The Engineering Design Process

From 1995 to 2001, Harley Davidson represented the engineering design cycle through their creation of the new V-Rod. The idea came about after Harley was starting to lose much of its revenue due to people buying sports bikes. They came up with the new idea of combining the speed of a car with the looks of a Harley. This resembles step one of the engineering design process because they recognized the need in the market for a faster bike. Next they defined the problem which was to design a faster, lighter bike at a lower cost that still resembled a Harley look.

The third step in their process was gathering information. They originally pulled the engine from the VR-1000 to serve as a rough model for the speed they wanted in the bike. They drew inspiration for the design from dragsters. Also, they researched liquid cooled engines that could push harder for longer. They looked at various materials for the bike as well, such as plastic, aluminum, and steel.

The fourth and next step was to generate conceptual ideas. They used computer programs to create a virtual model of the parts of the bike. Another strategy they used was carving the bike with clay to get a better visual of what the bike physically looks like. They brainstormed ideas
such as liquid vs. air cooled, one vs. two mufflers, and two rails on the top for more support. They also knew that looks were extremely important and knew they wanted to hide the radiator.

After hundreds of ideas and rough drafts, the team had to narrow down which of the thoughts they were going to use. This represents step five of the design cycle. One of the most important things for the project is when they worked with Porsche to make a cheap and legal, yet fast engine. The design team and the performance teams also had to come together and combine the physics of making a motorcycle, without compromising the iconic design. After hundreds of differing ideas between the two teams, they eventually came up with the look and speed that they wanted.

There were many struggles that arose in the making of the V-Rod. Designs constantly changed as certain issues had to be contended with. As design carried on, Harley found that there was not much room for a fuel tank. The idea was to move the tank under the seat, which had not yet been done on a Harley. When the location was determined, the actual size of the tank became the issue. Plastic was used for the tank since it could be molded to add another gallon to the small three gallon tank. The radiator and cooling system then became the issue. The engine was to be liquid cooled, but the radiator hose was covering a cylinder that ruined the look of the iconic Harley. It was rerouted through the “V” of the engine to the other side to leave the aesthetics of the bike intact. The air flow to the radiator was also an issue. The look of the front of the bike needed to be maintained while allowing for more air into the radiator. The cover was given air fins to pull in the air that was being pushed away by the front wheel. Harley also was looking into new ways to form the bike. As previously mentioned, hydroforming was used to form the frame and change the number of welds from 17 to 7 in the final version of the bike. The curved look extended to the exhaust which had a curved, double pipe system to accommodate for
the extra air needed. Also added to the exhaust was a new system to Harley, a “third volume” in the exhaust. This kept the look of the bike, but added the extra space needed to be over the legal limit. The final bike had 115 hp and could go 140 mph. This is a representation of step six of the engineering design process, analyze and design.

The seventh step was to fabricate and test prototypes. The design team and engineers fabricated a hydroformed frame that made durable frame with less yields. They created a special three volume muffler to hold the capacity of 12 liters of air, and created a hidden radiator for the front of the motorcycle. Also, they fabricated an engine from the ground up with porsche that would be a durable cheap performance engine. All of these designs were tested to see their limits. The bikes were tested to the absolute extremes. For example, they did a break and shake test in a lab to simulate rough road conditions and ensure the bike was durable. Then they did a radio wave test to make sure electronics didn’t interfere with the bikes functions. Their final test was a cooling test to make sure the engine wouldn’t overheat and would function properly after idling for hours in the signature parades. They drove the bike for hours in the scorching heat, let the bike sit in the heat for hours, then drove the bike again for hours in the heat. All the tests passed and then they began to manufacture the bikes.

The final step in their process was revealing the design to the public. Knowing that the name is very important for the overall impression, they spent over a year coming up with the perfect name that wasn’t copyrighted, and captured the essence of the bike. They eventually named it the V-Rod. Also, before the bike was officially on the market Harley-Davidson traveled around the country unveiling the bike to the public for the first time at different showcases. This got the public excited and made the bike more popular. More importantly, the public was able to give feedback that allowed Harley to restart the whole engineering process and improve the bike
for later models. When the V-Rod was finally released six years after the process started it was one of the biggest successes for Harley.