Use of the Design Process for the Taylor Energy Oil Spill

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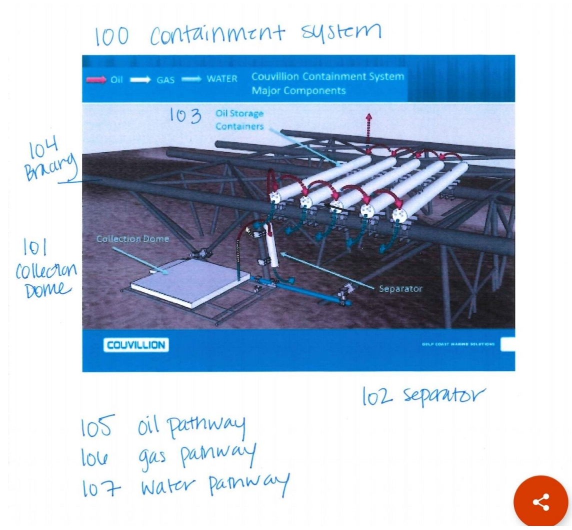
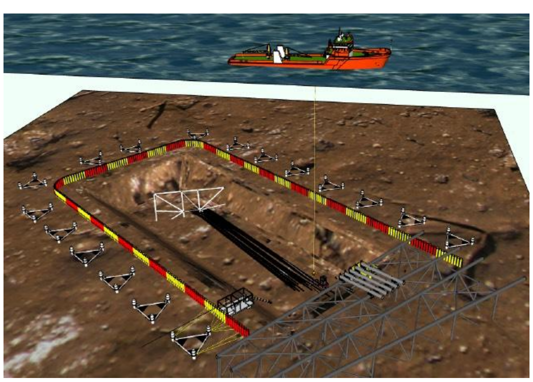
In 2004, an oil spill at an offshore Taylor Energy platform caused major environmental concerns. In order to address the issue, the US Coast Guard hired Couvillion Marine in 2017. The oil spill clean-up concept was first conceived by Jack Couch. He then used the design process to figure out the finer details with his colleagues. To aid in the design, they used Autodesk software and fluid simulators. I am presenting this effort since it's such a great example of experts applying the design process to solve real-world problems.

Taylor Energy is based in New Orleans, Louisiana. In 2004, Hurricane Ivan struck the Gulf of Mexico. The force of Ivan created an underwater mudslide 500 feet below the surface and 10 miles offshore. The mudslide sheared the supports of a Taylor Energy offshore oil platform, which immediately knocked it over. The oil platform, which served as the basis for 25 oil wells, began to spill oil. For 16 years, Taylor Energy avoided fixing the leak. They claimed the leakage was around 3 gallons per day, but the US Coast Guard determined that it was about 4,536 gallons per day. The Coast Guard sued Taylor Energy to stop the spill. Unfortunately, Taylor Energy was unable to comply, and the Coast Guard sought bids from offshore contractors.

In 2017, Jack Couch was first introduced to the problem when he was called into Taylor Energy's office to try and come up with a solution to the oil spill. When Jack asked, "Why don't you collect and ship the oil away while you wait on well cap operations?" Taylor's engineer claimed "the methane would overwhelm any oil capture system and there isn't any gravity underwater." This explanation did not make sense to Jack; he had seen many tools fall into the ocean's abyss during his 16 years as a commercial diver. When he returned home, Jack quickly sketched his idea on a piece of paper for an oil, gas, and water separator. Jack then started the patent process, and Oceaneering assigned Timmy Couvillion, a recent engineering school graduate, to help him with the project. Jack Couch's initial exploration of the problem and sketching of the solution is similar to when VEX students find a method through the design process to compete in the game.

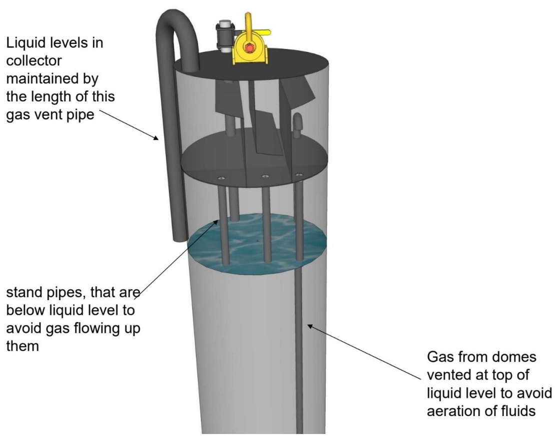
The next day, he proved the design would work for Taylor Energy. Taylor Energy was not interested in Jack's solution. At this point, the patent process was finished, and Jack had the patent. At the same time, the Coast Guard was taking bids from firms to contain or stop the oil leak. But Oceaneering didn't want to bid since Taylor Energy was threatening to sue. Timmy Couvillion circumvented this by forming his own company, Couvillion Marine, and entering the bid. They beat out 15 other companies for the Coast Guard contract because their design was passive, meaning it didn't require any extra energy. This is critical because of the strong Mississippi River currents that make it impractical to lay wires along the seabed. They also brought in Dr. Kevin Kennelley, who has a PhD in mechanical engineering, to help. They worked nonstop for the following four days to design and test a solution. Following that, they embarked on a four-month phase of intensive engineering, fabrication, and installation, during which they enlisted the help of Oceaneering. Their process is similar to VEX in that you first prove that the general concept works before you figure out the finer nuances and then build.

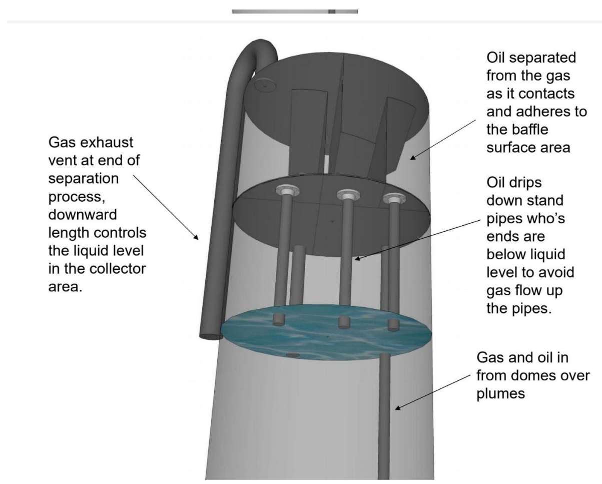




Their system has 3 major components: a dome, a separator, and tanks. The well is covered by a dome that collects oil, water, and methane. A tube then transports the water, oil, and methane to a separator, which separates the oil, water, and methane from one another so the oil can be stored in the tanks. The tanks can hold up to 67,200 gallons of oil and are emptied once a month by an Oceaneering ship that transports the oil to be recycled.

The separator works to separate the oil and methane from the sea water by first separating the gas with a turned-down gas vent. This only allows methane to escape once it has made and maintained a pocket. There is no methane detected at the surface as it's absorbed by the water. Baffles at the top help separate the liquids from the gas. Then the oil and water drop down into the separator, which works by having the oil float to the top of the liquid level in the lower section of the separator and then into the tanks. The separated water then goes out the bottom of the separator.





The tank's function is to hold the oil until a ship comes by and empties it, but once the tanks are empty, water begins to flow back into them to keep the enormous pressures of the sea from crushing them. This is achieved by having a water drop tube that goes down to the level of the collection dome. For every gallon of oil that flows out of the tank, a gallon of water enters the tank and vice versa. When the ship comes to the site to drain the tanks, they watch a gas buster to see if there's any water coming up the tube, which would mean the subsea tanks are empty of oil. If the tanks are empty, they then turn off the subsea pump and close the storage tank valves.

Couvillion Marine's team, including Timmy Couvillion, Dr. Kennelley, and Jack Couch, were able to design a separator and related components to help stop further environmental damage from the Taylor oil spill. Their system has captured more than 800,000 gallons of oil. This shows how using the design process and careful planning can create a professional solution to a major problem. Which is exactly what VEX is aimed at teaching kids. VEX has personally given me the tools and resources I need so I can help solve problems like this one.

CBS Interactive. (2021, November 5). *Containing the Taylor Energy Oil Spill*. Cbsnews. Retrieved December 28, 2021, from https://www.cbsnews.com/news/taylor-energy-oil-spill-60-minutes-2021-11-05/?fbclid=IwAR1VRfIHvge9rAL3VVBj1m2-eH6svGFdF03iyDuf9URIyWmPNSbWfZqvN8w

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