Chapter 12: Costs and Funding

STR 5.0.0, System Costs, required the drone price did not exceed $10,000 and was less than $6,000. The current production price of the drone was $2,400 However, this STR cannot be verified because the system was not completed and additional costs may occur as the project is continued, in addition to the increase in retail price for the product. Most of the cost is due to materials ordered, but additional labor costs were added to estimates due to the labor intensive process of sewing the envelope, soldering the PCB board, and 3D printing. This was added to simulate outsourcing the manufacturing work. Additionally, efforts were made to reach out to a number of UCSC colleges for funding and to compete in pitch competitions for monetary rewards.

## 12.1 System Costs

Total costs of the system are broken down into the following categories and summarized from the system’s Bill of Materials, which can be seen in the appendix in chapter 15:

* Total Component/Material Cost is : $1493.56
  + Battery Charger and Battery: $369.98
  + Passive components (resistors, capacitors, and voltage regulators): $30.95
  + Controllers, Processors, and Oscillators: $69.28
  + Sensors: $85.22
  + Actuators, Transmitters, and Receivers: $322.08
  + Screws, fabrics and materials, PCB fab: $609.37
  + Plug accessories (U.FL, pin headers, battery holder): $6.68
* Estimated Fabrication Labor Costs: $906.03
  + Outsourcing sewing of envelope (40 hours) - $800
  + PCB soldering could range from $1.34-$6.03 per board depending on bulk of order (PCBWay)
  + 3D Printing Services (5 hours) - $100
* Estimated Product Costs ~ $2400

The highest costs of our systems are components and materials, which included helium costs, ordering the PCB layouts, as well as ordering the fabric and materials needed to fabricate the envelope and 3D parts of the drone. Other high costs included ordering the battery and charger that was decided for the system.

The labor costs were estimated using an approximation of the hours needed to complete the fabrication and a typical pay per hour.These approximations were based on how long it took our team members to do these tasks. Although the approximations were scaled down to be more in line with the hours a professional would take, the approximations are likely still overestimated. For fabricating the envelope, about 40 hours were needed to complete the fabrication. By approximating $20 per hour cost[65] of fabrication for 40 hours we get about $800 dollars. The 3D printing was also approximated to cost about $20 per hour[65] and since it took about 5 hours total to 3D print all the needed parts, the estimated cost was $100. Lastly, for professional soldering of the PCB board, which would be done in a future PCB iteration, it was stated to cost between $1.34-$6.03 per board to solder based on bulk order quotes at various quantities from PCBWay[66].

The total cost of our drone was about $2400 dollars total. This was less than half of our stretch goal of less than $6,000 and well below our requirement of less than $10,000. However, since the project was not completed, this is not the final cost of our drone. Additional costs may incur before the project is completed due to replacements needed or additional design considerations needed to address a problem later in the design of the drone when physical testing is able to be completed. Due to the very low cost of the drone currently, it can safely be assumed that the total cost of the drone will be less than $10,000 when the drone is completed. Therefore, STR 5.0.0, System Costs, is expected to be fulfilled.

## 12.2 Project Funding

Due to the nature of our project, much of the initial costs were out of the pockets from the team members. Some of the team member’s colleges were then reached out for project funding. Porter College and Crown College approved funding for the project, while additional funding was received from winning Baskin Pitch Day 2021 and getting into the semi-finals of IDEA Hub 2021. A result of the funding can be seen in Table 12.1.

Table 12.1

Barone2 Project Funding

| Funding Source | Crown College | Porter College | Baskin Pitch Day | IDEA Hub | Total |
| --- | --- | --- | --- | --- | --- |
| Funding Amount ($ Cash) | 300 | 500 | 0 | 2,000 | 2,800 |
| Funding Amount(Etc) | N/A | N/A | $200 Amazon Gift Card | $5,000 AWS Credits | $200 Amazon  $5,000 AWS |

In total the team will receive $2,800 in cash, a $200 Amazon gift card, and $5,000 in Amazon Web Service(AWS) Credits. Only $300 in cash and the $200 Amazon gift card have been received so far, but the cash to be received is $200 above the estimated costs of the drone. However, this will help cover additional costs related to replacement parts bought for the project. The funding will be used to reimburse team members who have paid for materials out of pocket based on the receipts they have for project expenses. Excess funding will be invested in the further development of the project.

## 12.3 Conclusion

While the estimated drone cost is $2,400, the total funding received was a value of $8,000. The current cost is well below the requirement of $10,000, STR 5.0.0, System Costs. Additionally the cost is expected to go down since purchase prices will decrease with larger orders. However STR 5.0.0, System Costs cannot be verified because the project is not yet completed. Due to incomplete variable business costs and our limited knowledge, this has a possibility of changing the cost dramatically. The large amount of funding will allow the team members to be reimbursed for their personal costs with the project and will allow future work on the project to be paid for as well.

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# Chapter Outline

Develop the chapter outline here. Should become very detailed and broken down to paragraph level. Remember, if we invest time and effort into making a detailed outline, the actual writing will be far easier since we understand the flow and structure before we lay out the details. Before even writing a subsection, take the time to outline that subsection in the chapter outline. A lot of writing is in the layout. Remember to update this chapter in the Master Outline file so we can all keep track of the full outline of the report, its large so breaking it up this way should help everyone keep track of each other's ideas and work.

[65]“Average Maintenance Technician Hourly Pay,” *PayScale*. [Online]. Available: https://www.payscale.com/research/US/Job=Maintenance\_Technician/Hourly\_Rate. [Accessed: 07-Jun-2021].

[66]“Prototype PCB - Online PCB Quote - Full feature custom PCB prototype service at low cost - PCBWay,” *Custom PCB Prototype Manufacturer*. [Online]. Available: https://www.pcbway.com/orderonline.aspx. [Accessed: 07-Jun-2021].

# Chapter Draft

## Bill of Materials

## Estimated Labor Costs

## Estimated Production Cost

Total Materials Cost is : $1693.56

Battery Charger and Battery: $369.98

Passive components (resistors, capacitors, and voltage regulators): $30.95

Controllers, Processors, and Oscillators: $69.28

Sensors: $85.22

Actuators, Transmitters, and Receivers: $322.08

Screws, fabrics and materials, PCB fab: $809.37

Plug accessories (U.FL, pin headers, battery holder): $6.68

Estimated Fabrication Labor Costs

Outsourcing sewing of envelope (40 hours) - $800

PCB soldering could range from $1.34-$6.03 per board depending on bulk of order (PCBWay)

3D Printing Services (5 hours) - $100

Estimated Product Costs ~ $2400

## 

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## Conclusion

# Chapter Bibliography

We do have a full bibliography that should absolutely be updated with all content here. The point of the chapter bibliography is to help keep track of citations in the chapter since the numbering may change in the full bibliography with changes and additions. This way will isolate the sources in this section so you can cite here without having to worry about it, and can use a simple find and replace on your citations to update the new numbering when we combine everything in the final report.