



Company Information

Company Name	<i>GKN Automotive</i>	Date Submitted	<i>3/3/2023</i>
Project Title	<i>Design of an Imbalance Marking Improvement (GKN_MARK)</i>	Planned Starting Semester	<i>Fall 2023</i>

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	3	Electrical	2
Computer		Systems	

Company and Project Overview:

GKN ePowertrain, Newton is a leader in Tier 1 automotive differential assembly and component manufacturing. There are 2 plants on the Newton site. Plant 1 is the machining facility where hypoid ring and pinion gears are manufactured. Plant 2 is the assembly plant. With 13 assembly lines and 4 major products it is a lean and diverse facility. The four main products that are manufactured are RDM (Rear Drive Module), FDU (Front Drive Unit), PTU (Power Transmission Unit), and Hydraulic disconnect clutches. With each of these units there are variants of clutch engagement and differential gear ratio, up to 18 variants per product, per customer. Some product examples:

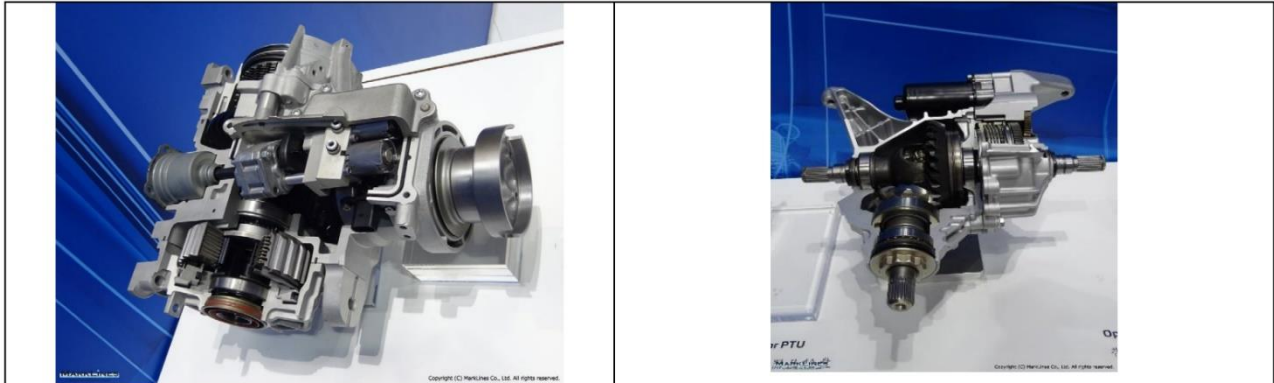


Figure 1 - Product examples

GKN Newton produces RDMs for an automotive OEM on a line that requires end of line balancing. This balancer utilizes an automated paint marker to indicate the location of the imbalance on the part. The paint marker needs a redesign/improvement as it causes frequent downtime on the line.

The upstream machine (the dynamic balancer) clocks the input shaft of the part so that the imbalance point is directly below the marking device. The marking device travels along a linear actuator (the part being marked has variants at different lengths) and marks the part on the dust shield as shown below in figure 3. This project's focus is to design and prototype a marking system to replace the head attached to the linear actuator (highlighted red in figure 2).



Figure 2 - Paint Mark station

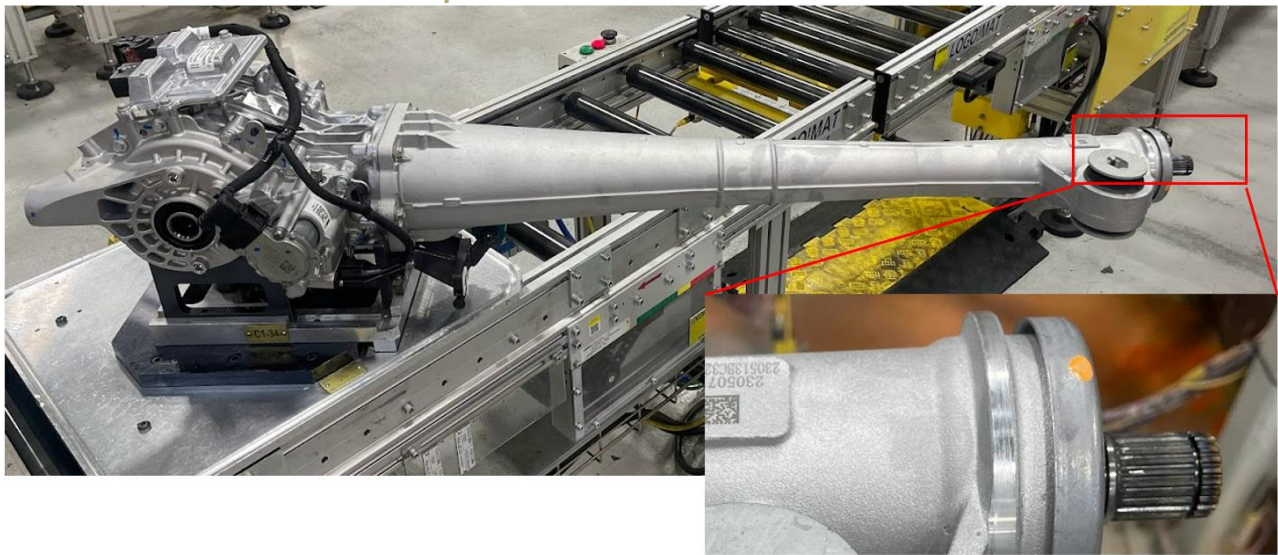


Figure 3 - Location of imbalance mark

Project Requirements:

The objective of this project is to improve the marking process improve uptime and reliability. Integration into the machine itself is not a requirement, but rather the development of a new marking system that can be retrofit to the machine by GKN. The process needs to produce a noticeable mark on the part that can be used at the vehicle assembly plant to align the imbalance point with the driveshaft. It isn't required that a paint dot is used, other methods of marking may be considered. GKN will help direct the design process to ensure compliance with requirements of GKN and the customer.



INDUSTRIAL SOLUTIONS LABORATORY

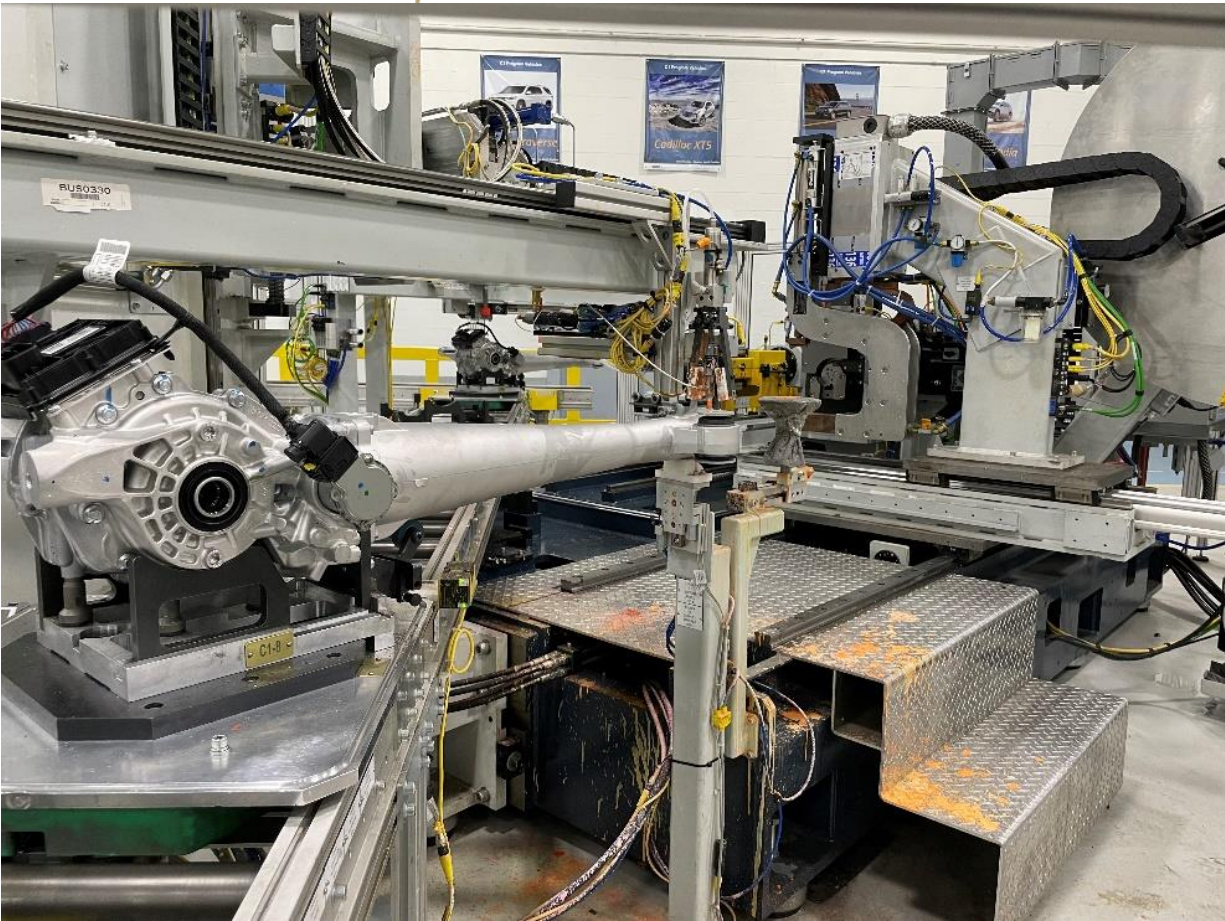


Figure 4 - Part in balancing cell being marked for imbalance



**INDUSTRIAL SOLUTIONS
LABORATORY**



Figure 5 - Close up image of marking process



Expected Deliverables/Results:

- Process design (to be implemented by GKN)
 - Detailed overview of station changes including new component designs
 - Mock-up of process and new design to prove feasibility (physical prototype)
- Documentation
 - BOM
 - Mechanical Drawings
 - 3D Models
 - Electrical Diagrams

Disposition of Deliverables at the End of the Project:

As this will be a prototype the students will have full ability to display their design at expo before implementation at the plant.

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

- CAD
- Fabrication
- Electrical/Controls
- Process Improvement
- Machine Analysis & Design
- FEA
- Ability to travel to the company's Newton, NC site.