Summary

Timken produces cross roller bearings under the XR series in the United States that are used in machinery such as vertical axis lathes in China. Timken currently measures bearing runout as a part of product quality control at the point of bearing manufacture. The current bearing-runout-measurement systems are suitable, but the machinery used for large-scale bearings is large and difficult to transport. This means that if a part is not performing adequately and the customer desires their bearing re-measured, they must return it to Timken for assessment, which can be a great inconvenience to the customer. Timken has asked us to create a new device that can measure the axial and radial runout of these XR bearing models while remaining portable for transportation to customer facilities and on-site runout measurement.

The team is comprised of students located in the United States at Penn State University and in Shanghai, China at Shanghai Jiao Tong University. We continue to follow our schedule by completing the tasks described in the provided Gantt chart. After presenting our statement of work proposal to representatives from Timken, we have worked to create four concepts that best suit the newest design specifications. Once we generated concepts, we analyzed each one in a detailed concept selection process and chose the best. We have supplied a bill of materials, material selection process, component selection process, CAD drawings, and some additional analysis to support our design.

The team has generated a detailed design that shows the potential for a working system based on a singular preload plate with load applied via hydraulic actuator. The measurement system will sit on one of the legs and have access to any portion of the bearing that needs to be measured. This design allows for the best possible runout measurement made at the expense of portability. We feel that making the most accurate runout measurement possible outweighs the portability criterion. The device is still movable by truck to customer facilities, but it will not fit into a suitcase as previously discussed due to design constraints made that maximize accuracy.

The team did not produce a prototype of the design due to time, financial, and other constraints. We further refined the design presented in the detailed design report through multiple revisions and conducted further analysis to ensure robustness of the design well past the design condition. We have included a complete collection of detailed design files, including all CAD files, drawings, and FEA analysis files per our deliverables agreement with this report.