INDUSTRIAL SOLUTIONS LABORATORY

Company Information

Company Name	*CID Attachments*	**Date Submitted**	*5/1/2025*
Project Title	*Design and Build a Vertical Static Precision Balancer (CID_BALANCER)*	**Planned Starting Semester**	*Fall 2025*

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	1-2
Computer	1	Systems	

Company and Project Overview:

At CID, we specialize in manufacturing an expansive range of attachments for skid steers, compact tractors, and mini skid steers. Our products are designed to meet the unique needs of our customers with a high degree of customizability. Founded in 2003, CID has been committed to producing durable attachments for over two decades. Today, we operate two manufacturing facilities located in Denton, North Carolina and serve customers across North America & South America. Our two facilities consist of plasma/laser cutting tables, press brakes, welders, powder coating lines, assembly areas, and shipping. Over the years, we have continuously introduced new attachments and now offer over 1,000 standard products.

We are driven by a team of dedicated professionals who go above and beyond to ensure our customers have the reliable tools they need to overcome their toughest challenges. We build dependable attachments that will help customers conquer any task with confidence and efficiency.

CID Attachments currently employs around 200 full-time employees in Denton, NC, including engineering, sales, aftermarket, manufacturing, and accounting.

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Project Requirements:

Two of our highest revenue products are Severe Brush Cutters and Reaper Brush Cutters. These brush cutters can clear thick, overgrown areas and up to 10” diameter trees. A reoccurring issue with these products is vibrations during operation of the attachment. It has been a known issue for a while and steps have been taken to reduce the issue. This project will build on those steps and improve the automation aspect of the operations. These blade holders and blades, as shown in the image below, can weigh up to 900lbs and have tip speeds of around 300MPH. At these speeds the slightest imbalance can cause vibrations when customers operate the brush cutter.

Blades

Blade holder

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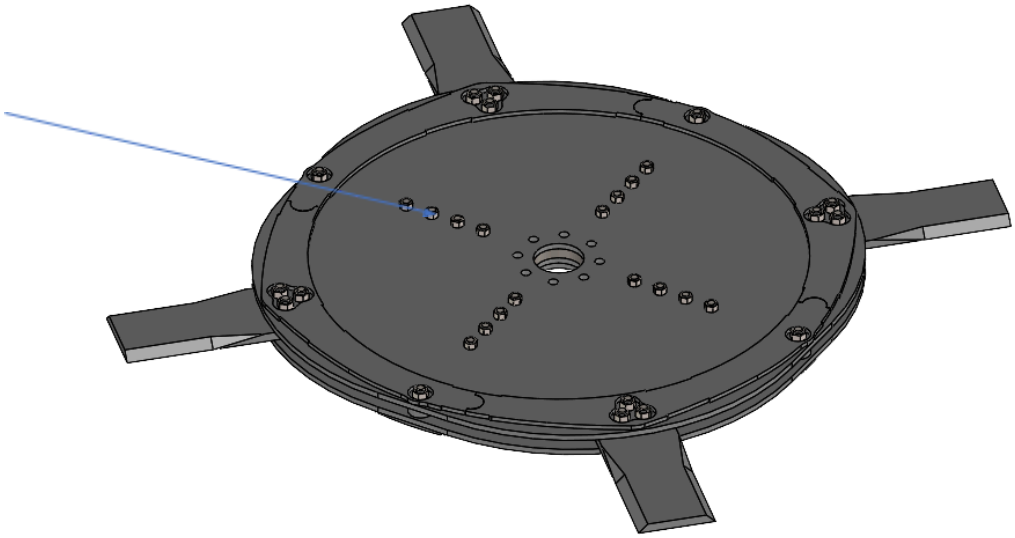

A team of engineers is needed to design and build a vertical static precision balancer with an automated milling system. This scope is envisioned to be done in a Phase 1 and Phase 2 senior design project. Phase 1 will focus on the balancer aspect.

Vertical static balancers are typically used for refiner plates and blades to prevent vibrations and low machine efficiency. Some balancers have a milling system, which allow for accurate material removal rather than simply grinding material away manually. The balancer must be easy to use, safe, and work efficiently during the assembly process of the blade holders. A forklift must be able to pick up the entire balancer. The balancer would need to allow the assembly team to build the blade holder on it, then test it once it has been assembled. The balancer must be able to determine where and how much material needs to be removed. The Phase 1 project will need to design the structure of the machine so that it can accommodate both the balancer function and the milling function that will be the focus of Phase 2. With the balancing information provided from the Phase 1 design, an automated milling system will be required to remove the necessary amount of material in the correct locations. The balancing test will be done iteratively until the milling has resulted in a balanced blade assembly. After the blade holder is tested, it will need to be removed by either a crane or using a forklift.

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The team will need to incorporate the current assembly process for the blade holders into the design of the balancer, which can be adjusted if necessary:

Current assembly process:

1. The bottom weldment is placed onto the stand.
2. The top weldment is placed onto the bottom weldment.
3. The blades, hardware, and bushings are installed.
    a. If the blade holder is installed on the balancer, the blades will not need to be installed during this process since they will be weighed and balanced separately.

   b. Loctite is also used with the hardware.
4. The assembled blade holder is taken off the stand and it is bolted to the brush cutter.

Expected Deliverables/Results:

- Determine allowable tolerance for this scale of a balancer.
- Develop a fully functional vertical static precision balancer prototype that meets the following criteria:
    - Ideally, would be able to fit within a 6’ x 5’ x 5’ area.
    - Must be able to be moved by a forklift.
    - Must be able to assemble blade holders ranging from 40” to 54” diameters.
    - Must be able to load and unload the blade holders with a crane or a forklift.
    - Must have an automatic milling system which mills based on the balancing systems information provided. (phase 2)
    - Utilize sensors to determine where and how much material needs to be removed.
- Develop a Standard Operating Procedure for the balancer.
- Exploded Parts Diagram must be provided.
- All CAD parts, assemblies, and drawings must be provided.

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team’s work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter’s location, it must be returned to campus for the Expo. It is also a mandatory part of this Program that the Industry supporter attend the 2 expos to grade their team’s performance. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

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

- CAD (SolidWorks preferred)
- Programming
- Instrumentation
- Machining
- Machine design
- Precision Metrology