

# **Design Engineer career in Oil & Gas industry**

**Team Number:** 1715B

**Team Name:** Big Brains

**Location of team:** Hopkinton Middle School, Hopkinton, Massachusetts, USA

## **Names of students:**

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## STEM career

The STEM career that we chose to research for this report is Design Engineer at Baker Hughes Masoneilan, makers of Valves for the Oil & Gas industry. The primary reasons why we chose this are:

1. they are in business for more than 100 years designing and making physical products
2. they use engineering design process for their everyday work
3. one of the parents of this team member work for this company & has been mentoring us

## Engineering design process

We interviewed the professionals in this company to learn about the Design Engineer profession in manufacturing companies, particularly in the oil & gas industry.

We learnt that even though they do not have a documented and standardized design process, they use the combination of the following steps and adjust accordingly to the nature of the work:

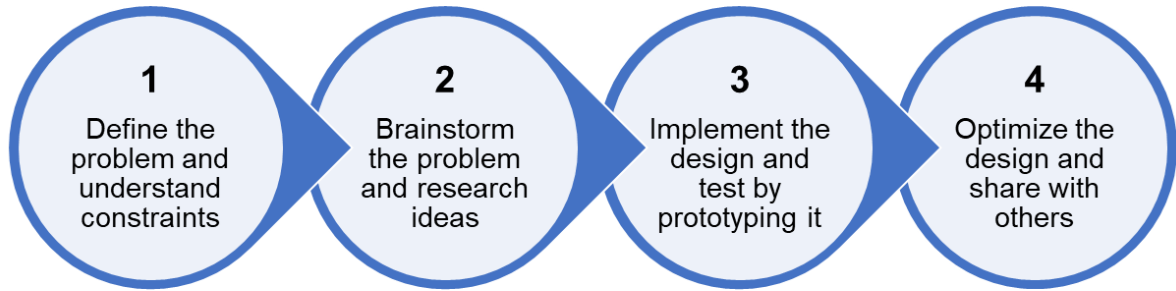
1. First, they start with defining the need or problem and understanding the constraints. The need could be to design something new or tweak an existing design. They typically use the 3Ws approach to define the need or problem:
  - a) What is the problem?
  - b) Who is having this problem?
  - c) Why are they having this problem?

The need and constraints are typically collected through the requirements from their customers directly or through market research and/or the feedback from the customers who have used their product. Some other constraints could be the environment and condition in which their product would be used.

Understanding and documenting this step is the most critical part of the entire design process.

2. Next, they start to brainstorm the problem to research ideas and explore various possibilities around the established criteria and constraints. They use various tools and techniques, learning from their previous experience, applying engineering principles & calculations, and availability of resources like tools, materials and machines to sort their ideas. They select the most promising solution among these and start to put together a design proposal.
3. Then they start to implement the design proposal using various computer aided design (CAD) software. Once the design is completed, they test them by prototyping it by 3D-printing the design or other manufacturing process. Sometimes, they consider alternative solutions documented from the earlier step based on the feedback from test results.

4. Finally, once the design is optimized and refined, they share the solution with other teams in the company to manufacture the product or present to their customers.



*Engineering Design Process used by Design Engineers*

## **Our design process**

We approached designing our robot by first studying the rules from the Game manual and understanding the constraints like the objects and interactions allowed.

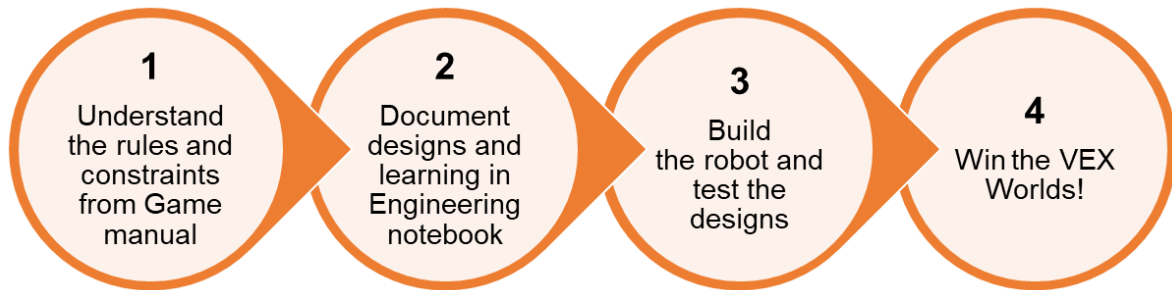
During the first few meetings, we brainstormed various design proposals and started documenting them in our Engineering notebook.

We then selected the most promising design based on the feasibility of the idea and how easy it would be to build it.

For every meeting, as we made progress with building the design, we captured the drawing of the design and documented what worked and what did not in our Engineering notebook.

We also started understanding various engineering principles like Gear ratio and shared those learning within our team by making videos of those principles for better understanding and later reference.

In our first competition, our initial design did not get us enough points to qualify for regionals and so we started redesigning our robot for our next competition. During this redesign, we reference back to other ideas we considered and documented originally in our Engineering notebook.



*1715B Big Brains design process*

## **VEX Robotics for Design Engineer career**

As we tried to relate the engineering design process used by the Design Engineers in a company with our design process to build our robot, we understood that both are similar. In general, the design process used by these engineers is a more advanced version of what we are doing with our robot design.

1. Design Engineers use advanced engineering knowledge to do mathematical calculations to help with their designs. Our learning of engineering principles in VEX, like Gear ratio, would help us to learn the advanced principles later in high school and college.
2. Design Engineers use various computer aided design (CAD) software to model their design and drawings. Our experience with VEXCode software to design and control the robot without the controller would help us to learn and use these advanced CAD tools.
3. Following the VEX guidelines, such as documenting all the designs and learning in the Engineering notebook, is seen as a best practice by Design Engineers in the company as well, like they store all versions of the drawings and designs in their software called Product Lifecycle Management (PLM). This is useful to redesign or improve the design by referring back to these notes and without having to spend all the time and effort!

We feel that our participation and learning in VEX Robotics ideally suit us for Design Engineer as a career option in manufacturing companies.

## **Credits**

- Professionals at Baker Hughes for their time and patiently explaining their process.
- Our parents for arranging and hosting the meetings at home and driving us back and forth!
- Our mentors for proofreading and guiding us with this essay.