

Project Team Charter

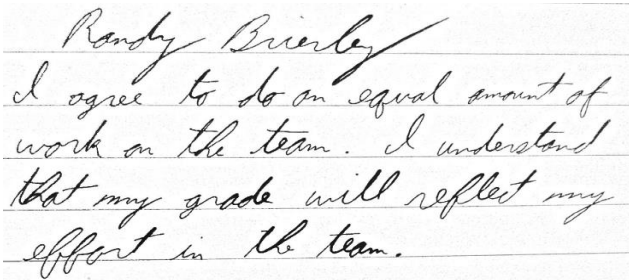
ME476C: Capstone I

Signature Cover Page

Each team member will copy the following statement in their own handwriting (LEGIBLY) in one of the designated areas below:

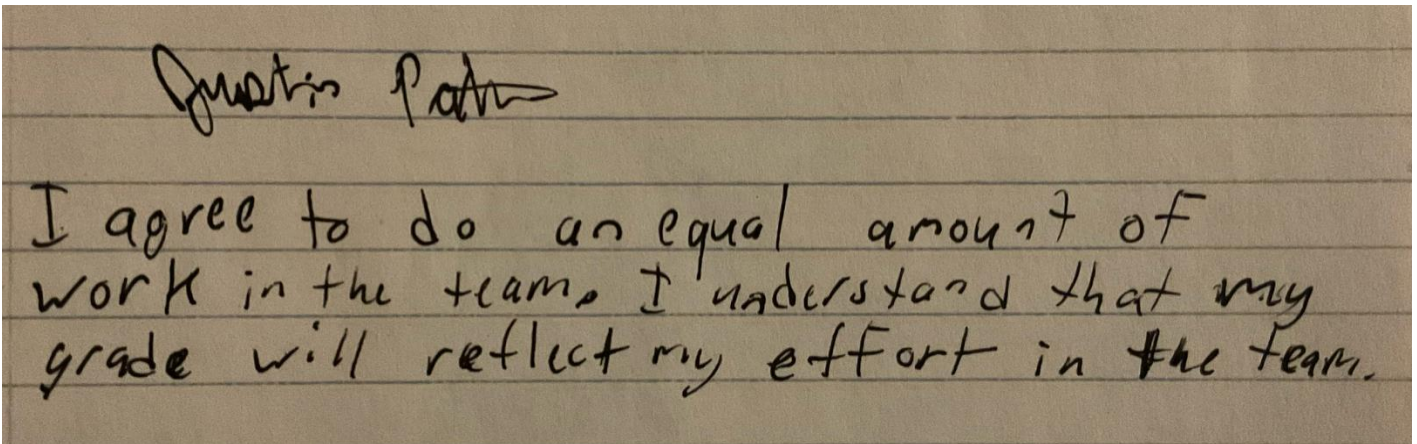
I agree to do an equal amount of work in the team. I understand that my grade will reflect my effort in the team.

Print Name: Randy Brierly



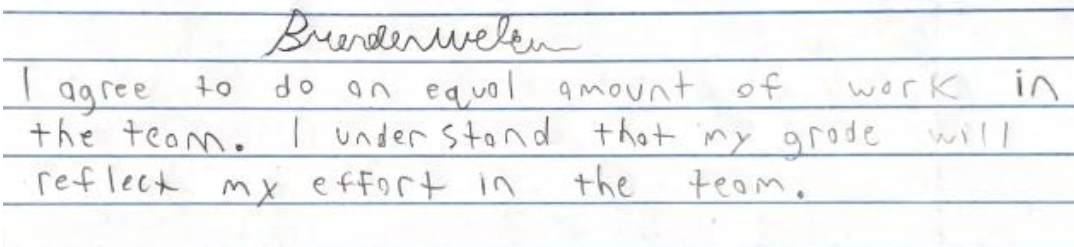
Randy Brierly
I agree to do an equal amount of
work on the team. I understand
that my grade will reflect my
effort in the team.

Print Name: Justin Patterson



Justin Pat
I agree to do an equal amount of
work in the team. I understand that my
grade will reflect my effort in the team.

Print Name: Branden Welker



Branden Welker
I agree to do an equal amount of work in
the team. I understand that my grade will
reflect my effort in the team.

Print Name: Eli Woolridge

Eli Woolridge

I agree to do an equal amount of work in the team.

I understand that my grade will reflect my effort in the team.

0. Team Purpose:

Our capstone team has been tasked by Professor Jennifer Wade and PhD Candidate Stephano Sinyangwe to design and build an experimental test rig able to validate previous CFD modeling they have performed. Funding for the project is provided by the Climate Solutions Lab and the industry sponsor SRP. Experimental validation of their modeling in practical conditions is intended to advance the design toward commercial application.

The team is expected to design and optimize a reactor for the vapor swing sorbent developed at the Climate Solutions Lab. CFD simulations are expected to be used throughout this process. Once this is completed the team must integrate the reactor into a vacuum evaporator capable of processing low quality water. The final product requested by the clients is a working test rig complete with sensors and controls that will allow the clients to verify their research.

1. Team Goals:

As a team we agree that achieving the technical goals of the climate solutions lab and creating a functional experimental setup hold a greater priority than our grade in the capstone class. Our team aims to achieve an A in the class. However, if there is a conflict between the needs of the climate solutions lab and the capstone course the former is to be prioritized. The project can be broken into two development phases, sorbent tube development and vacuum chamber development, each with their own set of technical goals. Additionally, all components are to be constructed from 316 stainless steel or other corrosion resistant materials to allow for the use of unprocessed low-quality water including sea water.

There are two core characteristics to optimize in the design of the sorbent tube. These being a minimal pressure drop across the sorbent, and maximum contact between the vapor and the sorbent. In this way we hope to maximize the amount of CO₂ collected per sorbent per hour. The tube must accommodate the sorbent currently being developed by the climate solutions lab but should also be able to test small quantities of other sorbents.

The vacuum system must be able to achieve less than two kilopascals of pressure in the boiler chamber with an ideal target of half a kilopascal. It must also include pressure and temperature sensors before and after the sorbent tube with the future goal of also accommodating a mass spectrometer. Pressure losses between cycles are to be minimized to improve efficiency and speed.

2. Team Member Personalities/Roles/Responsibilities: State each team member's personality style and what they can bring to the group. While some team responsibilities are shared by all members, collaborative teams work best when members also have unique roles and responsibilities. Consider these assignments carefully. Assign each team member at least one administrative role and at least one technical role.

Administrative roles:

- **Justin (ENTJ-A):** Project Manager- the project manager will be the point of contact for external help and mentors of the project. This includes talking with the vacuum pump manufacturer, Professor Wade, Stephano Sinyangwe, and any other Professors/Graduate Students to gather insight from in their specific areas of expertise. He will also ensure communication between the group with the information he has gained and/or adding team members to email threads and other forms of communication.
- **Elijah (INTP):** Budget Manager- the budget manager will focus on maintaining strict adherence to the budget we are going to be given by Dr. Wade and SRP. This includes making the budget and dividing it into sections to ensure organization. He will work with the Procurement Lead in obtaining quality parts for a fair price. This is very important as a key component in this project is the long-term scalability of this project for future use in combating climate change.
- **Randy (INTP):** Website Lead- the website lead will be the person that is mainly responsible for making the website and updating it as the project goes on with more information and media of the project. This will really help document the work we are putting into the project not only for Dr. Wade to see, but to give future employers a scope of the details of our project in a quick manner. It will be a great thing to attach to an online resume.
- **Branden (INFP):** Team Coordinator- the Team Coordinator will be a connection point for the group. He will be the primary reminder of certain events such as meeting times, building times and assignment due dates. He will assemble meeting times with group members to ensure everyone can attend. He will also ensure file organization and other forms of important organization.

Technical Roles

- **Justin:** Lab quality and integration lead- The Lab Quality and Integration Lead will fulfill quality standards given from Dr. Wade and Stephano. His involvement in Dr. Wade's Climate Solutions Lab for the past 6 months has enabled him to make connections and learn more about these DAC technologies. He will gather more information about the sorbents that we

will be using to ensure the sorbent holder that is designed will work as intended. He will also work with the ANSYS lead and learn from him on how to simulate our sorbent holders.

- **Elijah:** Modeling Lead- The Modeling Lead will be our main CAD model designer for the sorbent holder and any other low-tolerance parts that we may need. He has been working at the Cline Library Makerlab for a number of years now so he has a wide variation of expertise in many CAD software's such as SolidWorks, OnShape, TinkerCAD and more. He will be able to print our designs quickly and can fix the printers and change settings if needed.
- **Randy:** Procurement lead, electrical integration- The Procurement Lead will fulfill orders for parts on various websites. These parts will mainly be low tolerance, stainless steel fittings and hoses that can ensure a tight seal while our vacuum pump is running. He has been working for a start up for over 5 years and has vast experience with not only ordering parts for vacuum and mass flow applications but also implementing the parts. He will be ordering from websites such as Busch Vacuum Solutions, The Lab Depot and Scientific Instrument Services. Combined with his expertise in electrical work, he will be a great asset in assembling the reactor when all parts are acquired/created.
- **Branden:** ANSYS CFD Lead- The ANSYS CFD Lead will put in the most time and effort in training to evaluate our sorbent holders. He will be learning the software extensively between his ThermoFluid and Finite Element Analysis classes in addition to this project to become familiar enough with it to teach the rest of the group. Evaluating which design encourages the most surface area contact between the air and sorbent while maintaining a low-pressure drop is the most crucial development step. This will ensure low energy and in turn operation costs, which are the 2 main factors in large scale, worldwide development of this technology.

4. **Ground Rules:**

To maximize our team's productivity, we will be implementing a set meeting schedule. Our primary meeting time will be during our 2-hour and 30 min capstone session every Tuesday evening where we can meet with Professor David Willy to discuss class requirements. Additionally, we have set 1-hour meeting times weekly with our mentor, Stephano Sinyangwe, and every other week with our Advisor, Professor Jennifer Wade. In addition to these scheduled meetings, we will utilize a web-based scheduling tool to determine additional meeting times when necessary. These meetings will be held Online or In Person depending on the task at hand. Due to personal commitments, we will try and keep In Person meetings to a Monday through Thursday schedule.

During these meetings we will be following several ground rules for productive discussions. First, we expect all team members to show up to meetings ready to listen, take notes and ask questions. During every discussion we will establish a clear topic or goal, so we do not waste time jumping around. If someone begins to veer from the topic, we can politely remind them we are losing focus of the goal. If a disagreement arises, we will give each team member our full attention to share their opinion on the matter. If a compromise cannot be made, we will resort to a team vote with Stephano as our last resort

tie breaker. If conflicts do arise, we will not tolerate any negativity or hostility between group members. Additionally, if a mistake is made by a team member there will be no blame placed and as a team, we will focus on moving forward.

Outside of meetings we expect all team members to be actively engaged in the project. This includes Research, brainstorming or any CAE practice. Additionally, all members should frequently check MS teams and the team text chat for any important questions or updates. If any useful information is to be found individually it should be presented to the group. Lastly, we expect clear communication from all team members. If something is to come up in a team member's personal life that may interfere with the project, they should let the team know as soon as possible. If these rules are violated by someone, we will ensure they review the team charter, and their actions will be reflected in the peer review if necessary. If a team member has severe violations that begin to affect overall progress on the project, their actions may be reported directly to Professor Willy.

If there is need for future revision of this charter a team member may request a revision at any point. We will allow this charter to be rewritten or modified to fit our team's needs as we progress through this project. A revision would require all team members to sign a new cover page, and the old copy would be removed from our team files.

5. Potential Barriers and Coping Strategies:

There are a number of potential barriers to effective teamwork that could arise during the capstone project. Poor communication can easily happen if everyone is not consistent and thorough in sharing information with others. Disagreements are guaranteed; how they are handled will determine whether they are a barrier or not. Scheduling conflicts have already happened, and will continue to be something that needs to be worked around. Failure to complete individual tasks on time would throw off the progress of the project. Another possible barrier is individuals not completing tasks to an acceptable level of quality.

To handle these, the first step is this team charter; ideally, the charter will already have a process for handling issues. A key will be open and honest communication, allowing anyone to bring up and discuss any barriers that are experienced so that the team can constructively overcome it. Approaching communication in a straightforward but not blame-based manner will assist in this. The contents of this charter include team expectations and methods of conflict resolution, and the team will ideally fall back on this before anything becomes a serious barrier.

In the past, we have experienced having a team member who did not contribute much to the team, such as not keeping up with the state of the project. Should this come up, the team will bring it up at a staff meeting, ensuring that it is fairly discussed before resentment is created. Another team problem that has been experienced in the past is a team member who tries to do too much, not allowing others to equally work on things. If a discussion does not resolve these, then proceeding based on the conflict resolution in the charter will be the next step. A final problem that has been experienced in the past is having the work load inadvertently become imbalanced, just by the nature of how the project evolves. An important point in this team charter is that it is an evolving document – should the roles not balance out as we originally planned, then the team will come to an agreement on adjusting the roles.

6. Project Mentors:

We will have weekly meetings with graduate student Stephano Sinyangwe on Tuesdays at 8:30am in his lab located in the Engineering Building Room 246. The project manager has talked with Golnaz Najaf Tomaraei who is a post-doctoral researcher in Dr. Wade's lab about scheduling a meeting so she can show us the sorbents and so that we could bounce some ideas off her about how we should support them in the reactor. Dr. Feigenbaum and Sara Sarbaz conduct research on the mechanical and physical behavior of these sorbents so the project manager will also be in touch with them when questions arise. The team will likely seek out another graduate student with CFD expertise as we get deeper into that side of the project after initial CAD drawings are made.