A Logical Approach for the Consumption and Handling of Hot Beverages for One-Fingered Individuals

Carolyn Riegel, Dave Pedron, Jordan Tenerowicz
Engineering Design 100
The Pennsylvania State University, University Park, PA 16802

Abstract

Today, more than 41,000 US citizens are registered as someone who had an amputation of a lower, arm extremity specifically one or more fingers [1]. Therefore, some traditional products are not suitable for these individuals. To support such individuals with ease of functionality with everyday products, a challenge was introduced to create a coffee mug that would be suitable for such disabled people. No such products exist for such a case and little research has been conducted to determine what would make such products effective. In our proposed approach, we are set out to design a product that will suit the needs of one-fingered individuals, specifically with the handling of a coffee mug. The feasibility of proposed concepts is determined through concept selection, ranking, and determination of best possible ideas. A tall, slimmer mug, with separate finger handles for easier handling with an easy but secure pop off lid is proposed to best meet the needs of one-fingered individuals drinking from a coffee mug.

Key Words: Amputation, challenge, research, feasibility, suitable

1. Introduction

Product design and generation is a process that works to best suit the needs of customers while working under the constraints of feasible design and processing. Within the design process there are multiple steps that work to determine the best concepts and aspects of a particular design. The purpose of this design process is to think, generate, and put together ideas as a team

that would be effective for any one-fingered disabled person to enjoy a hot beverage easily and safely. For a one-fingered individual, handling of a coffee mug can be quite difficult. Therefore, manipulating the design of a traditional coffee mug will ensure that a one-fingered individual can effectively utilize the product.

2. Literature Review

While no prior research or development of a coffee mug design for a one-fingered individual exists, much of the research for our design was within the realm of a traditional coffee mug. A plethora of patents exist for traditional coffee mugs. From standard mugs, to ones that can be used on the go[2], many options exist that we could research in order to determine the best concepts for our new design. This gave an idea of what concepts should remain in the new design, as well as how we can manipulate the traditional design to better suit the needs of a one-fingered individuals. The traditional mug that we investigated is insulated, has a secure lid, and is designed in such a way to allow for use of the mug on the go[3]. We will use these traditional concepts to design a mug for one-fingered individuals with certain manipulations that will ensure safety and ease of handling for the individual.

3. Design Process

By investigating the proper design process, concepts were proposed that would best suit the needs of one-fingered individuals. By generating a mission statement, it was easy to decide which specific needs and concepts would be required in the design. These concepts were then narrowed down by ranking how effective each concept would be in the overall design. ranked the needs by level of importance and then into different concepts. The concepts were then ranked by how easy to use, handling, and affordable that certain concept would make our product. Based

upon importance, these concepts were narrowed down further to produce a final concept list that met the outlined specifications regarding aesthetic design, the body of the mug, possibility for finger pockets, type of lid, and the base of the mug. The best concepts were then finalized for the final design result.

4. Design Result

After working through the design process and narrowing down which concepts best met the needs and constraints of the customer, a one-fingered individual, a final design was generated. It was determined that the most important aspect of this design would be the tall, slim body of the travel mug. This design ensures that the individual can wrap their finger around, while ensuring stability and ease of handling. Within this body are finger pockets that the finger can be placed in to further ensure safety and easy handling. Other concepts that were important in this design include a pop-off lid. This allows for safety while travelling, as well as easy operation for the individual. The lid can easily be added and removed, but is secure enough to keep the product safe. The mug itself is made of stainless steel which makes it easy to clean, as well as affordable. Finally, the base of the mug will be made of a rubber, non-slip material to further ensure safety and stability of the product. This mug is expected to be safe, easy to handle, and affordable for one-fingered individuals.

5. Conclusion & Summary

Overall, the design process ensured that the final product would adhere to the best possible concepts for the product. Through ranking and customer needs determination, the final product is safe, affordable, easy to handle, and effective for one-fingered individuals. Although there were problems within this design process, re-evaluation of customer needs and concepts

helped to alleviate the struggles that were faced. The design process ensures the effective determination of concepts, an idea that is proven by the effectiveness of our final design product.

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Sensitive Payload Shock Absorber for Unmanned Aerial Vehicles

Carolyn Riegel, Jordan Tenerowicz, Dave Pedron
College of Engineering
The Pennsylvania State University, University Park, PA 16802

Abstract

Today, many companies, specifically Lockheed Martin, design and develop unmanned aerial vehicles (UAV) as a part of their company focus. These UAV products experience high shock loads upon impact during landing. Therefore, it is necessary for these parts to be lightweight and durable in order to endure conditions that are apparent during the landing process. To compensate for the high shock, an additional part can be added to absorb shock loads from the tail and elevator. Designing this part can be complex, as the material must be lightweight but also very durable to resist corrosion and destruction during landing. In addition, this part can be used for different plane designs but our design will focus on the standard tail plane. Extensive research exists detailing the various benefits and downfalls of materials used, specifically the benefits of using aluminum alloys. Therefore, our approach will focus on the use of duralumin, an aluminum alloy that is often used for automobile and military aircraft body parts. In addition, it is lightweight and will ensure the effectiveness of this UAV part. The success of this product design will rely upon the durability of the product upon aircraft landing, as well as the lightweight nature of the product to ensure prolonged flying time. A 3D printed design of the model will be used to illustrate the structure.

Key Words: design, lightweight, durable, complex, 3D printed design.

1. Introduction

The process of creating an unmanned aerial vehicle that can sustain multiple uses after crash landing is an important task, as it can potentially save Lockheed Martin millions of dollars

in repairs and new models. During the design process for this task, several key points were taken into consideration, including cost efficiency, durability of the product, and lightweightness of the product. Lockheed Martin is a military company, so it's important during the design process to remember that the UAV must be able to sustain shock from landing as well as harsh weather conditions and potential projectiles that may intercept and hit the drone while in the air from enemy fire. It is also essential to consider that the drone will be carrying loads, so the newly improved shock absorber can not be cumbersome and reduce the ability of the UAV to carry heavier loads. The purpose of this project and assignment ultimately is to develop a practical, durable solution to UAVs not getting much reusability after used.

2. Literature Review

There were two main concepts for the UAV shock absorbers already in place. The first of these involves a parachute that gets deployed when the UAV is ready to land. This concept is built around the idea of limiting the collision forces by slowing down the UAV using air force fighting against the parachute. While this isn't used much in a military sense, it can be slightly altered and optimized to face the heavy grind of militaristic use. At point of descent, the UAV deploys the parachute, which accelerates rapidly behind the drone catching the air, acting like a normal parachute on a human[1]. The second concept was focused on using magnetorheological landing gears, which uses hydraulic fluids to absorb shock in the similar method that cars use hydraulics to help go over bumps in the road without damaging the body of the car. This is much more suited for militaristic use, but its major downfall is the weight that it adds to the aircraft. Since the fluids weigh it down, it essentially cuts down the flight time by a large amount[2].

Typical UAV structure includes two parts, the front part and back tail part that separates upon collision. Shock is taken most at that point, because the weighted nature of the different

parts cause the separation point to take most of the shock. The shock absorber is placed right at that point, and helps keep the rest of the UAV secure by preventing the shock from reaching them [3].

3. Design Process

Original instincts created the original design, which was modeled very closely to the parachute design. Slight alterations would have to be added to that design, such as making the parachute a stronger material in case the drone faces opposing forces such as harsh weather or enemy fire. After examining the pros and cons of that design, it was decided that while it would create a nice buffer from the shocks from impact, it would increase the weight of the UAV (especially considering the newly designed durable parachute will have to be heavier than current materials), which would limit the carrying capacity and length of flight for the drone.

The next concept was to follow the design of the hydraulic fuel. Unfortunately, this created the same problem of absorbing shocks, but at the cost of weight of the UAV. Although liquids are very good at absorbing shock and maintaining durability, the hydraulic fluid and pistons would weigh down the UAV to a point where it wouldn't be able to fly nearly as far as it originally does. There is a possibility to reduce the amount of hydraulic fluid and distribute it differently, but that would adversely affect the shock absorption ability of the drone by a factor of the amount of liquid removed, not making optimal progress compared to the original design. More liquid removed would mean less weight, but also more of a risk of destruction of the UAV upon impact.

Keeping weight AND durability in mind, a third, original concept was created that used a durable material that could be compressed to absorb shock. The three different ideas were ranked. It was decided that the parachute and hydraulics weight were too much of a con to look

over, and that the spring material was best suited for the task at hand. The best topic was decided and the next process was started, optimizing the selection of the durable, lightweight springs.

After deciding on a concept, materials next had to be considered to ensure the best design for the drone. Since current UAVs are made of alloys, it was decided to think of different alloys that could be used. Possible solutions included a steel-copper alloy, an aluminum-copper alloy, or a mixed metal alloy. The steel-copper alloy provided strength but added weight. The aluminum-copper alloy, duralumin, was strong and lightweight. The mixed metal alloy was too ambiguous and heavy to really determine, so it was scratched from the beginning of the metal selection process.

4. Design Result

The final design that was chosen involved the durable spring-like material. In order to make this innovative and an improvement to the original current designs, it was important to choose a lightweight material for this option. After studying several different materials, it was decided to choose duralumin, which is an aluminum-copper alloy that is extremely durable and lightweight. It is used to build large scale airplanes, so the material is available for immediate use in the development of UAV shock absorbers. The design involved a matrix-like design, where the base structure would be repeated in a staggered pattern in order to maximize surface area of the shock absorption portion of the design. In addition to the lightweight material, the specific design is not very dense, including many air gaps that are featured to give the spring-like objects an opportunity and area to compress.

5. Conclusion and Summary

Ultimately, the most important factors going into this design were durability and weight. It was necessary to pick a material that wouldn't burden the UAV's ability to fly far distances,

but would also be strong enough to ensure that the UAV could sustain multiple uses without having to be replaced or repaired after every use. The current designs being used both by Lockheed Martin and other commercial companies don't fully utilize the correct materials to make these objects fly farther and safer. The parachute and hydraulic fuel designs are both extremely heavy in comparison to the duralumin, so the use of duralumin would actually enhance the flying capabilities of the UAV.

The duralumin spring shock absorber is a large improvement on the original design of the UAV. It provides more durability and longer flight time, both of which are extremely important to the success of a military drone used by Lockheed Martin. This is a concept that is original in design, and one that could essentially open a new area of drone flying capabilities, one where heavier loads could be attached to the drone and the drone could deliver it without fail to its destination, all while being returned safely by the receiver.

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