Project Charter

Predicting Defects in Parts Made via Additive Manufacturing

University of Colorado **Boulder**

Canopy Aerospace

Table of Contents

1. Introduction
- 1.1 Background, Canopy Aerospace

2. Project Summary
- 2.1 Problem History
- 2.2 Objectives
- 2.3 Benefit and Impact

3. Objectives and Scope
- 3.1 Business Objectives
- 3.2 High-Level Requirements
- 3.3 Project Scope

4. Project Approach
- 4.1 General Approach – Solution Delivery Process
- 4.2 Assumptions and Constraints

  4.3 Project Risks and Issues
- 4.4 Risk Mitigation Plan

5. Project Plan
- 5.1 Key Deliverables
- 5.2 Major Milestones
- 5.3 Stakeholder Role/Responsibility
- 5.4 Time and Cost Estimates
- 5.5 Acceptance Criteria

Revision History (Last Revised October 8, 2023)

Change Description	Approved by	Date of Revision

Approval: ______________________________

Introduction

1.1 Background, Canopy Aerospace

Canopy Aerospace is a startup company dedicated to the production of materials to be used in aerospace engineering. They seek to manufacture parts that can withstand the extreme conditions and temperatures of both the process to get to space and space itself.

The complete statement: https://www.canopyaerospace.com/about

Project Summary

2.1 Problem History

In order to better create materials that can withstand extreme conditions, Canopy has worked to create ceramic parts that are more durable and offer high performance capabilities for aerospace engineering. This leads to making sure that the ceramic itself is not made poorly or printed with incorrect measurements. In order to do this they currently have a couple engineers who look over the files and spend a lot of time checking the geometry to make sure the part has the correct wall thickness and will print out to be usable.

2.2 Objectives

This project aims to be able to create a program that can detect these issues that currently a couple of engineers have to do manually. The program will be able to create a visual showing the wall thickness of the file we want to print and will extremely improve the time it takes to print out these parts.

2.3 Benefit and Impact

The obvious benefit to this is that the engineers who are currently spending their time combing through these files will now be able to do it in significantly less time and will therefore be able to work on other aspects of the project. Another benefit is that as this company grows they would have a very difficult time if they had to hire new employees to simply stare at files as they increase the number of projects. With this visual that we would create, the company that is purchasing the part will also now be able to have a visual representation of what their part will look like along with what the thickness of the walls will be.

Objective and Scope

3.1 Business Objectives

The business objectives are for Canopy Aerospace to quickly analyze a part for how well their equipment will be able to manufacture the part, or if they can even do so.

We will be implementing multiple algorithms:

- Wall Thickness Algorithm
- Hole Size Algorithm
- Fillet Radius Algorithm

Along with implementing a visualization tool for these algorithms so that Canopy can quickly identify where the part needs to be altered and be able to effectively communicate this information to the client.

3.2 High-Level Requirements (In-Scope)

- A method to measure the wall thickness of a component in STL file format
- A visualization tool for the wall thickness of a component
- Color mapping for the visualization tool
- Implementation of parallelization for runtime
- Implement a method to measure fillet radius of a component in STL file format
- Implement a method to measure hole size of a component in STL file format
- Implement a visualization tool for both the fillet radius and the hole size
- Incorporate visualization methods into a mocked website

3.3 Project Scope

In Scope:

- Wall thickness, fillet radius, and hole size algorithms
- Visualization tools with color mapping for these algorithms, and a mocked website for these

Out of Scope:

- Performance refinement and refactoring the code base

Project Approach

4.1 General Approach – Solution Delivery Process

Develop a thorough understanding of the current code which already partially implements the following: nodes, binary search tree, bounding box, and initial sphere. Each part of the project will be developed then tested consecutively. Each implementation will be approved by our Project Sponsor and then documented.

4.2 Assumptions and Constraints

- The current codebase is not significantly developed but can easily be expanded.
- Once a preferred implementation is identified, both the project team and project sponsor will maintain full support for the implementation plan unless changes are explicitly discussed.
- The project team is responsible for choosing the implementation of the algorithms for certain algorithms.
- There will not be any new algorithms developed. The project team will only use existing ones.

4.3 Project Risks and Issues

- The code must be designed to scale efficiently so that it can work with larger datasets and more complex 3D models.
- Proper documentation of the codebase will be needed for future reference and maintenance.
- Some code may have to be rewritten or further optimized in the future.
- Continuous communication between the project team and project sponsor will be maintained to ensure that implementations correspond to expectations, and that any ambiguities that arise during development can be resolved with mutual understanding.
- The project team will document any problems that arise in the weekly status reports.

4.4 Risk Mitigation and Change Control

- Any proposed changes to the scope will require a discussion between the project sponsor and project team and will require approval between both parties.
- Any proposed changes to the scope will be formally documented in the weekly status report.
- All major implementations added to the codebase will be reviewed and tested.

Project Plan

5.1 Key Deliverables

GitHub repositories that contain but are not limited to:

- Project documentation including but not limited to
    1. Project Charter
    2. Functional/Non-Functional Requirements
    3. Project Plan – GANTT chart
- The source code to working implementations of additive manufacturing visualizations and red light/green light algorithms.
- The source code to any other component related to the project.
- Administrative documents such as meeting logs, attendance, time sheets, and weekly reports.
- Any resources used for this project.
- A document detailing how to use, maintain, and update the applications, codebase, and face base.

5.2 Major Milestones

The following dates are estimations and not set in stone.

Deliverable	Deliverable Date
Set-up VMs	Early-October
Shrinking Sphere Implementation	Mid-November
Algorithm Visualization	Mid-November
Parallelization	Mid-November
Identify Fillet/Hole Algorithms	End of November
Develop visualization controls	Mid-January
Implement Fillet/Hole Algorithms	Mid-April
Cleanup/Close	End of April

5.3 Key Stakeholder Roles & Responsibilities

Stakeholder	Role/Responsibility	Contact
Alan Paradise	Instructor	Alan.Paradise@Colorado.edu

John Howard	Project Owner	john@canopyaerospace.com
Michael Hoefer	Teaching Assistant	Michael.Hoefer@colorado.edu
Gerard Beck	Lead Developer (Tech contact)	gerard@canopyaerospace.com
Victoria Nawalany	Student Developer	Victoria.Nawalany@colorado.edu
Will Manning	Student Developer	wima8483@colorado.edu
Aldous Jeon	Student Developer	alje8278@colorado.edu
Calvin Stought...	Student Developer	Calvin.Stoughton@colorado.edu
Ash Duy	Student Developer	asdu8905@colorado.edu

5.4 Time and Cost Estimates

Costs
- Labor Costs $0.00
- Team Cost $0.00

Project Hours
- Team meeting 2 hours per week.
- Sponsor meeting 1 hour every week.
- Software development 8 hours per team member per week.

5.5 Acceptance Criteria

- Implemented and optimized additive manufacturing validation algorithms
- Implemented mock website visualization integration
- Created documentation to facilitate future improvements and use of the validation system

Project Sponsor Approval: *Complete*