# *Titanic* and Forensic Naval Architecture
# Questions and Answers

Philip Sims
September 19, 2011

## I. Forensic Naval Architecture Committee Questions

Q. What is the Forensic Naval Architecture Committee?
A. A voluntary research group sponsored by five major marine technical organizations.

Q. What does it do?
A. Those familiar with TV crime dramas know what a "cold case" police squad is – it reopens unsolved old cases based on new information. The FNA Committee is a cold, deep, wet and dark case squad. It is not interested in recent wrecks, subject to investigation by modern authorities, but old and forgotten ship accidents upon which new technology can be brought to bear.

Q. What is the new technology?
A. 1) Improving sonar imagining technology which allows wrecks, thought to be lost forever in the deep, to be found. The finding Air France 447 would have been impossible 10 years ago.
2) Mini-submarines and Remotely Operated Vehicles which allow deep wrecks to be explored in detail.
3) Personal computers allow analysis, formerly prohibitively expensive, to be conducted on any wreck than can be explored.

Q. Who participates in the FNA committee?
A. The panel is an information exchange group involving the various communities involved in wrecks: salvors, wreck owners, amateur divers, deep-sea explorers, ship designers and archeologists. Attendance at meetings and supporting work is entirely voluntary.

## II. *Titanic* Questions

Q. Did the owners go 'rule shopping' to avoid extra expense?.
A. Yes, to avoid Lloyd's Classification Rules, they found that British Board of Trade rules, set up for much smaller ships, allowed them more freedom to do what they thought was the minimum required.

Q. Why were there too few lifeboats on the *Titanic*? Were the owners being cheap?
A. The two agreed-upon expected causes of a ship sinking in the early 1900s were grounding or collision with another ship. Lifeboats were not a place of refuge; they were shuttle craft to take passenger to the beach or the relatively undamaged ramming ship. They were expected to make several trips doing this, so 100% capacity was not needed.
The owners disliked the boats because they spoiled the passengers' enjoyment of the ship by cluttering-up the walking areas. The solution was the invention of the gravity davit. See Appendix A.

Q. If an ordinary person has watched the many *Titanic* TV shows, he has seen several explanations of how and why the *Titanic* sank. A person can get confused - what is "the cause" of the sinking?
A. There is no "the cause". Accidents are usually a "chain of events' – specialists like to explore their link in the chain. Sailors like crew decisions, metallurgists like rivets, and naval architects like the flooding rate. Specialists, overly focused on their part, are sometime accused of being "Link Polishers"

Q. What have we learned from watching the TV shows?
A. Collectively, the documentaries have been a study in the rapidly growing technology of deep under water exploration. Prior to 1989, a ship lost in the deep was gone forever. The first generation of wreck exploration was using Dr. Ballard's camera-on-a-wire bobbing up and down from the mother ship's motions. The second generation was *Alvin, Nautile* and *Mir* mini-subs exploring the outside. The third generation was mini-Remotely Operated Vehicles entering inside the ship.

Q. Why was Captain Smith willing to go through an ice field at high speed?
A. Iron and steel ships had been surviving collisions with icebergs since the 1859 collision of the *Edinburg* (53 years prior to the *Titanic)*. The track record was that bigger ships did better than smaller ships and newer ships were stronger than older ships. Thus, as the new and biggest, Captain Smith thought *Titanic* should be iceberg proof. Worst that could happen would be like the *Kronprinz Wilhelm*, which hit an iceberg in 1907, resulting in bloody nose of beat up plates and scraped away paint.

Q. Once the lifeboats were away, could the crew have done anything to save themselves?
A. They could have backed towards the ship lights in the distance. Going ahead pushes water into the bow and makes a ship with bow damage sink faster. Going backward doesn't hurt and may actually help slow the sinking. In 1916, the sinking-by-the-bow battle cruiser *Sedlytz* got safely back to Germany by backing partway.

Q. Anything not happen the night of the sinking?
A. After famous ship disappears, notes-in-bottle are occasionally found claiming to be the last words of a doomed crew or passenger. If that were a natural human thought on a slowly sinking ship, there should have been several hundred Champaign bottles bobbing about the next morning.

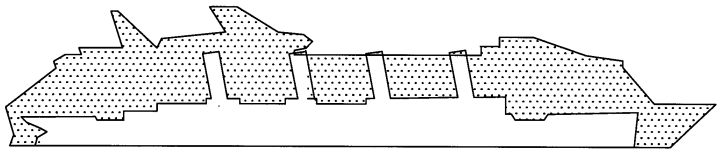
Q. Was the *Titanic* a bad design?
A. The *Titanic* was a good girl – she took greater-than-expected damage and remained upright and sank slowly. The Naval Architect's nightmare is the *Empresses of Ireland* that took an expected damage, capsized and sank within 15 minutes. The *Empres*s sinking killed more passengers than the *Titanic* – the total death toll was less because the crew was more successful in getting to the lifeboats than the passengers.

Q. What was the ultimate cause of the loss of the *Titanic*?

A. The ultimate cause is humans make linear projections about the future ("housing prices will always go up") but we live in a non-liner and discontinuous world. The energy in a moving object is mass times velocity squared – a hyperbolic increase.. Compared to the iceberg-surviving *Kronprinz Wilhelm* of 1907, the *Titanic* was three times as big, moving 30% faster so it had 5 times the impact energy pushing in her side plates – creating damage not seen during previous iceberg collisions. *Titanic* was too big and going too fast.

III, *Titanic* and Modern Ships

Q. How does the *Titanic* compare to modern cruise ships?
A. Below is a comparison of the profile of the *Titanic* of 1912 to the *Voyager of the Seas* of 2000. At 46,329 gross tons volume (one gross ton = 100 cubic feet), the *Titanic* would fit comfortably inside the *Voyager of Seas* of 137,399 gross tons. In turn, the *Voyager of the Seas* seem small compared to the current size record holder *Oasis of the Seas* at 225,282 gross tons or just under five times the *Titanic*'s enclosed volume.



***Titanic* profile in front of *Voyager of the Seas***

Q. Long tears down the side like the *Titanic* cannot happen again, right?
A. The solution to icebergs was radar. Unfortunately, pinnacle rocks and reefs don't show up on radar and can rip holes down the length of a ship. In 1998 *Monarch of the Seas* hit a reef with extensive holing down the length of the ship. Fortunately, there was a nearby beach to put her bow onto to avoid the risk of sinking. [ for *Monarch* incident background see http://www.incidentnews.gov/incident/7361 The complete report is at http://marinecasualty.com/documents/monarch.pdf ]

Naval architects are once again pushing the boundaries of big – 80,000 gross tons volume used to be a big ship but now considered moderate size in comparison to the 225,000 gross ton *Allure of the Seas.* There are still surprises out there – nobody thought the outside of a cruise ship could catch on fire but it did on the *Star Princess*.
[ http://www.maib.gov.uk/cms_resources.cfm?file=/Star%20Princess.pdf ]

Q: Can anything useful be learned by looking at an ancient wreck like the *Titanic*?
A: The bulk carrier *Derbyshire* disappeared with no witnesses in a Pacific storm in 1980. Because her sister ships had structural problems aft, it was widely believed that she sank due to structural failure in the stern. The wreck was found with the bow intact and the stern crushed by water pressure – exactly like the *Titanic*. Suddenly the ship sinking had hundreds of witnesses,

although 68 years in time and an ocean away. The *Derbyshire*'s bow must have flooded slowly on the surface and then violently dragged the stern down.

IV Fate of the *Titanic*

Q. What will become of the wreck?
A. It will collapse on itself and become a pile of rust, with some embedded bronze and ceramics, on the bottom. Due to being in cold, low oxygen and relatively still water, after 100 years the *Titanic*'s bow is in better shape than the *Andrea Doria* of 1956 which has fallen apart. The *Andrea Doria* example shows the final collapse will take a relatively short time. The *America* took only fifteen years to fall apart in warm oxygenated surf of the Canary Islands.
[ http://en.wikipedia.org/wiki/SS_America_(1940) ]

Q. After a 100 years, who still cares enough to visit the wreck?
A. The following groups are interested in returning to the *Titanic* periodically in the future:

Microbiologists - interested in following the full life cycle of the bacteria causing the rusticles

Metallurgists - interested in the steel decay patterns

Archeologists - used to dealing with already crushed wrecks, it provides a case study of the collapsing process

Intellectuals - there is a strain of intellectual thought that enjoys contemplating the ruins of empires - see "The Pleasure of Ruins" by Rose Macauley at http://www.archive.org/details/pleasureofruins010331mbp

## Appendix A – *Titanic*'s Lifeboats as Deck Clutter and the Modern Gravity Davit

The *Titanic*'s lifeboat formed a wall between the passengers and seeing the sea.

**Figure 1 is from http://www.titanic-titanic.com/pic/boat_deck.gif**

Modern ships are fitted with gravity davits, lifting boats up as in Figure 2, which converted the unwanted deck clutter of lifeboats to a welcome supplier of shade or light rain protection to deck chairs. Since the boats could be lowered and passengers put aboard by a limited number of non-technical crew, there was no longer a large number of seamen around the boat tempted to take it for themselves, as in the *Arctic* incident.

**Figure 2: The installation of Gravity Davits solved the lifeboat clutter problem**