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Company Information

Company Name	*Fontaine Modification*	**Date Submitted**	*04/07/2021*
Project Title	*Universal Commercial Truck Drive Shaft and Wheelbase Measuring System* **(FONT_MEASURE)**	**Planned Starting Semester**	*Fall 2021*

Senior Design Project Description

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	5	Electrical	
Computer		Systems	
Other ( )			

Company and Project Overview:

Fontaine Modification is known for modifying trucks from various OEMs to meet customer request or specifications. We have exclusive ship-thru agreements with the leading OEMs to maximize end-user convenience and minimize delivery costs. These ship-thru arrangements expedite final delivery time from orders anywhere in North or Central America and facilitate modification efforts with minimal financial impact. We provide engineering solutions to meet customers' unique requirements and specific applications, all while adhering to federal safety standards. Trucks can be modified for a variety of purposes, some as simple as fleet decals, others more complex. Some examples:

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For many of our modifications, it is necessary to change the truck wheelbase for a customer's specific needs. In order to ensure that the vehicle meets the customer expectations and performs in a safe and efficient manner, the wheelbase length, drive shaft lengths and drive shaft angles must be measured prior to modification as well as after the modification. The shaft lengths and angles are then analyzed to determine if there could be any potential issues including binding and excess vibrations. It is essential that all these measurements are accurate and repeatable. Trucks to be considered range in size from class 3 through class 8 vocational and over the road tractors.

The scope of this project would be to design a universal solution for any variety of wheelbase and driveshaft types that will result in providing accurate measurements of the wheelbase length, driveshaft lengths, driveshaft offsets and drive shaft angles, transmission angle and rear differential pinion angle. This solution must be more time efficient and provide more accurate measurements when compared to the current manual process. The universal solution could be a completely computerized measurement system that provides an output of the required measurements. Alternatively, the solution could be a hybrid of automated and manual measurement actions. The proposed universal solution will have to have a total cost of no more than the target cost of $1000. The ideal system would measure all driveshaft angles and offsets at the same time comparing these measurements to accepted standards, accurately stating the measurement results and alert our engineers of drivelines that do not abide by company standards.

This solution would be implemented at all our 10 facilities to ensure standardized practices and accurate measurements. In addition to the design of the equipment to be used, we require a user guide so that our technicians can effectively use and maintain the system.

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Project Requirements:

The wheelbase measurement tool will take an accurate measurement from the center of the front axle to the center of the rear axle and be able to accommodate both single and dual tires on the rear axle. It must be able to securely attach to both steel, aluminum or a combination of both wheels without removing or modifying the wheels or chassis. The system will need to be able to measure either side of the truck, ideally both at the same time to determine that the axles are square.

The driveshaft length measurement tool must be able to accurately and repeatably measure shaft lengths from center of yoke to center of yoke with driveshafts installed in the truck. Types of shafts to consider are listed below. The measurement tool must also be able to measure horizontal driveshaft offsets.

The driveshaft angle measurement tool must be able to accurately and repeatably measure all different types of commercial truck drivelines when installed in the truck. The ability to measure the rear axle pinion angle and transmission angle must also be included. Shafts to consider include but are not limited to:

- SPL170 Series
- SPL250 Series
- 1710 Series
- 1810 Series
- Meritor RPL Series

- The wheelbase measurement tool must be accurate to plus or minus 0.25" and able to measure wheelbase lengths from 24" to 400".
- The driveshaft length measurement tool must be accurate to plus or minus 0.1"
- The driveshaft angle tool must be accurate to plus or minus 0.1 degree
- Industry standards for acceptable shaft lengths and working angles must be considered for all on-road commercial trucks from class 3-8. These industry and company standards need to be used in all comparisons of actual measurements to standards for identification of alerts in any output report.
- The equipment must be able to accommodate driveshaft systems from 1-5 shafts as well as AWD configurations where there is a transfer case and driven front axle.
- As part of the final package, a user training document and user manual must also be included to ensure appropriate use of equipment and accurate measurements.

The team can assume that the chassis to be measured will have no bodies installed on the chassis at the time of measurement, to ease access to the drive shafts, transmission and differential.

The universal solution needs to be portable and be moved to the chassis to be measured. Set up time of the equipment and measuring should be at least 20% faster than current measurement times. and take no more than 2 people, with 1 person being ideal. The overall measuring process should take less time than is consumed by the current manual process of measurement.

Some form of output of the data by the user should also be included in the design. As part of our processes, our technicians record OEM vehicle measurements as well as measurements post modification. The post modification measurements and any alerts must then be analyzed by our engineering team to ensure that they will result in proper safety and functionality of the modified vehicle. Often, after the initial analysis, changes and iterations must be performed to reach the optimal results. The pre and post modification measurements are then kept on file for later reference.

A user interface to view and send the measurements in a clear and concise manner is also required. The more user friendly and easy to incorporate into Fontaine's existing systems, the better.

Expected Deliverables/Results:

- Complete design of universal commercial truck wheelbase and driveshaft length and angle measurement system including any software required for the solution's operation.
- Working prototype of measurement system.
- Training and User manuals
- Ability to output results of measurements to company systems for analysis and record keeping, including systems of 1-5 shafts and AWD configurations where there may be multiple shafts from the transfer case to front axle.

Disposition of Deliverables at the End of the Project:

Typical handover following Expo is acceptable

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

- Ability to travel to Fontaine Modification site in Mt. Holly, NC.