Were Rivets to Blame For *Titanic* Sinking?

For decades, scientists have wondered why the mighty ship *Titanic* sank. The huge passenger ship hit an iceberg on its first trip and sank April 15, 1912. Before its only voyage, people said the *Titanic* was so solid it was "unsinkable."

Now some scientists say the ship was not as solid as once thought. They think some of the rivets that held the 46,000-ton ship together were not strong enough. Rivets look like smooth screws. They are the "glue" that holds together sheets of metal that make up the body of the ship.

Some rivets used in the front, or *bow,* of the *Titanic* were made from iron that was not the best quality. Those rivets might break more easily, the scientists said. They think the rivets snapped when the ship hit the iceberg, which allowed water to rush into the ship. The *Titanic* sank in fewer than three hours, and 1,517 people died. If the rivets had been stronger, the ship might have stayed afloat longer and more people might have been rescued, the scientists said.

NEWS WORD BOX

decade passenger
voyage skilled rivets
quality rescued solid

Scientists also say that some workers hired to work on the *Titanic* were not as skilled as they should have been. They say the company had problems finding enough highly skilled riveters to do the job right.

The company that built the *Titanic* is still in business today. Company officials disagree with the scientists. The officials say there was nothing wrong with the rivets. As proof, they point to the fact that the *Olympic* -- one of the *Titanic's* sister ships -- did not experience problems in its 24 years of sailing.

MORE FACTS ABOUT THE *TITANIC*

- The company that built the *Titanic* was building two other huge ships at the same time, the *Olympic* and the *Britannic.* Each of the three ships needed *3 million* rivets.

THINK ABOUT THE NEWS

People have been interested in the sinking of the *Titanic* for almost 100 years. Why do you think people find the event so interesting?

ADDITIONAL RESOURCES:

http://www.rmstitanic.net/index.php4 RMS Titanic, Inc

http://www.hartfordciviccenter.com/ .

"Titanic: The Artifact Exhibition" on View at the
XL Center April 12th for a limited engagement

(Hartford- CT) On April 10, 1912, the world's largest ship, the Titanic, embarked on her maiden voyage leaving Southampton, England. The ship's passengers included titans of commerce and industry, artists and movie stars, senior members of governments, immigrants dreaming of a new life, mothers, fathers, sons and daughters.

Now 96 years after that historic sailing, the XL Center announced that Titanic: The Artifact Exhibition will make its long awaited, limited engagement in Hartford. The Exhibition opens to the public on April 12th.

The Exhibition has been designed with a focus on the legendary RMS Titanic's compelling human stories as best told through nearly 300 authentic artifacts and extensive room re-creations. An officer's megaphone, a leather shoe, a gentleman's spectacles, china etched with the logo of the elite White Star Line, the Ship's notorious whistles ? these and many other objects offer haunting, emotional connections to lives abruptly ended or forever altered.

Visitors are quickly drawn back in time to 1912, as each receives a replica boarding pass of an actual passenger upon entrance. The Exhibition will then take guests on a chronological journey through life on the Titanic; from the ship's construction to life on board, the fated sinking, and modern day recovery efforts. Attendees will marvel at authentically re-created first and third class cabins, view the Ship's Boiler Room, feel the temperature drop as they press their palms against the iceberg, and learn of the passengers and their countless stories of heroism and humanity.

http://www.nytimes.com/2008/04/15/science/15titanic.html

April 15, 2008

In Weak Rivets, a Possible Key to Titanic's Doom

By WILLIAM J. BROAD

Researchers have discovered that the builder of the Titanic struggled for years to obtain enough good rivets and riveters and ultimately settled on faulty materials that doomed the ship, which sank 96 years ago Tuesday.

The builder's own archives, two scientists say, harbor evidence of a deadly mix of low quality rivets and lofty ambition as the builder labored to construct the three biggest ships in the world at once — the Titanic and two sisters, the Olympic and the Britannic.

For a decade, the scientists have argued that the storied liner went down fast after hitting an iceberg because the ship's builder used substandard rivets that popped their heads and let tons of icy seawater rush in. More than 1,500 people died.

When the safety of the rivets was first questioned 10 years ago, the builder ignored the accusation and said it did not have an archivist who could address the issue.

Now, historians say new evidence uncovered in the archive of the builder, Harland and Wolff, in Belfast, Northern Ireland, settles the argument and finally solves the riddle of one of the most famous sinkings of all time. The company says the findings are deeply flawed.

Each of the great ships under construction required three million rivets that acted like glue to hold everything together. In a new book, the scientists say the shortages peaked during the Titanic's construction.

"The board was in crisis mode," one of the authors, Jennifer Hooper McCarty, who studied the archives, said in an interview. "It was constant stress. Every meeting it was, 'There's problems with the rivets and we need to hire more people.' "

Apart from the archives, the team gleaned clues from 48 rivets recovered from the hulk of the Titanic, modern tests and computer simulations. They also compared metal from the Titanic with other metals from the same era, and looked at documentation about what engineers and shipbuilders of that era considered state of the art.

The scientists say the troubles began when its ambitious building plans forced Harland and Wolff to reach beyond its usual suppliers of rivet iron and include smaller forges, as disclosed in company and British government papers. Small forges tended to have less skill and experience.

Adding to the problem, in buying iron for the Titanic's rivets, the company ordered No. 3 bar, known as "best" — not No. 4, known as "best-best," the scientists found. Shipbuilders of the day typically used No. 4 iron for anchors, chains and rivets, they discovered.

So the liner, whose name was meant to be synonymous with opulence, in at least one instance relied on cheaper materials.

Many of the rivets studied by the scientists — recovered from the Titanic's resting place two miles down in the North Atlantic by divers over two decades — were found to be riddled with high concentrations of slag. A glassy residue of smelting, slag can make rivets brittle and prone to fracture.

"Some material the company bought was not rivet quality," said the other author of the book, Timothy Foecke of the National Institute of Standards and Technology, a federal agency in Gaithersburg, Md.

The company also faced shortages of skilled riveters, the archives showed. Dr. McCarty said that for a half year, from late 1911 to April 1912, when the Titanic set sail, the company's board discussed the problem at every meeting. For instance, on Oct. 28, 1911, Lord William Pirrie, the company's chairman, expressed concern over the lack of riveters and called for new hiring efforts.

In their research, the scientists, who are metallurgists, found that good riveting took great skill. The iron had to be heated to a precise cherry red color and beaten by the right combination of hammer blows. Mediocre work could hide problems.

“Hand riveting was tricky,” said Dr. McCarty, whose doctoral thesis at Johns Hopkins University analyzed the Titanic’s rivets.

Steel beckoned as a solution. Shipbuilders of the day were moving from iron to steel rivets, which were stronger. And machines could install them, improving workmanship.

The rival Cunard line, the scientists found, had switched to steel rivets years before, using them, for instance, throughout the Lusitania.

The scientists discovered that Harland and Wolff also used steel rivets — but only on the Titanic’s central hull, where stresses were expected to be greatest. Iron rivets were chosen for the stern and bow.

And the bow, as fate would have it, is where the iceberg struck. Studies of the wreck show that six seams opened up in the ship’s bow plates. And the damage, Dr. Foecke noted, “ends close to where the rivets transition from iron to steel.”

The scientists argue that better rivets would have probably kept the Titanic afloat long enough for rescuers to arrive before the icy plunge, saving hundreds of lives.

The researchers make their case, and detail their archive findings, in “What Really Sank the Titanic” (Citadel Press).

Reactions run from anger to admiration. James Alexander Carlisle, whose grandfather was a Titanic riveter, has bluntly denounced the rivet theory on his Web site. “No way!” Mr. Carlisle writes.

For its part, Harland and Wolff, after its long silence, now rejects the charge. “There was nothing wrong with the materials,” Joris Minne, a company spokesman, said last week. Mr. Minne noted that one of the sister ships, the Olympic, sailed without incident for 24 years, until retirement. (The Britannic sank in 1916 after hitting a mine.)

David Livingstone, a former Harland and Wolff official, called the book’s main points misleading. Mr. Livingstone said big shipyards often had to scramble. On a recent job, he noted, Harland and Wolff had to look to Romania to find welders.

Mr. Livingstone also called the slag evidence painfully circumstantial, saying no real proof linked the hull opening to bad rivets. “It’s only waffle,” he said of the team’s arguments.

But a naval historian praised the book as solving a mystery that has baffled investigators for nearly a century.

“It’s fascinating,” said Tim Trower, who reviews books for the Titanic Historical Society, a private group in Indian Orchard, Mass. “This puts in the final nail in the arguments and explains why the incident was so dramatically bad.”

The Titanic had every conceivable luxury: cafes, squash courts, a swimming pool, Turkish baths, a barbershop and three libraries. Its owners also bragged about its safety. In a brochure, the White Star Line described the ship as “designed to be unsinkable.”

On her inaugural voyage, on the night of April 14, 1912, the ship hit the iceberg around 11:40 p.m. and sank in a little more than two and a half hours. Most everyone assumed the iceberg had torn a huge gash in the starboard hull.

The discovery in 1985 of the Titanic wreck began many new inquiries. In 1996, an expedition found, beneath obscuring mud, not a large gash but six narrow slits where bow plates appeared to have parted. Naval experts suspected that rivets had popped along the seams, letting seawater rush in under high pressure.

A specialist in metal fracture, Dr. Foecke got involved in 1997, analyzing two salvaged rivets. He was astonished to find about three times more slag than occurs in modern wrought iron.

In early 1998, he and a team of marine forensic experts announced their rivet findings, calling them tentative.

Dr. Foecke, in addition to working at the National Institute of Standards and Technology, also taught and lectured part time at Johns Hopkins. There he met Dr. McCarty, who got hooked on the riddle, as did her thesis adviser.

The team acquired rivets from salvors who pulled up hundreds of artifacts from the sunken liner. The scientists also collected old iron of the era — including some from the Brooklyn Bridge — to make comparisons. The new work seemed only to bolster the bad-rivet theory.

In 2003, after graduating from Johns Hopkins, Dr. McCarty traveled to England and located the Harland and Wolff archives at the Public Record Office of Northern Ireland, in Belfast.

She also explored the archives of the British Board of Trade, which regulated shipping and set material standards, and of Lloyd’s of London, which set shipbuilding standards. And she worked at Oxford University and obtained access to its libraries.

What emerged was a picture of a company stretched to the limit as it struggled to build the world’s three biggest ships simultaneously. Dr. McCarty also found evidence of complacency. For instance, the Board of Trade gave up testing iron for shipbuilding in 1901 because it saw iron metallurgy as a mature field, unlike the burgeoning world of steel.

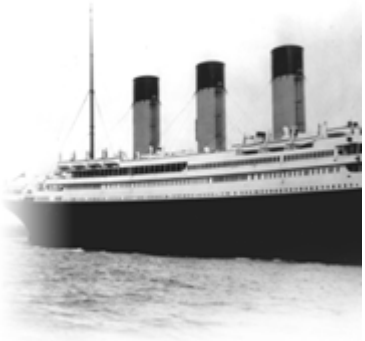
Dr. McCarty said she enjoyed telling middle and high school students about the decade of rivet forensics, as well as the revelations from the British archives.

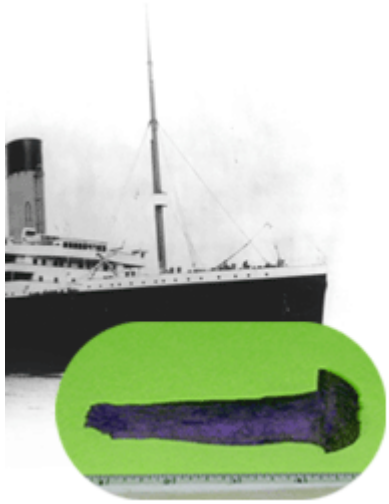
“They get really excited,” she said. “That’s why I love the story. People see it and get mesmerized.”

http://www.nist.gov/public_affairs/licweb/quality_titanic.htm Quality Control and the Titanic

Quality Control and the Titanic

If NIST Standard Reference Materials had been available to the builders of the Titanic in 1911, perhaps the tragic sinking would not have occurred. The Titanic's steel hull was held together with wrought iron rivets. In 1998 a NIST metallurgist found that a number of these rivets contained three times as much slag-a waste product from ore smelting-than normal. The extra slag made the rivets more brittle and prone to break on impact. This may have been a major factor in the Titanic's sinking.





http://www.nist.gov/public_affairs/update/upd980217.htm

***Titanic* Metallurgy**

Failure of Tiny Rivets May Have Sunk 'Unsinkable' Liner

When the remains of the *RMS Titanic* were discovered more than two miles beneath the surface of the North Atlantic in 1985, the story of the great liner once dubbed "unsinkable" by the press began moving from legend into scientific fact. Numerous research investigations have been piecing together the details of what really occurred on April 14-15, 1912, after *Titanic* struck an iceberg, broke in half and carried more than 1,500 people to their deaths. Now, the answer to one of the most elusive questions--Why did the 46,000-ton ship sink in less than three hours?--may be contained in a new report from NIST.

The culprit, says NIST metallurgist Timothy Foecke in the report, is very possibly one of *Titanic's* smallest components--the 3 million wrought iron rivets used to hold the hull sections together.

Foecke performed metallurgical and mechanical analyses on steel and rivet samples recovered from the *Titanic's* hull. His examinations revealed that the wrought iron in the rivets contained three times today's allowable amount of slag (the glassy residue left behind after the smelting of ore), making it less ductile and more brittle than it should have been. This finding provides strong evidence that *Titanic's* collision with the iceberg caused the rivet heads to break off, popped the fasteners from their holes and allowed water to rush in between the separated hull plates.

Photographs of *Titanic's* sister ship, the *RMS Olympic*, back up the rivet failure theory. Taken after the *Olympic* collided with another vessel in 1911, the photos clearly show dozens of vacant holes in the hull where rivets once sat. Sonar and other evidence gathered during a 1996 visit to the *Titanic* also point to seam and rivet failure.

For a single copy of *Metallurgy of the* RMS Titanic (NISTIR 6118), send a request to Public Inquiries by fax at (301) 926-1630 or by email at inquiries@nist.gov.

http://en.wikipedia.org/wiki/RMS_Titanic Wikipedia, Titanic

http://en.wikipedia.org/wiki/Rivet Rivet

From Wikipedia, the free encyclopedia

Jump to: navigation, search

Solid rivets

Metal wheel with riveted spokes and tyre.

A **rivet** is a mechanical fastener. Before it is installed it consists of a smooth cylindrical shaft with a head on one end. The end opposite the head is called the buck-tail. On installation the rivet is placed in a pre-drilled hole. Then the tail is "upset" (i.e. deformed) so that it expands to about 1.5 times the original shaft diameter and holds the rivet in place. To distinguish between the two ends of the rivet, the original head is called the factory head and the deformed end is called the shop head or buck-tail.

Because there is effectively a head on each end of an installed rivet it can support tension loads (loads parallel to the axis of the shaft); however, it is much more capable of supporting shear loads (loads perpendicular to the axis of the shaft). Bolts and screws are better suited for tension

http://pghbridges.com/termsMet.htm **Rivet**

A metal fastener with a large head on one end, used to connect multiple metal plates by passing the shank through aligned holes in the plates and hammering the plain end to form a second head

http://query.nytimes.com/mem/archive-free/pdf?res=940DEEDB1F31E233A25753C1A9629C946396D6CF

LONDON, April 9.—The White Star liner Titanic, the largest vessel in the world, will sail at noon to-morrow from Southampton on her maiden voyage to New York.

Although essentially similar in design and construction to her sister ship, the Olympic, the Titanic is an improvement of the Olympic in many respects. Capt. Smith has been promoted from the Olympic to take her across. There are two pursers, H. W. McElroy and R. L. Baker.

Among the passengers to sail to-morrow on the Titanic are Mr. and Mrs. H. J. Allison, Mrs. Aubert, Major Archibald Butt, Mrs. Cardeza, Mr. and Mrs. W. E. Carter, Mr. and Mrs. Herbert Chaffess, Norman Craig, Mr. and Mrs. Washington Dodge, Mr. and Mrs. Mark Fortune, Mr. and Mrs. W. D. Douglas, Col. Gracie, Benjamin Guggenheim, Mr. and Mrs. Henry Harper, Mr. and Mrs. Frederick Hoyt, Mr. and Mrs. Isidor Straus, Mr. and Mrs. J. B. Thayer, and Mr. and Mrs. George Widener.

HOLD-UP MEN CAPTURED.

Three Cornered 60 in a Saloon, but Got Nothing—One Gets Away.

Three men entered Bernard Naddler's saloon, at 2 Rutgers Place, last night and demanded $25 from Naddler. He declared he had only $15 in the cash register, and one of the men stuck a revolver into his face, declaring:

"Then you'd better get it quick. If you don't produce we'll kill you. We mean business."

The other men meantime had covered a crowd of about sixty men seated in a rear room of the saloon with their revolvers, and finally they ordered them all into the street. The crowd made a rush to obey, and then the men turned to Naddler and his bartender, John Davis, again. Two of them choked Davis almost insensible, while the other backed Naddler against the wall and threatened him with instant death if he didn't produce $25.

Naddler was protesting that he didn't have that much when the bandits heard a noise outside. They started for a window in the back and Davis tackled them. They beat him off, leaving him half conscious on the floor, and leaped through a rear window just as some of the crowd they had driven from the saloon returned, headed by a policeman.

Naddler reported the holdup at the Madison Street Station and Detectives Farley and Cohen started on a search for the men. In a saloon in Monroe Street a man ordered three beers as they entered the place.

"That's the same voice," exclaimed Naddler, and the detectives started toward the man. As they did so he and two others rose and made for a side door. One got through and escaped. The others were arrested. They said they were Julius Cline of 105 Monroe Street and Samuel Plaks of 24 Orchard Street. Both denied having been concerned in the holdup, but they were locked up.