

## The Revolving USB Hub

For the second design project, my class was put into new groups and we were given multiple project topics to choose from. This project was sponsored by Lockheed Martin and all of the topic choices were associated with real issues the company was facing. We chose Project #4, the USB hub. Our goal was to design a USB hub with these requirements:

- 4-7 ports
- Horizontal and vertical mounting
- Ability to stack 3-high
- New cable retention for USB cables and power
- Environment 0 to +25 degrees C
- Vibration loading

### Researched Ideas

We started by researching ideas that we could incorporate into our design. We decided that the best possible design would probably be a combination of multiple other good designs. Here are two of the designs we thought about using:



The design on the left was great for offering vertical and horizontal connections, but there's no easy way to mount or stack them if you needed more than one. The design on the right offered a lot of customization with the adjustable ports, but there's also no way of conveniently stacking or mounting them.

These next two designs ended up playing huge rolls in our final design. We incorporated both of them into one USB hub.



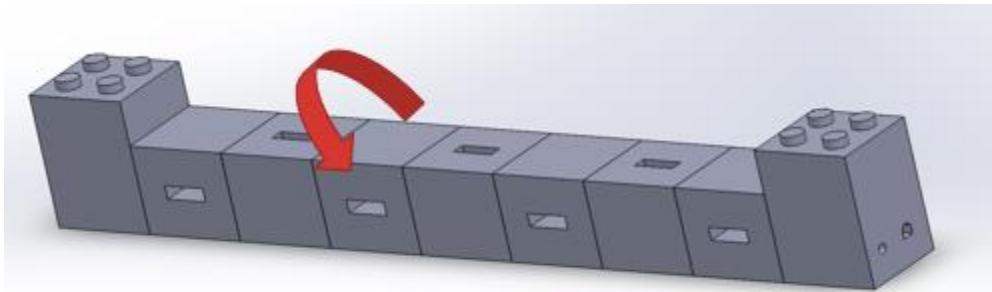
The design on the left made it easy to add 7 ports. We also loved the design of having each port able to individually rotate. That allows for maximum customization. The design on the right, the Lego design, was the solution to our mounting problem. Legos are easy to connect and disconnect, but are also secure and sturdy.

### Classification Tree

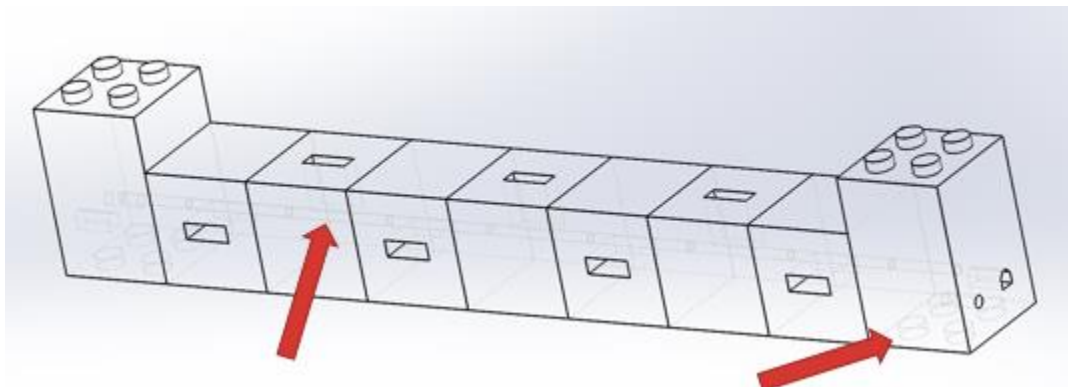
We took all of these different ideas, sorted the concepts into categories, and created a classification tree. We ended up with 36 different possible solutions. After weighing the benefits and concerns we had with each design, we came to a final decision.

### Concept Selection/Final Design

Our final design incorporated the individual rotating ports and the Lego stacking device, just as we originally planned. We couldn't find a more perfect combination of ideas. Here is what the final model looked like.



The arrow shows how the middle blocks rotate. The Lego-looking blocks on the end are stuck to the rod holding all of the pieces together, so they cannot rotate. Here is a view that shows how the inside works and how the pieces are connected:



The arrow on the left shows the rod that is holding all of the pieces together. The arrow on the right is showing how the extruded pieces on top of the Lego are also indented on the bottom, so the pieces will fit nice and snug together and not fall apart.

This is what they would look like if they were stacked 3-high, like specified. This is also extremely convenient because it can be laid horizontally or stacked vertically while all still being connected. Our

final design met all of the project requirements, and we think we came up with a great solution for Lockheed Martin.

