**Team Assignment: TQ and MS**

1. What is this problem really about?

Design a way to accurately measure the true valve position independent of the actuator, and determine a way to directly measure the actuator output torque. The issue at the core of this project is that valves and actuators degrade over their working life, so Bray would like a way to measure this degradation in real time so they can identify errors and the need for preventative maintenance more quickly.

1. What implicit expectations and desires are involved?

Design a valve that degrades less over time by monitoring torque and using the data to use preventative maintenance. If the valve position can also be monitored then more insights and to preventative maintenance and degradation can be made. A “stretch goal” is determining a method for identifying valve leakages in real time, but it is expected that we work on the other goals before beginning this last one.

1. Are the stated customer needs, functional requirements, and constraints truly appropriate?

To the best of our knowledge the main constraint is that the sensors should be embedded into the valve. We will clarify this constraint more when we go to the Bray site on September 8th.

1. What avenues are open for creative design and inventive problem solving?

The method for measuring valve position and valve leakage is not specified so we will have creative freedom on how to best measure the true valve position.

1. What avenues are limited or not open for creative design? Limitations on scope?

Bray R&D has developed their own valves and already have a way to measure torque so the project will be confined to meet what they have already designed. The sensor will have to fit onto the already designed valve and not impede the purpose of the valve.

1. What characteristics / properties must the product have?

The product must be independent of the other part of the assembly. For example, a sensor for the valve must be independent of the actuator, and a sensor for the actuator must be independent of the valve. This is so the parts can be packaged easily and sold separately to Bray’s customers.

1. What characteristics / properties must the product not have?

It must be independent of the actuator so that the data collection method/product is not dependent on actuator type. In other words, the product for the valve must not be dependent on the actuator and vice versa, so that the parts can be sold separately and can work independently.

1. What aspects of the design task can and should be quantified now?

It would be useful to quantify what sort of valves we are working with exactly, what size they are, and what kinds of actuators are being used so that we design the proper sensor/other product for the valve assembly.

1. Do any biases exist with the chosen task statement or terminology? Has the design task been posed at the appropriate level of abstraction?

The main bias for this project is the deliverles Bray identified versus what the customer wants. Bray identified true valve position, actuator torque and leakage as the 3 main values to measure. Bray’s research into the wants of their customers revealed leakage and torque to be the main concerns. Bray wants these specific sensors on the valve when the customer may not know how it affects the performance of preventative maintenance and monitoring the conditions of the valve.

1. What are the technical and technological conflicts inherent in the design task?

As a group, we have little experience with sensor technology and design of sensor placement in order to report valve position. We also have limited understanding of how valves work and operate. We will need to research how butterfly and ball valves work in detail since those are the two main types of valves that we will be working with.

**Mission Statement: Bray Embedded Valves and Actuators Project**

**Product Description:**

Bray needs an embedded device to monitor and measure the output torque of their actuators in real time and the true position of the associated valves, as well as a method of determining valve leakage.

**Key Business or Humanitarian Goals:**

Increase the life time of valves.

Monitor leakage of the valve.

Increase notice time for preventative maintenance.

**Primary Market:**

Companies wishing to use Bray’s valves and actuators in order to safely transport a desired fluid.

**Secondary Market:**

Any parties who consume the products produced in facilities that use the Bray’s valves. If a valve in the flow process were to have a weakened actuator or became stiff, the reduced flow rate in that pipe could change the composition of the final product.

**Assumptions:**

Little/no leakage desired, incorporate position directly into actuator or status monitor, independent of actuator type. Method/product must be easy to use for customers.

**Stakeholders:**

Bray, who sells these valves and actuators, their customers who purchase these valves and actuators, and the team (us) who are designing the product.

**Avenues for Creative Design:**

Sensor types, sensor placement, dual function of sensors, leakage prevention method, system data processing recording.

**Scope Limitations:**

Valves: Ball valve and Butterfly valve.

Solution System must be embedded in the valve (not an external monitoring system).

Cost of sensors for measuring leakage.