

Restated Scope and Project Plan

**Senior Design Project (EML 4552C) -Spring 2014
Team 07 - Microalgae Photobioreactor**

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1.0 Work/Problem Statement

The customer defined the problem statement in the project proposal as:

“The UFPR-FSU senior design teams have worked in the past with photobioreactors that work in batches. Growth media is added initially to microalgae to be grown in the photobioreactor for a period of approximately 15 days. At the end of that period the biomass is extracted and a new batch starts.

We anticipate enhance biomass productivity by using a continuous growth system (as opposed to batch) in which biomass is continuously extracted as new cells grow attempting to maintain a nearly constant ideal cell concentration within the photobioreactor. Media (nutrients and water) will need to be added in the necessary amounts to make up for the extractions.

The implementation of a continuous system, requires at least: (i) a concentration sensor, (ii) an automatic unit of media supply, and (iii) a biomass extraction unit. The concentration sensor was partially developed by the 2012-2013 team (see link under background), and it will be further enhanced as part of a master thesis. What you are asked to design is the units (ii) and (iii), and amend the previously developed concentration sensor (i).”

Thus, the customer needs a way to transform the photobioreactors’ current “batch” growth systems into “continuous growth systems.” In order to achieve this, the customer is requesting the design or development of an “automatic unit of media supply” and a “biomass extraction unit”, as well as an improvement to the “previously developed concentration sensor.”

2.0 Major Goals and Objectives

The main goal of this project is to satisfactorily complete, as defined by the customer, objectives 1-4 listed below. The deadline for this goal is the end of spring semester 2014. The FAMU-FSU College of Engineering and Federal University of Paraná will work together to accomplish these tasks. The objectives were either obtained from the project proposal submitted by the customer or through dialogue with the customer about the project.

The main objectives for the SPRING SEMESTER are as follows:

1. *Grow enough microalgae to fill 20-35L airlift photobioreactor*
2. *Design and develop two devices (units) for low cost, automatic growth media addition and biomass extraction from airlift photobioreactor designed this semester*
3. *“Submission of an invention disclosure in the US and a patent in Brazil of a concentration / mass flow rate sensor.” (Senior Design Proposal)*

4. *Design and develop a platform airlift photobioreactor that holds 20-35 Liters of microalgae which implements new addition and extraction units.*

3.0 Critical Changes

Several changes have been made to the FALL 2013 objectives. The team agreed that these changes are possible and are in the best interest of the project. These changes were determined after meeting with our project sponsors, Dr. Ordonez and Dr. Vargas, the first week of the semester. The changes are listed below:

1. This spring, an airlift photobioreactor (20-35L) will be designed and constructed based off the existing design in Brazil. This photobioreactor will be semi-continuous. Our team will not be working with the mini-photobioreactor built last year.
2. The new addition and extraction units will not be implemented into the design of the mini-photobioreactor built last year. The new units will be part of the airlift photobioreactor mentioned above.
3. Each Friday, Team 7 will meet with Dr. Ordonez and Dr. Vargas to go over the progress made and set new weekly goals.

4.0 Schedule Changes

Some changes, mentioned above, have been made to the objectives of our project. Because of this, our project schedule has been changed. Other than presentations and report due-dates, the project schedule will be updated at least one week in advance during the progress meetings with the project advisors. The beginning semester schedule for weeks 1-3 is shown below:

WEEK 1 (Jan 6-10):

- Sponsor meeting to discuss plan changes for spring semester

WEEK 2 (Jan 13-17):

- New airlift photobioreactor CAD complete and presented to Dr. Ordonez and Dr. Vargas.
- Start counting algae cells daily to establish a growth curve.
- Develop basic electrical diagram and components list for sensors.
- Updated Scope Report.

WEEK 3 (Jan 20-24):

- Finalize CAD design and create bill of materials for procurement.

WEEK 6 (Feb 10-14):

- Midterm Presentation 1
- Design Review #1

WEEK 11 (Mar 17-21):

- Midterm Presentation 2
- Design Review #2

WEEK 12 (Mar 24-28):

- Operations Manual Report Due

WEEK 13 (Mar 31 – Apr 4):

- Design for Manufacturing/Reliability/Economics Report Due

WEEK 14 (Apr 7-11):

- Walk-Through Presentation
- Design Review #2

WEEK 15 (Apr 14-18):

- Open House
- Final Presentation.
- Completed Webpage.
- Final Report Due.

WEEK 16 (Apr 28 – May 2):

- Student Evaluations Due

Sponsor Meeting Flow Chart

WEEK 1

- ✓ Schedule and complete first meeting with sponsors to discuss any plan changes for the spring semester.



WEEK 2

- ✓ Create Pro-E CAD of new airlift photobioreactor
- ✓ Start counting cells to establish microalgae growth curve
- ✓ Develop electrical diagram and component list for sensors
- ✓ Finish updated project scope report and submit online by Friday



WEEK 3

- ✓ Complete bill of materials and procurement for airlift photobioreactor (not new units)
- ✓ Finalize CAD and order pipes and fittings for Airlift (not the new units)
- ✓ Create list of all sensor parts and complete first function test



WEEK 4

- ✓ All Parts are being shipped (only airlift)
- ✓ Design frame for airlift (CAD)
- ✓ Order and create bill of materials for new addition/extraction unit
- ✓ All chemistry equipment should arrive from chemistry/bio department

Sponsor Meeting Flow Chart

WEEK 5

- ✓ Assemble all parts and check water integrity of airlift (not including new sensors)
- ✓ Perform airlift flow test (not including new sensors)



WEEK 6

- ✓ Design I Presentation
- ✓ Create CAD with airlift and new addition/extraction units
- ✓ _____



WEEK 7

- ✓ Airlift and new units should be assembled
- ✓ _____
- ✓ _____



WEEK 8

- ✓ _____
- ✓ _____
- ✓ _____