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# Grain Drying Test Stand

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# Grain Drying Test Stand

## **Problem Statement**

- Dr. Dirk Maier is a post-harvest engineering professor at Iowa State University and wants to expand the grain processing program
- A continuous-flow grain dryer for labs and research is needed.
- The dryer is to be designed, built, and configured all from scratch by the capstone team, implementing the designs and specifications Dr. Maier requires.
- Our dryer will be finished by the next technology capstone team and be used by classes to come.
- This project's broader scope and initial capstone stages were developed from two previous capstone projects, referenced below.

## **Disciplines**

Bioresource and Agricultural Engineering | Industrial Technology

## **Authors**

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# IOWA STATE UNIVERSITY

Department of Agricultural and Biosystems Engineering (ABE)

TSM 416 Technology Capstone Project

## Grain Drying Test Stand

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**Client:** ABE, Prof. Dirk Maier

## 1 PROBLEM STATEMENT

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### Problem Statement

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### Business Case Statement –

**The ISU post-harvest program needs a grain dryer to be researched and studied**

## 2 GOAL STATEMENT

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- **Main Objective(s) and Specific Objectives**
  - **The main objective is to:** design and build a research grain dryer
  - Functioning grain dryer
    - Dries wet grain
    - Continuous flow
  - 3 Separate Columns
    - Implement a design from a major manufacturer into each column
    - GSI, Mega, Sukup, QED
  - Transportable
    - Can be loaded onto a trailer by forks
    - Short enough to fit under Ames overpasses
- **Rationale**
  - Our client will be able to dry over 100 bushels of wet grain per hour
  - Temperature, moisture, and airflow sensors
  - Our client will be able to control the functionality of the dryer
- **Project Scope**
  - Building the grain dryer
  - Purchasing a used grain dryer was considered, but decided against

### 3 PROJECT PLAN/OUTLINE

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#### A. Methods/Approach

- Reference Material(s)
  - Company websites were researched, Dr. Maier's paper, other grain research, emailed and contacted companies.
- **Data collection:**
  - The data we collected was used to give our project dimensions, fan and burner sizes, and a real grasp on the project size.
- **Skills:**
  - Understand the grain drying process
  - Metal manufacturing
- **Solutions:** Team meetings
  - CAD drawing
  - Calculations
  - Material list
- **Organization:** Emailed weekly, meet bi-weekly
  - Could meet only when Maier was on campus
  - Multiple team work hours at BCRF

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**B. Timeline**

Milestone Performance				
Work Breakdown Structure		Summary/M easurable	Verification Date	On / Off Schedule
<b>1.0</b>	<b>Fully understand the scope of the project</b>			
1.1	Research how dryers work			
1.1.1	Talk to Dr. Maier		10/4	
1.2	research dryer rates		10/22	
1.2.1	rates of different dryer stiles		10/29	
1.2.2	contact feedmill		10/22	
<b>2.0</b>	<b>grain flow rates</b>		11/5	
2.1	calculations for drying		11/5	
<b>3.0</b>	<b>Cad Drawing</b>			
3.1	General dimensions		10/29	
3.1.1	rough paper sketch		10/29	
3.2	Seperate parts to make individually		11/5	
3.2.1	make the individual parts		11/5	
3.2.2	assemble parts into one cad file / parts list		11/26	
<b>4.0</b>	<b>Start Assembly</b>		2/10	
4.1	Frame Assembly			
4.1.1	Grate and fan / burner assembly			
4.2	plumbing propane			
4.2.1	wire and mount sensors			
<b>5.0</b>	<b>Present</b>			
5.1	powerpoint			
5.1.1	live demo			

## 4 RESULTS

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**Results/Deliverables**

- Dryer is built. All major components are in place. Project is ready to be handed-over to the legacy team.

## 5 BROADER OPPORTUNITY STATEMENT

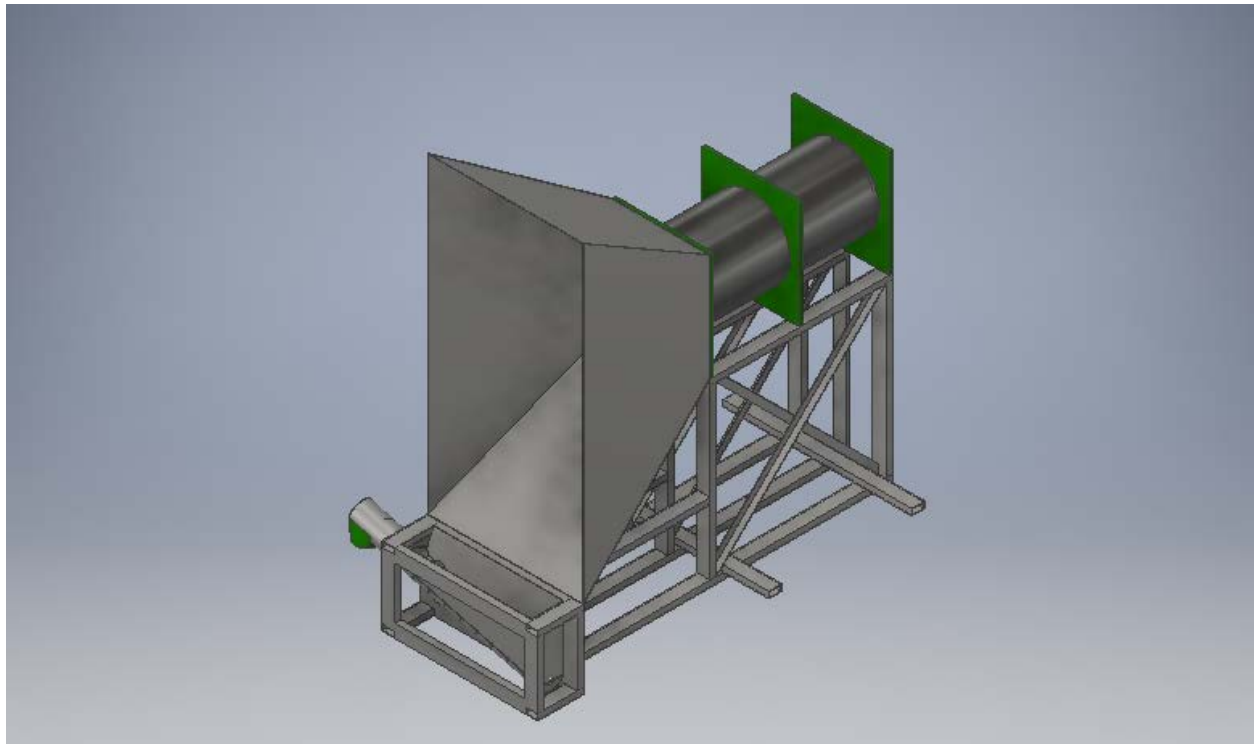
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- A. The average student will be attracted to a large metal structure with moving components and a lot of buttons and dials.
- B. Our project provides a solution to a hands-on approach for upcoming students in the Iowa State University grain handling labs and further research into safe grain storage practices.
- C. Farmers across the Midwest could improve their grain storage.
- D. The grain handling industry and academics.
- E. Iowa State University is thinking about a new focus program in grain drying.
- F. This project showcases all drying methods across the industry to use the collected data together and improve grain drying industry-wide.
- G. Companies are willing to work and spend money with us for this project.

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## 6 GRAPHICAL ABSTRACT

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*Limit of 4-page maximum.*

## 7 REFERENCES

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Blake Wilson, Nick Decker, Christian Slater, Cody Paggen, Ty Willke, Joseph R. Vanstrom and Jacek A. Koziel. Building of a Prototype Grain Dryer. Final Report. TSM 416 Technology Capstone Project, April 28, 2017.

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