UNC CHARLOTTE
The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

UNC Charlotte – Lee College of Engineering Senior Design Program

Senior Design Project Description

Company Name	*Oerlikon*	**Date Submitted**	*11/19/19*
Project Title	*Design Capacity Expansion for Additive Manufacturing Bin Collector System* **(OER_BIN)**	**Planned Starting Semester**	Spring 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	4	Electrical	1
Computer		Systems	
Other ( )			

Company and Project Overview:

Oerlikon AM is spearheading the revolution that is Additive Manufacturing. We have gathered together a dynamic team with deep industrial knowledge, backed with state of the art facilities worldwide, built specifically for AM.

We provide AM solutions in metal alloys, ceramics and plastic materials. We support our AM printing capability with our own metal powder production, research and development, component design, application engineering, and finishing capabilities.

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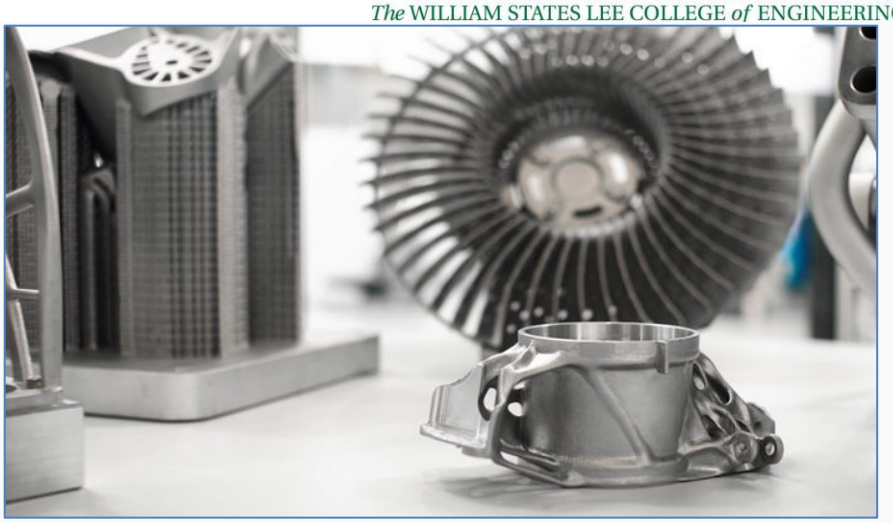

We are pioneering AM for all scales of manufacture from 1 custom part to series production runs lasting decades, and across all industries.

AM allows the creation of new components which cannot be achieved by any other process. There are obvious benefits. Weight may be reduced, saving material costs and providing benefits for the service life of the product. Strength may be increased, and several components may be combined into one. Manufacturing costs may be reduced, while product performance and durability can be increased.

Laser Powder Bed Fusion of Metals (PBF-LB), also known as Selective Laser Melting (SLM), and Electron Beam Powder Bed Fusion (PBF-EB), also known as EBM, form a family of powder based additive manufacturing processes. These processes can be utilized to manufacture complex metal prototypes or series parts rapidly and without any tooling. This project will work to design a collector capacity expansion/solution for a leading large volume PBF-LM machine.

Project Requirements:

The EOS M 400 is an additive manufacturing system for the production of large, high quality metal parts with detail resolution down to ~0.2 mm. With a building volume of 400 x 400 x 400 mm, the EOS M 400 can be utilized to produce large metal parts on an industrial scale. To start this process, CAD models are first sliced into 20-90 μm layers before being transferred to the machine. A thin layer of powder is laid on a substrate via a recoater before a laser exposes and melts that layer according to the CAD slice. The substrate then drops one slice thickness and the next powder layer is deposited and exposed. In this manner, components are built from the bottom up, allowing for a much higher degree of design freedom than traditional subtractive machining methods.


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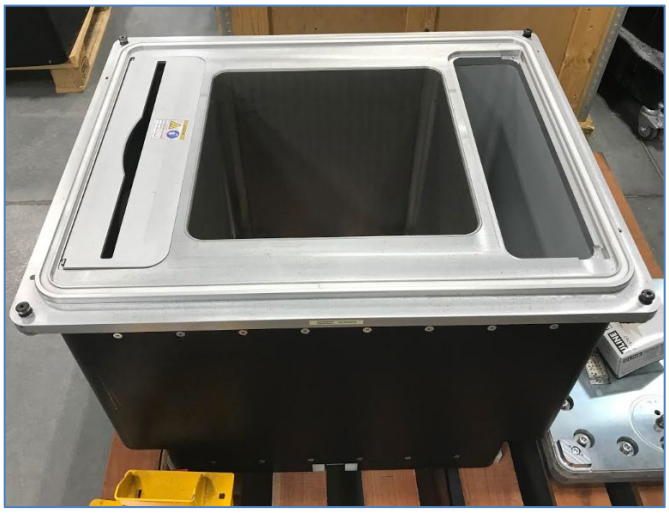
Process Station
Setup Station
EOS M 400
EOS M 400

EOS M 400

The additively manufactured component is built up within an exchangeable frame shown in the photo below:

There are collector bins on either side of the central build chamber that collect excess powder from the layer recoat and any debris generated by the process. For most parts, the bin capacity is sufficient, but with certain complex geometries and extremely large parts, the collector bins are filled before the part is complete. When this occurs, the process must be stopped, the chamber opened, the bins emptied via vacuum, and the process resumed. This is non-trivial as the atmosphere is inert during the build process and any stoppage may result in slight shifts or witness lines in the component.

In the below photo, the build chamber is in the center and collector bins are on either side. There are covers on both bins. The cover is shown on the left side and removed on the right.



A top view of the frame is shown below:

The objective of this project will be to study this machine and its operation for long cycle parts and develop a solution that allows the production to complete in one cycle, without having to stop and clean-out the machine. The solution must fit in the available space and power environment, be done remotely while the machine is operating, maintain the inert environment, and maintain the quality of the AM process.

Expected Deliverables/Results:

- Fully document a complete design solution that can be retrofitted into the machine
    - Bill of material
    - Drawings
    - Modification instructions
    - Operation instructions
- Design solution to accommodate non-stop operation for largest parts that Oerlikon manufactures.
- Develop a test strategy for the solution/prototype verification on the EOS M 400 or separate if not possible to do it on an actual machine.

Disposition of Deliverables at the End of the Project:

Hardware and deliverables to be provided to Industry supporter at the conclusion of the Expo.

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

- Interest in Additive Manufacturing
- Experience with CAD software and machine design