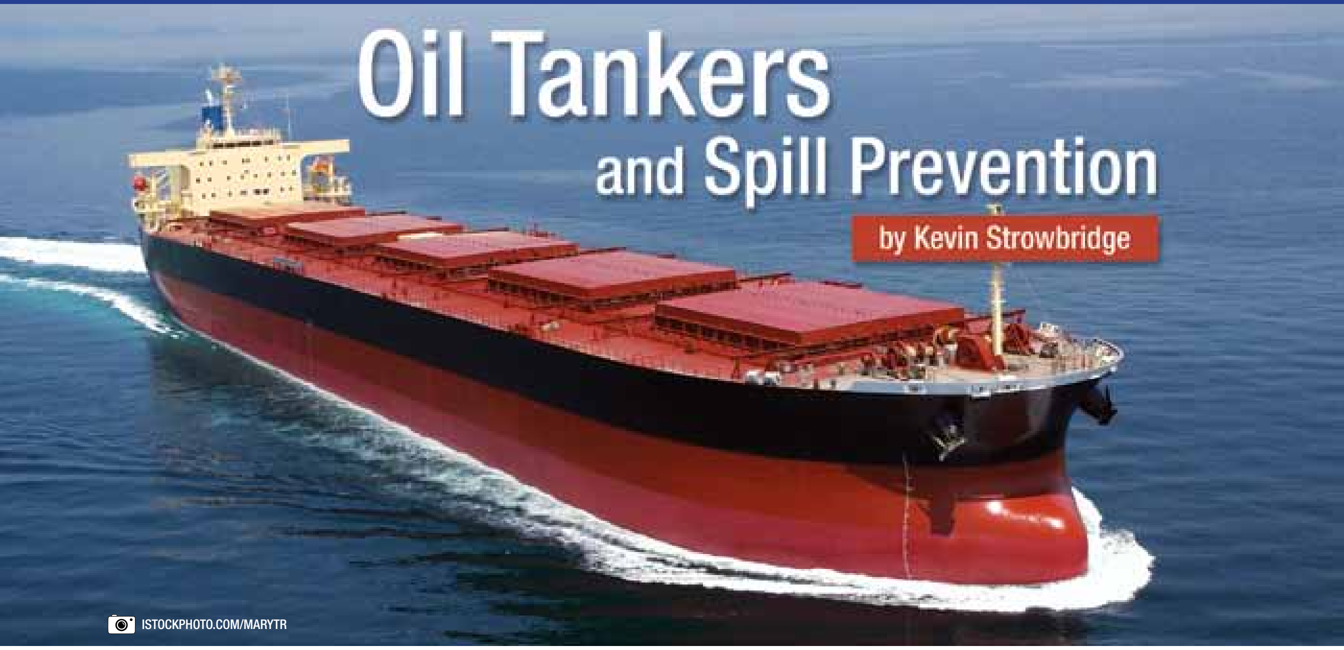

Oil Tankers and Spill Prevention

by Kevin Strowbridge

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Since the late 19th century, man has utilized ships to transport oil across the oceans. Early oil tankers were simply single-hull wooden sailing ships used to transport non-polluting light oils. The first half of the 20th century saw the development of larger oil tankers (10-15,000 DWT). These were single-hull, riveted steel construction, engine powered, with the same non-polluting cargos as their wooden predecessors.

Oil tankers designed and built post WWII progressed upwards in size to 500,000 DWT. These were also single-hulled, but welded steel construction to accommodate a new cargo of crude oil. Design techniques were pioneered that increased the confidence level of the designers,who then felt they could decrease previously-employed safety factors. Use of finite element analysis allowed designers to reduce structural weight by increasing the frame spacing and reducing the size of the structural scantlings [dimensions of the structural parts of a vessel]. Doing so allowed for the construction of lower cost tankers which could carry a large volume of oil; however, it lead to the loss of many tankers and to some serious oil spills.

A historic oil spill occurred when the *Exxon Valdez* ran aground in Prince William Sound, Alaska, in 1989. This spill was considered to be the most devastating manmade environmental disaster at the time. The sheer magnitude of the spill caused enough public outcry for governments, regulators, and industry to adopt new standards in the way oil tankers were designed, built, and operated. New standards, such as the US OPA 90 and MARPOL Annex 1, have greatly increased safety factors and reduced the potential for large-scale oil tanker related spills.

One of the most notable changes was the incorporation of an inner "hull" into the tanker design that contained the cargo oil. The space between the inner hull and outer hull was used to carry ballast water, which is ocean water. This double-hull design is now the global modern tanker design.

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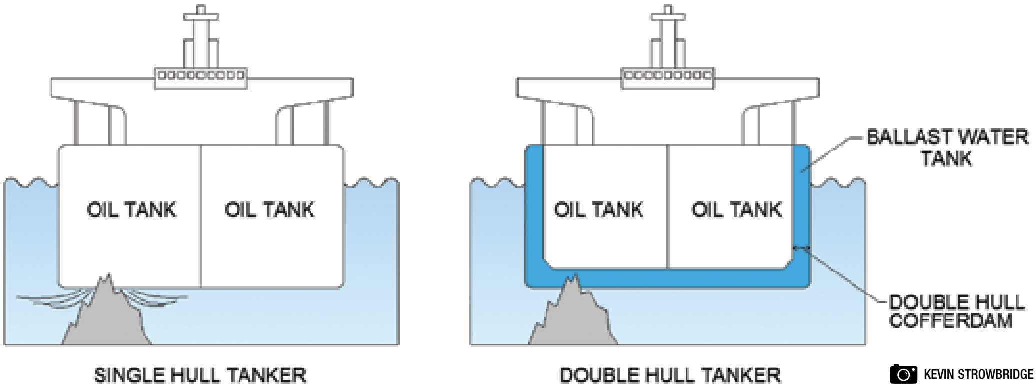

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Since the introduction of the double-hull concept, the depth of the innerbottom and width of the wing tanks have been increased to give an even larger factor of safety. Doing so, however, has reduced the volume of oil that a tanker can transport, meaning that additional voyages are necessary in order to transport the volume of oil required by the markets. Each additional voyage increases the risk of an incident or accident occurring.

The double-hull concept has presented marine engineering systems designers the opportunity to route ballast pipes through the innerbottom ballast tanks. Unlike the single-hull tankers, keeping the ballast pipes away from the cargo oil tanks means that the risk of oil leaking into a ballast pipe and then being accidently dumped overboard has been eliminated. Furthermore, access into the double-bottom region for inspection purposes is easily achieved. Ship operators can now perform ongoing comprehensive inspections to maintain structural integrity and screen for areas of corrosion or damage.

Improvements in the coating systems utilized within the ballast and oil tanks have slowed the degradation of the structure due to corrosion. Preventing corrosion reduces the risk of structural fatigue, which can lead to the formation of cracks.

Along with the double hull, other design concepts have been implemented, such as subdivision of the cargo tanks. This was introduced so as to reduce the size of each single cargo tank. In the event that a cargo tank is breached, the volume of oil in that tank will be much less, thus reducing the scope of the spill.

Another improvement is in the quality of the construction materials. Modern tankers are now built from higher quality steels that are able to resist higher ranges of stress and are more resistant to crack propagation. This, combined with enhanced welding techniques, ensures that the hull is both resilient and remains oil tight.

The ability of oil tankers to prevent oil spills involves a high quality design and construction, with high grade materials and workmanship, and ongoing comprehensive inspections to ensure that the vessel is well maintained throughout its service life. Competent operation and management of the vessel and crew training are equally as important.

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