Designing an Affordable High Pressure Fire Monitor

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Course : Mechanical Engineering BEng

INTRODUCTION

A fire monitor is best described as a water cannon for fighting fires from a distance. The high-pressure fire monitor I will design will be a useful tool in fighting fires and boundary cooling vessels. It will also allow members of the crew to fight the fire without within proximity of the flames.

I identified the need for a cheap fire monitor through both experience and market research. I performed a survey with Warsash Maritime Academy cadets and found that only **22%** of cadets had sailed with a fire monitor.

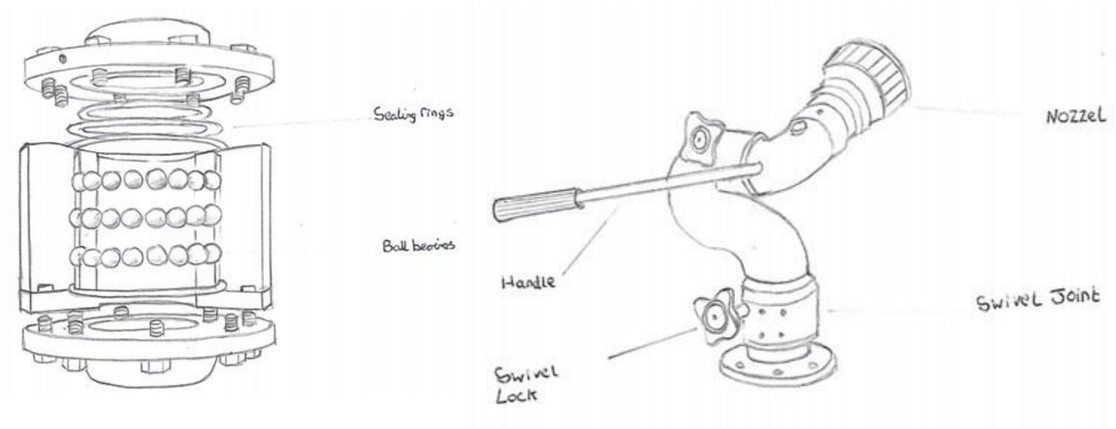
This provided evidence that there was a lack of fire monitors at sea. I concluded that designing an affordable version would increase the likelihood of smaller vessels implementing fire monitors, consequently increasing this percentage.

AIM

The aim of the project it is to create a fire monitor which is affordable and offers the performance of a high-end model. I intend to make a fire monitor that will cost less but not compromise on performance. The low cost and effectiveness of my design will allow fire monitors to slowly integrate onto smaller vessels. At the end of the project, I would like to have a Solidworks model of the fire monitor. If there are no more contingencies caused by COVID 19 I will also create functioning model. The product should also be safe and have a high factor of safety.

CONCEPT DESIGN

The initial concept design was to have two swivel joints allowing for 360 degree rotation. The design would also have a method of locking the rotation for when the fire monitor is being used. It will also contain multiple sealing rings to prevent water from leaking out the joint.

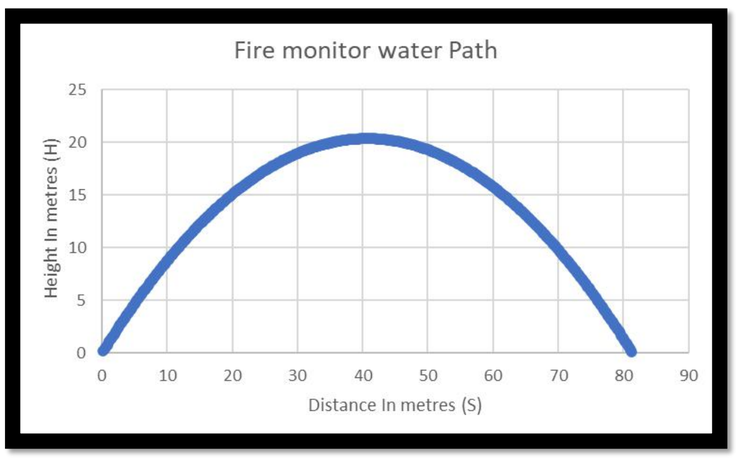


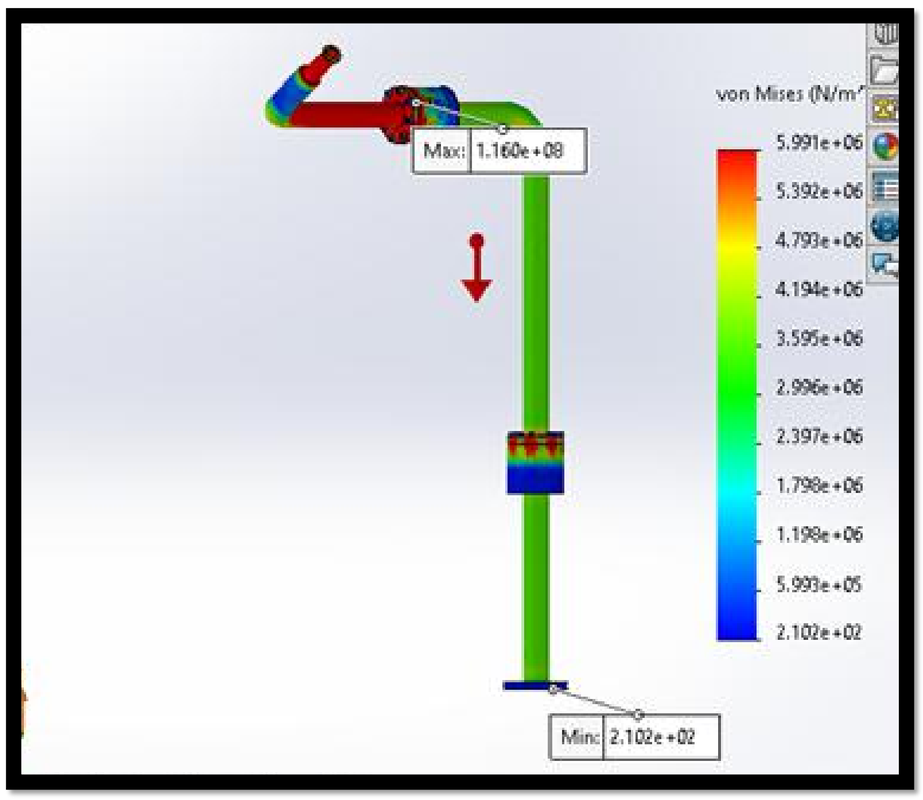
DESIGN DEVELOPMENT

Step 1

The first step was to create a mathematical model that would predict the distance obtained by the water jet with various input parameters.

From my model I determined that with a jet velocity of **28.3 m/s** I would achieve a distance of over 80 m.



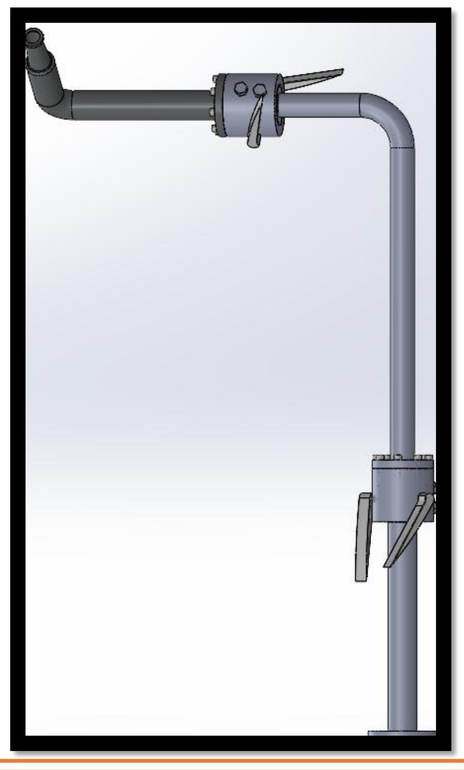


Step 2

From the mathematical model I calculated the desired pipe diameters and created a design based of the initial concept drawings .

Stresses in the system were then estimated using maximum shear stress theory. These stresses where combined with research to choose an appropriate material from Granta material database.

The components where created using Solidworks software.



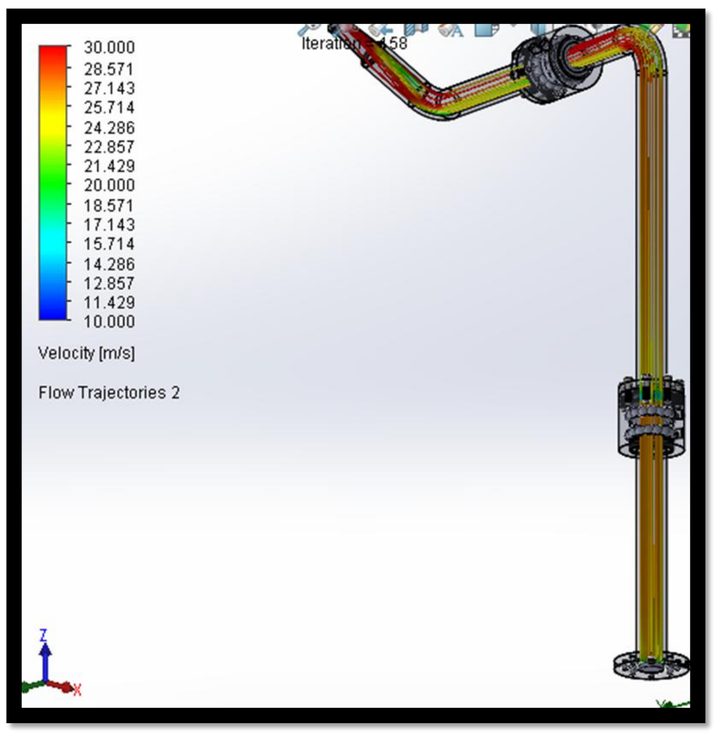
Step 3

A fluid simulation was then performed to find the ideal input parameters that would achieve the output velocity **28.3 m/s.**

Step 4

An FEA simulation was then performed on the model to ensure it could withstand the induced forces.

The maximum stress in the system was **116 MPa** which produced a **factor of safety of over 3.**
(This is means the product is extremely safe).



CONCLUSION

- The estimated cost of my product was 360 GBP. This was **53 .17 %** cheaper than the cheapest fire monitor found during my market research. I believe this was evidence of my fire monitor being affordable.
- My survey showed that **100%** of the questioned cadets answered yes to the following statement " do you think that a fire monitor costing under **360 GBP** would allow ships with smaller budgets to consider their installation". I believe this is evidence I achieved my objective of creating a fire monitor that could be integrated onto a smaller vessel.
- I was unable to create a physical model due to COVID 19
- The product had a factor of safety over **3**. I believe this is evidence that the product is safe.
- If I where to do the project again I would look into optimising the system. This would further reduce the cost of the system whilst increasing its performance.

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