



Company Information

Company Name	<i>Oerlikon AM</i>	Date Submitted	<i>11/17/2021</i>
Project Title	<i>Smart Container for Metal Powder used in Additive Manufacturing (OER_SMART)</i>	Planned Starting Semester	<i>Spring 2022</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.

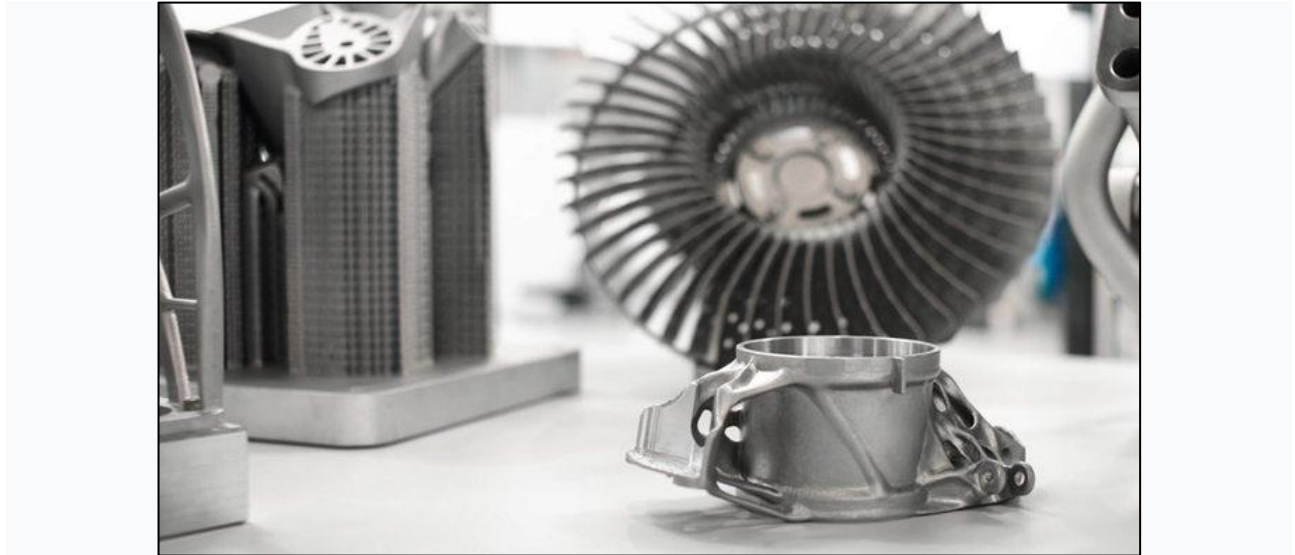
Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

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

Company and Project Overview:

Oerlikon AM is spearheading the revolution that is Additive Manufacturing (AM). We have gathered together a dynamic team with deep industrial knowledge and have built state of the art facilities specifically for AM in multiple countries.

We provide AM solutions with a focus in metal alloys for the Aerospace and Defense industries. We support our metal printing capability with our own metal powder production, research and development, component design, application engineering, and finishing capabilities. We are pioneering AM for all scales of manufacture from a single custom part to series production runs lasting decades across all industries.

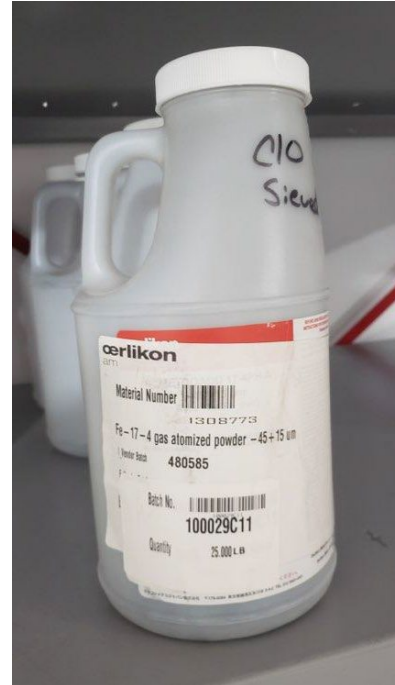


Additive manufacturing allows the creation of new components and designs which cannot be achieved by any traditional manufacturing process. Component weight can be reduced, saving material costs and providing benefits for the service life of the product. Component strength may be increased and several components may be combined into one. Manufacturing costs and time to deliver may be reduced, while product performance and durability can be increased. In addition to these many technical advantages, the AM process consumes much less material to produce a component when compared to traditional processes such as machining, resulting in less waste.

This project seeks to design an intelligent powder storage solution to better understand and control the metal powder feedstock utilized in the AM process. A successful smart container design will utilize a series of sensors to provide relevant information such as humidity and temperature history inside and outside of the container, weight of powder remaining in the container, time the powder remains stationary, and more. This container will need to be fully reusable to further reduce waste in this new manufacturing process.

Project Requirements:

Most metal powders used for additive manufacturing are delivered in a container similar the two types shown below. The containers have limited possibility for reuse. They are difficult to clean and the wear on the containers and/or poorly secured lids may lead to increased moisture uptake within the powder which is detrimental to the manufacturing process. The plastic can be recycled in most cases but a greener solution to this problem needs to be identified.



The primary objective of this project is to design a smart container which will ensure the quality of the metal powder within and the quality of the final AM component as a result. This container needs to be fully reusable and contain multiple sensors to record the following variables over an extended time period:

- Humidity inside the container
- Humidity outside the container
- Temperature inside the container
- Temperature outside the container
- Weight/Volume of the powder stored in the container
- A record of motion of the container (can influence powder settling)

The data collected should be easily converted into a report to support the quality control initiatives within the facility. Proof of concept to install and test these systems may be performed on one of the metal powder handling container used along with current blending and sieving processes, shown below.



For the final prototype, the design of the container should be such that:

- Storage space is minimized once the container is emptied to allow for easy return shipping
- It is compatible with the multiple types of powder handling equipment utilized at Oerlikon AM
- Cost is kept to a reasonable minimum to allow for scale up

Finally, relevant information such as a certificate of conformance and purchase information should be stored and easily accessible within the smart container.

The team will have access to the metal 3d printing technology used at Oerlikon AM to help in their design efforts if required. This project can be taken as far as the team decides to take it.

Expected Deliverables/Results:

- Design a fully reusable smart container which measures and stores relevant data to the AM process over extended times periods.
- Provide the following for the design solution:
 - Bill of material
 - Engineering drawings
 - Operating instructions
 - Troubleshooting and maintenance procedures



Disposition of Deliverables at the End of the Project:

The prototype design, sensors, and supporting documentation will be delivered to Oerlikon AM at the completion of the project after Expo display.

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

- Interest in additive manufacturing/3D printing
- Experience with sensors, data collection systems, and data analysis
- CAD and Design experience