The Nittany Flask
By Ecolife

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2- Abstract:

For project 2, the Ecolife team decided to create a PSU aluminum drinking flask with Penn State decals and a nittany-lion screw off cap. This fun twist on the ordinary flask helps students show their Penn State pride while drinking out of a sustainable drinking container compared to plastic shot glasses and red party cups. If some students were to switch from drinking out of plastics to out of our flask, less waste around the campus would be generated. Through sustainability analysis and building our prototype, it was decided aluminum would be the best material to use for our prototype due to its highly recyclable nature and its light weight. While pleased with our results, further improvements to the Nittany Flask would make the product more aesthetically pleasing and desirable to consumers.
3 - Introduction:

Pennsylvania State University is currently in the process of making efforts to become a more sustainable university. With its large amount of people, achieving this goal is going to be a challenge because of the amount of things in this place that are not sustainable. As a group, we noticed the amount of trash-produced daily from beverage containers on campus. These containers are sometimes not recycled properly and end up in landfills or even worse, never making it into the trash, taking away from the beauty of the campus. Our goal was to decrease the amount of trash from beverages containers with a reusable eco friendly container with PSU pride. We designed the Nittany Flask. The idea we had in mind was to make a beverage container that was light, medium-sized, durable, and ultimately, aesthetically pleasing. Our group decided that a flask design was the best design option when compared to other bottles that might be in production because it was unique and something that Penn State does not have. What makes our flask different from other flasks is that you can purchase it from stores. The majority of flasks made today are made out of stainless steel, which is not as eco friendly when compared to our anodized aluminum flask made out of recycled aluminum. Also, you’re not going to find a flask like the Nittany Flask anywhere. With a PSU lion mascot head used as the cap and PSU logos all over the flask, the Nittany Flask will make current students and alumni eager to purchase, especially on game days! Ultimately, drinking out of the Nittany Flask is way cooler than a plastic cup, and way more sustainable.

4 - Customer Needs Analysis:

This project requires the creation of a product both appealing to the company producing it as well as the consumers purchasing it. All of which must benefit Penn State in a way that helps increase sustainability on campus. To create a product appealing to Alcoa, the design must be
simple enough for mass production, be constructed mostly or entirely out of aluminum, and have a large customer base.

In order to increase sustainability, the customer does not need to be Penn State. It could instead be on campus residents and visitors that consume energy or generate waste. Fortunately, Penn State has many on campus residents, fans, alumni and regular visitors. For instance, during football game weekends, Penn State must accommodate upwards of 150,000 people on campus over the course of a day. The product depends greatly on which customer we choose to target. If we choose to target Penn State as the main consumer of the product, the demand and value must be high, because there will likely only be one, (or very few) production run(s). Whereas if we choose Penn State residents, the consumers of resources and producers of waste, we can have a large scale, long term production of a product that helps Penn State become more sustainable.

5 - Problem Statement:

Penn State merchandise has always been highly marketable, especially to alumni, students and fans of Penn State. Merchandise such as lanyards, t-shirts, bumper stickers and hats have all been successful selling products.

However, an item that has not been marketed yet is a Penn State flask. The incredible magnitude of students and alumni involved or still involved with Penn State life makes the PSU flask marketable to a huge clientele base. Football culture will increase usage of the flask and because of the tailgating and drinking culture the PSU flask could be very lucrative due to the probable high demand for it.
Aluminium is a highly recyclable material that can be used in many different products to eliminate plastics or materials that would sit in landfills for hundreds of years if otherwise used. The PSU aluminum flask would cut both waste generated on game day weekends and can be recycled if the purchaser does not wish to use it anymore, therefore not contributing to landfill waste.

6 - Target Specifications:

- Make a sturdy and durable aluminum flask
- Make the aluminum flask aesthetically pleasing with PSU pride
- Make the aluminum flask something someone would actually love to carry around
- Reduce the quantity of trash and cleanup time after events where the amount of trash from drinks is greatest
- Become the school’s number one university merchandise item
- Keep Beverages cold or warm

7 - Concept Generation and Concept Selection:

The original product planned for use in this project was an aluminum low-flow shower head. This shower head would both save lots of money for Penn State by reducing their on campus water usage and create the business with Penn State that Alcoa desired. This product could be expanded to custom low-flow sink heads and perhaps selectable strength toilet flush valves, all of which would be both producible by Alcoa with a guaranteed customer. Unfortunately, because this product is already in existence, there is not much incentive for Alcoa to produce it for Penn State. It is too small of a market and is not a product Alcoa would really be able to make in the long term.

The next step in the process was to evaluate alternate ideas that have a higher focus on Alcoa as a company rather than Penn State as a school interested in reducing waste. The table
below shows some ideas and how they meet some of the more broad target specifications of this project.

<table>
<thead>
<tr>
<th></th>
<th>Low Flow Shower Head</th>
<th>Aluminum Cata Bus Parts</th>
<th>Penn State Flask</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aids in Sustainability for Penn State</td>
<td>5</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Marketable to Alcoa</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Utilises the Intrinsic Properties of Aluminum</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Practical Design/Ease of Implementation</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total (of 20 Possible pts.)</strong></td>
<td><strong>15</strong></td>
<td><strong>12</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

As mentioned before, and as demonstrated in this chart, the aluminum shower head is a good choice for sustainability. It also is a very practical solution for Penn State; It is easily installed, and is a low maintenance product. Not to mention it is a project that could be well done in the time given. Yet it failed to be a financially beneficial product for Alcoa to produce. Another idea was to create specific bus parts for the Cata Busses. The busses could benefit from lightweight parts that improve efficiency and reduce cost. This idea was not researched in much
depth, but it was clear that these parts would not supply a significant amount of money savings for Penn State. Not to mention, Alcoa would be producing these for a very small and specific market. The implementation is fairly low as well as it would cost a lot to both purchase these parts (the small quantity (est. production would be in the dozens) would create a high cost/value for these parts) and to install them on the entire fleet. The final design was a Penn State flask. After only a short amount of research, it was clear that a Penn State-branded flask was hardly in existence. This idea does meet all of the specifications very well. For instance, Aluminum is a lightweight and durable material that is already used to make flasks. Not to mention, Alcoa can make high volumes of this product and benefit from the cost reduction of mass production. The flask also helps reduce waste during game days when cups and water bottles are thrown away. Finally, this product is something that can be designed well and documented in the time given. This final solution was the product chosen for this project. It met all of our criteria and scored the highest on the concept selection matrix.
8 - Model Solution:
The Lion Flask

The Lion flask consists of only three main parts. The first is the flask body. It is based off of the typical design and shape of a flask and is intended for pant and coat pocket transportation. The second part, is technically two parts combined. It is the screw-on lid and the lid arm. The arm is designed to attach the lid to the flask body while still allowing it to thread on and off. The lid is set inside of the arm, with a narrower area where the arm can surround the lid, without touching it. This eliminated the need for extra fasteners or parts to secure the arm around the lid. A model of a lion head was set on top of the lid to make this flask more unique and Penn State branded. Finally, the lid attaches to the body with a small bolt. The bottle would be manufactured
with aluminum and anodized. This adds durability and extends the life of the product. If the product were not durable, it would not last long and contribute to waste. Also, a variety of colors can be applied with anodization, giving the product variety and the inexpensive option of a large, diverse line of Penn State flasks.

9 - Testing and Evaluation:

This design was modeled and tested using a 3D printer. This allowed for accurate evaluation of all of the features and design aspects without sacrificing cost or time. As a result, it is clear there are a few main design flaws that would need to be changed before final production. The first main flaw is the size. Obviously with a flask, there is a tradeoff between size and portability. The original design turned out to be very large and impractical for easy transportation. The shape was modeled after typical flask designs, but the size must be refined. Another size issue was with the lid and the lid arm. The lid and the arm both protrude from the confines of the flask body excessively. Although the lid was intended to have the lion head be a prominent feature that stands out, the lid as a whole is too big. Perhaps the head could be scaled up slightly while the lid gets reduced to keep the head defined without the excessively large lid in the way. Also the lid arm could very easily be reduced at the edges and corners, some of which are grossly oversized and simply add bulk to the product. Another large necessary design change is the hinge. The hinge is only single sided which makes for a flimsy feel that could break easily. A good solution to this would be to duplicate the portion of the hinge on the flask body, putting it on either side of the lid arm so it can be much more robust. Also, instead of a bolt, perhaps a small rod secured within the lid arm would reduce the part count even further and simplify the design. Other small changes to the design could be a gripped or rough lid surface so screwing and unscrewing is easier as well as an embossed ‘PSU’ logo on the body of the flask. When
modeling the design of this flask, production was taken into account, yet the all-in-one lid/lid arm design may be something difficult and require redesign. Many flasks have a similar design, where the lid is surrounded by a single-piece arm to ensure the lid is not lost. It is clear this design is possible, but with the addition of the complicated lion head feature, it is unclear if the design would have to be changed to accommodate for effective production of this. If this feature did require special production, it could lower Alcoa’s willingness to produce this product and fail to meet our target specifications. The rest of our specifications are being met without question. The production of this product in anodized aluminum is a possible process, done very inexpensively with aluminum water bottles. The properties of aluminum allow for a durable product that can last a long time.

10 - Solidworks Sustainability Report:

For the Nittany Flask we chose 1023 Carbon Steel Sheet (SS) and 1060 Aluminum Alloy. The most effective and sustainable location to produce the Nittany Flask where the majority of its consumers would be located. North America was chosen as both the manufacturing and use region to minimize potential pollutants. This would be more eco friendly than producing the flask overseas and shipping it to America. Both the life span and duration of use for the flask was set (arbitrarily) at 10 years because having the lifespan anything less than this would be inefficient. The main point behind Ecolife’s idea is to remove the use short-term lifespan of beverage containers such as plastic bottles, paper cups, and aluminum cans. When comparing the carbon steel sheet to the aluminum alloy, you’ll notice that the carbon steel sheet is very dense - 2.69 pounds for the flask. The Nittany Flask is designed to be lightweight and easy to carry, not a drinking dumbbell. Surprisingly, the 0.923 pounds of aluminum is just as durable as the heavy Carbon Steel due to aluminum’s tough and stellar intrinsic properties. Even though Carbon is
cheaper than 1060 aluminum alloy by $1.80, the end of life analysis proves that in the longer run, Carbon Steel Sheet isn’t as eco friendly or as sustainable of a material. The end of life cycle for Carbon Steel is 33% recyclable, 13% incinerated, and 54% landfill. When compared to the 1060 Alloy, 57% recyclable, 30% incinerated, and 13% landfill, it is clear that in the long run the 1060 Alloy is better. Also the carbon footprint of the Alloy is slightly smaller at 1.0 kg and consumes about 18MJ less than Carbon Steel. Even though the price to produce the Nittany Flask might be a little higher with the aluminum alloy, Ecolife decided that using the most sustainable product and recyclable material available would coincide with Penn State’s efforts to become sustainable. Cutting corners would not solve any problems.

11-12, - Conclusions:

While the Ecolife team tried to meet all of its target specifications, not all were met with the intended results laid out in the beginning of the project. One of the big selling points for our PSU Flask was the large cartoonish Nittany Lion head that would be mounted on the screw off cap. This part was accomplished, yet not exactly how it was intended to be. The primary setback to producing a 3D model of the nittany lion, which is exceptionally hard, might be the lack of design experience and software Ecolife currently knows how to use. Solidworks might not be the best available software to use for this issue, and more exposure to design software could be the fix to this setback. If the cartoon lion head is accomplished the way our group imagined, then the flask could be a huge seller.

Another interesting matter is the results of the sustainability report. It was found through solidworks simulation that steel would actually be a more ‘sustainable’ material. While this may be true, the Ecolife team is still set upon using aluminum for two very important reasons. Lightweight is an essential to a flask. People tend to carry their flasks in their jacket pockets, pant
pockets or some type of storage place on themselves. Due to steel’s heavy-weight, the flask itself would be too dense. On top of that, the flask would contain liquids, making the product uncomfortably heavy. Aluminum on the other hand is a very light material, relative to steel, and would be much more suitable for this project. The second is that our employer, Alcoa, is an aluminum company and does not manufacture steel.

This project taught us how to go through a full design idea, from ideas to implementation. This project was very helpful because now the Ecolife team has experience and insight on what companies look for and how to professionally format an idea. One of the biggest skills Ecolife learned was the art of refining a design to make it better. As talked about previously, there are some minor changes or accommodations the Ecolife team would like to add to the prototype. While happy with our initial prototype, a few points that are summarized below can potentially make our product better. To briefly summarize, the bulkiness of the flask, the hinge, additional decals, the Nittany Lion Head and a grippy surface around the cap are all possible places of improvement. The Lion head would be the biggest change that would have to be made, followed by the hinge and then the bulkiness. Making the hinge a more sleek and sturdy design would greatly improve the looks of the flask and the durability. The bulkiness issue is another topic of discussion. The prototyped flask is quite large, and in order to make it more portable it has to be scaled down. While this does mean lessening the amount of liquid the flask can hold, it has to be done for convenience. These changes would make the product not only better looking but would also lead to a larger, more satisfied client base.
13- Citations:

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