

Adjustable Portable Makeup Chair

Scope of Work

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Abstract

This Scope of Work (SOW) document highlights the work that has been completed so far in designing an adjustable portable makeup chair and relevant findings that have been found. The overall purpose of this product is to provide the makeup artist with more flexibility and comfort while providing services to her clientele. As a team, some of the things we have accomplished so far was conducting an initial meeting with the sponsor for the purpose of gathering more detailed information about the product. A questionnaire was sent to our sponsor and her team to get any more information about the wants and needs of the product that may have been overlooked. Preliminary research has begun about similar products on the market, the competition, and technical challenges that may occur. In this document, the problem statement, design specifications, and the stakeholder's wants, and needs can be found in detail along with the overall scope of the product. Our design process including analysis and techniques that we believe are necessary to complete this project can also be found in this document. For example, A Gantt chart will be used to assign tasks to members of the team and help manage deadlines for key deliverables. Methods such as creating an Engineering Specifications table and Quality Function Deployment (QFD) were important steps we used that will help with producing the best solution for the sponsor. By the end of the project, we plan to deliver a prototype and a CAD file with manufacturing plans to our sponsor.

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1. Introduction

The current portable makeup artist chairs on the market come in specific height sizes based on the client's height as well as the makeup artist's comfort height to work with. This is a problem as makeup artists need to purchase various height chairs to accommodate all artist height/sizes. Leah Gilbertson of Dreamcatcher Artistry is sponsoring our project to help artists around the world have a single adjustable, portable makeup chair that can accommodate height needs.

For our project, the design challenge will involve creating a chair that will adjust in seat height. It needs to lower to a standard chair seat height of about 18 inches, up to the tallest height of 29 inches. This will allow artists who offer both hair and makeup services to be able to use the same chair for the entire duration of their job whether doing hair, makeup, or both. Ideally, the artist will be able to adjust the height quickly and efficiently without any fuss. It must lock in place in a way to keep the 250lb weight capacity. It also needs to stay lightweight and portable (preferably foldable) and can keep the side tables intact. The chair must withstand constant movement, folding/unfolding, and height adjustment while keeping its sturdiness and longevity.

The team is comprised of Christina Totorica, Erik Mote, Cristian Garcia, and Edgar Sanchez. All four of the team members are pursuing a mechanical engineering degree but all with distinct concentrations to allow for a large range of skills to be used if the project requires their implementation. The team's main goal to accomplish by the end of the project is to have a production-ready design package that will be provided to a manufacturer to create the designed makeup chair. The production-ready design package will consist of but is not limited to a Computer-Aided Design (CAD) model, manufacturing plans, and working prototype. This report will lay out what our design process and methodology will consist of throughout the entirety of the project. It will provide an understanding of what major problem we are trying to overcome through our goals and process plan. The report will have the following: a background section explaining the findings of our research, the scope of the project defining the goals of our project, an objectives section discussing the design specifications, a project management section elaborating on the process, and a conclusion section summarizing the document.

2. Background

During our initial background research, we focused on three main sections: customer research, product research, and technical research. The first few weeks of this project involved multiple conversations with Leah Gilbertson that were intended to communicate the requirements of the problem's resolution. Product research involved finding competitive products and commercial versions of products. Technical research was comprised mainly of patents which help us get a full view of the related technology that may help us in solving the problem and developing the product.

2.1 Customer Research

To better understand the scope of the project, we interviewed our project sponsor to gain a better understanding of her requirements for this project. Below is a list of her wants and needs summarized from the initial interview:

- Has 2 folding side tables
- Has a full-width footrest for clients
- Padded armrests for optimal comfort
- Can be adjusted easily and quickly
- Can be compacted to transport
- Can fit into most cars
- Aluminum frame
- Lightweight
- Operates safely for the client and artist
- Adjustable shoulder carry straps that help carry makeup chair

We also have sent a questionnaire to our sponsor and will receive more feedback from more makeup artists, that are the main target for our product, that we will consider when brainstorming and creating our solution to the problem at hand.

2.2 Product Research

During the product research, we found similar products and evaluated them according to the required function and needs of our project.

One of the main competitors of this project is a company called Tuscany Pro (Figure 1). This is the brand of makeup chairs that our sponsor, Leah Gilbertson, currently has. It is lightweight, portable, durable, and user-friendly, and has lots of features, such as a Black 630D Polyester Fabric, a full-width footrest, two foldable side tables, a storage net, an adjustable shoulder carry strap, round arm rests, elbow pads. Figure 1 shows a picture of the type of makeup chair Leah currently has. She wants to keep most of the features on the chair but needs it to be adjustable and more portable preferably.



Figure 1: Tuscany Pro — Tuscany Pro Tall Makeup Artist Portable Chair (“Tuscany Pro Tall Makeup Artist Portable Chair -29’ Seat height”).

Another one of the main competitors of this project is a company called Innovative Earth Products (Figure 2), which has a very similar makeup chair design to Tuscany Pro’s makeup chairs. Their most popular makeup chair, the Makeup Pro Tall Artist Chair with Makeup Case, comes equipped with a “fold-out side table, cup holder, side pockets, and mesh storage shelf” (“Executive VIP Tall Directors Chair with Folding Side Table”). This makeup chair also “folds up in seconds for easy set-up and take-down” (“Executive VIP Tall Directors Chair with Folding Side Table”). Like our needs and wants, their chair comes with comfortable padded arms, a side table, and a free makeup case. It also has stability and a full-width foot bar.



Figure 2: Innovative Earth Products — Makeup Pro Tall Artist Chair with Makeup Case
 (“Executive VIP Tall Directors Chair with Folding Side Table”).

Another competitor that has similar makeup chairs is Cantoni Chairs (Figure 3). Their makeup chair idea was conceived from experience in the field when it became apparent that there was a need for a portable makeup artist chair that could also be adjusted in height. This is the exact goal of our project. Cantoni has made an adjustable portable makeup chair but without some of the needed features that are required for our project. Figure 3 shows a picture of Cantoni Chairs’ adjustable makeup chair.



Figure 3: Cantoni Chairs — Makeup Artist Chair (“Makeup Chair, The Professional One for Makeup Artists”).

Makeup chairs from Costway are one of the most elegant and cheapest pieces of furniture in their store. Made of white leather, this chair has a comfortable seat and a backrest. A chrome-plated metal frame also finishes the chair. Not only can it adjust seat height, but it also has a 360-degree swivel. The gas springs hidden in the chair’s base can be raised or lowered in a variety of ways, which is how it raises and lowers the seat height. Its adjustable height and swivel mechanism make this product one of the main competitors for our project although it is not portable and would not fit in line with the transportation and movement our solution should provide. Figure 4 pictures this makeup chair with its skid-free base.



Figure 4: Costway — Costway Vanity Chair (Mariyam, “What's The Best Makeup Chair?”).

Dir Salon Furniture has a reclining makeup chair that comes with heavy-duty aluminum frame and steel structure. It allows clients to sit upright, recline their back, or lay flat in the chair. It comes with a hydraulic pump that allows the height of the chair to be adjusted. This makeup chair also has a removable headrest and padded seats and armrests which makes it easy for the artist to clean, which are some requirements we need for our project. Its T-bar footrest locks in place to provide comfort for the client. Although it's one of the most expensive makeup chairs on the market, it has high-density memory foam and high-grade soft vinyl for maximum comfort and durability. Figure 5 shows a picture of this all-purpose reclining makeup chair. Again, as stated the Cantoni chair would not be suitable to move around and transport easily, but these are some popular makeup chairs in the market that has some of the features we are aiming to implement in our product, and we can use these chairs to make sure our solution is up to par with what is out in the market currently.



Figure 5: Dir Salon Furniture — All-Purpose Reclining Makeup Chair (Mariyam, “What's The Best Makeup Chair?”).

2.3 Technical Research

To begin the research on how to go about designing our solution we first did the research not only on existing products in the market and look at the patent of the current chair our sponsor is using but we researched different solutions that were not necessarily makeup chairs. An article released in the International Journal of Industrial Ergonomics deals with a similar problem of finding a solution to a similar problem to ours, finding a way to adjust a desk chair for students. In their research and development of a solution, they came up with a mechanism for adjusting the height of the desk as can be seen in Figure 6.

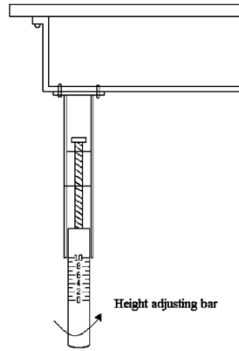


Figure 6. Adjusting the height school desk with a height adjusting bar.

Here, there is a height-adjusting bar that can be twisted to move the desk up and down to the desired height. In the article, a method for adjusting the seat backward and forwards was also discussed and although this is not the goal of our solution, there is a mechanism, as seen in Figure 7 of using spring buttons and “holes” for the buttons to go in. When you adjust the seat, you push the buttons which let you adjust the seat. This can be translated to moving something up and down as well, which can be useful to our need for a height-adjustable chair.

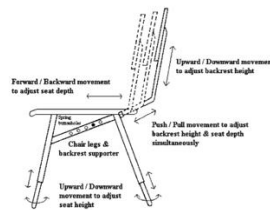


Figure 7. Adjustable backrest for a school chair that uses table and holes to adjust placement.

A similar problem researched by the Reykjavik University, Engineering Department, proposed a solution that involves gas spring and pull pins to move the desk up and down. The main mechanism of getting the desk up and down to a specific height are the pull pins that are used to lock the desk into place. Like the spring tab and holes from the previous solution, the pull pins work by simply clicking into place when the desired height is set. As seen in Figure 8 there are legs attached to the tabletop. These legs have holes in them and then they slide into the bottom frame which has the pull pin at the top of it. The pull pins are “activated” when the desired height is reached and then the table is supported by the pins.

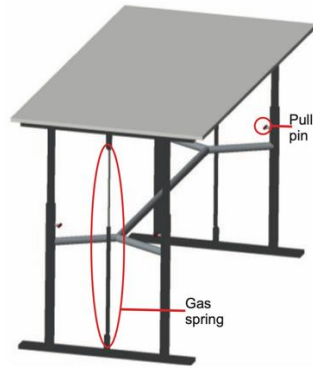


Figure 8. Adjustable desk that uses pull pins and gas springs to set a certain height

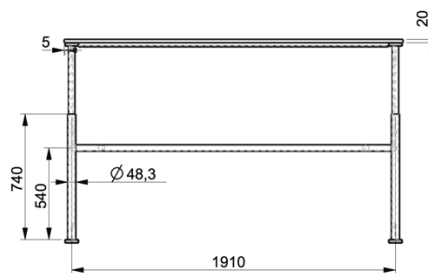


Figure 9. Side view of adjustable height desk

Apart from previously discussed solutions to similar problems, to accomplish our sponsors goal/need for the problem solution of making the chair adjustable, actuation systems can be implemented in accomplishing that goal. Linear actuators which are known as “movers” use to create linear motion. There are electro-mechanical, pneumatic, and hydraulic linear actuators that can be used for this application. Electro-mechanical linear actuators rely on an electric motor to “convert rotational motion in motors into linear or straight push/pull movement” which would accomplish one of the main goals of our sponsors need for adjusting the height of the chair with minimum hassle. Pneumatic linear actuators which are used in some adjustable height electric desks, use this type of linear actuator to achieve desired desk height. It relies on compressed air in order to convert to linear motion “with a piston rod extending and retracting but can also be designed with a carriage that moves on the cylinder tube or guideway”. This would eliminate some hassle of manually trying to move the chair to a certain height and it would automate the height adjustment to make it easier for the user. One downside would be the cost; if we can figure out how to just use one singular actuator in our design this would be relieved.

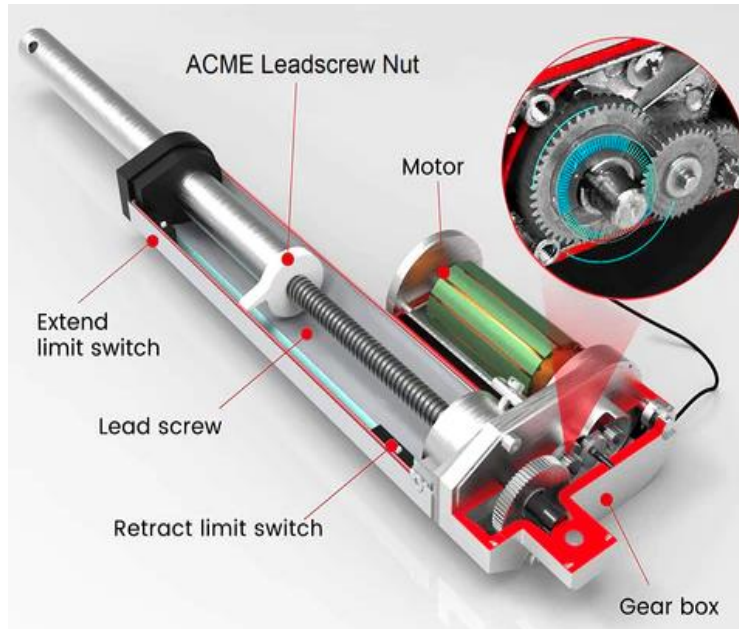


Figure 10. Electromechanical linear actuator inside view, a rotating motor converts rotational motion into linear motion.

Another aspect of our problem solution we researched is how to make our solution compact as our sponsor desired. We found another Cal Poly, senior project, "Azelia's Walker." That dealt with creating a walker that had "several key design features" such as height adjustment of the walker, to be able to be transported. The senior design project used an accordion-style collapsible method for the back of the walker to make it portable. This could be useful in our solution as being able to make our solution compact is needed.



Figure 11. Accordion collapsible backing on a walker

After researching different problems that are related to aspects of our goals, we can see there are aspects of each problem we saw we could implement or translate into our solution even though

our design problems are not the same. With adjusting the height, clicking tabs are used a lot for adjusting heights and lengths since they are relatively simple and rely on mechanical principles. Linear actuators would be another useful mechanism in helping us accomplish the height-adjusting function of our solution. For creating a compact solution, an accordion method as seen for the walker is also simple and does not require external power to collapse which could be beneficial to the user.

3. Project Scope

Figure 11 below shows the boundary sketch/diagram of the sponsor's ideal chair to further elaborate and understand the scope of the project. The chair's main functionality would be its ability to adjust seat height from 18 inches to 29 inches. Two other functions of the chair would be as compact and portable as possible compared to other existing makeup chairs. This function would require the chair to be lightweight and can fit into most vehicles with no hassle. One last important function of this chair would be that it must have a quick setup process. Some of the other features of the chair would include two armrests, footrests, and two pop-up tables: one for the client and one for the artist. Planned deliverables include CAD files complete with steps on how to manufacture the chair and a prototype of the chair.

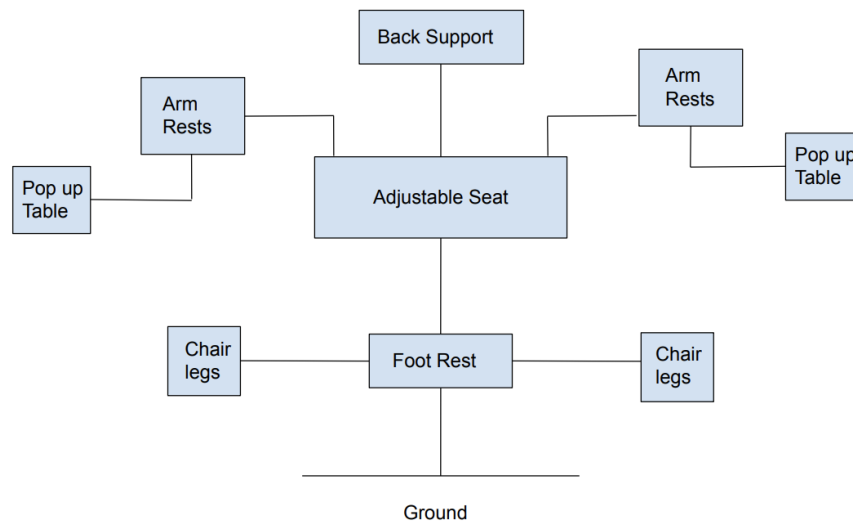


Figure 12. Adjustable Portable Makeup Chair Boundary Sketch

4. Objectives

Our sponsor needs assistance to perform her work as best as possible and provide her clients with the best service. She is not able to do that with the current line of chairs she currently has. The goal is to come up with the best solution possible considering the specifications and constraints made. The specifications of this product were made using the QFD method as seen in the appendix below. A QFD house of quality listed the main specifications and ranked them in order of importance. For example, the weight capacity could not exceed passed the listed amount of 250 pounds for the chair to be fully functional. These specifications will be used and referred to in the future design process when tests on the chairs are being performed. The requirements, as specified mostly by the sponsor and her team, are the main things to consider when coming up with the solution and sums of their needs/wants.

There is some risk when coming up with the design, with the main one being safety. It will be challenging to come up with a design that will be compact, portable, and still be able to maintain the weight capacity needed. Other high-risk specifications would be seat adjustability and how our approach might affect its functionality. Will the seat be able to adjust without the chair failing? Will it create more work for the sponsor if the chair becomes too complex to operate? These are things to consider and some compliance such as analysis, inspection, and testing are needed to ensure that the chair works as intended. Below is an Engineering Specifications Table that documents the main specifications that will help with the final design.

Weight capacity is one of the main specifications where the chair would only be able to support a maximum weight of 250lb so it can still function as intended. Seat adjustability is another main specification where the sponsor would prefer that the chair starts from a standard height of 18 inches up to 29 inches. The time to set up the chair is a specification that would require only 45 seconds max to set up. Ideally, it would be best if it could be set up quicker, so it does not create too much of a hassle. One more specification to keep in mind when coming up with a solution is the folded dimension, specifically the folded height of the chair. It must be able to fit in the trunk or back seat of a car so a target height of 22 inches with a tolerance of ± 2.0 inches is preferable.

Table 1. Engineering Specifications Table

Spec #	Specification Description	Requirement or target	Tolerance	Risk	Compliance
1	Weight Capacity	250 lb.	Max	High	A, I, T
2	Seat adjustability	18-29 inches	±0.5 inches	Medium	A, I, T
3	Time to set up	45 seconds	Max	Low	T
4	Folded Height	22 inches	±2.0 Inches	Medium	A, T

- A = Analysis, I = Inspection, T = Testing

5. Project Management

The main design process we plan to follow for the full project is the Engineering Design Process. The process consists of defining the problem, specifying requirements, background research, choosing solutions, developing solutions, test solutions, and communicating results. While this is the chronological order of the design process, sections can be reconfigured to accommodate problems throughout the entirety of the project. This means that certain sections can be revisited again in the future if a situation arises that needs the prior milestone changed.

The first approach to our design process is defining the problem where we must break down all the components that make up our problem to identify all the possible solutions down the line. For our project, we were able to define our problem as makeup artists need to purchase various height chairs to accommodate all client sizes. This problem was brought to our attention by Leah Gilbertson of Dreamcatcher Artistry who needs a way to adjust her makeup chairs because she wants to provide better service to her clients. This is the overall problem our project needs to resolve in a brief statement.

The second approach to our design process is specifying the requirements our project needs to satisfy to effectively conclude our defined problem above is resolved. Our specified requirements are that makeup artists need a lightweight, adjustable, portable, and reliable makeup chair that can vary in height (18-29 inches) with a maximum weight limit of 250lb. It also needs to have a

maximum weight of 20lbs and needs to stay constrained in place when opened. These specifications will allow the makeup artist to comfortably work with people of all sizes with a single makeup chair while allowing for ease of transportation and portability.

The third approach to our design process is performing background research to view products that are currently out on the market. Our current plan consists of:

Table 2. Design Research Plan

	Research Type	Where to search	Possible topics/keywords to research
Customer/Need Research	Sponsor / Company Info	dreamcatcherartistry.com	
	Case Studies	Redesigning school chair (similar to us kinda)	
	Customer Data	"How to choose right professional makeup chair" PROFESSIONAL MAKEUP ARTIST CHAIR – A BUYING GUIDE How to choose the best makeup chair How to choose a good makeup artist's chair	
Product Research	Similar Products / Competition	Tuscany Pro Innovative Earth Products Cantoni Chairs Camera Ready	

		Lumina Pro Chairs Makeup chair -archiexpo	
	Patents	patents.google.com US20210145178A1 - Cut and Go Barber Chair - Google Patents (Cut and Go Barber Chair) US2698047A - Adjustable chair - Google Patents (Adjustable Chair)	Cosmetic, height adjustable, portable, chair, lightweight
Technical Research	Journal / Conference Papers	Adjustable school chairs An adjustable height desk	Convenient adjustable chairs for different people
	Standards (SAE, ANSI, ASME, IEEE, etc.)	The American Society of Mechanical Engineers - ASME	ASME
	Previous Senior Projects (not just CP)	Adjustable Seating Systems	
	Research Reports	Field studies of comfort and discomfort in sitting	

The fourth and current approach to our design process is choosing a solution for our defined problem that satisfies the requirements. The team individually created sketches of makeup chair designs that we can view to discuss as a team which solution we believe is the best amongst them. The solution is not a specific design a team member came up with but rather a combination of all the characteristics we unanimously decide our project needs to process.

The rest of the approaches to our design process are developing solutions, testing solutions, and communicating results. These approaches are less methodologically driven and take on more of a practical approach based on our progress results. After we choose our solution, we need to develop the thermotical concept into an actual approach. This then needs to be tested to verify it follows all the requirements it needs, more specifically that it solves our problem. The last approach allows us to communicate our results by presenting our new product.

To manage our progress to make sure we are on track with completing our project within our limited time, we will be using Gantt to view our project milestones along with their due dates. This provides us with a project time calendar that allows us to monitor our progress. Since we are early in the project, we only have our major milestones implemented on our Gantt chart which are listed below.

6. Conclusion

Our mechanical engineering team believes we can create a solution for the mechanical facets of our adjustable portable makeup chair design. The current portable makeup artist chairs on the market come in specific height sizes based on the client's height as well as the makeup artist's comfort height to work with. This is a problem as makeup artists need to purchase various height chairs to accommodate all client sizes. Our design challenge is to protect the health of the makeup artists back, whilst allowing them to work with their clients at eye level. There are many existing products that perform the tasks of an adjustable makeup chair but most of the products are too heavy and aren't portable. The key point of this document is to lay out what our design process and methodology will consist of throughout the entirety of the project. The next project deliverable for our team will be the Preliminary Design Review (PDR), due November 17th. We are asking for confirmation of the project scope from our sponsor, Leah Gilbertson.

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Appendix B: Gantt Chart

