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Team 521: Housing/Chassis Design for Engine Electrical Accessories

Team Members: Marcus Cowan;Mosad Elsankary;Matthew Marshall;Austin Watson

FAMU-FSU College of Engineering 2525 Pottsdamer St. Tallahassee, FL. 32310

Abstract

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1.5 Concept Generation

The concept generation allows for the group members to brainstorm and develop ideas that could be used to accomplish the overall goal of the project. The group was able to come up with the following concepts based on further meetings with the team sponsor to make sure that some of the ideas were feasible. It was important to make sure that each concept will allow for the overall assembly time of the housing to be decreased while still maintain strength and not increasing the overall price of the assembly significantly.

Concept 1.

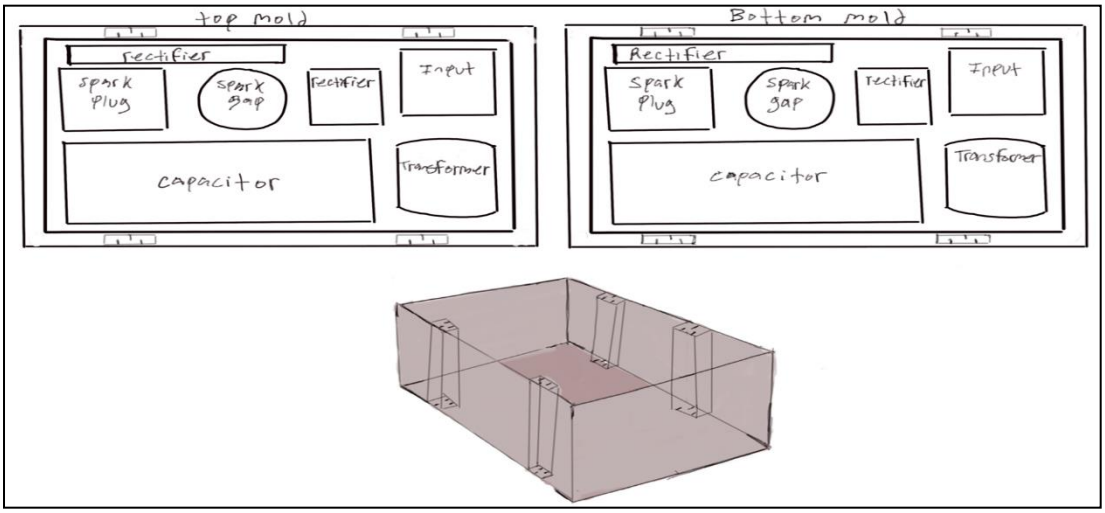

Figure 1: Support system consisting of plastic mold that slides into place using guide rails.

This concept consists of two plastic molds, one for the bottom of the box and one for the top. The molds are cut out in the shape of the components inside the box. The bottom part will be placed down inside of the exciter box first by sliding the mold onto the support guides on the side of the outer housing. Once in place the ignition exciter components will be dropped in their appropriate spots within the mold. To finish securing the components the top part of the mold will then be lowered onto the guide rails and fitted over the assembly.

Pros:

Having a mold basically completely covering the components from top and bottom provides excellent support and stability to the system. This concept allows for easily assembly of parts simply by dropping them into place and securing them with the top cover, no glue or extra components are needed. This also helps cut down on assembly time and allows for easy modifications to be made. If the shape of the components inside the assembly ever change it will be easy to make adjustments since the mold is made out of a material that is inexpensive and easy to form.

Cons:

Although the sliding guides add stability to the system they also take up a considerable amount of room. This could become a problem due to the fact that certain constraints on the design limit the size of the box from increasing by large amounts. The guides could also increase the cost of the assembly depending on what type of material is used. Furthermore if a guide were to break during operation there would be nothing holding the components in place.

Concept 2.

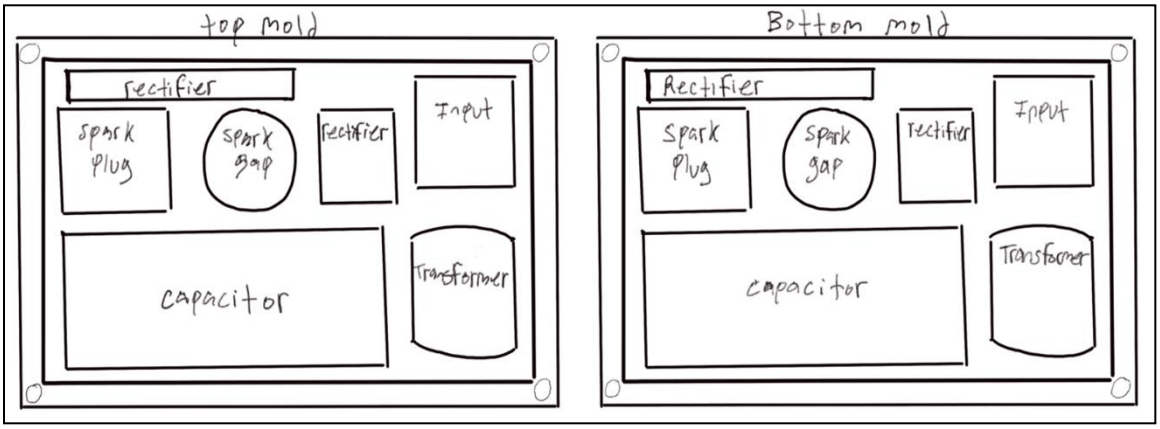

Figure 2: Support system consisting of plastic mold that is attached using four round pegs.

This concept is an alteration of the previous design consisting of two plastic moldings. However this concept is assembled differently in that it doesn't use the sliding guide rails seen in the previous model. Instead the bottom of the mold is inserted into the ignition box, then four pegs are stuck down inside the bottom mold on each corner of the box. The top piece of the mold is then placed on top of the components and the pegs extruding from the bottom mold.

Pros:

This design also allows for protection of the ignition components inside the housing. The thick plastic molding is perfect for providing insulation between the inner components and the metal outer housing. The concept is simple to assemble and will reduce manufacturing errors by getting rid of hard to use products.

Cons:

The disadvantages of this design are similar to the previous method in that under extreme vibrations the component could hit against the plastic molding due to the small spacing between them. This could cause failure to the ignition parts over time. The small round pegs do not provide as much support as the guiding rails in the previously mentioned design, and therefore could snap under large stresses. Since the pegs are not attached to the actual housing like the guide rails, this version will also increase cost of production in that pegs will have to be ordered or manufactured separately.

Concept 3.

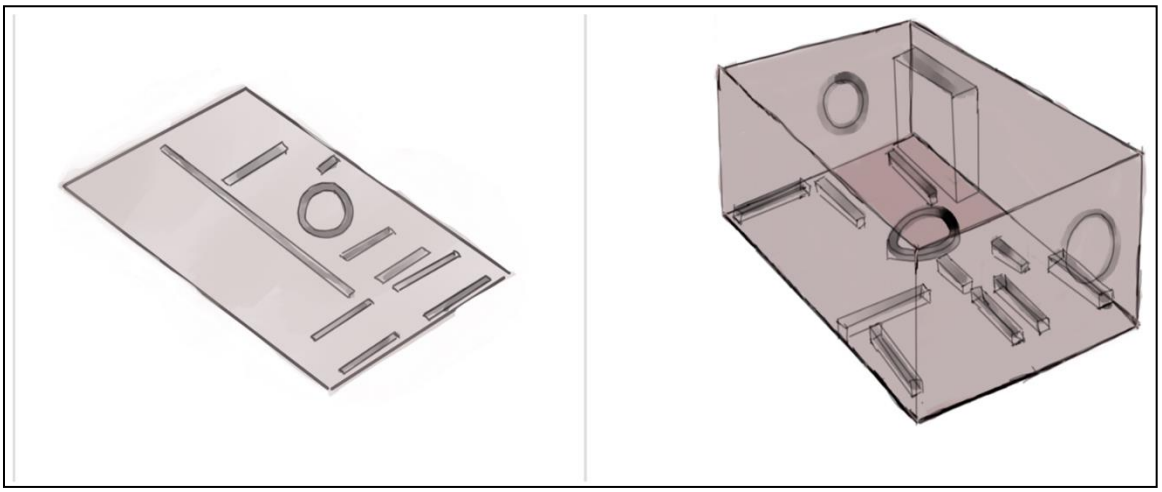

Figure 3: Support system press fitting components in place with plastic extrusions.

As shown in figure three this concept uses plastic stoppers to secure the ignition components in place. Small extrusions are created on the bottom of the housing unit surrounding

the inner parts of the system. The components are snugly placed up against the stoppers allowing little room for movement. Then a cover with similar extrusions is fastened over the top to firmly hold the parts in place.

Pros:

Due to the tightly pressed fit of this design the stoppers on each side of the components help to ensure that they will remain in place and be secure during operation. These extrusions are small, this gives a simplistic solution to the fact that there isn't much space to work with inside the housing.

Cons:

While the tight press fit creates good stability where the components will not vibrate much; it can also cause parts to fracture under fatigue stress. Tolerances also have to be very tight when fabricating this design which increases cost of manufacturing. There are also many extrusions that have to be made to secure the whole system using this method.

Concept 4.

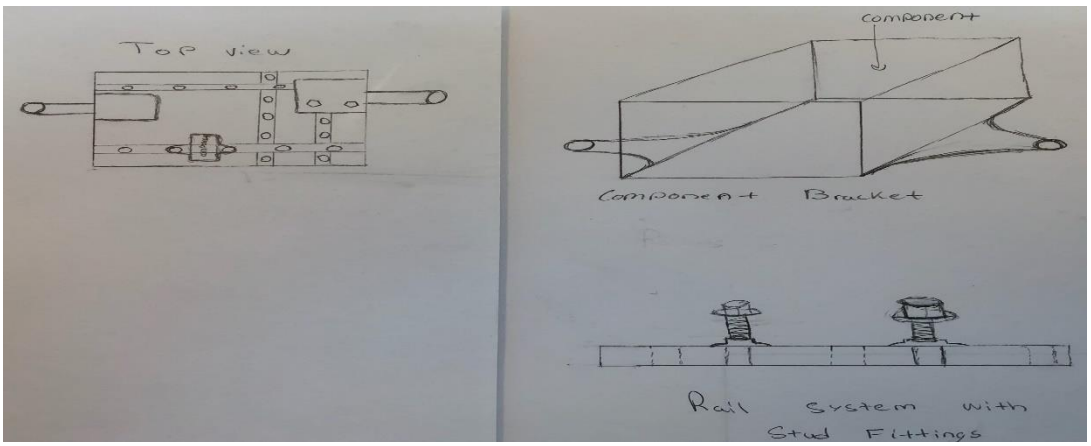

Figure 4: Component Bracket Mounting System

The “Component Bracket Mounting System” is a concept that will allow for the components within the housing to be secured in a modular fashion by giving the assembler a choice of where that specific component should be placed within the housing. This concept will require each component in the housing to be placed inside of a specifically dimensioned bracket for that component. Once the component is mounted in its bracket using a press fit or adhesive securing method, the component will then be secured onto the rail system. Two threaded Single fitting studs will be used to secure the component within the housing. bracket on to a rail system within the housing. The components will be secured by using single stud fittings.

Pros:

The ability for the component to be quickly assembled inside of the box is a very important feature. The total assembly time would decrease because the components would not need hours to cure if the adhesive previously used was applied. Instead, the components could be press fitted into the component housing securely. If any maintenance is needed for the component in the box, it could be quickly disconnected with the threaded fitting studs and serviced. The tradeoff of price for assembly, disassembly and service time could be beneficial.

Cons:

The problem with the design is that the components would need a type of adhesive or silicon molding to hold it in place securely within the bracket. Our goal is to not use any type of adhesive because of the amount of time it needs to cure. Also, this concept will need a railing system for the connection of the threaded studs and the components, welded into the housing before it is sent to unison industries. This could cause an increase in price. Lastly, special brackets would need to be made for each component in the housing. This will also increase the overall price

of the housing. The size of the housing will also need to be increased due to the railing system and component brackets.

Concept 5.

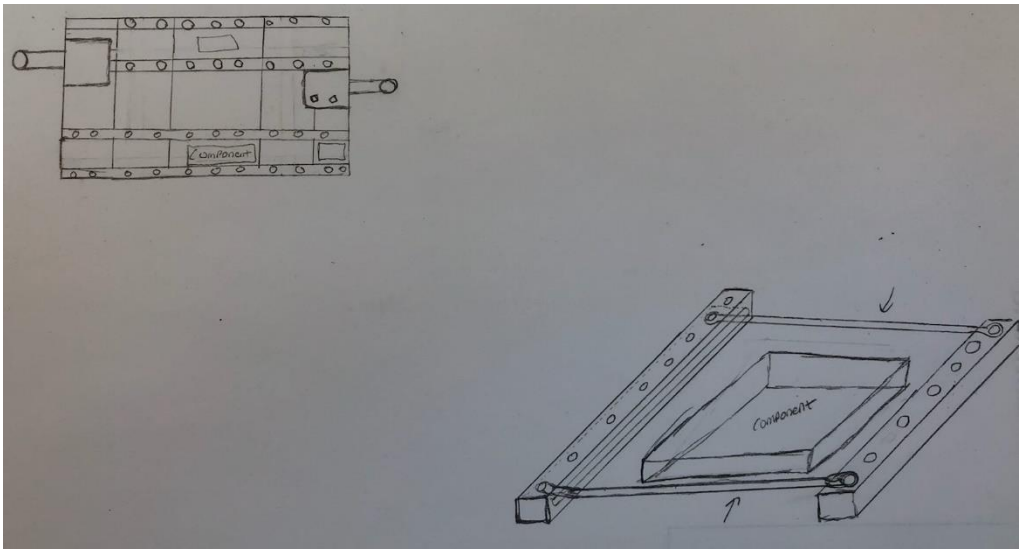

Figure 5: Movable Grid Mounting System

The "Movable Grid Mounting System" concept will allow for the components to be placed securely in the housing without needed a bracket for each component. When the component is placed into an opening in the grid, the moving rails will be places tightly up against each component on two sides, in a "Sandwich" fashion. The rail will be secured by placing a threaded fitting stud at the end of the rail to restrict it from moving.

Pros:

Placing a component directly into the housing without using any type of adhesive or glue is advantageous to the project. This will increase assembly, disassembly and manufacturing time

because there will be no special component bracket needed to secure the component. The maintenance time will also decrease.

Cons:

The price will be increased if this method is used because rails will be needed for the single stud system to hold the sliding rail in place once its in the correct position to hold the component in place. This system may also have trouble clamping each component fully because of the varying sizes of each component. The size of the housing will also need to be increased to fit the railing system in.

Concept 6.

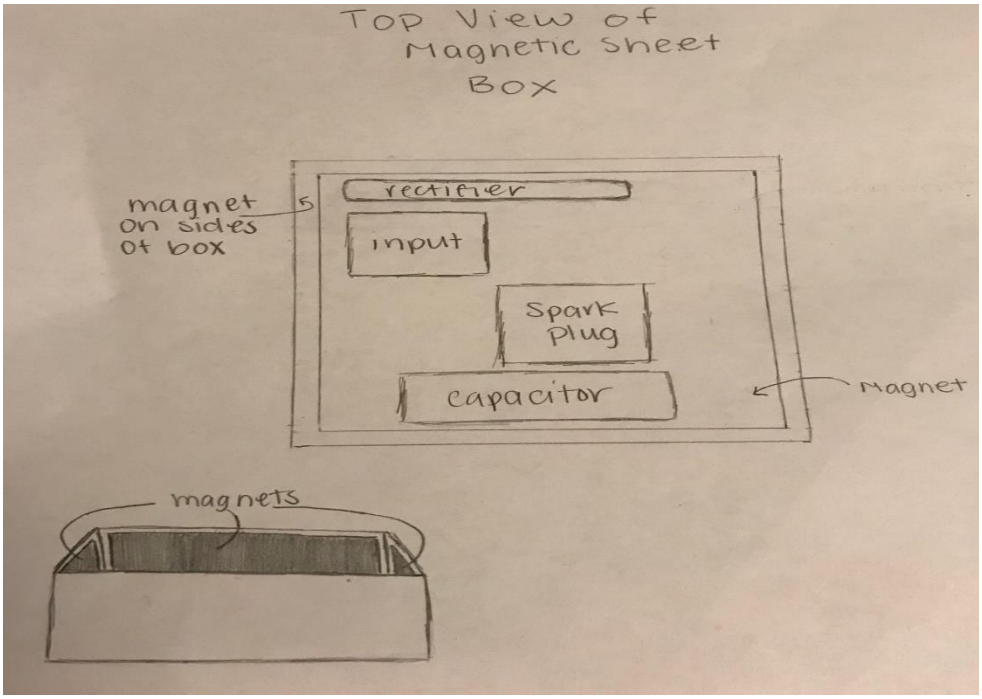

Figure 6: Magnetic Box Concept

The magnet concept shown above will be accomplished by attaching a magnet to the inside of the housing. Magnets will be attached to the sides and the bottom of the housing by welding or

using an adhesive. Each magnet will bind the components to the box and prevent the components from experiencing any vibration produced by the turbine engine. The use of this magnet will speed up the process of assembly and disassembly.

Pros:

The magnet will cover each wall in the box, allowing the components to adhere to the box with greater ease as well as reduce labor costs. The assembly time will decrease because of the quick attachment that the magnet concept will allow.

Cons:

A possible limitation of using a magnetic case is that certain components may not attach to the case as some components may not be constructed with magnetic materials. The magnet may also interfere with the conductivity of the housing. This may cause problems if the housing is struck by lightning.

Concept 7.

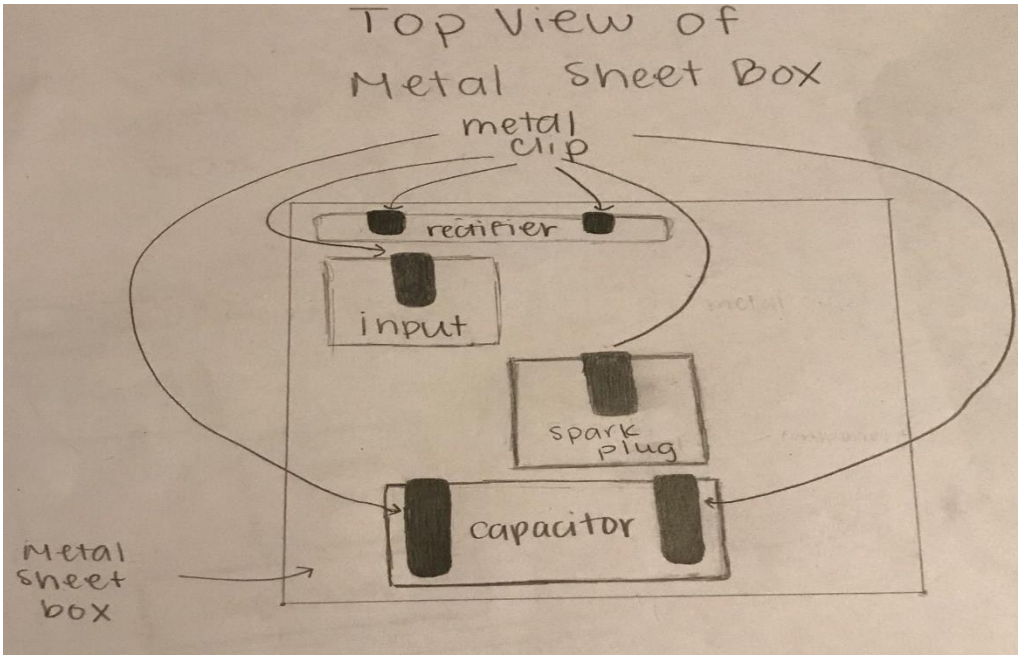

Figure 7: Metal Clip Concept

To ensure that the components will not vibrate during the use of the turbine engine, a metal clip will be attached to each component by tightly securing the component within the clip. The clip will then be connected to the housing by either using adhesive or by welding. The time taken to assemble the housing, as well as, the time taken to disassemble the housing, will be reduced by using the metal clip to adhere the components to the housing. The cost of labor will also be reduced due to the previously mentioned reduced time of assembly and disassembly.

Pros:

The cost of the metal clip is inexpensive, which will reduce costs. Use of the metal clip to hold the components in place will reduce the assembly time as well as disassembly time. This is

because the components can be easily switched in and out of the box. Maintenance and service costs will also decrease.

Cons:

A possible limitation of welding the metal clip to the metal sheet box is the possibility of the formation of undercutting. Undercutting could cause the welds to be weak and ultimately allow the components to break away from the housing. Lastly, the welding process could increase the labor costs because welding is a more labor-intensive process than using the previous adhesive method.

Concept 8.

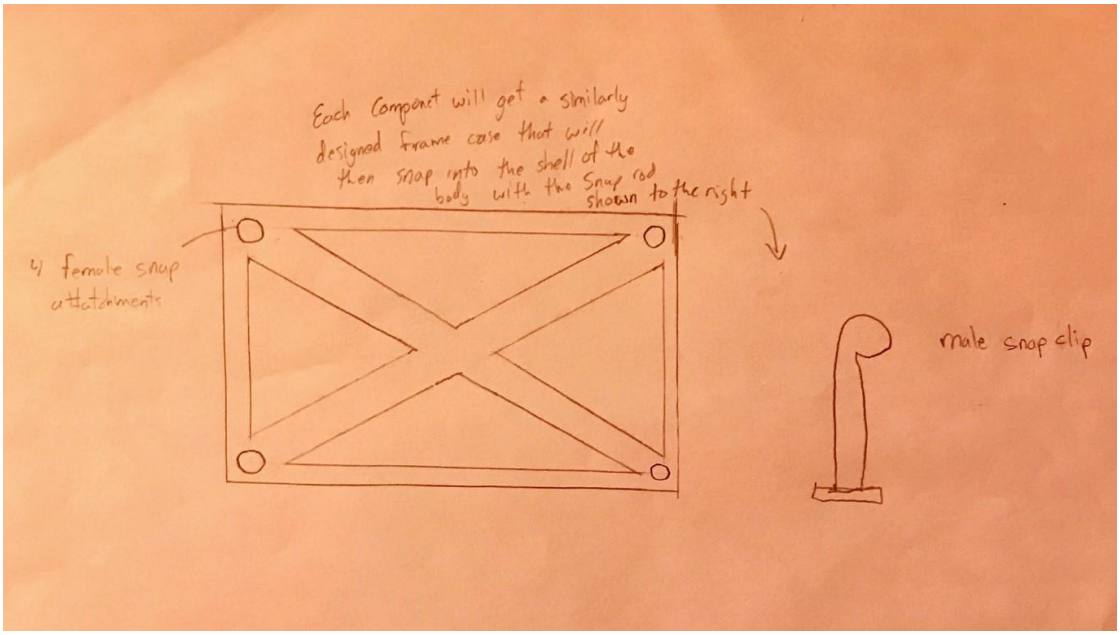

Figure 8: Individual Component Case Concept

The individual case design will incorporate a individual case for each component to ensure support and vibration protection for each component inside the box. The case would be equipped with a female clip attachment inside to allow for a snap fit with the box. The designer would also have to make the male side of the clip for the box. The manufacturing time will decrease as the cases would allow for snap in components. Also designing specific cases for each component gives the designer the opportunity to change the shape of the component (by its case) to fit better inside the box.

Pros:

Each component will be secure and supported by it's own case. The manufacturing time will be reduced with the snap in type connections.

Cons:

The cost of manufacturing a case for each component could be expensive and become a negative when trying to reduce cost.

Concept 9.

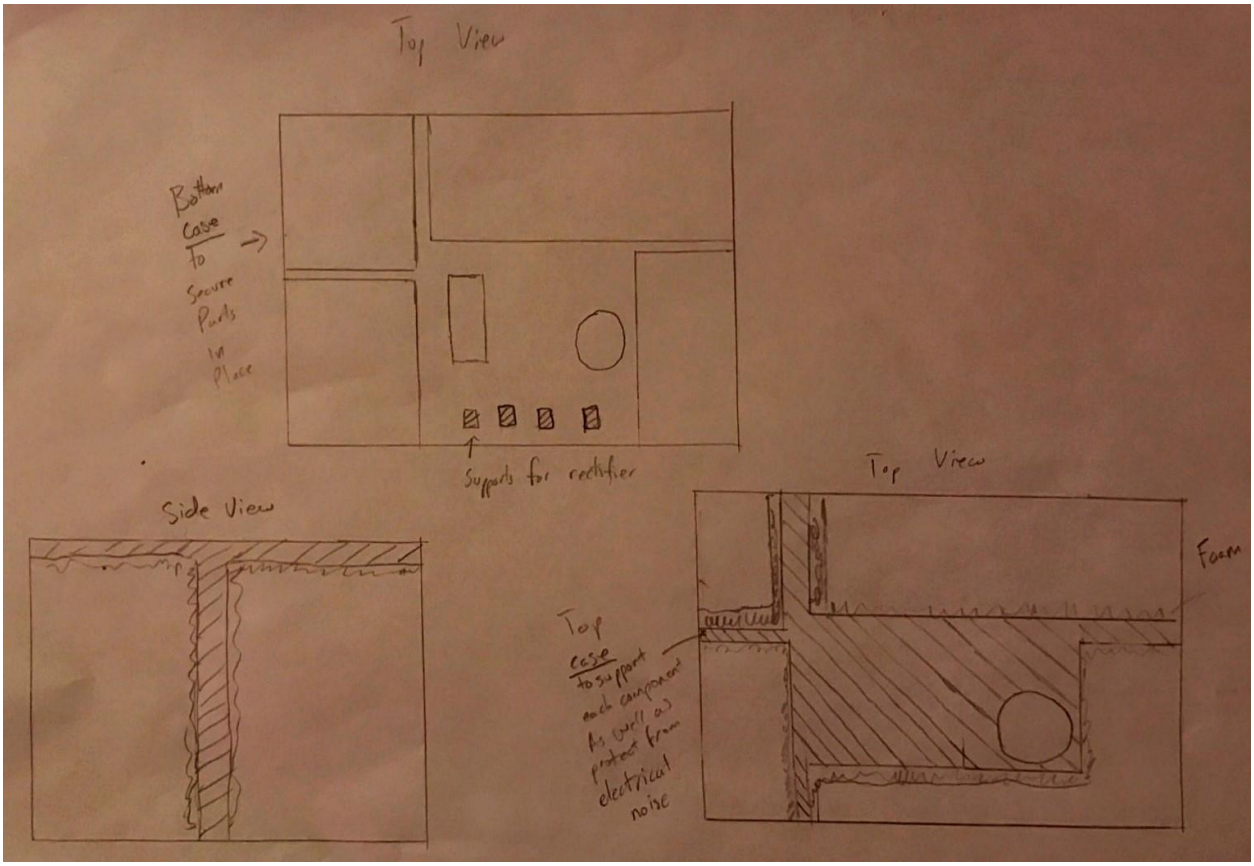

Figure 9: Top and Bottom Case Concept

The Top and Bottom Case design consists of components inside the box will be supported with a case that will hold them in place from the top and the bottom. The bottom case will be a frame on the floor of the box that will surround the components of ignition exciter. The fit from the frame around the components will not be tight as the frame will be generic for many different sized components. A O-ring or silicon filler will have to be put in place to hold each component to the frame. The top frame will be similar, on the top of the box it will surround the components and have partitions going down to the bottom frame, in between the components to support them. The partitions will be covered in a silicon-based foam that will be used to compression fit the

components in place as well as protect from vibrations and any electrical noise. The partitions will also be used to snap fit the top frame on the bottom frame.

Pros:

The manufacturing time will be decreased because of the snap fit and bottom and top frames. Structural integrity will also be maintained and possibly improved because of the top and bottom frames protecting each component.

Cons:

The silicon will have to be applied which will add some time to the maintenance. Some cost will be acquired due to purchasing the frames.

Concept 10.

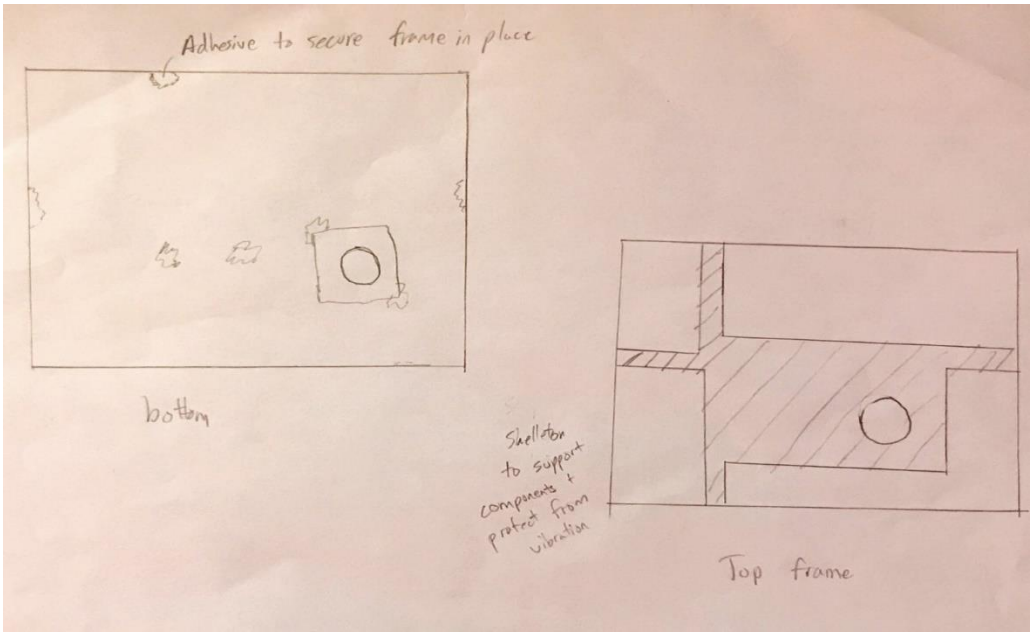

Figure 10: Top Case Concept

The Top Case design is about being as simple as possible. To drastically reduce the amount of adhesive used in the manufacturing process, a top frame only will be created. The top frame will surround the components at the top and fit down in between the components, using adhesive to attach the frame to the floor. The frame will support the components and protect them from vibration. The design still incorporates adhesive but the amount will be much less with the frame.

Pros:

This design will keep cost low while still reducing the manufacturing time. With the simplistic design, little can go wrong.

Cons:

Adhesive is still being used in the design, which takes some time to cure or dry. This time would make the design assembly take longer.