

# The Agitators

## Milestone 2

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Customer Needs and Wants

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This document outlines the customer (Merrick) needs and wants. During questions and conversations, the project advisor made statements regarding guidelines and desires for the project. These customer statements were then interpreted into actual needs that the project will aim to achieve.

## 1 – CUSTOMER NEEDS AND WANTS

| Question/Prompt                                                                                                     | Customer Statement                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Interpreted Need                                                                                                |
|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| What metrics are most important (cost, efficiency, safety, reliability, manufacturability)                          | In order of priority:<br><ol style="list-style-type: none"> <li>1. Usefulness (primary objective is to get data)</li> <li>2. Manufacturability (want to quickly have a useful prototype, so ideally something we (or you) can manufacture)</li> <li>3. Safety is always a consideration, but this is a Lab instrument to be operated only by trained personnel</li> <li>4. Cost is always a consideration, but this is a one off, so not the first priority.</li> </ol> | The instrument prioritizes capturing torque data over manufacturing, safety, and cost, which are more flexible. |
| What resources is Merrick able to provide? What resources (software, hardware) does Merrick want us to incorporate? | Probably anything you need, from fabrication to software support. The real question (for me), is what can you (or FSU) provide?                                                                                                                                                                                                                                                                                                                                         | Merrick can provide hardware, software, and fabrication.                                                        |
| How would a successful project outcome look?                                                                        | A working prototype with which we have obtained real, useful data.                                                                                                                                                                                                                                                                                                                                                                                                      | The instrument logs data that is used to find real torque values.                                               |
| How many different agitators should we be aware of?                                                                 | The entire set of possible agitators is pretty large, but if we can test a couple of designs, and have the ability to test more, that would be good.                                                                                                                                                                                                                                                                                                                    | The instrument works to test multiple different agitator geometries.                                            |
| When/how often will we have access to Merrick facilities?                                                           | As often as necessary, but I would expect for you to do most of your work at FSU or elsewhere                                                                                                                                                                                                                                                                                                                                                                           | Merrick's facilities can be used, however most work must be performed elsewhere.                                |

|                                                                                                                |                                                                                                                                                                             |                                                                                                                                     |
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| Does the scope of the project include making torque predictions about augers as well as the agitators?         | Not yet.                                                                                                                                                                    | The instrument does not need to interact with an auger/feeder.                                                                      |
| What is the budget? What will funding look like throughout the course of the project?                          | Budget/resources will go through FSU-PC first, then Merrick as a last resort.                                                                                               | The instrument will be funded by FSU-PC.                                                                                            |
| Are there any environmental considerations for building materials?                                             | Probably not for the build materials, but sometimes the test materials (e.g. powders) can be somewhat hazardous. You will not be exposed to anything hazardous.             | The device prototype does not have to accommodate hazardous materials.                                                              |
| Could we buy a Torque Sensor to get Torque Data?                                                               | No. Expensive, Long lead time and we would need to guess torque range we need which would be an expensive mistake.                                                          | The device will have a customized sensor to measure torque.                                                                         |
| Who are the primary users/operators for the tester and predictive model?                                       | Merrick engineers. This will be proprietary information, not released to the public (i.e. our competitors)                                                                  | The device is designed to be used by engineers that are familiar with the device and its purpose.                                   |
| How is Merrick currently selecting motors and gear ratios for this application? (What is the current process?) | Based on experience. There have been some significant failures                                                                                                              | The device provides data allowing motors to be selected for various agitator geometries.                                            |
| What do you like about the current process?                                                                    | It is free, but failed ranges are a possibility.                                                                                                                            | The device gives accurate and reliable data without being overly expensive.                                                         |
| What do you dislike about the current process?                                                                 | Equipment failure is expensive if the current method is done incorrectly. Based on personal experience and previous trails. Oversizing motors to meet minimum requirements. | The device will use an efficient and reliable process.                                                                              |
| Typical uses.                                                                                                  | Determining starting torque, running torque, log data, and creating an algorithm with the data collected from the device.                                                   | The device collects and logs data related to the torque, which is then used to specify motors for full-scale agitator applications. |

|                                                           |                                                                                                                                  |                                                                                                   |
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| Could we use angular velocity to determine torque values? | No. A torque must be read when the motor is running, but static.                                                                 | The device will be able to read torque from both a zero and non-zero speed.                       |
| How large should the agitator be?                         | The agitator can be sized depending on the size of the hopper.                                                                   | All aspects of the device will fit with the hopper, which has maximum dimensions of (10"x10"x10") |
| What volume of material can we expect?                    | Enough to supply sufficient force against the agitator, but not too much to where the hopper has to be too big to be 3D printed. | The hopper will fit within the limitations of available 3D printers (10"x10"x10" build volume)    |