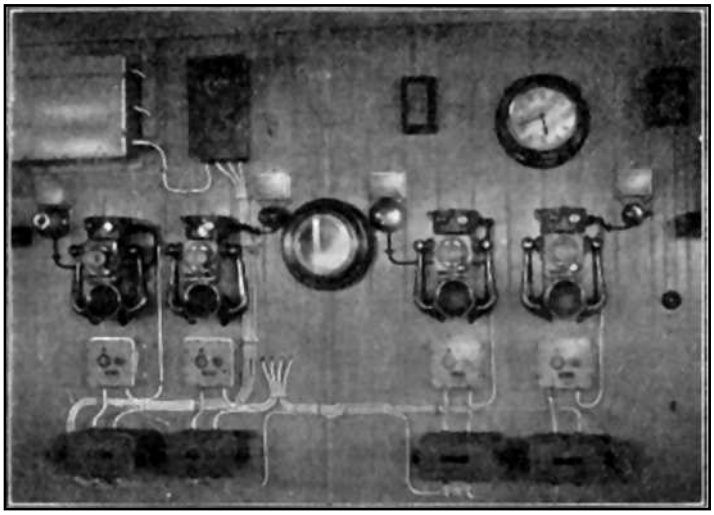
of the bridge. (Under normal circumstances when the ship was maneuvering or in pilotage waters, the pilot or captain would call engine orders to a junior officer stationed at the telegraph, and the Junior Officer would then transmit the actual orders by manipulating the telegraph handles.)

On the centerline of the bridge, facing the windows, was a helm with the ship's wheel and a binnacle housing a steering compass immediately forward of it. This wheel was not what could be considered the main ship's wheel, as it was only used when the ship was subject to frequent changes of course or maneuvering, as would be done near land, in a narrow channel, in port or when docking. When in use it was connected via an overhead mechanical linkage to the main steering mechanism located further aft in the wheelhouse. (This linkage is visible in the photograph of *Olympic's* bridge on the preceding page.) Once the ship was at sea under a normal steaming watch, the wheel on the bridge had its linkage disconnected, and the ship was then steered from inside the wheelhouse.

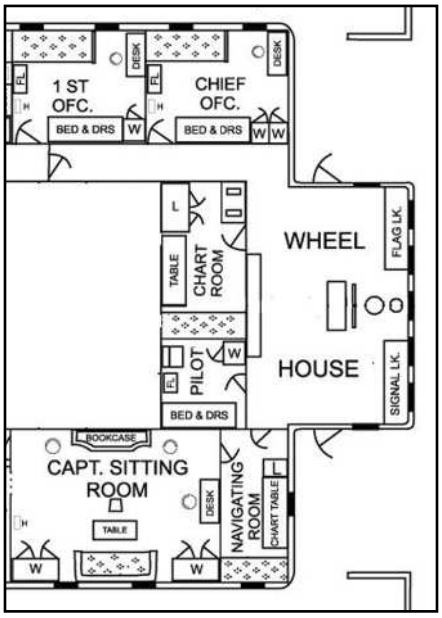
If you were standing in front of the bridge wheel and turned to face aft, you would be facing the wheelhouse and be able to see inside it through large windows on its forward side. Those within would have a clear view of everything on the bridge and out the bridge windows facing forward. Inside the wheelhouse was located the main ship's wheel, and immediately forward of it another binnacle housing a second steering compass. The wheel at this location was connected to a steering mechanism called a Telemotor. Since it would have been impossible to move the rudder of a huge ship like *Titanic* without some sort of mechanical assistance, a large and powerful steering engine at the stern turned the rudder; this steering engine was controlled by the Telemotor. When the wheel on the Telemotor was turned one way or the other, a hydraulic system actuated the steering engine which ultimately moved the rudder.

On the rear wall of the wheelhouse (below) were two clocks (one for Greenwich Mean Time, and the other for the local ship's time); an inclinometer, showing how many degrees the ship was listing to port or starboard; and four telephones.[3] These telephones were all on dedicated circuits (not requiring the user to go through the ship's switchboard) and ran between the wheelhouse and the following locations (listed fore to aft):

- Either of two locations on the Forecastle Deck near the anchor-handling gear, where a portable telephone box could be plugged in;
- The crow's nest;
- The Reciprocating Engine Room; and
- The docking bridge aft.



*Rear wall of the wheelhouse, showing two clocks and four telephones. (*The Electrician*, August 4, 1911, courtesy of Bruce Beveridge)*



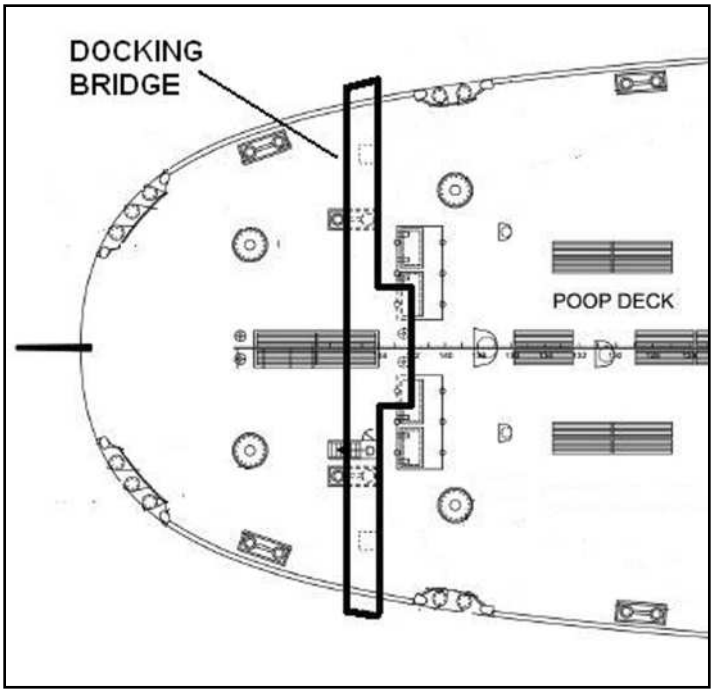
Wheelhouse drawing, modified from General Arrangement plans. (Drawn by Bruce Beveridge; used by permission.)

A door on either side of the wheelhouse gave access to the Bridge area and, as the sides of the bridge structure were open here, direct access to either bridge wing. At the back of the wheelhouse on the port side was a door to the Chart Room, and a corridor where the officers' quarters were located. On the opposite side, a door at the back opened into the navigating Room; a door from there led to the Captain's Quarters.

A pause here is appropriate to introduce the "other" bridge on the ship, the docking bridge on the Poop Deck. Referred to by some of the crew as the "after bridge" (they referred to the navigating bridge as the "fore bridge"), this was a raised platform extending across the breadth of the ship and extending beyond it for several feet on either side (see drawing on following page). It was equipped with an auxiliary helm (steering wheel) and could be steered from here if the telemotor system on the navigating bridge failed. The docking bridge had two telegraphs similar thoese on the navigating bridge. One could transmit engine orders forward; the other could transmit helm (steering) orders aft. The latter also did double duty through use of an inner dial and could transmit line handling commands aft and the status of any lines forward. When docking the ship, this telegraph was especially necessary as the location of the docking bridge, together with its extension just beyond the ship's sides on either end, permitted an officer to view the area around the stern of the ship which could not be seen from the navigating bridge. This was also useful when tugs were in attendance to assist the ship in moving in or out of her berth.

Now let's take a look at the normal Deck Department watch that was on duty on above decks at any given time, and the functions of the individual crew members and officers. In order of rank, there was:

- One Senior Officer (Chief Officer, First or Second Officer);
- Two Junior Officers (Third, Fourth, Fifth or Sixth Officers);
- Three Quartermasters, who ranked as Petty Officers; and
- Two Lookouts.



Drawing of the docking bridge, modified from General Arrangement plans. (Drawn by Bruce Beveridge; used by permission)

Senior Officers were also referred to as bridge Officers. They worked four hours on and 8 hours off, and were therefore on duty at the same times every day. They were the only ones other than the Master (Captain) who could be in charge of a watch. (Junior Officers could only be responsible for a watch at the discretion of the Master, and then only in good weather and at sea.[4]) Regardless of which officer had the watch at any given time, that officer was referred to as the Officer of the Watch. He had direct responsibility for the navigation and safety of the ship. He was expected to remain on the bridge at all times, either inside the bridge itself or on either of the bridge wings, and could not absent himself until relieved. There was no chair to sit in; he was expected to remain on his feet, attentive and observant of what was going on and the seas ahead.

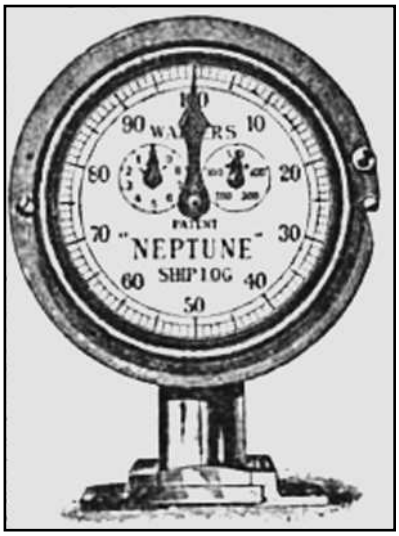
As noted above, when the ship was at sea on a steady course, the ship was steered from the wheelhouse. There was always a Quartermaster at the helm; he was the one who actually steered the ship. The helm arrangement here was a duplicate of the one just forward on the bridge: as the Quartermaster faced the helm, he could look over the wheel at the compass housed in a teak binnacle. The 10-in (25.4 cm) diameter compass was visible through a window in the binnacle and was illuminated at night with a dim lamp. In steering the ship, the Quartermaster had to keep the fixed "lubber's line" corresponding to the ship's head centered on the point of the compass card that matched the course required. To ensure that no one trusted to memory as to the required course, it was marked on a "course board" close to the binnacle. As further insurance, one of the Junior Officers was stationed in the wheelhouse to see that the required compass course was being steered, and the Quartermaster at the helm had to state the course he was steering every 15 minutes.

The other Junior Officer on watch was responsible for calculating the ship's position by means of star sights that were taken[5] as well as checking compass errors by comparing the course being steered in the wheelhouse with what was shown by the standard compass on the Compass Platform on the Boat Deck. (The latter, positioned roughly amidships, was located at a point where the iron in the ship had the least influence on the compass, and therefore it was used as the standard for checking all other compasses carried on board.) This Junior Officer was also required to make rounds every hour, and essentially this meant he had to "go the whole rounds of the ship and see that everything is in order."[6]

The second Quartermaster, designated the standby Quartermaster, had varied duties. Every half hour he struck the ship's bell mounted outside the bridge windows by pulling the lanyard inside[7], and report what bell it was[8] to the Officer of the Watch. Air and water temperatures had to be taken every 2 hours, and it was the standby Quartermaster's responsibility to do this and enter the readings in the log, plus make any other entries required. The standby Quartermaster also ran any messages required, such as on the night of April 14th when the Carpenter was summoned to check the fresh water system and take precautions against freezing. Overall, the standby Quartermaster was responsible for whatever might need doing at the direction of the Officer of the Watch.

The third Quartermaster had what was perhaps the most pleasant duty in fine weather, and the most odious in foul weather. His post was at the stern, on or under the docking bridge on the Poop Deck. His primary responsibility was tending the ship log at the stern. The log here should not be confused with the log on the navigating bridge, which was a book into which entries were made as to changes of course, speed and other events. The log at the stern[9] was a device, some 9 inches in length, with a propeller-like rotator that was streamed behind the ship on a stout line about 60 fathoms (360 feet / 110 meters) long; on it was a dial with two inner dials (below) that indicated how many miles had been run since last it was reset. The log was deployed continuously while at sea, reset daily at noon and checked every two hours by the Quartermaster on watch there. Although the distance traveled by the ship over time was actually calculated more accurately from the engine revolutions, the log was also useful in measuring the ship's progress.

Returning to the forward end of the ship, stationed in the crow's nest were two lookouts[10]. The crow's nest was about 90 feet (27.4 meters) above the water. At that height a Lookout would have been able to see an object on the horizon almost 12 miles (19 kilometers) away under good conditions, and large ships much further than that as the funnels or smoke would be visible before the hull cleared the horizon. The crow's nest had about a 26-foot (7.9 meter) height advantage above the bridge, which meant that the lookouts could see about a mile and half (2.4 kilometers) farther. Mounted to the mast directly above the crow's nest was a 15-inch (38-cm) brass warning



Ship's log dial. (Author's collection)

bell. To alert the bridge of something ahead, the lookouts would ring the bell[11] and then pick up the telephone to report what they saw and in what direction. The crow's nest was reached from below by climbing a ladder inside the mast, which was hollow and made of steel, with an opening at the crow's nest level. Access to the ladder was from the crew area in the forecastle on C-Deck.

The White Star Line differed from some other lines in that lookouts were hired expressly for that purpose, and did not have to perform other duties. In this regard, Second Officer Charles Lightoller said, at the US Senate hearing (Day 5), "The White Star Company, I may say incidentally, is the only company in the world, so far as I know, that carries six Lookout men. We carry men who do nothing else, night and day, from the commencement to the finish of the voyage, except keep a lookout . . ." They were required by the Board of Trade to pass an eye examination, and had a certificate to that effect. Although *Titanic's* lookouts had been provided with binoculars on the trip from Belfast to Southampton, they were not made available to them on the occasion of her maiden voyage[12].

Lightoller was questioned about the lookouts' capabilities, and he explained further that crew members who were hired expressly as lookouts were generally experienced, and usually worked a full year in one ship. When asked if "they get to be expert in detecting objects on the horizon", he replied "They do. They are very smart at it, indeed. There is one man here, who has been subpoenaed, who is the smartest man I know at it." [13] And yet before this, he surprised his questioner, Senator Jonathan Bourne, by stating that "we place no reliance on them." Bourne questioned this:

> Senator BOURNE – What are they there for?
>
> Mr. LIGHTOLLER – They are there to keep a lookout; to assist you.
>
> Senator BOURNE – Then, why is no reliance placed upon them?
>
> Mr. LIGHTOLLER – Because, speaking personally, I never rely on a lookout. I keep a lookout myself, and so does every other officer.
>
> Senator BOURNE – Then, it is merely to afford a dual opportunity of getting sight of things that you utilize the crow's nest and the men in it?
>
> Mr. LIGHTOLLER – We use the men in the crow's nest for keeping a lookout. Occasionally a man will see a light or a vessel first, particularly in daytime, when naturally we trust to them seeing. Especially all through the daytime lookout men are keeping a keen lookout, and will report a steamer long before she is in sight, apparently, by her smoke. In that instance the lookout might be very useful. In nighttime, particularly in channels where there are a great many lights, we may be watching one light, and there may be another light in our course, and the man in the crow's nest will strike, say, one bell. That signifies something on the port bow, and calls our attention to it. So that the ship can approach close to us without the bridge being notified, even though the officer has not himself already seen it.

The above should not be taken as a statement of no confidence in the lookouts' abilities, but rather how experienced officers regarded their own responsibilities when on watch.

So having introduced all the players, let us step onto the bridge at 11:38 pm, one minute before *Titanic's* lookouts spotted the iceberg. The bridge is entirely dark. There are no lights on anywhere, and even the dim lights in the Binnacle forward of the helm, and in the telegraphs, would have been turned off[14]. No lights would have been on in the well Deck, and in fact any stray light sources at all had been dealt with, as at about a quarter past seven when Lamp Trimmer Samuel Hemmings was asked to "get the fore-scuttle hatch closed, there is a glow left from that, as we are in the vicinity of ice, and I want everything dark before the bridge." (B17707) Acquiring night vision takes up to 30 minutes, but can be lost in seconds from a single light, even one that is not of great intensity. For this reason all lights on the Boat Deck were shrouded on their forward sides if they were visible from the bridge. (Even so, no officer would have looked aft because even the dim light cast onto the deck would have degraded his vision.)

Four of Titanic's officers: standing, L to R - 5th Officer Lowe, 2nd Officer Lightoller, 4th Officer Boxhall. Sitting, 3rd Officer Pitman.

But those in the wheelhouse required some light in order to do their jobs. The Quartermaster at the helm needed some light to see the course board; there had to be enough light to see the clocks and answer the telephones if it became necessary to do so, and of course to steer. For the latter purpose there was a small light within the binnacle to illuminate the compass within, and a second one on the course board. Even in the absence of any other lamps, the light from these – dim as they were - would have been sufficient to see everything else in the wheelhouse after one's vision became acclimated. But if visible through the wheelhouse windows, it could be problematic for those on the bridge. It was not, though, because all the windows in the wheelhouse were shuttered after dark. The helmsman was steering blind, so to speak, but contrary to what logic tells us, he did not need to see what was ahead – he only needed to see the compass. During the daytime being able to see ahead certainly relieved the monotony, but in order for him to do his job he had to keep his eye on the compass anyway. Nor did the Junior Officer with him need to see – his job was only to see that the required course was being steered, and that any new course changes ordered were carried out Only upon order of the Watch Officer would the officer in the wheelhouse order a course change – he would never do so on his own initiative – and the Quartermaster would never alter course on his own. (In theory, a good helmsman would hold course until ordered otherwise even if the ship was heading right for the beach.)

There was no noise and no conversation from either the bridge or the wheelhouse. Unnecessary talking was not permitted; everything was silent except for the sounds of the ship and the sea. *Titanic* was traveling at a speed of 22.5 knots, about 26 miles

per hour (42 kilometers per hour).[15] Earlier that evening, she had "turned the corner" and changed course to a more westerly heading to put her on track for the Nantucket Lightship. 892 miles remained until *Titanic* would pick up the New York Harbor Pilot at the Ambrose Lightship, two and half days hence in the early morning hours of Wednesday, April 17. Then, at 11:39 pm, the crow's nest bell rang three times.

At this point we will pause the action and put names to the players involved. It doesn't matter with regard to the main focus of this article, but is useful to know since the names are so often discussed with regard to the events, and for this reason those involved will be referred to by name from this point forward. So, at the moment the warning bell rang, this is who occupied the various positions:

- Officer of the Watch: First Officer William Murdoch, age 39. He had relieved Second Officer Charles Lightoller at 10 pm for a 4-hour watch. At the time the crow's nest bell rang he was alone on the bridge.
- Junior Officer in the wheelhouse: 6th Officer James Moody, 24. Like the other Junior Officer, he came on at 8 pm for a 4-hour watch and was standing behind the Quartermaster at the wheel when the bell rang.
- Quartermaster at the helm: Robert Hichens, 30. Like the other Quartermasters, he came on watch at 8 pm; he took the helm at 10 pm for the remainder of his 4-hour watch.
- Standby Quartermaster: Alfred Olliver, 27. He had been relieved at the wheel by Hichens at 10 pm. At the time the bell rang he was on the compass platform amidships, trimming the light in the binnacle there.
- The other Junior Officer: Fourth Officer Joseph Boxhall, 28. At the time the crow's nest bell rang he was just coming out of the Officers' quarters. He had spent most of his watch in the Chart Room performing calculations to determine what the ship's position had been as of 7:30 p.m as well as taking star bearings at the compass platform to determine the current compass error to determine the true course that the ship was on.
- Quartermaster on the Poop Deck: George Rowe, 32.
- Lookouts: Frederick Fleet, 24, and Reginald Lee, 41. Both had come on duty at 10 pm for a 2 hour watch. Fleet was on the port side of the crow's nest and Lee on the starboard side.

When 1st Officer Murdoch had relieved 2nd Officer Lightoller at 10 pm as Officer of the Watch, Lightoller said he had noted to Murdoch that at any time they should be "round the ice". Inquiries at the post-sinking hearings carried a note of disbelief as to the ship not reducing speed at this point. Lightoller's testimony (B14351) helps understand why: " Let me explain my point and we will get it far clearer. You see we were making for a vicinity where ice had been reported as you say year after year, and time and again, and I do not think for the last two or three years I have seen an iceberg although ships ahead of us have reported ice time and time again. There was no absolute certainty that we were running into an ice-field or running amongst icebergs or anything else, and it might have been as it has been in years before ice reported inside a certain longitude."

Maintaining speed was simply standard practice, as Lightoller stated (B13726): "I have never known speed to be reduced in any ship I have ever been in in the north Atlantic in clear weather, not on account of ice." Every other ship's captain who gave testimony at the hearings affirmed this point; some were quite emphatic about it. Any iceberg large enough to require an alteration of course, it was believed, would be seen with ample time to react.

Resuming the action, the job of the lookouts was, of course, to alert the bridge to the presence of anything in the ship's path - period. It must be emphasized that their responsibility was not to waste time identifying what it was they saw, but to provide an immediate warning of whatever they saw ahead. At 11:38 pm, lookouts Fleet and Lee saw what Fleet later described (B17276-17277) as "a black object", "high above the water." Fleet immediately rang the warning bell three times, the signal for something ahead. He then crossed over from his position on the port side of the crow's nest to the telephone located on the starboard side. Being a dedicated circuit direct to the wheelhouse, it rang immediately and was answered by 6th Officer Moody. Fleet testified (B17285) that when it was answered he asked "if they were there, and they said yes." According to Fleet, Moody asked "What do you see?" and Fleet said "Iceberg right ahead", to which Moody replied "Thank you." At this moment, according to Lee, the ship started turning to port.

Hichens testified (B986, 993) that just after the three gongs of the bell sounded, he heard Murdoch run to the engine-order telegraphs and heard the sound of the telegraphs being worked, and that Murdoch called "hard-a-starboard" at the same time. Hichens said (B973) that "about half a minute" passed between the three gongs of the bell and Murdoch's "hard a-starboard" order. On the bridge, when Bridge Officer Murdoch heard the warning bell, his immediate reaction would have been to attempt to spot and/or identify what the lookouts had sounded the warning bell for. It's even possible that Murdoch saw the iceberg at the same time. His height above the water, being slightly less than that of the lookouts in the Crow's nest, may well have given him an advantage in seeing the iceberg as a little more of it would have appeared above the horizon and not lost in the dark ocean. And recall Officer Lightoller's testimony, in which he stated that "speaking personally, I never rely on a lookout. I keep a lookout myself, and so does every other officer." The fact that they were entering an area where some ships had reported

Engine-order telegraph
(Illustration by Michael McMillan)

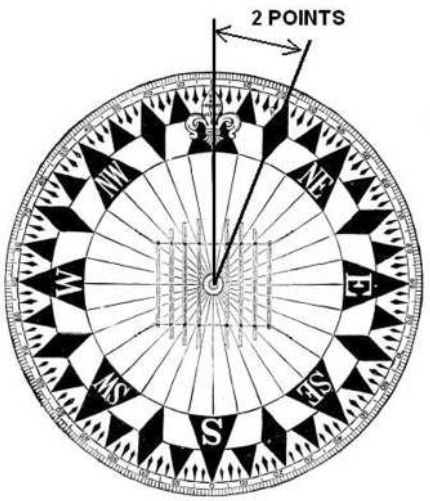
ice, coupled with the moonless night that reduced forward visibility, would have heightened any officer's vigilance.

Owing to the iceberg appearing at only such a short distance, Murdoch had only seconds to assess the situation and decide what action to take. *Titanic* researcher Sam Halpern points out[16] that although the iceberg was "right ahead", the sketch that Lookout Frederick Lee later drew put the iceberg slightly off to starboard rather than exactly in line with the ship. Thus in the limited time he had, Murdoch might have considered whether the ship would clear it, albeit very closely, if he held course. In that case, as Halpern indicates, ordering a turn to port might have actually caused a collision since the stern of the ship would initially swing in the opposite direction – toward the iceberg. Murdoch did decide that a turn was necessary, and what he hoped to do, according to Boxhall's claim, was to "port 'round it": follow his initial hard left rudder order ("hard a-starboard") with a hard right rudder order ("hard a-port") that would move the stern away from the iceberg once the bow had cleared it.

There is often confusion as to why Murdoch's helm order sounds backwards, seemingly ordering a turn in the opposite direction from what is logical. In 1912, helm orders were given with reference to the tiller head and not the way the rudder was to turn. Imagine you are sailing a small boat, sitting in the stern with a long handle extending forward from the rudder. If you want to turn your boat one way, you need to move the tiller handle in the opposite direction. For centuries large sailing ships had a tiller connected to the rudder as well, although it was much larger. Located under the deck and requiring some form of mechanical advantage to move it, a system of ropes and pulleys was rigged to a wheel on the deck above. Although by 1912 steering systems on ships like *Titanic* had evolved into something very different, helm orders continued to be given the way they had been for centuries.

We know the helm orders Murdoch gave, but the orders he telegraphed to the Reciprocating Engine Room are unclear because those in the wheelhouse –with the windows shuttered - could not see him. As Hichens later testified (B986) , "I could not see the officer on the bridge. I cannot see anything, only my compass." It is fairly certain – and logical – that he telegraphed a Stop order, but whether or not he followed this with a Full Astern order is unknown. Although it is unlikely based on what Murdoch would have known of the ship's handling characteristics, testimony from those who tried to recall what they saw after entering the bridge, as well as testimony from surviving engine room crew, is conflicting. This article will not attempt to determine what actually happened, as several articles have done so in great detail[17]. It is worth noting, however, that even had Murdoch ordered Full Astern immediately, it would not have been possible to reverse the engines in the short time prior to collision. Unlike diesel-electric propulsion systems of today, *Titanic's* reciprocating engines took much longer to reverse. In a "crash back" maneuver the Engineers first had to close the reciprocating engine throttles; the engines then had to be allowed to slow down as much as possible on their own until the only rotational movement remaining would be that caused by the "windmilling" of the propellers in the flow of water aft along the still-moving hull. Following this, the reversing levers of both engines had to be moved from "ahead" to "astern" while also moving a valve to shift the flow of exhaust steam to bypass the turbine engine. Then, the reciprocating engine throttles had be reopened, slowly at first, until the reciprocating engines were running in reverse. Under the best of circumstances, with engineers standing by to receive orders via the telegraphs, reciprocating engines of the size and type on *Titanic* could be stopped and reversed within 30 seconds, with another 50 to 60 seconds elapsing before the engines would be backing hard. On the night of April 14th, however, an emergency Full Astern order would have caught the engineering watch completely by surprise, so additional reaction time would have to be factored in.

Upon hearing Murdoch's order, Hichens immediately began turning the wheel counter-clockwise to effect a turn to port. It took four complete turns[18] until the rudder was "hard over" at its maximum angle of 40 degrees from center. Hichens would have felt increasing resistance as the rudder increased its angle and approached the "hard over" point; this was an intentional design of the Telemotor that gave the helmsman the same feel as if he was manually steering a ship with a direct mechanical linkage to the rudder[19]. Hichens testimony is conflicting at times, but it would seem that he was able to get the wheel hard over just before the ship struck. By this time the ship had, according to the lookouts' and Hichens' testimony, turned about two points to port, although recent analysis by Sam Halpern suggests that the ship had only turned about one point up to the moment of impact.[20] Reference to the image at right – a compass card from *Titanic's* era – will illustrate the "point system" for indicating bearings relative to the ship's heading. Each black triangle or diamond is one point. Two points translates to 22.5 degrees. And how much time actually passed in the eternity it must have seemed between the initial sighting and the impact? The British Inquiry concluded that impact took place about 40 seconds from the initial sighting. But Sam Halpern has calculated that it occurred about 20-25 seconds[21] after the "hard a-starboard" order was given. If we take this figure along with Hichens' estimate of the time between the warning and the helm order – about half a minute - it would mean that *Titanic* struck the iceberg just under a minute after it was sighted.



When the 3 gongs of the warning bell sounded, it was heard by others who were not on the bridge. On the Compass Platform, Quartermaster Olliver heard it - and Fourth Officer Boxhall, just leaving the Officers' Quarters, heard it. Both made for the bridge.

Immediately after the collision, Murdoch closed the watertight doors[22]. Unlike what was portrayed in the movie *Titanic*, the watertight door control - a mechanism with a single lever, and no lights to indicate whether the doors were open or closed. - was located on the bridge and not in the wheelhouse. We don't know exactly where it was situated, but the testimony of several crew members definitively places it on the bridge and not the wheelhouse[23]. Fourth Officer Boxhall said he entered as Murdoch

was pulling the lever; Quartermaster Olliver said he saw Murdoch at the control as he was entering the bridge. Olliver also testified that he heard Murdoch order "hard a-port" after the iceberg had passed the bridge, which would have the effect of swinging the starboard side of the ship, and the stern, away from the iceberg to minimize further hull or propeller damage[24]. Captain Smith entered just after that[25].

And what of Quartermaster George Row on the Poop Deck? He was unaware of anything happening until he felt "a slight jar", then saw an iceberg passing down the starboard side of the ship – "so near that I thought it was going to strike the [docking] bridge" (US Day 7). He immediately went up on the docking bridge to check the log, which was on the port side of the bridge. He then remained there near the telephone, unaware of events and awaiting orders, until he saw – much to his surprise - a lifeboat in the water.

Acknowledgements

Thanks to Sam Halpern for sharing his knowledge of navigation and position fixing, and for reviewing the timeline of events. Sam has a wealth of *Titanic* articles available on his website on his own site, www.titanicology.com/Chart_Room; Thanks to Bruce Beveridge and Scott Andrews, co-authors, TITANIC: The Ship Magnificent for reviewing the technical material in this article, to Scott for providing an explanation of the reversing process for the reciprocating engines.

Sources

- All testimony quoted from the US Senate Inquiry and British Wreck Commissioner's Inquiry has been sourced from The Titanic Inquiry Project online at www.titanicinquiry.org.
- Additional information about *Titanic's* bridge and wheelhouse can be found in TITANIC: The Ship Magnificent, vol. 1; additional information about all equipment and fittings located therein can be found in volume 2. (Beveridge, Bruce, et al, 3rd ed., June 2009, published by The History Press).
- An explanation and computer-graphic images of *Titanic's* engine-order telegraphs can be found on www.marconigraph.com: click on *Titanic*, then *Titanic's* Engine-Order Telegraphs by Bill Sauder.

Endnotes

[1] In outlining the layout of the bridge and wheelhouse areas, some detail (ancillary fittings and equipment) has intentionally been left out, in order to focus on the key elements.

[2] "The White Star Liners '*Olympic*' and '*Titanic*'," The Shipbuilder, souvenir issue No.21, summer 1911, p. 121.

[3] The Electrician, August 4, 1911.

[4] White Star Line "Book of Regulations," 1911 edition, author's collection.

[5] To fix the position of a ship at sea, a set of star observations was taken during morning and evening twilight hours. This involved selecting a number of stars visible in different directions and measuring their angular heights above the horizon, with the precise time of each observation recorded. This data was then used with data from a nautical almanac to "work out" the ship's latitude and longitude by means of tedious and time-consuming mathematical computations.

[6] Boxhall, U.S. Day 1.

[7] Both Lookouts in the crow's nest were required to answer this bell every time it was struck by calling out. (U,S. Inquiry, Day 3, Boxhall).

[8] The watch bell was struck every half hour, starting with one bell at the end of the first 30 minutes, then two bells at 60 minutes, and so on. This did not indicate clock time, but how many minutes of the watch had passed. For someone who had a four-hour watch, therefore, their watch would be over at eight bells.

[9] Although *Titanic's* log was a Neptune model, it was referred to by the crew as a Cherub log because that was the name that had evolved into common use even though the actual model had changed.

[10] According to Second Officer Lightoller (B. 13520), in anything but clear weather, it was standard practice to post extra lookouts: if possible, all the way forward at the stem (Where Jack and Rose did their flying scene in James Cameron's film) or, if the seas were too rough to safely permit that, on the bridge.

[11] One ring signaled something off to port, two rings signaled something off to starboard, and three rings something ahead.

[12] The fact that binoculars were not provided to *Titanic's* Lookouts was questioned at both the U.S. and British inquiries, but their absence did not contribute to the lookouts inability to see the iceberg at a greater distance.

[13] He was speaking of George Symons, who had been on watch as a lookout from 8 to 10 p.m. on the night of April 14.

[14] "*Titanic's* Engine-Order Telegraphs" by Bill Sauder (www.marconigraph.com/titanic/telegraphs/mgy_eotelegraphs1.html): page 2, "Physical Configuration of Engine-Order Telegraphs", section 6, left image caption.

[15] 1 knot = 1 nautical mile per hour. By comparison, the Cunard liner Queen Mary 2 has a cruising speed of 26 knots, and the Royal Caribbean cruise ship Freedom of the Seas 21.6 knots.

[16] Halpern, Sam, "She Turned Two Points In 37 Seconds", available on the *Titanic* Research & Modeling Association website (www.titanic-model.com), p 22.

[17] See *Voyage* issue 65, Autumn 2008, "Debunking some details of a dark night" by Ioannis Georgiou in the section "Report from the Engine Room" on pp 17-19; also "Turning in Circles" by Sam Halpern, www.titanicology.com/Titanica/Turning_in_Circles.ppt, slide 19.

[18] According to Sam Halpern in "She Turned Two Points In 37 Seconds"(p 19), it would have taken about 10 seconds to turn the wheel four revolutions.

[19] Beveridge, Bruce, et.al., TITANIC: The Ship Magnificent, vol. 1. (3rd ed., June 2009: The History Press) p. 524.

[20] Halpern, Sam, "She Turned Two Points in 37 Seconds", pp. 17-21.

[21] Halpern, Sam, ibid., p. 23.

[22] Only the (lowermost) watertight doors at the Tank Top level were controlled from the bridge – there were others higher up in the ship that had to be cranked shut by hand.

[23] Hichens, B. 1032, Boxhall, B. 15352, Oliver, U.S. Day 7.

[24] Although Boxhall makes no mention of this, Olliver was unequivocal in his testimony (U.S. Day 7), and his claim is supported by George Rowe's testimony from the docking bridge. Rowe testified that although the iceberg passed close by the stern, it did not rub against it, and it would certainly have been in contact along the entire length of the hull if the helm had not been reversed.

[25] Hichens said that Capt. Smith came out onto the bridge about a minute after the collision (B. 1025).