Design Project 2

Lockheed Martin has asked engineering students to redesign the current USB hub mounting bracket that is most likely going to implemented in their aircrafts. In order to find a solution to this problem, we, as engineering design students, researched and analyzed current USB brackets and designed a 7 port, with a vertical mounted USB port that survives vibration loading. Through this design process, we used an analytical hierarchy process which enables them to rank the customer needs and a concept generation tree was created in order to figure out the different possible designs. Prototyping and testing with conducted through the use of CAD software (solid works) and will be 3D printed. The final design will enable Lockheed Martin to effectively connect multiple devices to their data processors via USB cables.

Requirements given by Lockheed Martin

- Vertically mounted USB Hub stacked 3 high
- Survive vibrational loading
- Ensure cable retention
- Temperature control: 0 – 25 degrees Celsius

Analytical Hierarchy Table (AHP)

	Temperature Control	Cable Rentention	Shock Absorption	Stacking	Total (Ri)	Weight
Temperature Control	1	0.333333333	0.333333333	0.2	1.86	0.08306043
Cable Retention	3	1	1	0.6	5.6	0.25007443
Shock Absorption	3	1	1	0.6	5.6	0.25007443
Stacking	5	1.666666667	1.666666667	1	9.33333333	0.41679071
Total					22.3933333	
Temperature	can withstand hot temperatures	space between each port	water cooling system	fan		
can withstand hot temperatures	1	0.2	1	1	3.2	0.125
space between each port	5	1	5	5	16	0.625
water cooling system	1	0.2	1	1	3.2	0.125
fan	1	0.2	1	1	3.2	0.125
Total					**25.6**	
Cable Rentention	clamps	tube for power cable	zip ties to post			
clamps	1	0.20	0.333333333		1.53	0.11111111
tube for power cable	5	1.00	1.67		7.67	0.55555556
zip ties to post	3	0.6	1		4.6	0.33333333
Total					**13.80**	
Shock Absorption	suspension system	rubberized bottom	gel			
suspension system	1	0.333333333	1		2.33333333	0.2
rubberized bottom	3	1	3		7	0.6
gel	1	0.33	1		2.33	0.2
Total					**11.67**	
Stacking	cylindrical screwing	lego style	slots			
cylindrical screwing	1	0.33	0.2		1.53	0.11111111
lego style	3	1	0.6		4.6	0.33333333
slots	5	1.666666667	1		7.66666667	0.55555556
Total					**13.80**	

Current USB Hub Bracket in the Market

Final Product Description

Stacking: Saves space by stacking USB brackets and the clamps securely attach one bracket to another; keeping them from falling off.

Cable Retention: Ensures the cables stay intact within the tube. Crescent shaped vertical tube behind the bracket that holds all the cables. Three posts in the front of the bracket that you zip tie the front lines to the posts.

Shock Absorption: Uses rubber because it’s durable and survives vibration loading (absorbs shock).

Temperature Control: spacing out USB ports prevents overheating.