

## Sinking of the Andrea Doria July 25, 1956

On July 25, 1956, the Andrea Doria (an Italian luxury passenger liner) was struck off Nantucket by the Stockholm (a Swedish passenger liner). Andrea Doria was struck head on, which was bad enough. What made it even worse was that Stockholm was outfitted with a reinforced icebreaking bow for its travels in frigid waters. If you look at the severe damage to Stockholm's reinforced bow (estimated to be \$1 M in 1956 dollars), it's no surprise that Andrea Doria suffered fatal damage.

### Step 1. Outline the Problem

<b>What</b>	Problem(s)	SS Andrea Doria and MV Stockholm collide
	Date	July 25, 1956
<b>When</b>	Time	11:10 p.m.
	Differences	Foggy
<b>Where</b>	Physical Location	Off Nantucket, Massachusetts
	Unit/Process/Equipment	Two luxury ocean liners
	Work/Task Being Done	Transporting passengers

### Impact to the Goals

<b>Safety</b>	51 passengers & crew killed (46 Andrea)
<b>Materials, Labor</b>	Loss of the Andrea Doria (\$29M)
	Heavy damage to the Stockholm (\$1 M)

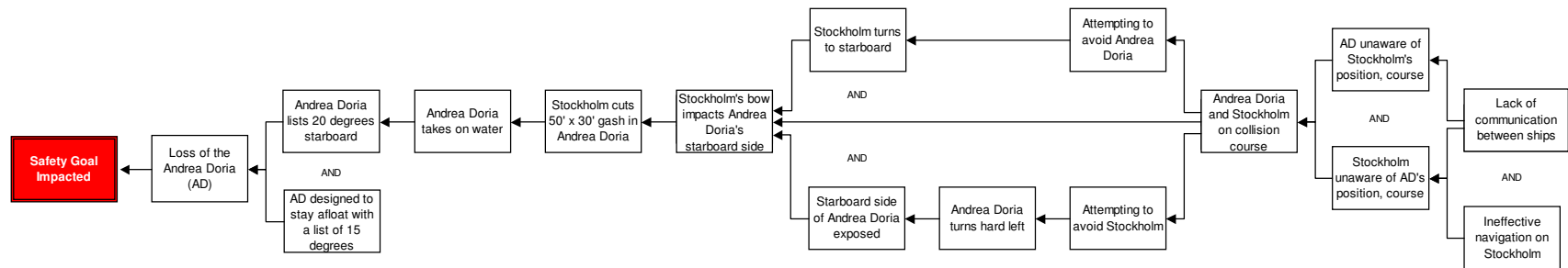
Although one lesson we can take from this is to never be arrogant enough to call your ship "unsinkable", we can perform a root cause analysis into the tragedy to determine what else went wrong. A thorough root cause analysis built as a Cause Map can capture all of the causes in a simple, intuitive format that fits on one page.

First, we look at the impact to the goals. 51 people were killed (46 on Andrea Doria, 5 on Stockholm). This is an impact to the safety goal. The \$29 M (1956 dollars) Andrea Doria was a total loss, and Stockholm suffered \$1 million worth of damage. These are both impacts to the material goal.

When Stockholm struck Andrea Doria, it ripped a 50x30 foot hole in Andrea Doria. This compromised Andrea Doria's watertight compartment system, so it began to take on water. Within 5 minutes of the collision, it was listing 20 degrees starboard. It was designed to stay afloat with a 15 degree list, but not as much as 20, so the ship sank.

Now, why did the Stockholm's bow strike Andrea Doria's side? Stockholm turned starboard, trying to avoid Andrea Doria (AD) because they were on a collision course. The turn was insufficient because of a delay in response time by Stockholm while they plotted the course of the oncoming vessel, which was standard procedure, and because their speed was not reduced. Both the delay and the speed not being reduced were partially caused by an inexperienced watch - a 3rd mate was in charge and he was the only officer on deck. It is also believed that the navigator on Stockholm was unaware of the fog.

Andrea Doria's starboard side was exposed because they made a hard left turn, attempting to avoid Stockholm, which was also insufficient due to their speed. Operations in fog call for "moderate speed", which is defined as the speed at which a ship could be stopped within its visibility distance. Andrea Doria's visibility was 1/2 mile, while its stopping distance was far greater.



Andrea Doria made an unexpected turn, to attempt to pass Stockholm starboard to starboard, despite the fact that ships normally pass port to port, per rules of the road. They did this because they believed Stockholm was already to their starboard side. They were unaware of Stockholm's course because they did not plot it. Additionally, Stockholm was north of its recommended route, because the recommended route added distance and time, and was very crowded.

Stockholm turned starboard, to try and avoid Andrea Doria; however, Stockholm had miscalculated Andrea Doria's position and course, partially due to ineffective navigation on Stockholm.

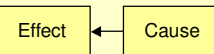
The ships also suffered from a lack of communication: Stockholm was not using proper signals (its fog horn and turn signal). There was no visual contact between the ships due to reduced visibility from fog and the fact that the ships were traveling at night. Also, there were no radios to communicate between the ships (a fact that has thankfully been remedied). The attached PDF, available for download, has a high-level visual root cause analysis (cause map) of the incident. Even more detail can be added to this Cause Map as the analysis continues. As with any investigation the level of detail in the analysis is based on the impact of the incident on the organization's overall goals. (In the case of Andrea Doria, the high level cause map has 16 boxes; the detailed map has more than 100.)

### Cause Map Detail Level



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### Why?



NOTE: Read the Cause Map from left to right with the phrase "Was Caused By" in place of each arrow.