

Engineering Program Management

What exactly is engineering? That was a question I had asked myself during my junior and senior years of high school. I generally understood engineering to be designing products, and I knew that engineering required a solid grasp of mathematics as well as science. Those areas seemed to align with my general interests and academic abilities, so I decided to study engineering. However, I was unable to answer this question fully until I had worked in the field for several years, and I think the way I would answer the question has also changed over the years. The question has many answers, as there are many different fields and types of work under the umbrella of 'engineering'. So an engineer's specific area or field of work will shape this answer significantly.

What is required to begin an occupation as an engineer? Generally speaking, an engineering job will require a bachelor's degree in engineering. I attended Grand Valley State University in Michigan and was impressed by their engineering program in how it prepared me for the workplace. Advanced degrees in engineering are also available if one desires to specialize further in a certain area, but this is not required for a majority of engineering jobs.

What does an engineer do? That also was a question I had asked and was unable to answer in detail, even after completing my schooling and several internships. I understood parts, but couldn't figure out what could keep all these engineers busy week after week. It turns out that the process for designing and developing new products is very detailed and time consuming.

If one would conduct a brief internet search, the following definitions would be found:

Engineering is the creative application of scientific principles used to plan, build, direct, guide, manage or work on systems to maintain or improve our daily lives.

An engineer is a professional practitioner of engineering, concerned with applying scientific knowledge, mathematics, and ingenuity to develop solutions for technical problems.

The work of engineers forms a link between scientific discoveries and their subsequent applications to human needs and quality of life.

So what exactly does this mean?

Engineers are involved in a variety of industries in a broad range of specialties. Engineers design roads and bridges, plastic soda bottles, buildings and homes, cars and trucks, furniture, children's toys,

software and apps, satellites, shoes, airplanes, leaf rakes, cell phones and virtually any other product that you could imagine. Engineers also design and develop the equipment needed to make these products—assembly machines, stamping presses, injection molding machines, machines that create circuit boards, and many more.

My occupation is in the field of mechanical engineering, and I work in the automotive industry for a Tier 1 supplier. That means that my company designs and manufactures certain parts for cars/trucks, and we sell these parts directly to the OEMs (Original Equipment Manufacturers—Ford, GM, Chrysler, Toyota, Honda, VW, ect).

The specific products that I work with are the exterior mirrors that are placed on cars and trucks produced by Ford Motor Company. These are the mirrors attached to the drivers and passenger sides of the car with the words “OBJECTS IN THE MIRROR ARE CLOSER THAN THEY APPEAR” on the glass.

These mirrors are custom designed for each vehicle based on the styling and features that the customer wants in the mirror for that specific vehicle. The process for designing, developing, and producing a mirror is lengthy (typically 2—3 years of work prior developing the product, followed by 5—6 years of production). The process begins with the customer (Ford, in my case) deciding to design and produce a new vehicle (sometimes this is a brand new model and other times a redesign of an existing model). There are a number of companies competing for the job of supplying the mirrors for a particular car model, and once the car maker decides who will supply the mirrors, the work beings.

Initially, for a period of around 6 months, we (the mirror engineers) will work with the engineering and styling team at Ford. The objective is to agree on the size and appearance of the mirror. This is a significant challenge because typically the goal of the styling team is to make the mirror as small and sleek as possible, while the goal of the mirror engineer is to have enough room to design all the internal parts of the mirror and make it easy to assemble while meeting all the specifications and requirements that apply.

Once the surface design is agreed to and released, we work on designing each component that makes up the mirror assembly. This process takes around four months. There are the structural pieces that attach to the vehicles, motors to move the glass, lights that blink with the turn signals, 360 degree cameras, glass of different types (some with lights that illuminate when a car is next to you, others that have a convex spotter in the corner, and still others that dim at night when a car is behind you to reduce the glare).

Once each piece is designed, then it is time to build the tools required to manufacture each component. This typically takes 4–5 months. In the mirror business, these tools typically include plastic and metal injection molds, metal stamping tools, and machinery to assembly all the pieces of the mirror into one assembly.

Once all the tools are completed, all the components can be made and the first mirror assemblies can be put together. This begins the part of the launch in which the mirrors are tested to ensure that they meet all the customers' requirements, and solutions are developed for the parts of the design that do not meet the customers' requirements. The testing and design refinement phase of the project lasts for about five months.

Once the mirrors have met all the customers' requirements, they are submitted to the customer for approval (along with a significant amount of test reports and other paperwork). This begins that phase of the program in which the customer is assembling the mirrors and the rest of the components onto the complete vehicles and getting the vehicle ready to sell at the dealerships. This phase consists of several different builds at the customer's assembly plant. The builds are separated by several weeks, and during each build problems are identified that need to be corrected. By the end of the builds, the objective is that all the problems are solved and the vehicle is ready to go into high volume production and be available for purchase at the dealerships. This phase of the project lasts about four months.

Once the project starts high volume production, the work is not over. Inevitably there are problems that appear on a few parts that need to be investigated and corrected, as well as changes to the products that are requested by the customer—perhaps a new feature or a new paint color.

A mirror engineer will have multiple projects going simultaneously, and these projects will all be at different stages, so there is truly no typical day as far as the specific work you would be doing. It might consist of arriving at the office at 7:30 a.m. and reviewing emails that have come in overnight from suppliers or customers in Asia or Europe. Each week there will typically be a team meeting for each mirror program that is being developed, and also meetings with the customer to keep them apprised of the status of the mirror development and any problems that are being encountered. There will be parts that need to be built for testing, designs and drawings that need to be completed or updated, testing that needs to be completed, reviewing with the manufacturing team the ease of assembly, and developing ways to improve the assembly process. Time will also be spent updating the budgets of the

program to ensure that the project is still on track to be profitable, and creating and submitting quotes to the customer for requested changes.

Each engineering or manufacturing company is different in the specifics of how it is structured and who does which tasks of the project, but at my company the engineers are divided into project teams. A project team is led by a program manager and consists of a project engineer, a design engineer, a tooling engineer, a quality engineer, and a manufacturing engineer. The objective of the program manager is to lead the project team through the design and development of the mirror while meeting the customers' requirements within the cost quoted to the customer through a design that is able to be consistently manufactured and assembled with ease for the workers who put the mirrors together, and at a high quality level.

I enjoy this work because it is always challenging and fast paced. Although you may think that two years of work on a single mirror would be dull, it is far from that. There are always a host of problems that need to be resolved, and there is pressure to solve all the problems so that they do not impact the development and launch of the entire vehicle.

In this field of work, I am always awestruck by the amount of effort, thought, and labor that goes into the construction of a single vehicle that will be useful for 10—15 years of transportation and then be sent to a scrapyard. This is magnified when I look and see God's creation in all its majesty, changing from season to season, exactly as God has designed it. Man's creations, with all the thought, energy, analysis, and technology, are still fraught with problems, but God's creation, which is incomparable in its complexity and vastness, even now in its fallen state, is magnificent—from the minutely tiny subatomic level to the incomprehensible galaxies that are unfathomable distances away.

This is something of which my occupation makes me keenly aware. While it may take me seven months to complete a flawed design of a few plastic pieces that can be assembled together into a mirror that is a small piece of an entire car, it took God six days to create perfectly this entire world and all the universe.

My occupation in engineering has also required some business travel. This travel has been either to meet with customers or to meet with suppliers. These travels have brought me to various places in the USA as well as Germany, Costa Rica, China, and South Korea. While it is difficult to grasp fully the size of

this earth, these travels have brought the expansiveness of the world into a frame of reference for me. God's power, as displayed in the passages below, becomes more and more vivid as I realize, in part through these travels, how massive the earth is and how incredible it truly is that God is completely in control of all things, not only on the earth, but in the entire universe of which this earth only comprises a tiny portion.

Hebrews 1:3: "...upholding all things by the word of his power..."

Matthew 10:29–30: "Are not two sparrows sold for a farthing? And one of them shall not fall on the ground without your Father. But the very hairs of your head are all numbered."

Isaiah 46:10: "...declaring the end from the beginning, and from ancient times things that are not yet done..."

It is my prayer that you will continue to look to our great God to guide you as you embark on the paths to various occupations. If you have any questions related to the engineering field, please feel free to contact me via email at nathan.pastoor@gmail.com.

Proverbs 3:6: "In all your ways acknowledge him, and he shall direct your paths."