Module 4.3 Completion Report Example

Team # X
Team Leader: B
Team Members: C, D
Project Name and Number:
Faculty Advisor:
Teaching Assistant:
Industrial or Internal Consultant:

A. Websites:

1. Stellar Website: Used to check-in on important announcements, submit homework assignments, reference upcoming lectures and deadlines, access reference documents, and check for feedback from our instructors on our Written Reports. We found the Stellar Website to be useful and convenient for exchanging assignments and feedback and checking for announcements and important dates, but there is room for improvement in the organization of documents on the site.

2. Collaboration Tool Box Website: The Collaboration Tool Box Website served as a nice compilation and home for all the team-building documents. We heavily utilized this site throughout the course, but especially at the beginning of the semester when there was a big focus on forming the team and getting accustomed to the class. The team found the example documents and templates to be very useful, as they provided us with a foundation for creating our own related documents.

3. Drop Box organization and utilization in the course: The Dropbox folder was incredibly useful for sharing different documents with the team. Further, the suggested organization of folders in the Dropbox enabled us to easily locate specific documents immediately without having to search around since everything was easily compartmentalized by the suggested folder labels and hierarchical structure of the folders. For example, when a team member was not able to make a meeting, he could very easily look up the Minutes to see what was discussed. At the beginning of the semester, the Dropbox served as a house for large PDFs of relevant literature that were too big too send via email. Additionally, our advisors could always check-in on our day-to-day progress by opening our Weekly Progress Reports and viewing data that had been collected and uploaded. Further, it was very convenient to work on collaborative written reports through the Dropbox since team members could simply take turns editing and commenting on a document although you cannot edit at the same time. The Dropbox also enabled us to instantly review updated versions of oral presentations when we were working remotely from each other.

4. Library website (new for 2015)

5. Writing Website (new for 2015)

B. Oral Presentations:

Though the members of our team had varying levels of experience in giving technical oral presentations coming into the class, the ground rules enabled each of us to work together to prepare for successful delivery. From the first rotation, we were very careful to stick to our ground rules to help Abe prepare for the first Oral Presentation. Prior to creating the Power Point, we worked together to find relevant literature and drafted a rough outline of the presentation slides, based on the content in our submitted Proposal. Abe then created a draft of the deck on his own and solicited feedback from us during our weekly team meeting. The team was always open to providing honest and thoughtful feedback since we genuinely wanted each other to succeed.

The CI Meetings further supported the implementation of our oral presentation ground rules by providing us with another opportunity to do a run-through rehearsal of the presentation and solicit additional suggestions for improvement. Moreover, each additional run-through helped make the presenter more comfortable and confident in the delivery of the presentation. Finally, after the first rotation, we found that it was very helpful for the presenter to meet with the faculty advisor at least two days in advance of the presentation date to review the overall structure and content of the Power Point. While we did not explicitly add this to the ground rules, we each understood that reviewing the slides with the faculty advisor would be very beneficial. Abe had set this precedent during the first rotation, and Susan and I both followed through on this for the second and third presentations.

Other than this implied new ground rule, we did not feel the need to make any changes to our ground rules for the oral presentation since the process of preparation worked very well the first time around. Abe had a successful delivery and received positive feedback on the structure, pace, and content of the presentation and his confidence. He was not as confident in addressing the questions that were posed after the presentation, so we decided to place more emphasis on helping the presenter prepare for post-presentation questions for the next two rotations. Helping the presenter prepare for possible questions was already stated in the ground rules, so we did not need to amend the ground rules, but we made a note to place more emphasis on this for the next two rotations.

During the Teambuilding Lecture on Oral Presentations, we found that many other groups used similar strategies that involved drafting an outline together, performing multiple run-throughs, openly soliciting and providing feedback, and meeting with instructors and advisors to gain further insight on improving the presentation. It seemed that this was a successful way to ensure a good oral presentation for many groups, so this further confirmed our belief that we didn't need to make changes to

the ground rules and should continue what was done for the first rotation in order to prepare for the second and third oral presentations.

During the second rotation, I was the Oral Presenter and followed the same ground rules and preparation that enabled Abe's successful delivery. Since we all understood that additional run-throughs enhance the quality of the delivery, I also asked the team to meet for an additional run-through the morning of the presentation date. Our ground rules encouraged this since they state that the other team members will "listen to the presenter practice the presentation and provide suggestions for improvement". Susan and Abe also made sure to ask me many post-presentation questions to prepare me for any inquiries that the actual audience may have. This focus on questions was very beneficial; as I was later asked some of the questions they posed during the actual presentation. I received praise for my confidence and knowledge of my slides and content, as well as my ability to skillfully address the post-presentation questions.

During the third rotation, Susan was the Oral Presenter and once again had a very successful presentation after following the same preparation steps that Abe and I had engaged in. By the time of this rotation, we were all very familiar with the process for developing a successful presentation and we breezed through all the preparation steps, from creating the outline of the presentation from the Final Report Draft, to setting up additional meetings to do run-throughs of the presentation. Though we were not able to present the results that we had originally hoped to, Susan was able to keep the presentation very engaging and explained the many obstacles we faced in lab that resulted in our lack of conclusive data at the end of the semester.

C. Writing Assignments:

1. Literature Search (new category in 2015)

2. Proposal – As our first major written assignment, the proposal helped us gain familiarity with expectations of technical writing for this specific course, become more knowledgeable about our project, and learn about each others' writing styles. Prior to writing the proposal, our team sat down together to develop an outline and a pre-proposal (as suggested by our faculty advisor) to provide a solid launching point for our individual proposals. These actions were supported by our ground rules, which stated, "The proposal is written individually, but specific meetings will be held by the team to collaborate on content. All content will be agreed upon by the team and will be the same in the individual papers." This ensured that our proposals contained similar content and were structured on a unified front.

The CI Meetings were very valuable in providing us with examples of past student Proposals, and prompting us with discussion points for the content of our own papers. For example, our group was a bit confused on the difference between the Introduction section and the Background and Significance section. After reviewing a

sample Proposal during the CI Meeting, we had a discussion on how content should be split between these two sections in our own papers, which further ensured that the content across our proposals would be consistent. Finally, certain parts of the proposal were approved to be identical between our proposals (i.e. the Safety Chart, the Gantt Chart Work Plan, and the Budget). As stated in our ground rules, we clearly delegated these sections and shared them with each other through the Dropbox so that we could use them in our individual proposals. Abe created the Safety Chart, Susan designed the Gantt Chart Work Plan, and I developed the budget.

After our first drafts were handed back with valuable feedback, we all shared the comments we received from our instructors and advisors with each other so that we could gain additional insights on the proposal content and structure before we took action to improve upon our writing for the submission of the second draft.

3. Progress Report – Though this was the second writing assignment, it was the team's first truly collaborative paper in that only one product was submitted from the three of us. Our ground rules helped us develop a plan of action for collaborating on and successfully completing the Progress Report on time. Because we just started going into the lab the week before Spring Break, we decided to take advantage of the offered extension so that we had more time to create relevant products in the lab and obtain initial experimental data that could be included in the report. Since the new due date of the report was two days after the end of Spring Break, we made sure to follow our ground rules and develop a writing plan early on so that the report could be developed smoothly, even with Spring Break taking place in the middle. Before sections of the paper were delegated, we sat down together to create an outline for the paper's content. Afterwards, the Team Leader delegated the different sections of the paper and shared a timeline for completing the paper's content 24 hours before the deadline to ensure time was available for editing and proofreading.

Throughout this process, we all made sure to ask clarifying questions about the sections we were delegated (ask we agreed upon in the ground rules) to ensure we all had the same level of understanding on our sections. Finally, because the document could only be edited by one person at a time, we made an effort to consult each others' schedules to determine who would work on the document at specific times to prevent overlapped work, merged changes, and lost work. We shared our travel plans with each other and discovered that Abe was travelling at the beginning of break, while Susan knew he would be without computer while on a cruise through the middle of break, and I was travelling at the tail end of break. Accordingly, we decided that I would input my sections at the start of break, Abe would input his sections next, and finally Susan would write up his sections at the end of break. Each time one of us opened and closed the doc, we made sure to send out a group text so that we would never be trying to edit the document at the same time (which could potentially lead to lost work), which capitalized on our use of the communication ground rules that state that "all team members must be aware of each week's activities" and "team members will communicate via email and texts

out of lab".

Similar to the CI meetings about the Proposal, the CI meetings about the Progress Report helped us gain a better understanding of how content should be divided across sections and provided us with an example of a good Progress Report written by students in a previous semester. This helped enhance our application of the ground rules that indicated that the team would clearly delegate writing responsibilities and clearly understand each section they are writing.

Once all our individual sections were uploaded into the document at least 24 hours before the deadline, we took turns going through the document and making comments to suggest edits and to ask for points of clarification on specific sentences/topics. Again, we took each others' schedules into account to determine who would work on the document at which specific times and made sure to text the group when we opened/closed it. Finally, before submitting, we sat down together in person one last time to address any remaining comments before making necessary changes and submitting. Because Abe's flight was delayed, he was not able to sit down with us in person to review the comments, so we Skyped him into the discussion instead.

After faculty reviewed the paper, we received feedback on how to make the introduction more convincing, how to adjust figures and images to make their message clearer, and how to restructure the report by topic (i.e. Films, DMA) instead of by steps in the process (i.e. Experiment Methods, Results and then Discussion) to provide a more cohesive report. Accordingly, the Team Leader delegated sections that required editing based on the sections that we had worked on for the first draft and we reviewed each others' schedules to develop a plan for addressing the edits. Throughout this entire process, the ground rules provided us with a baseline for content development, the editing process, and on-time submission which all enabled us to write a successful Progress Report. In the end, we received an A on the second draft!

4. **Teambuilding Presentation on Collaborative Writing** – Before we started writing the final report, we had the opportunity to learn more about how other teams wrote collaboratively through one of the Teambuilding Presentations. We were not surprised to learn that other groups that communicated less frequently were not as successful in developing collaborative papers. We also found it interesting that many other methods for splitting up content development existed, but since we had been successful with our strategies so far, we simply took these ideas from other teams into consideration for future collaborative writing assignments outside of this course. We learned that team dynamic can have a big impact on the end-product on collaborative writing, and we believe that our team's dominant conflict style of compromising was beneficial for the collaborative writing process since we were willing to work around each others' busy schedules in order to complete the assignments for the sake of the success of the team as a whole.

5. **Final Report** – The final report has not been completed yet since the team has not tied up the finishing touches on the data analysis. Though the team was successful in sticking to deadlines for completing the Proposal and Progress Report, we were unable to do the same for the Final Report. Though we have been following the same initial steps for a successful on-time report submission – create an outline together, develop a writing plan, delegate sections, ask clarifying questions, upload content at different times based on individual schedules – we have not been on schedule with our data analysis and we have also been busy with final projects and papers in other classes, which has caused the delayed progress and completion of the final report.

As the Team Leader for this rotation, I created an initial timeline for completion of the report, including a deadline for first-draft content, first-draft editing, second-draft content, and second-draft editing and delegation of the various sections in the report. However, we have not been successful in sticking to this timeline because our data analysis produced unexpected results, resulting in multiple changes in scope for our project over the last few weeks. While the team was able to respect this timeline for the content that did not depend on the analysis of data from our homemade apparatus, we were not able to begin developing content for the remainder of the report until two days before the submission deadline. Because of all the unanticipated obstacles, our work in the lab was significantly pushed back. This resulted in a flurry of data collection near the end of the term.

When the time came to analyze the data, I overused one of my dominant conflict styles – Avoiding. When we began initial data analysis, we faced unrealistic results – we found that the conductivity of our films was negative, which is physically impossible. Instead of immediately brainstorming other options for presenting our data, I avoided the issue and decided to encourage the team to continue analyzing the remainder of the data using the same analysis method, even though we knew we were not going to get realistic results. This led to wasted time and further hindered the completion of our final report. From these mistakes, I have learned many lessons that I will carry with me for future projects. For example, I learned that we need to start analyzing data as soon as it is collected so that we can avoid wasting time and materials on performing experiments that won't produce any valid data. I also learned that is it important to immediately act upon items that have the potential to change the scope of a project instead of avoiding the challenging obstacles.

After an enlightening meeting with the faculty advisor, we came up with a new plan for presenting our results and I developed an adjusted writing plan for the remaining sections accordingly. The team is ready for finish up these sections after the Oral Presentation is delivered, and we will still be able to finish the content development 24 hours before the deadline to provide adequate timing for edits. The steadfast ground rules will provide us with support during these last two days of collaborative writing to produce a successful final report that will be submitted on time, even after all the data analysis obstacles transpired.

6. **Weekly Progress Report** – These weekly summaries of the team's progress were critical in reminding the team (including the students, TA, faculty advisors, and other instructors) of the work that has been completed, work that still needs to be done, and the overall team dynamic. They serve as valuable documentation of the team's progress over time and also remind the team of the end goal and the scope of the project, as well as why and how the scope has changed. Based on the information provided in the weekly Progress Reports, we are able to adjust our work styles and activity lists accordingly in order to maximize the effectiveness of the team. For example, by reflecting on which team life cycle stage we were in each week, the Team Leader had a better sense of the most effective way to communicate with the team and to delegate tasks. Additionally, the Team Leader was reminded of each members' strengths and weakness and delegated tasks accordingly to either capitalize on a member's strengths or provide him/her with the opportunity to address weakness(es).

7. **Agendas** – Organized agendas were key for running effective and efficient meetings. The creation of agendas 24 hours in advance of each meeting compelled the Team Leader to organize the team's discussion points beforehand and also provided other team members with a directed sense of the talking points that would be brought up in each meeting. Team members could then think about what they had to say to each point beforehand, which saved time during the actual meeting. Further, the budgeted times for each discussion point on the agendas ensured that the team would be able to give due time and respect to each discussion point instead of getting overly engrossed in one topic and then realizing that no time is left to talk about any of the other important items on the agenda.

8. **Team Leader Transition Reports** – These reports were useful in highlighting the progress of the team, especially in the sense of team formation instead of just technical progress. They encouraged the team to reflect and served as an opportunity for each team member to think about how each member (oneself included) has helped contribute to the success of the team as well as ways in which each member could improve for the next rotation. Reviewing these reports enhanced the motivation and commitment of each team member since it compelled us to reflect on our contributions to the team. Further, it was incredibly valuable for the outgoing Team Leader to pass on leadership suggestions to the next Team Leader, since these points could be considered and implemented immediately to improve the team's effectiveness. Many suggestions that were made in these reports were not obvious points of concerns to the other team members, since they were busy fulfilling their other roles during each rotation. Thus, it was nice to have a document where the leader could write and share these suggestions for improved leadership.

9. **Activity Lists** – During the first rotation, activity lists were neglected until the last couple weeks since the team had been a bit initially overwhelmed with all the other documents that had to be completed. Additionally, for virtually the entirety of the first rotation, bar the last couple weeks, the team was simply combing through

literature to find background information on how to approach the project. Thus, the activity lists would have simply outlined different topics to be researched. During the second rotation, activity lists became more meaningful since we started performing lab work and they served as a nice checklist of things that needed to be done each week in order for our team to make tangible progress on the project. We viewed the activity lists as a more structured and detailed version of the "Work to Be Done" section of each Weekly Progress Report. After receiving feedback from the Team Coordinator that the activity lists needed to include outside work and estimated times, I made sure to include this information in the third rotation's activity lists. As the semester has progressed, the activity lists have become more and more useful for keeping the team aware of items that need to be completed each week and general timeframes for getting those items done.

D. Completion of Task and Team Functions:

The scope of the project has changed multiple times over the last few weeks of the semester, due to unanticipated obstacles and challenges that the team faced in lab, including the cracking of films, the poor insulation of the DMA apparatus, and the verification that underlying assumption for DMA analysis did not hold true in our experimental conditions. Thus, while we did not accomplish the initial task that we set out to achieve at the beginning of the semester, we have changed the scope of the project accordingly to reflect these challenges and the remaining time left for lab work and data collection. Throughout all these challenges, the team has progressed from the synthesis stage into the accomplishment stage, and we are now finally in the completion stage of the team life cycle.

To help facilitate the progression of our team into the completion stage, I made sure to take many of the former team leader's suggestions from his Team Leadership Transition Report into account. For instance, I checked up on our individual and team strengths and weaknesses that we documented at the beginning of the semester and updated throughout the course on the Weekly Progress Reports. Based on these strengths and weaknesses, I delegated tasks accordingly and was not afraid to assign tasks, as Abe suggested. For example, Susan is very comfortable with performing lab work, so I asked him to take control of operating the DMA apparatus. On the other hand, Abe desired to develop his ability to apply chemical engineering knowledge from the classroom to solar cells, so I delegated some of the data analysis to him so that he could form the connections between ChemE lab work and heat transfer equations and applications to real-life solar cells. I also incorporated Abe's suggestion of clarifying the milestone of film characterization and data analysis. We decided that films only needed to be characterized by two aspects: nanoparticle size and crystal structure. We also clarified the plan for data analysis after discussing the best approach with the faculty advisor. Additionally, I implemented the suggested changes in activity lists by assigning people to tasks, including activities outside of lab, and noting expected duration times for each activity.

One suggestion from the previous team leader that I did not follow through on was

revising the ground rules. Because the team members were all very passionate about the lab work and eager to begin collecting and analyzing data, we did not have much time to sit down and revisit the ground rules, especially since I did not call for a specific meeting to examine this topic as the team leader. I believe that we could have made some improvements to our ground rules by creating a specific "Data Analysis" section that provided guidelines for how to approach the process of turning data points into meaningful findings. I had been overusing one of my dominant conflict styles of "Avoiding" during this time by not addressing the issues surrounding data analysis and instead pushing forward the data collection. I now realize that this was a big mistake on my part, and I have learned from this mistake and will be sure to refrain from doing it again in any future projects that I work on.

At this point of the class and the team life cycle, we have completed all lab work and the final oral presentation and are adding the final edits to the final report. The team has reflected on whether we have achieved our personal and collective goals, and we have openly discussed that we did not accomplish the task that we originally set out to do. However, we still feel that our team has accomplished and learned a lot through this course and we were still able to deliver meaningful next steps that other people can take to continue on with our project to achieve its original mission of determining the thermal conductivity of nanostructured TiO_2 films that are utilized in dye-sensitized solar cells. Further, our team was able to highlight the flaws in using Dynamic Measurement Access as a simple method to calculating the thermal conductivity of thin films due to the non-ideal heat loss to the environment in actual conditions. Moreover, we each learned valuable lessons on how to work on a team, how to manage conflict through principled negotiation, and the importance of ground rules and discussion of team formation.

From the challenges in data analysis at the end of the semester, the team learned a few key lessons that we will each be sure to capitalize on the next time we are working on a technical project team. These lessons include analyzing data as soon as it is collected instead of collecting lots of the same type of data before realizing that it is not usable, labeling data files very clearly and in a systematic manner so that they can easily be identified later by anyone, and representing data visually from the start so that correlations can easily be noted and relevant analysis can be performed accordingly. Our team has overcome many conflicts, achieved multiple milestones, and addressed and adapted accordingly after facing challenges and obstacles, and I am very proud of all that we have learned and done throughout this semester.

During the implementation of our project, our team adopted many ethical standards, namely exhibiting high standards of honesty and integrity and ensuring that all work is conducted in a safe, professional manner. To start, we were always honest with feedback to each other, and we were also always honest about mistakes that were made. When Susan forgot to save a data file from a run and that data was lost, he told us immediately instead of trying to cover up his mistake and sneaking in another run. When Abe turned up the Bunsen Burner too high too quickly and the film burst into smaller pieces, he informed us immediately and we took the

necessary steps to clean it up and replace the film. When I accidentally flipped a wet film upside down, rendering it useless, I told the team right away, cleaned it up, and started making a new one. If we ever see a teammate operating in an unsafe manner, such as forgetting to put on goggles after entering the lab, we make sure to tell each other to ensure each others' safety and professionalism. These high ethical standards that we followed helped us stay safe in the lab while remaining true to engineering codes of ethics and improving the team dynamic.

Additionally, our team found that positive criticism is an effective means of helping the team grow. By framing areas for improvement in a positive light, the recipient of the feedback is much more likely to really listen to and take in the feedback. It also highlights the importance of being open and honest with other teammates by sharing thoughts for helping them develop as a person and develop the project. Our team made more efforts to provide positive criticism after learning more about it from the presentation. For instance, in lab, if we felt that another member was not performing tasks efficiently, we made a note to suggest that they make the most out of their time in lab and capitalize on their individual skills and abilities by engaging in other tasks while waiting for data to be collected, films to dry, etc.

F. Team Culture:

1. Metamorphosis of Individual Weaknesses into Strengths

Susan – Throughout his work in the lab and on data analysis, Susan was able to improve his initial technical weaknesses in data presentation, thermodynamic relations, and lab work as a group. For his oral presentation, Susan produced multiple substantial and meaningful visual representations of data that had been analyzed through the application of thermodynamic relations (namely heat-transfer-related). This also transferred over to the metamorphosis of his writing weakness in presenting data in the written reports. Additionally, Susan always responded well to being delegated tasks in the lab by the team leader and was always asking about other ways that he could help whenever he faced downtime in the lab. Susan was also able to work on his interpersonal weakness of dealing with setbacks. The team faced many unanticipated obstacles in the lab, and Susan was able to deal with them in a professional and productive manner by helping the team think of workarounds to the issues and encouraging the team and himself to move forward from the setbacks. Further, he responded well to absences of other team members and capitalized on his dominant conflict style of accommodating in these instances. He ensured that everyone still contributed to the project even when they had to miss a meeting by either calling into the meeting or doing additional catch-up work.

Abe – Abe was given the opportunity to address his technical weakness of not having any prior lab experience with nanotechnology by reading up on relevant literature on lab procedures for working with nanoparticles and then applying his learned knowledge in the lab. Throughout the semester, he did a significant amount

of work with the nanoparticles to produce various types of TiO_2 films. He also addressed his interpersonal weakness of reserving his ideas by making sure to contribute to discussions during team and faculty meetings and team discussions in the lab. For example, when one team member suggested breaking up a section of the final report one specific way, he offered his own opinion of breaking up the section differently and provided evidence to back up his reasoning. The other team members realized his idea would make the paper more effective and decided to implement his idea. His teammates also helped him build on this weakness by directly asking him, "What do you think about ___?" whenever new ideas were posed. Further, Abe was able to work on writing more efficiently through the collaborative writing process. Because each team member depended on the others to complete the delegated sections of the written report in a timely manner, Abe was compelled to write more efficiently so that his teammates could contribute to the collaborative papers in time before reviewing the entire reports together for edits.

Bob – I capitalized on many opportunities to develop my technical weaknesses during this term. Through the Logic Framework exercise, I learned how to break down a broad problem into relevant and applicable concepts in chemical engineering, and I now have this framework as a handy tool that I can apply in any future technical big-picture projects. I was also able to enhance my understanding of complex heat transfer processes, as our project directly dealt with heat transfer and I took part in the data analysis of the heat transfer. Further, I gained lab experience by helping to create the films and learning how to operate the DMA apparatus from Susan's instruction. Moving to interpersonal, writing, and presentation weaknesses, I made great strides in communicating in a scientific environment. Much of my development in this area was from CI meetings and receiving and incorporating feedback from my instructors and teammates on both written reports and my oral presentation. I felt that I had truly overcome my weakness in giving technical presentations when one of my instructors came up to me after my oral presentation and said, "I think you did a great job up there and you handled questions very well."

2. Meeting Personal Expectations

Abe– The majority of Abe's personal expectations were met. He was vocal about asking clarifying questions to both the instructors and to other team members and always made sure he fully understood the team's intentions and plans before moving forward with any action steps. He also strongly focused on the communication component and the results of the project by completing his written report sections and oral presentations on time and providing valuable feedback to other teammates' written sections and oral presentations. While he was the team leader, the team was able to progress through unanticipated obstacles, which meets his expectation of leading the team into a positive direction and paying attention to important issues. Further, he made sure to prepare his presentation well before the delivery date and asked us to give feedback on his run-throughs multiple times outside of the CI and team meetings.

Susan – Susan met most of his personal expectations for this class. He prioritized the work of the class for the most part, but there were a few times when he did not attend meetings due to other commitments. He did a great job at facilitating success within the team and encouraging a positive environment – he always found a way to tell a good joke to get us laughing and to lift up our spirits by telling us to think about all the achievements we had already made when we ran into unanticipated challenges. He also was honest in admitting shortcomings, including the time he accidentally deleted the file of collected data, and was willing to put in additional work, such as by staying late in lab to make up for the lost run. Through the ground rules, he was able to submit drafts of written assignments well before the deadline and worked well with the team to take in instructors' feedback before submitting the revision. Given the challenges we faced and the milestones that we reached, Susan also met his personal expectation of being as effective as possible throughout the semester by always getting tasks done on time in efficient manners. For example, he would multi-task while the DMA apparatus was running by working on his oral presentation slides.

Bob – I have met most of my personal expectations for the course. I made sure to always consult my calendar before taking on any work to ensure that I would only commit myself to what I knew I was capable of accomplishing. I also made sure to reach out to faculty and TAs both in person and via email whenever I had any questions. This was especially evident at the end of the semester, when the team was confused about the weird results from initial data analysis. I kept on checking in with our faculty advisor both during the faculty meeting and through outside emails to ask all my questions and to address my points of confusion. I was able to stay organized and keep track of the assignments I committed to through use of the Activity Lists and my personal checklist, and I also kept the end goal and mission of the project in mind, as it was also emphasized in written reports and oral presentations and highlighted in every Weekly Progress Report. I did not meet my expectation of attending all scheduled meetings on time at the beginning of the semester due to conflicts with job interviews and a Varsity swim meet. However, I made sure to stay in communication with the team even when I was absent so that I could stay aware of my delegated tasks and stay up to date on discussions surrounding the project.

3. Utilizing Individual Strengths

Each of us brought different strengths to the class based on our previous experiences. Susan was very skilled in lab work, especially mechanical work and apparatus design, so he was given the lead in developing and running the DMA apparatus. Meanwhile, Abe's strength in researching literature efficiently and effectively enabled us to find relevant information that provided insight into why we ran into various challenges in the lab and potential solutions to these challenges. My strength in organization was helpful in ensuring the team was always aware of upcoming deadlines, keeping track of all the items in the lab, and structuring the

written reports and oral presentations. Together, our strengths complements one another and we were able to make the overall team stronger than its individual parts in order to accomplish the task.

4. **Managing Conflicts**:

After receiving the results of our TKI and MBTI conflict styles, we sat down together to review our preferred styles and to understand the typical actions that we would each take when conflict arose. Abe, Susan, and my dominant conflict styles were Compromising, Accommodating, and Accommodating respectively. The team's overall dominant conflict style was Compromising. After going over the TKI charts for reference on the Collaboration Tool Box site together, we had a better understanding of when it was appropriate to use certain conflict styles, and we made a conscious agreement to encourage each other to think back to this reference sheet and to our known preferred styles whenever conflict arose so that we could address it as effectively as possible. The implementation of this knowledge helped our team function more effectively, as we were better equipped to deal with conflicts and already had a general idea of how to approach conflicts before they occurred.

One recurring conflict was that each team member had to miss 1-3 team or faculty meetings over the course of the semester. When this issue arose at the beginning of the semester, I was the one that had to miss some meetings so I engaged in the Competing conflict style and told my teammates that I wouldn't be able to make the meeting. At this time, Susan was the team leader and engaged in his dominant conflict style of accommodating and was okay with me missing the meeting at his own expense, especially since the team was primarily concerned with literatures searches at the time and we were simply familiarizing ourselves with the project and not engaging in much lab work. As the semester moved forward, when a team member had to miss a meeting, we all began using our team's dominant conflict style of compromising. We asked the team member who could not attend the meeting to Skype or call in, and if the Recorder was the one missing, one of the other team members would take on the job of taking minutes. This typically served as an acceptable settlement that partially satisfied everyone's concerns and enabled the team to keep up with important meeting communications even though not everyone could be there. This was the most effective style in addressing this type of conflict, and we found a good middle ground that didn't hinder the progress of the project and allowed team members to stay committed to both the project and to outside commitments.

Looking at each team member individually, Susan and I both tended to overuse our dominant conflict style of Accommodating at times. When another team member brought up a point of conflict, we often times resorted to satisfying the other teammate's concerns at the expense of our own. For example, when Abe and I were continually unsuccessful in producing a sturdy reliable mold for the films for a period of time, we asked Susan if he could work with us to brainstorm ways to

address this issue, and he agreed, even though he still needed to take more time to finish the construction of the DMA apparatus. On the other hand, Abe tended to underuse the Competing conflict style. While Abe was leader, there were times when he felt that he should have delegated more tasks to other team members by being more assertive and taking charge of the project during his rotation as leader. For instance, he independently took on the task of combing through literature to figure out why the films were cracking, when he instead could have asked at least one other team member to help search through the literature so that he could balance more lab work time with the literature combing.

5. Faculty Advisor Expectations

The team met most of the faculty advisor's expectations. The team was able to work well together throughout the entire semester by ensuring open communication and sticking to the guidelines outlined in the ground rules. The team also was constantly innovative and thorough throughout the course, from the start of the semester when we did deep literature searches and brainstormed unique ideas for approaching the project, to the middle and end of the semester when we faced many unanticipated obstacles in the lab but always pushed through to develop innovative solutions after further in-depth literature analysis and discussions with the faculty advisor, internal consultant, and TA. We also made a conscious effort to respect and adapt to the 10.26 objectives and policies even if we initially disagreed with some of them. Because the team ran into many unanticipated obstacles, there was a slight bit of late-term panic when the data analysis proved to be unfruitful, so we fell a bit short of the faculty advisor's expectation there. However, we dealt with this issue through innovative means and ended up with a solid plan for future work.

6. Milestones: The team accomplished all major assignment milestones on time – we were confident and happy with our final proposals, progress report, and oral presentations. In the lab, we were not successful in reaching the initial desired milestone of determining the thermal conductivity of nanostructured TiO_2 films, but we did achieve several other stepping stone milestones in the lab, including the creation of the DMA apparatus, the simulation of DMA in COMSOL, the production of TiO_2 films using solvent, the production of non-cracked and cohesive TiO_2 films using polyurethane, and the data collection of temperature of the components of the DMA apparatus over time for blank runs, glass slide runs, and film runs. When the team faced unanticipated challenges such as the cracking of films, the poor insulation of the DMA apparatus even when using highly insulative Aerogel to surround the apparatus, and the inability to produce meaningful conductivity values of the films from the used method of data analysis, the team was able to discuss and shift the scope of the project to define new milestones to be reached. While we were a bit disappointed that we did not come close to achieving the original goal that we set out to achieve, we feel that we still accomplished many tangible tasks throughout the course of this semester, some of which only transpired due to the shift in scope of the project.

7. Progression Through Team Life Cycles: The team quickly progressed through the formation and criticism periods of the team life cycle during the first rotation period. At the start of the semester, team members asked many questions to gain a better understanding of the project, the course expectations, and to familiarize each other with one another, and the team sat down together to develop ground rules, expectations, rotation roles, and goals/a mission statement. These actions during the first couple weeks of the semester enabled the team to quickly move from the formation stage into the criticism stage. The criticism stage occurred when the team transitioned from literature searches to lab work and ran into unanticipated issues in the lab. During this period, we found that we were slightly frustrated that we had not previously anticipated the challenges that we ran into and we engaged in lively discussions surrounding the team's original mission and goals. One impediment that prevented us from exiting the criticism stage more quickly was that the faculty advisors were also confused as to why we were experiencing some of the challenges that came about and were not able to provide direct guidance for our next steps to overcome the challenge.

To move past this stage, the team broke down the end-goal into smaller milestones that were much more appealing and achievable. The team also became more aware of one another's conflict styles by referencing the TKI results and experiencing actual conflicts between one another, which helped push the team forward into the synthesis stage. After initial challenges in the lab were addressed, the team felt a renewed sense of optimism and a feeling of team identity. Further, members made a conscious effort to resolve problems and achieve group harmony. When team members could not make a meeting, the other team members typically engaged in the team's dominant conflict style of compromising by letting the missing member Skype or call into the meetings or just catch-up on the meeting later. Energy was shifted to the team's goals and we saw an increase in productivity – the construction of the DMA apparatus was completed, non-cracked films were produced, and blank runs were performed.

These successes led the team into the Accomplishment stage, where we began to feel that our team was "greater than the sum of its parts" and a "can do" attitude was prevalent among team members. Whenever a team member completed his or her assigned tasks for the day and there was still other work to be done by other members, he or she would always inquire about ways that he/she could be of assistance in order to make the most effective use of our time. An impediment that prevented the team from moving from the Accomplishment stage to the Completion stage was the issue in data analysis that was discussed previously. The team's progress and accomplishments came to a bit of a standstill when we realized that our method of data analysis was not producing meaningful or useful results, and we went to our faculty advisor to seek guidance on how to move forward from our unfruitful data analysis. Once we decided on a new conclusion that could be drawn from the data during the final faculty meeting, our team was able to create new visual representations from the same data to prove our new conclusions and we successfully outlined a plan for future work that could be done to come closer to

achieving the initial goals that we had set at the start of the semester. This has moved the team into the Completion stage, where we are feeling mixed emotions and are a bit uncertain of how to end the project with finality. We plan to acknowledge the upcoming transition out of this project and our plans for the future. I have full confidence that our team will continue to keep in touch after the project, as we have become good friends throughout this semester and enjoy not only working with each other, but also simply hanging out with each other. In fact, our team has already made plans for a celebration evening of our accomplishments on Thursday night after our final classes end.

8. Ground Rules: The ground rules remained the same from the start to the end of the semester. The team developed quite a hefty and thorough set of ground rules at the beginning of the course, and they served us well from rotation to rotation. The team frequently referenced the ground rules during the first rotation when we were still familiarizing ourselves with the course, the team, and the project. However, after the first rotation, we had practiced so many of the ground rules personally that they became internalized and we did not have a need to change them. At the end of the third rotation, we realized it would have been helpful to have a stronger set of guidelines for data analysis, but since the course is coming to a close now, there is no motivation to go back in and change the ground rules for the last two days of the course.

9. Mission Statement: The team frequently referenced the mission statement, which was stated in every Weekly Progress Report and was paraphrased in every written report and oral presentation. The mission statement helped the team keep the end-goal and bigger-picture of the project in mind throughout the semester. It served as a driving force of motivation that kept the team excited to work on the project and enabled us to feel that we were making a meaningful contribution to the world and not just going through the motions to obtain a grade in a required class in our major.

10. Time Management: The team was very successful in managing time from the beginning to near the end of the course. The shared Google Calendar, which outlined each team member's schedule, was useful in allowing each member to see when other members were busy. The team was also open about communicating when we had big projects/tests in other classes or events in extracurricular, which further enabled us to be respectful of each others' time. Additionally, creating agendas for meetings and sending them out in advanced helped ensure that time was not wasted during meetings and that all topics to be discussed were given fair attention. Lastly, the Team Leaders always sent out timelines for the completion of written reports, which included a deadline for individual content of the first draft, a deadline for edits, a deadline for incorporating instructors' feedback on the first draft, and a deadline for edits on the second draft. These timelines were effective in helping the team manage their time for the first two written assignments, but for the final report, the team did not abide to the initial timeline due to hindrances in data analysis. Because the team ran into delays in making meaningful analysis of the

data, we were not able to complete the content of the first draft on time, which led the team to fall behind on managing our time for the final report. Once the data analysis was addressed and discussed with the faculty advisor, the team only had a few days left before the course's deadline for submission, so the timeline was adjusted and the team was a bit rushed at the end to finish the final report.

11. Role Rotation: The role rotation was very useful in providing us with a concrete sense of our individual purpose and tasks throughout each rotation and giving us the opportunity to experience various roles on a technical team over the course of the semester. The rotations compelled us to own each of the types of roles and challenged us to interact with one another in ways that we were not all initially comfortable with when coming into the class at the beginning of the semester. The role rotations that we decided on at the beginning of the semester proved to be very effective.

Susan started out as the Team Leader in the first rotation, and he did an excellent job at getting the project up and running and motivating the other team members to become invested in the project. It made sense for him to kick-start the semester as Team Leader because he has a good amount of previous experience in leading a technical team through his engagement in another Course 10 CI-M in a previous semester and his involvement in GEL. Susan mainly used the directing situational leadership management style at the beginning of the course, which fit the team's needs well since we were still familiarizing ourselves with the project and with each other, so we weren't very competent, but we were very committed to the project since we were excited to get to work on a real-world ChemE problem and we were going into the semester with fresh minds coming out of IAP. Near the end of his rotation, he mainly used the supporting leadership style, as the team members became more competent through gaining knowledge from literature searches and starting lab work, but our commitment began to vary as the semester picked up.

During Abe's leadership in the second rotation, he had just transitioned from the role of Oral Presenter, so he was very comfortable with speaking knowledgeably about the project, and the team had been off to a good start through Susan's leadership. Because we were just starting our work in the lab, Abe predominantly continued to use the supporting situational leadership style. As we got settled into our individual tasks in the lab, the supporting style enabled us to operate more autonomously in the lab areas that we each became experts in. Though he helped facilitate and take part in decisions, each team members was ultimately in control of their respective tasks. When the team faced an obstacle, such as the cracking of the films, Abe was very supportive and helped boost our confidence and motivation and encouraged us to refocus on the end goal and to think about alternative solutions instead of dwelling on the issue.

In the third rotation, I used both the delegating and supporting situational leadership styles. Because each team member was very comfortable with his or her individual tasks and highly competent from the experiences that were accumulated

over the course of the first two rotations, and because the members were also highly committed during this period since we were eager to finish up the project to learn the results from our data collection, I applied the delegating leadership style for the majority of the semester. However, during the past week or so, when the team ran into issues with the data analysis producing insignificance results, I switched to the supportive style to encourage the team to stay positive and motivated throughout the issues that arose.

I feel that the leadership training was not very substantial and we would have benefitted from additional leadership training to help prepare each of us to serve as successful Team Leaders. The leadership training could have been more interactive to help us better understand how to lead in certain situations. For example, instead of only giving a lecture presentation on the different leadership styles, perhaps we could have been given different relevant scenarios that could arise throughout the semester, act them out, and then decide which situational leadership style would best fit the situation. I understand that this was part of one of the April Presentations, but I think it would have been more beneficial if every student in the class had the opportunity to engage in a similar interactive activity.

12. Weekly Faculty and Team Meetings: These meetings were useful in setting aside time for the team to discuss their work in the lab and address any challenges that have arisen without being distracted in the lab environment. Weekly team meetings were always held either the day before or a few hours before the faculty meeting so that team members could review what would be discussed at the faculty meeting and bring up any questions or concerns that should be addressed at the faculty meeting. Additionally, these team meetings were used to update each other on our upcoming schedules for the week so that the team could plan out work for the week accordingly. Finally, they provided us with an opportunity to get to know one another better outside of lab, which helped shape the team dynamic. Meanwhile, the faculty meetings were incredibly valuable opportunities for us to receive feedback from the faculty advisor and TA on the work that we have accomplished as well as the work that we plan to do. These meetings were critical in helping us address challenges and obstacles that we faced in the lab, especially when we were not able to come up with a solution ourselves through literature searches. Lastly, the faculty meetings were heavily utilized to help us make meaning out of our data, since the faculty provided us with guidance and direction on how to analyze our data in different ways when initial attempts failed to produce meaningful results.

13. Utilization of the Weekly Progress Report By Faculty – The faculty used the Weekly Progress Reports to stay up to date on our team's progress both in and out of lab, as well as to reference past work and tasks that the team had completed. During faculty meetings, the team would usually cover everything that was noted in the Weekly Progress Reports, so there was no need to explicitly bring up the Progress Reports, but the faculty advisors knew that they could always go into the Dropbox to view these documents in case they wanted to re-check something that

was brought up during the meeting. In essence, the Weekly Progress Reports served as documentation of the team's week-to-week progress, and the faculty advisors used these weekly updates to get a sense of the overall continual progress of the team throughout the semester.

G. Utilizing Concepts from the Logical Framework Exercise

Through the Logical Framework exercise, our team learned how to construct a logical hierarchy of Objectives using if-then logic. This overarching hierarchical system enabled our team to think through and distinguish the project's deliverables (outcomes) from the strategic intent (purpose and goal) at the start of the semester when we were still familiarizing ourselves with our project and the goals for the course. This framework exercise also showed us the importance of verifying measures of success, including underlying assumptions that are critical to success, and taking all this information into account in order to form tangible steps of how to achieve the end goal through project management. Our team used the example of the Logical Framework applied to Noah's Ark Project to create a Logical Framework for our own project at the start of the semester. This activity was very helpful in providing us with a big picture of our goals before breaking them down into tangible action steps that needed to be taken. Completing this exercise made the overall project seem less daunting since it enabled us to formulate a plan for completing the project and helped us clarify the project's deliverables and strategic intent so that we understood the significance of our project and methods that we would use to measure success.

H. Suggestions for improving the course:

Problem: Students in the class were not always aware of when there was a required lecture.
Solution: Even though the required lectures are outline in the Course Manual, it is very useful to send a reminder email the morning of a required lecture, as we constantly check our emails as busy MIT students, but we don't always remember to check out the Course Manual. Additionally, early on in the semester, a statement from one of the faculty members about a required lecture conflicted with the date outlined in the Course Manual, which was a point of confusion for many students.

Problem: Stellar Website - Because the class separates the storage of documents into two sites, we often had a hard time figuring out which documents were located on which site.
Solution: Merge the two sites and enable students to navigate to different materials by clicking on separated sections on the left navigation bar.

Problem: The Calendar allows for hyperlinks to assignment submission web pages, but not for slides.
Solution: Link the slides from the required lectures to the Calendar. so students could easily see information that was covered on a specific date.

Problem: Lecture notes all over two website and are not in any coordinated area.
Solution: It would be nice to have one section on one site with all the Lecture Notes from the required lectures so that we could easily find information that we learned from each specific lecture.
Problem: Not all of the teambuilding curriculum is relevant to all the teams, and some times could use more teambuilding activities, while other teams could have spent more time working on projects in lab if their team dynamic was working well.
Solution: Develop a tailorable teambuilding curriculum that includes different tiers of activities that can be selected and carried out based on the dynamic of a specific team.

Problem: There was a lack of standard commonly used lab materials and equipment in the sub-basement, including hot plates, glass stir rods, pipettes, Bunsen burners, etc.
Solution: Ask faculty advisors to submit a list of common items that will likely be needed for their projects well before the start of the semester so that the lab can be stocked up decently and students don't have to waste time searching for Wetzel or TAs to find equipment during valuable lab time.

Problem: Students often had a hard time finding TAs to be available to come into lab outside of class when extra work needed to be performed.
Solution: Ask TA's to each hold "Office Hours" throughout the week. During these Office Hours, the TA will be available in the subbasement so that students can come in for extra lab time.