

Senior Design Project Description

Company Name	<i>Timken</i>	Date Submitted	<i>05/11/2020</i>
Project Title	<i>Design for Improved Ergonomics for Shot Blast Operation – Phase 2 (TIM_ERGO2)</i>	Planned Starting Semester	Fall 2020

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	3	Electrical	2
Computer		Systems	0
Other ()			

Company and Project Overview:

The Timken Company designs a growing portfolio of engineered bearings and power transmission products. With more than a century of knowledge and innovation, we continuously improve the reliability and efficiency of global machinery and equipment to move the world forward. Timken posted \$3.6 billion in sales in 2018 and employs more than 18,000 people globally, operating from 35 countries.



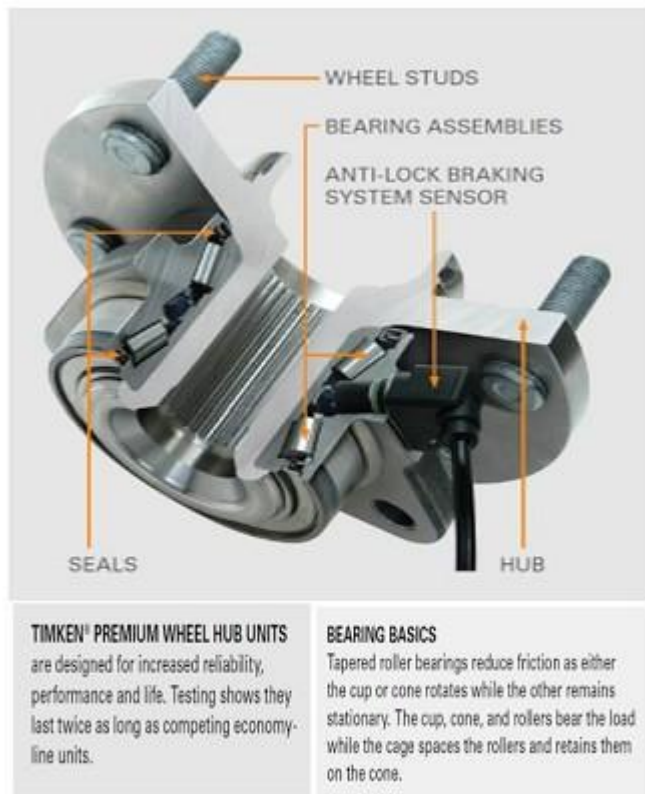
This project will be at the Timken plant in Iron Station, NC where Timken has a 610,000 sq. ft. facility on a 286-acre site, is located off Highway 27 in Lincoln County. From bearings used in heavy trucks, farm equipment and earthmovers to wheel hub units found in pickup trucks, the Timken Lincolnton Bearing Plant helps keep industries and consumers in motion.

The Timken Company, a \$3 billion global manufacturer of bearings and mechanical power transmission products, opened the Lincolnton Bearing Plant in 1979 with a strategic focus on



medium-volume production of industrial bearings. It was considered the most modern tapered roller bearing manufacturing facility in the world at that time.

Since 2002, the plant has undergone several expansions to broaden its original capabilities and add production lines for Timken® premium wheel hub units. These packaged bearings have multiple rows of rollers and are pre-adjusted, pre-lubricated and pre-sealed for easy installation during truck manufacturing and aftermarket service. Today, Lincolnton is the company’s principal domestic source for wheel hub units and is the supplier for wheel hubs for the popular F-Series Ford pick-up truck. (Source: Lincoln Herald.net). This Project will focus on a project in the heat treating area of the plant.



Project Requirements:

Timken uses a variety of metallurgical processes to produce bearings and associated parts to the specified hardness tolerances. In one stage of the process, parts are moved from a heat treat process to a machine that performs shot blasting to remove a carbon coating from the previous step. The parts are done in a bulk process and the operator has to load the carbon coated parts onto steel racks which enter the shot blasting chamber and cycled for a specified amount of time.

The following pictures show the process:



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The shot blasting chamber is the back of the photo. Parts (the black ones on the left) are loaded onto steel racks that cycle into the shot blasting chamber. When the cycle is complete, the machine cycles and the freshly blasted parts (silver colored) emerge from the right side and a new batch enters on the left.

Parts entering the process arrive on a towed trolley that has two large bins that hold many parts. To start the process, the operator stands on the upper catwalk and reaches over and down into the tub that is on the trolley. They bend over, grab parts, stand up and turn and walk to the waiting empty steel rack. They load the steel hanging rack as shown in the photo.

This is a picture looking down into the incoming part tub:



The current operation requires bending and lifting. Timken is interested in redesigning this operation so that it is less stressful for the operator. The objective of this project is to evaluate this current operation and develop a new process design that reduces or eliminates the physical exertion required by the operator.

The purpose of this project is to eliminate those ergonomic concerns by bringing the parts within easy reach of the operator. The current concept (developed by the Phase 1 team) to achieve this is to remove the parts from the basket using a robotic actuated magnet and conveying them to a station conveniently positioned directly in front of the operator, who will then load the parts onto the tree support for the shot blast operation.

The proposed concept accomplishes this using a FANUC R-2000iB/165F robot and accumulation table provided by The Timken Company coupled with a 16 inch diameter “electro-permanent magnet.” These components were selected on the basis of the robot and accumulation table availability at Timken. Completion of the project will optimally result in the delivery of a production system to the Timken factory shot blast area. If conditions at Timken prevent the factory floor implementation, then the project deliverable will be a full-scale prototype or proof of concept model addressing all aspects of the operation appropriate to implementation on the factory floor.

All experiments, data gathering and hardware development will take place in an experimental area at the Timken factory in Iron Station, NC. Team members will be required to travel to the Iron Station site regularly in order to complete the project.

Expected Deliverables/Results:

- A new design for this operation that uses existing or new tools, fixtures, equipment, etc. in such a way to eliminated the bending/lifting operation and result in better operator ergonomics.
- Equipment built during the prototype stage may be budget limited, so team should have regular discussions with the supporter regarding budget constraints. If desired by the Supporter, based on the team’s progress, they may be interested in increasing the budget. Authorization must be received from ISL for any budget changes.
- Complete drawing package for any items built.
- Full testing and verification that demonstrate ergonomic improvements using full scale equipment or a proof of concept model if full scale is beyond budget.
- Operations and maintenance guide.

Disposition of Deliverables at the End of the Project:

Hardware developed will be handed over at the conclusion of the Expo.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Ability to travel to Iron Station, NC for plant visits. As a Phase 2 project, this project has



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developed a significant amount of hardware for implementation at site. Therefore, students must be able and willing to go to the Timken site for multiple trips. Timken will have procedures in place following CDC guidelines.

- SolidWorks
- PLC programming/Factory automation
- Industrial sensor implementation
- Shop or Industrial experience