

## Step 1. Outline the Problem

<b>What</b>	Problem(s)	Collision of U.S. Navy ship and submarine
	When	March 20, 2009
	Time	~1:00 a.m. local time
<b>Where</b>	Differences	Submarine submerged
	Physical Location	Strait of Hormuz (near Iran)
	Unit/Process/Equipment	USS Hartford (nuclear-powered submarine) USS New Orleans (amphibious ship)
Work/Task Being Done		Heading into port
<b>Impact to the Goals</b>		
<b>Safety</b>		15 sailors received minor injuries
<b>Environmental</b>		Spill of 25,000 gallons of diesel fuel
<b>Cust. Service</b>		Rise in price of oil
<b>Production</b>		Potential for delay in oil shipments ?
<b>Materials</b>		Significant damage to sail of submarine
		Ruptured fuel tank on ship

## Collision of USS Hartford and USS New Orleans March 20, 2009

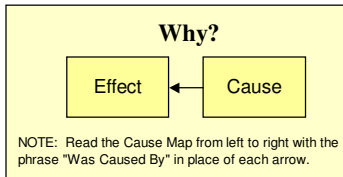
Early this morning, the USS New Orleans (an amphibious ship) and the USS Hartford (a nuclear-powered submarine) collided in the Strait of Hormuz, near Iran. The details of the collision are pending an investigation, but we can begin a root cause analysis based on what we know so far.

There were 15 submariners who received minor injuries, which is an impact to the safety goal. 25,000 gallons of diesel oil were spilled from the New Orleans, which is an impact to the environmental goal. The incident resulted in an increase in oil prices, which we will consider an impact to the customer service goal. There was the potential for disruption of traffic in the Strait of Hormuz, which is a major shipping channel, so we will consider that an impact to the production goal. Finally, there was "significant" damage to the submarine's sail and a ruptured fuel tank on the ship, which are both impacts to the materials goal.

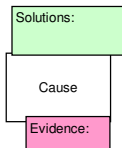
We'll look at the injuries first. In our basic root cause analysis, the injuries were caused by the collision of the ship and the submarine. The collision also caused the damage to the submarine's sail. The diesel oil leak was caused by a ruptured fuel tank on the ship. The fuel tank rupture was also caused by the collision. The collision also caused the potential for disruption in the Strait, through which 40% of the world's sea-transported oil is shipped. It was because of this potential that oil prices were increased. (The U.S. Navy has stated that both vessels have left the strait and shipping was not disrupted.)

So, what caused the collision? This is where we're somewhat lacking in details, but we can make some guesses. In order for the submarine and ship to collide in the Strait, they both had to be in the Strait. They were both in the Strait heading to ports in the Persian Gulf to stock up on provisions. It is likely that the collision occurred because the ship and the submarine were unaware of each other. The submarine was submerged, so the ship wouldn't be able to see it visually. Additionally, submarines are designed to be practically undetectable by ship's equipment. A remaining question is why the submarine was unaware of the ship. We will be able to fill in more detail on our visual root cause analysis (or cause map) as more information comes to light. Click on the "Download PDF" button above to see the cause map associated with this incident.

## Step 2. Cause Map



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.



### Cause Map Detail Level



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