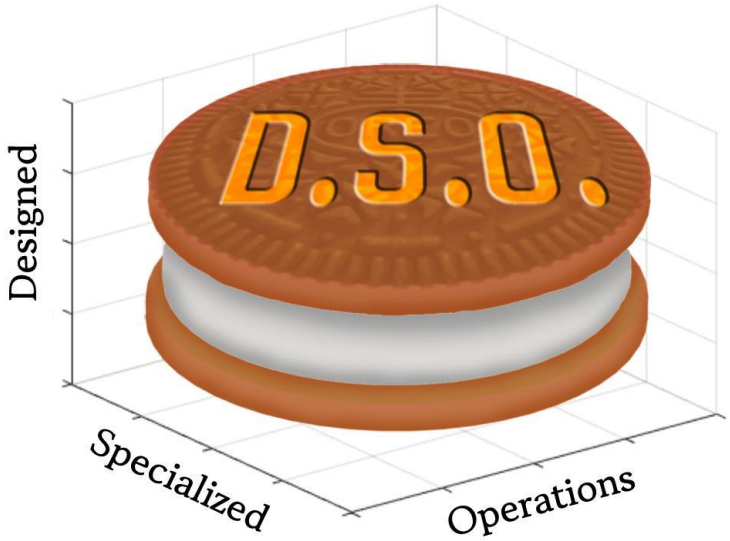
Compact Cable Case

Phase 1 Progress Report

10 February 2022



Designed Specialized Operations

ME 263 - Section 127

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Executive Summary

The purpose of this report is to prepare information regarding the problem Designed Specialized Operations plans on solving, in accordance with research gathered for the problem. D.S.O. saw a prevalent issue that many people face in their everyday lives and routines that could be improved quite easily. The problem that D.S.O. chose to improve on is the transportation of cords, whether for computers, phones, calculators, etc. and the complications that come with tangling and portability when you need to take them somewhere.

Gathering data for this was done using a survey that D.S.O. conducted with 162 correspondents to evaluate what the consumer is looking for in a compact cable case. Furthermore, research was done on existing products to determine their effectiveness to meet certain benchmarks. The evaluations made from this research allowed D.S.O. to create a house of quality where we were able to see how well current products addressed the issue. The house of quality showed our team what customer requirements are most important for the end goal. Engineering specifications were made in order to measure the requirements set by the customer. Another way the Designed Specialized Operations went about market research was in visualizing the issue for the general public. The way that was done was the creation of personas to give insight on how different target customers view this problem. Lastly, a gantt chart was made by D.S.O. to ensure phasing was met for the design process.

From the Survey research of over 160 respondents, D.S.O. deduced the primary customers were students and travelers. This gives rise to a large percentage of the country as on Purdue's campus alone there are tens of thousands of students that all need a computer to complete their studies. Secondly, travel will always be present and the need for improved transportation of cable is a necessity that is seen in the survey results. Additionally, the survey concluded that the majority of people travel with their charging cords about half the week and use it around twice a day on average. Designed Specialized Operations wants to find a way that students, travelers, and anyone who uses any kind of charger does not feel the hassle of having to bring it only occasionally and the issue of them getting tangled or messy. The personas mentioned above also outline general cases of the target market.

The research done by Designed Specialized Operations found that the need for a better way to travel with cords is a common issue that so many people across the world inevitably face. Currently, existing products do not meet customer needs as seen in market surveys. D.S.O. saw this and is interested in designing, testing, and presenting a device that maximizes portability and size while also being able to function how the customer wants in order to comfortably transport their chargers and cables.

Table of Contents

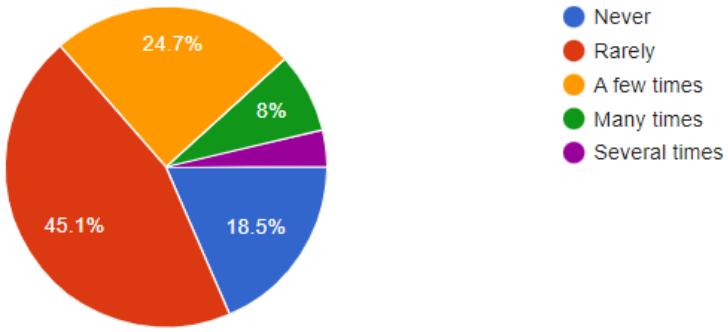
Introduction

This report is being written to address the problem of chargers getting tangled and broken and the research that team Designed Specialized Operations has done in regards to the problem. As just stated, the problem being examined is the tangling and breaking of charging cables. People try to organize their cables all the time, whether it's for traveling, commuting, or organizational purposes. This involves wrapping the cables up in a sense in which they often get tangled and occasionally break. From survey results, it's determined that 92% of people deal with cable disorganization such as knots and tangles. Furthermore, 82.7% of people get frustrated when this happens, which means there is an evident problem and an evident urge to fix the problem.

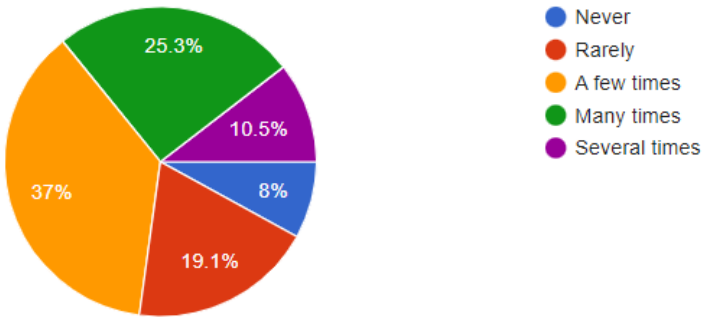
The sections of this report are split up to create a holistic review of the progress made so far in regards to the problem at hand. The first section examines the survey and its results along with market research on the problem and current solutions. It then bridges into a section discussing the house of quality which encompasses all of the research into a numerical model that helps further define the problem. After the house of quality, the formal problem definition is introduced and explained in depth. This will be the groundwork for the following phases of the project and will help guide the team in its progression. The report will then move on to discuss the human centered design of the product as it relates to its actual usability. Lastly, this report will detail and outline the project schedule moving forward and conclude this phase of the project.

Survey and Research Results

To get a better idea of the market and gauge demand and customer interest for such a product, the team conducted customer research in the form of surveys. Through market research and the survey results, it was concluded that 54% of the population uses charging cables at least 3 times a day and that 83% get frustrated from cable disorganization and damage. This benchmark made it clear that there is potential for a prevalent demand to exist in the market. Furthermore, it was discovered that 93% of the population travel with their chargers every week. This made it clear that the product has to prioritize portability. Respondents have also shown that misplacing chargers and dealing with disorganization/clutter are also common issues, as shown by the survey results below:



How often people lose their chargers (Figure 1)



How often people deal with cable disorganization or clutter (Figure 2)

There are some products in the market that solve such problems and cater to the population, however, there are none that have a generalized modular mechanism that allows the customer to swap out the charging wire inside. One competitor, BeatBuddy, is designed well for portability, but lacks durability and accessibility. Other competitor brands such as Global Industrial Cable Retractor and PC Nation also have similar issues as they lack aesthetic, accessibility, or adjustability. D.S.O. aims to develop a product that meets all of such customer requirements. A strong demand exists for a solution as 96% of the population claim they would be willing to spend more than $10 in purchasing a product and 43% are willing to pay over $20.

Apart from existing brands, there are also some notable patents that exist. The "Retractable cable assembly" (US20020040945A1) patents a particular design of a retractable cable assembly that employs a spring tension mechanism to retract a coiled cable. This design however, does not offer a removable/replaceable cable design. D.S.O. aims to develop a product that prioritizes accessibility and convenience by allowing users to use any cable with the product. Such a dynamic design has not been patented. Another notable patent that exists is the "Retractable cord reel" (US8657087B2). This patent is of a specific retractable reel design that uses a conductor to pass a current with a spool when engaged. When disengaged, the ratchet cannot make electrical contact with the conductor on the spool. Neither of these designs are of severe threat to the team's potential design and product as the customer requirements are different.

House of Quality

The research done by Designed Specialized Operations was transferred to a more visual representation in a House of Quality (Appendix A). This provides a more qualitative understanding of the customers desires for the solution of this problem. From this D.S.O. determined that the most important requirements were the selling price, total weight, and the maximum cable diameter.

Another aspect of the House of Quality are the engineering specifications that give a means to measure the customer requirements. The various benchmarks in this section correlate to the customer requirements and allow us to see patterns that arise. From those patterns, it helps in the iterative design process to change what was previously thought.

Along with the customer requirements and the engineering specifications, analysis of three other existing, similar products was done to evaluate how well they met customer requirements. In these evaluations, it was seen that the products fell short of many benchmarks and indicated a lack of existing product for which we are aiming to create. For example, the PCNation Retractable Cable did not have the carrying capacity to accommodate a larger cable.

Figure 3. PCNation Retractable Cable

Visibly, this does not meet customer requirements found in the house of quality and market research. As a result of further market research, D.S.O. discovered that the target price

that consumers request is around $10-$20 and out of the three existing products, they are all near the upper limit of that. The most important aspect that Designed Specialized Operations wants to maximize is the total weight and total volume so that a big problem is solved when it comes to transporting these cables.

Conclusively, the house of quality outlined the most prevalent design aspects to be total size and volume, selling price, and the maximum cable diameter that could be fed into the device. Another conclusion was that there is ability for future optimization of this product and that is what Designed Specialized Operations will aim to solve.

Problem Definition

Designed Specialized Operations is to design a product for cable organization for individuals who own technology devices which will feature compact, non-tangling cable storage and portability. The target consumer audience is anyone owning a technology device such as a phone, tablet, computer, or anything else requiring cable charging.

People who own technology devices often run into problems with their charging cables getting disorganized, tangled, or even ruined. From a survey distributed by Designed Specialized Operations, it was found that 91.9% of people with tech devices deal with these problems on a regular basis (figure 2). From talking directly to a few survey takers, they described their frustration with chargers being cluttered on the floor and getting tangles in their chargers when commuting with them. The takeaway that D.S.O. took from these conversations and the survey results was that a product needs to be designed to conveniently organize any cable of choice while being both portable and hard to lose.

Currently, consumers solve the problem of cable disorganization with many different solutions, one of the most prevalent being small cable hook guidelines. Another common solution when taking into account the portability of cables is retractable chargers. However, these solutions have their gaps. Cable hooks are a more temporary solution for when consumers hope there will be a better product on the market, which is what D.S.O. intends to make. The retractable charger products currently on the market are the inspiration for the product being designed by D.S.O. However, these retractable chargers are cheaply made, ineffective at charging, and non-durable. D.S.O. looks to use the concept of this product to design a much better quality, more durable, and more universal product.

The product being designed by D.S.O. is supposed to be universal to whatever cable is being used. The Compact Cable Case is to function similar to a tape measure, such that the cable will remain organized inside its casing until required use. Then, the consumer can pull out the desired length of cable for use. When finished with use, the consumer can let the cable retract back into the casing. There will be a carabiner attached to the casing of the product so it is easy for consumers to take with them on the go. Depending on what cable is being used, the consumer can open the casing and change out the cable to their choice.

Through different types of research, D.S.O. has come up with the most important customer requirements. These include being low cost, durable, portable, adjustable, aesthetic, ergonomic, and accessible. The engineering requirements associated with the customer requirements can be found in the House of Quality in Appendix A. From these engineering requirements, D.S.O. aims to make the solution under 100in^3 in volume, hard to break, able to fit up to 0.5in diameter cables, less than 24 ounces, and priced at or under $20.

In their survey administered, D.S.O. found that consumers would be most willing to pay for a product priced between $10 and $20. Through further research, D.S.O. discovered that in 2018, 69.6% of the US population has a smartphone [1]. This is equivalent to approximately 227 million people just in regards to one sector of usability for the product being designed [2]. From this number, a reasonable estimate for yearly sales would be 227 thousand units sold. D.S.O. thinks they can reach 0.1% of the population in the US due to the newness of the product and the fact that human nature likes to stick with what they know works.

Human Centered Design:

One of the team's main goals is to develop the ergonomics of the product. The main customer requirement of this product is to prioritize convenience and accessibility. To accomplish this, the team plans to make a dynamic design that allows the user to insert any cable of their choice into the universal retractable cable housing case.

Humans are often forgetful; the team plans to employ magnetic behavior to elevate the accessibility properties of the product. This way, users can stick the cable case on any magnetic surface, such as a fridge, and thus reduce the number of times they lose the product. Humans are also often lazy and prioritize convenience and simplicity. For this reason, D.S.O. plans to ensure a simplistic design that can be easily repaired at any local hardware store. The team also plans to make the product very easy to use with a "snap-on, snap-off" mechanism.

Lastly, humans value the aesthetics of products they own. For this reason, the team plans to make the product ergonomic and aesthetically pleasing with a modern design. In the future, D.S.O. plans to implement a variety of colors and designs to appeal to a larger audience and demographic.

Project Scheduling

D.S.O's plan for Phase 2 and 3 is to begin designing and prototyping our Compact Cable Case. Throughout the rest of the project, the team will work relentlessly to modify and design the best Compact Cable Case that is durable, accessible and portable, as per our House of Quality (HOQ).

D.S.O. plans to begin phase 2 by translating our customer feedback into ideas. The team plans to spend the first two weeks brainstorming ideas to modify the product to align it with the consumer's requirements. In the general survey sent during Phase 1, we asked surveyees to leave their email if they were willing to be contacted back regarding their feedback. Once we design these modifications, we intend to conduct another consumer survey to gauge the consumer's approval of our new ideas. The team plans to repeat the cycle in Phase 2 until the consumers generally approve the design. A projected Gantt chart for the second phase of the project can be seen in Appendix C. The team will also present a second oral report documenting our progress at the end of Phase 2.

Once D.S.O. gets general consumer approval in Phase 2, the team will move into its third phase - designing and prototyping. The team will first make computerized models of the product to help us visualize our design and make any further changes before we begin prototyping it. The final part of Phase 3 will focus on the assembly and production of the product as highlighted on the Gantt chart. A projected Gantt chart for the third phase of the project can be seen in Appendix C. The team will present a final oral report documenting the team's progress and challenges faced throughout the semester.

Conclusions and Recommendations

Throughout the first phase, the team has primarily focused on consumer and market studies to help understand what the consumers want. This highlighted the consumer's focus on the accessibility, durability and portability of the product. The team has received valuable feedback about potential modifications to the product that would benefit the practicality and usability for the consumer.

Our consumer and market surveys showed that there are very few products that meet the specifications that consumers want on the market. The survey conducted by D.S.O. showed that consumers do not have much preference about the aesthetics of the product, but would rather have a product that is dependable and would last a long time. The market research showed that none of the products on the market were able to fulfill both requirements - either they would break easily or not work majority of the time. D.S.O's goal throughout the second phase is to extensively research how both of these requirements can be fulfilled.

During the survey conducted by the team, consumers generally agreed that they would be willing to pay $10-$20 dollars for the product. As the team researches solutions to the problems prevalent in existing products, they must consider modifications in the most cost effective manner.

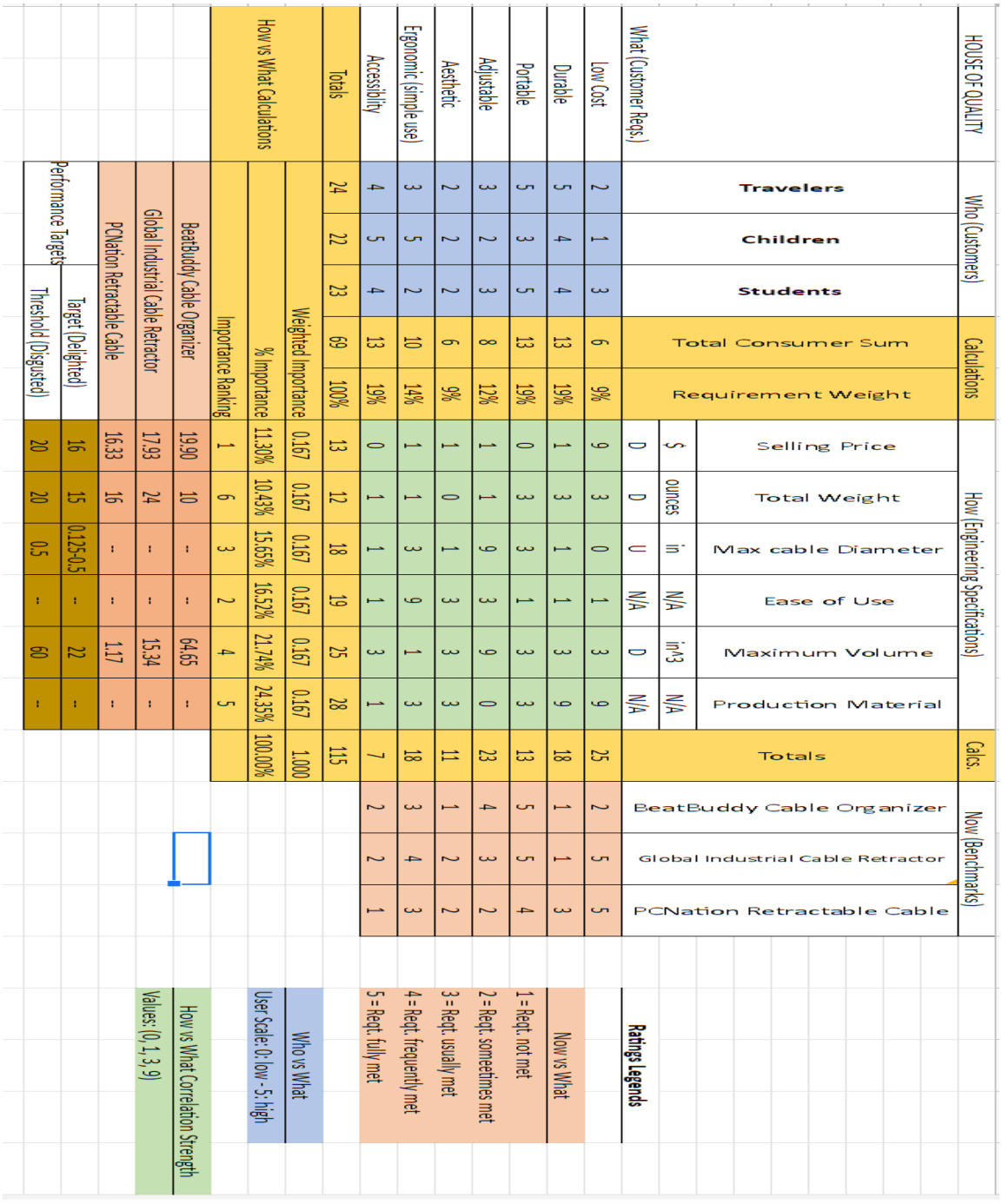
D.S.O's project is centered around helping make a human's life more convenient, and thus focuses on human centered design. Since people tend to be forgetful while distracted, D.S.O. plans to incorporate a magnetic casing to help make the product harder to lose. Additionally, people tend to break or damage their belongings often. As the team focuses on human centered design, they plan to make the product easily repairable in case any damages occur.

D.S.O. has set a thorough and comprehensive plan for the rest of the project to help the team successfully achieve the goal. The team will continue to model and design prototypes while aligning to the consumer's requests. During the initial survey, surveyees were given the option to provide their email and contact information if they would like to be contacted in the future about the product. As the team progresses, they intend to reach out to consumers to gauge their feedback and approval on potential design ideas.

As shown by the consumer surveys and market studies, an effective compact cable case is a well desired product. D.S.O. plans to work diligently to design a product that gives consumers what they want.

Appendices

Appendix A: House of Quality



The House of Quality represents the culmination of market and customer research done by D.S.O. formulated in a graphical representation.

Appendix B: Personas

Persona: Esteban Rosi - Student

"My laptop dies before my classes are over"
Rosi is a sophomore in college and dreads bringing his bulky laptop charger with him everywhere. The cord often gets tangled up and is difficult to neatly store in his bag.

"I hate when I take my charger out and everything in my bag comes out with it"
Rosi wishes there was an easier and more organized or convenient way to carry his charger with him in a bag.

Goals:
- Hassle free charger storage
- Easy cable management
- Improve organization

The Problem:
Rosi is frustrated by constantly having to untangle his chargers and spend time sorting out a mess instead of focusing in class.

Expectations:
- Aesthetic device for cable management
- Inexpensive
- Works well
- Doesn't need batteries

Persona: Nickolas Parris - Traveller

"My charger always gets tangled in my backpack when I travel"
Nickolas travels frequently for work, and this has to travel with his charger often. He notices that it tends to get tangled at the bottom in his backpack, which is very inconvenient.

"I always lose my charger when I travel"
Nickolas tends to stay at hotels often, and often loses his charger whenever he travels. He is often frustrated by the cost and inconvenience of having to buy a new charger.

Goals:
- Easy, Compact storage without sacrificing changing capabilities
- Hard to lose

The Problem:
Nickolas does not like the inconvenience of having to dig through his backpack or buy a new charger everytime he travels.

Expectations:
- Compact and Portable
- Relatively Cheap
- Charges his device well
- Hard to lose

Persona: Grayson Hawthorne - child

"My parents get mad when I leave my cords out"

Grayson has a tendency to leave his iPad charger out around his house. His parents constantly have to lecture him to pick them up so nobody trips on them.

"I lost two chargers"

Being a kid, Grayson has a tendency to lose things. This includes his last two iPad chargers. His parents are getting frustrated because they keep having to buy more chargers for him.

Goals:

- Cable storage and organization
- Hard to lose
- Portability

The Problem:

Grayson doesn't like constantly getting lectured by his parents about leaving his cords out and losing them.

Expectations:

- Organizes chargers
- Portable
- Charges his device well

These are the personas that define our target customer audience. The three categories include students, travelers, and children. Students are a great audience because they travel everyday with their technology to classes and need some way to conveniently store and travel with their charging cables. Travelers are more generally just commuters. Similar to students, travelers are constantly traveling with their technology devices and cables. They would benefit greatly from a portable cable organizer. The last persona created was made in regards to children. Children are messy with their cables and tend to lose them often. Making a device targeted to prevent these two things from happening would greatly benefit this group of people.

Appendix C: Gantt Charts

Designed Specialized Operations

Anirudh Bharadwaj, Adam Horner, Agathiya Tharun, Jacob Whitehouse

	Task Name	Start Date	End Date	Week Ending													
				2/13/2022	2/16/2022	2/19/2022	2/22/2022	2/25/2022	2/28/2022	3/3/2022	3/6/2022	3/9/2022	3/12/2022	3/15/2022	3/18/2022	3/21/2022	3/24/2022
	Phase 2																
☐	Modeling and Brainstorming	2/11/2022	2/19/2022														
☐	Research on Potential Modifications	2/11/2022	3/1/2022														
☐	Research Cost of Materials	2/11/2022	2/21/2022														
☐	Cost Benefit Analysis Of Modifications vs. Cost	2/20/2022	3/1/2022														
☐	Computerized Models of Brainstormed Ideas	2/19/2022	3/24/2022														
☐	Reach out and survey consumers to gauge feedback on modifications	3/1/2022	3/24/2022														
☐	Review, Revise Modifications	3/1/2022	3/24/2022														
☐	Final Cost Benefit Analysis	3/15/2022	3/24/2022														
☐	Finalized Prototype and Computer Models	3/19/2022	3/24/2022														
☐	OR	3/22/2022	3/24/2022														
☐	PR	3/22/2022	3/24/2022														
☐	Phase 2 Design Review	3/22/2022	3/24/2022														

This is our Gantt Chart for Phase 2. This is used to benchmark the team's progress.

Designed Specialized Operations

Anirudh Bharadwaj, Adam Horner, Agathiya Tharun, Jacob Whitehouse

	Task Name	Start Date	End Date	Week Ending													
				3/24/2022	3/27/2022	3/30/2022	4/2/2022	4/5/2022	4/8/2022	4/11/2022	4/14/2022	4/17/2022	4/20/2022	4/23/2022	4/26/2022	4/29/2022	5/2/2022
	Phase 3																
☐	Finalize Computer Model	3/24/2022	3/27/2022														
☐	Finalize Materials After Cost Benefit Analysis	3/24/2022	3/27/2022														
☐	Design Prototypes in the Lab	3/27/2022	4/20/2022														
☐	Consumer Survey to gauge consumer's feedback	4/14/2022	4/20/2022														
☐	Modify Prototypes in the Lab	3/27/2022	4/20/2022														
☐	Review Protoype	4/20/2022	4/22/2022														
☐	Edit and Modify Prototypes	4/22/2022	4/28/2022														
☐	Use ME263 resoure to help enter then product on the market	3/27/2022	5/2/2022														
☐	OR	4/24/2022	4/28/2022														
☐	PR	4/24/2022	4/28/2022														
☐	Phase 3 Design Review	4/24/2022	4/28/2022														

This is our Gantt Chart for Phase 3. This is used to set the team's goals during this phase.

References

1. O'Dea, S. (2020, April 8). *Smartphone penetration in the U.S. as share of population 2010-2021*. Statista. Retrieved February 3, 2022, from https://www.statista.com/statistics/201183/forecast-of-smartphone-penetration-in-the-us/
2. *U.S. population 1950-2022*. MacroTrends. (n.d.). Retrieved February 3, 2022, from https://www.macrotrends.net/countries/USA/united-states/population