

Off-Road Bumper

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By:

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Project Description

- + This project requires the students to do an extensive CAD design to create three bumpers for two different vehicles.
- + These CAD files will be converted in to DFX format and transposed into a 2-D surface to be cut and then fabricated.

+ Two Clients

Dr. Carson Pete



2008 Chevy Silverado 3500HD

David Bui



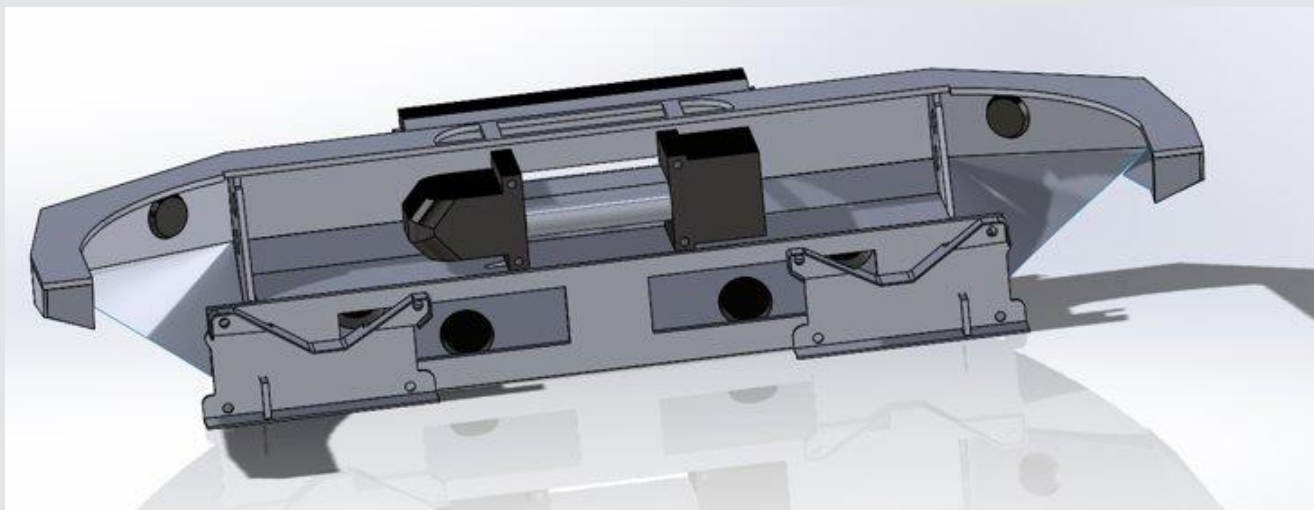
2011 Jeep Liberty

Design Requirements

- + Top customer requirements
 - + Factory line Design
 - + Tow winch
 - + Durability
 - + Functionality
- + To ensure these requirements are met the team will preform the following technical analyses.
 - + Bolt shear strength and selection
 - + Winch mounting plate and bumper plate thickness and material properties
 - + Shear moment and stress on different materials and factor of safety

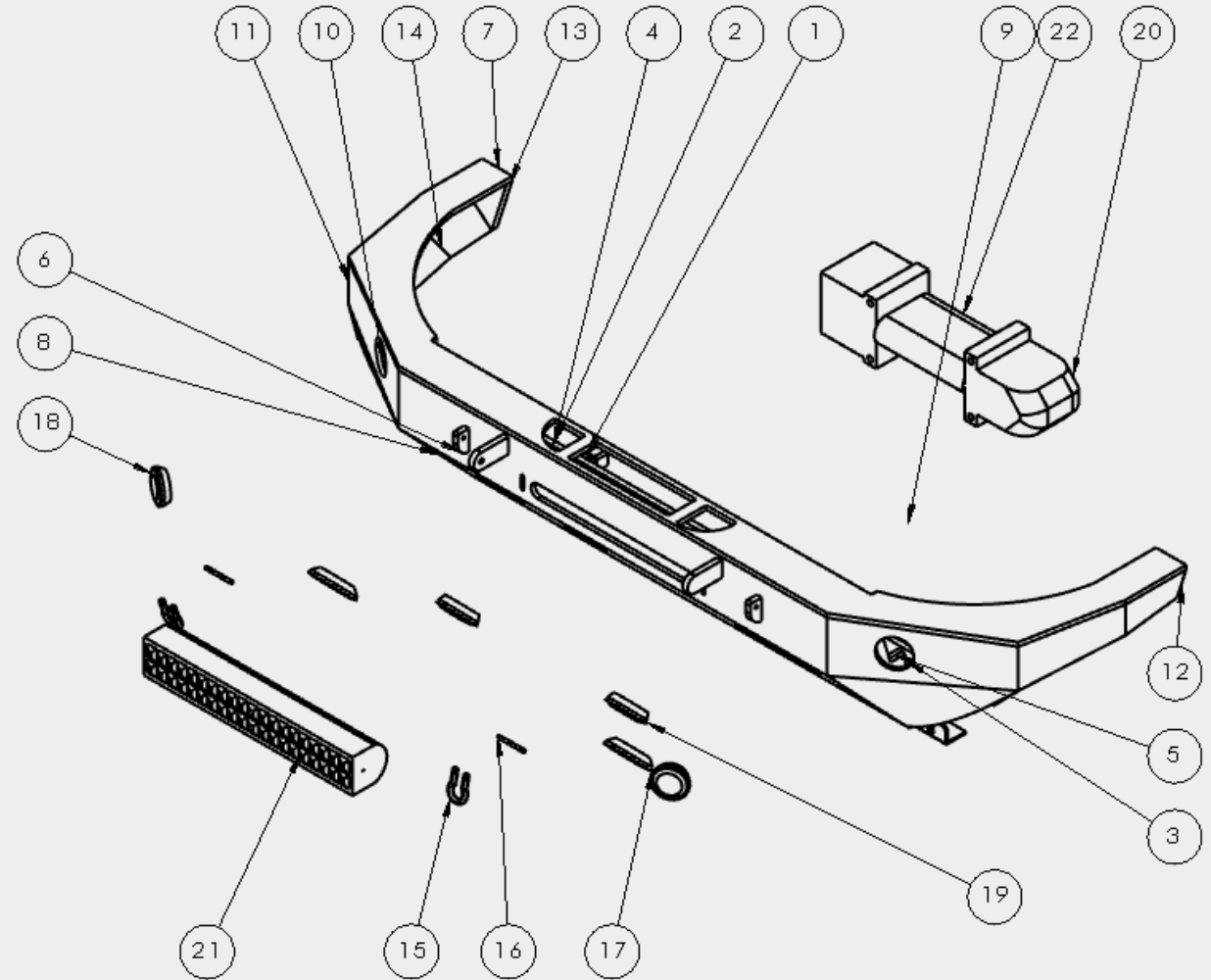
Customer Requirements	Importance
EGR Engravement	3
Light Pods	3
License Pod	3
Factory Line Design	9
Sensor outlet	3
Tow Winch	9
Maintain Existing Hook Points	3
Functionality	9
Resistances	1
Durability	9
Reliability	3
Inexpensive	3

Design Description

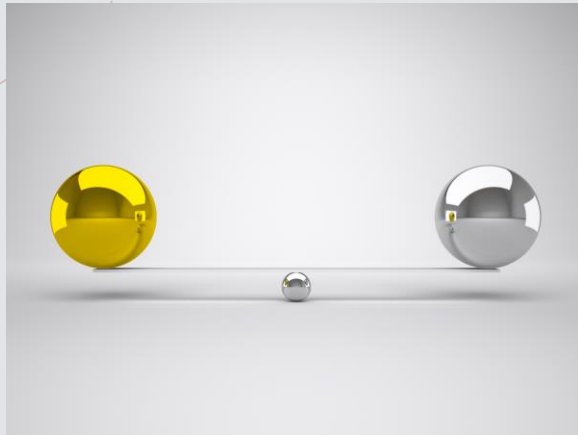


Bill of Materials

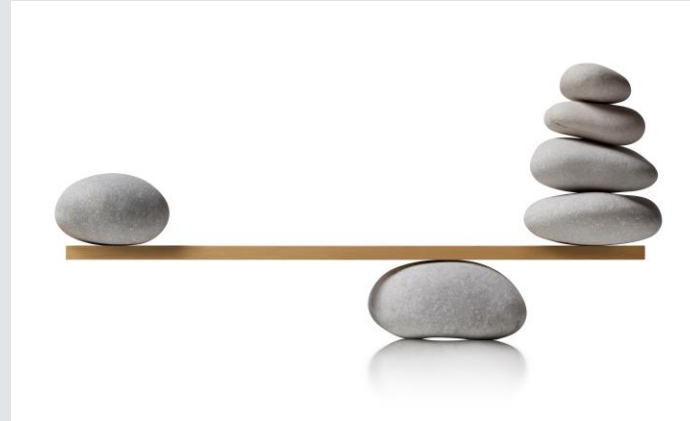
ITEM NO.	Name	QTY.
1	winch^ bumper	1
2	Part4^ bumper	1
3	Part5^ bumper	1
4	Part6^ bumper	1
5	Part7^ bumper	1
6	Part8^ bumper	1
7	Part9^ bumper	1
8	Part11^ bumper	1
9	Part14^ bumper	1
10	Part15^ bumper	1
11	Part16^ bumper	1
12	Part17^ bumper	1
13	Part18^ bumper	1
14	Part19^ bumper	1
15	Tow Hook	2
16	Pin	2
17	Light pod 3.8	2
18	Light Pod 2.8	2
19	Light Pod 3.2	2
20	Winch	1
21	Bar Light	1
22	Wire	1



Testing Procedures



The testing procedures that the team will be performing will be a mini test run of a smaller version of the bumper.



By ratio of the mini version vs the original we could estimate how the final production will likely perform.



The mini version will be made of 1020 steel and testing will be done with a gage pressure.

Test Procedures

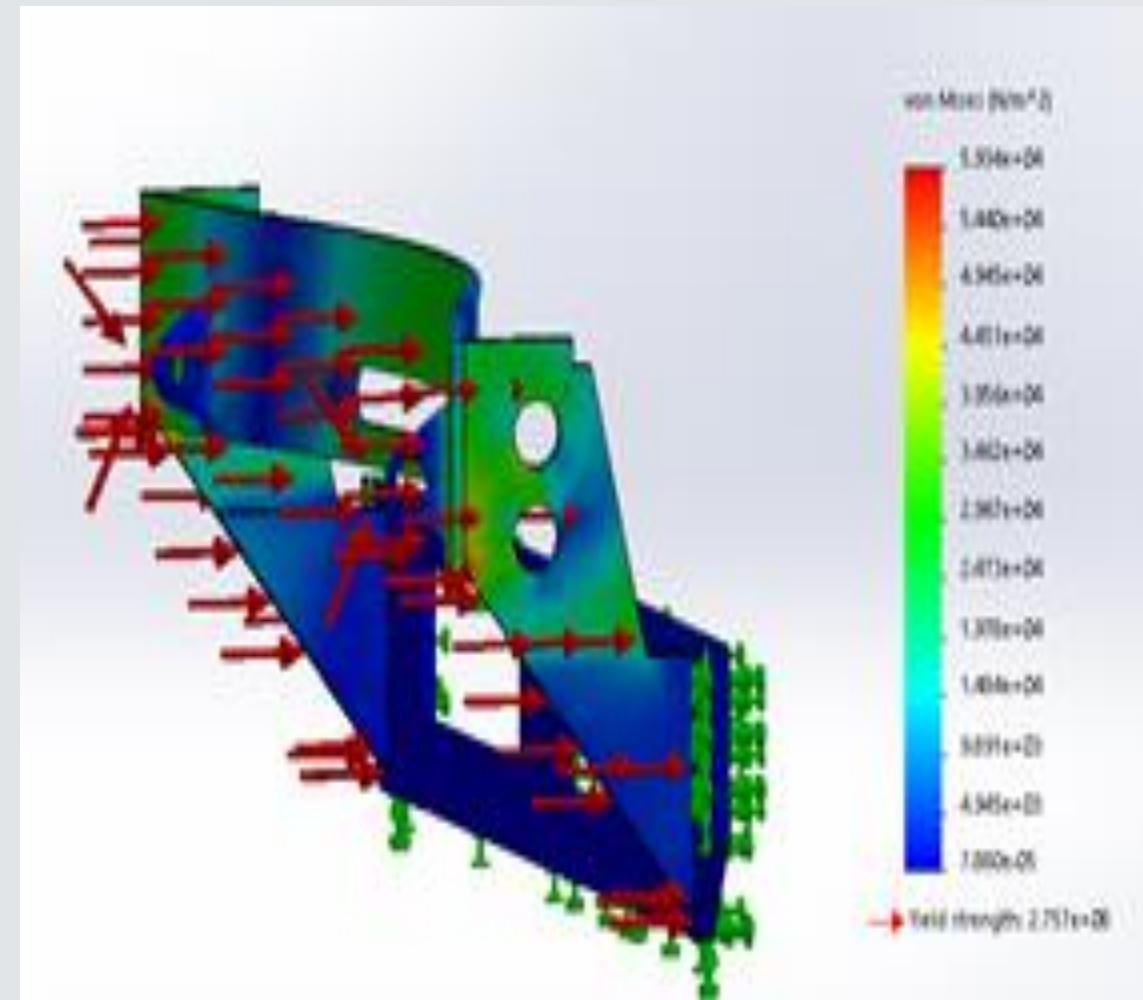
+ Fitment testing

- + To meet the customer requirement of keeping the factor lines the team will create bumper from cardboard or a cheap consumable material per the DFX file.



Design Validation

- + Critical component being reviewed by FMEA
 - + Dr. Carson Pete's front bumper frame
- + Findings
 - + Potential failure at the front facing plate between two supports
- + Correctional action
 - + Forward facing plate will be $\frac{1}{4}$ " thick as opposed to $\frac{3}{16}$ for added strength.
- + Risk Management
 - + All Frame components are being constructed of $\frac{1}{4}$ " steel to have increased strength for the bumper and added protection.
 - + This allow the team to assure that the necessary strength is available to protect the vehicle and the winch as well as keep the bumper in tack.



Budget

Current Budget:	\$179.24		Under/Over:	11.95%	Total Spent by Team:	\$1320.76
Item	Units	\$/Units	Total Cost	Team Cost	Description	
Carbon Steel Sheet	2	352.96	\$705.92	\$705.92	.1875" thickness (4x8 ft) A36	
Carbon Steel Sheet	1	560.1	\$560.10	\$560.10	.25" thickness (4x4 ft)	
Winch	1	322.99	\$322.99	\$0.00	David Winch	
Winch	1	499.99	\$499.99	\$0.00	Carson Winch	
Light Pods	8	59.99	\$479.92	\$0.00	Total of eight pods	
Steel Pipe	1	54.74	\$54.74	\$54.74	2.5" OD with length being 5 feet	
Tow Shackles	4	22.99	\$91.96	\$0.00	Total of two hooks	
Light Bar	1	32.39	\$32.39	\$0.00	Length of light bar is 22"	

This is the total budget for all three bumpers.

Schedule

Summer Schedule

Final CAD	Team	66%	4/19/23	4/30/23
Final Report	Team	50%	4/19/23	4/26/23
Final Prototype	Team	5%	4/30/23	5/3/23
Final Website Check	Team	1%	5/1/23	5/10/23
Summer				
Finalize Cad and convert to DFX	Team	0%	5/21/23	6/4/23
Materials cut out	Team	0%	6/4/23	6/18/23
Assembly/Welding	Team	0%	6/11/23	7/9/23
Test fitment	Team	0%	7/16/23	7/30/23
Modifications to original design	Team	0%	7/30/23	8/27/23
Final Fitment check for both front bumper.	Team	0%	8/13/23	8/27/23
ME486C Self learning	Team	0%	8/13/23	9/4/23
Project management	Team	0%	8/20/23	9/11/23

Fall 2023 Schedule

TASK	ASSIGNED TO	PROGRESS	START	END
Tasks leading up to 33% build				
Self Learning Activity	Individual	0%	8/27/23	9/13/23
Project Management	Team	0%	9/13/23	9/21/23
Website Check 1	Individual	0%	9/21/23	9/27/23
Completely done with one bumper	Team	0%	2/24/23	9/27/23
Start Testing	Team	0%	9/27/23	10/13/23
Tasks leading up to 67% build				
Finalized Testing	Team	0%	10/12/23	10/23/23
Ugrads Registration	Team	0%	10/23/23	10/30/23
CAD adjustments of second bumper	Team	0%	10/23/23	11/6/23
Finalize second bumper	Team	0%	11/6/23	11/13/23
Draft of Poster	Team	0%	11/6/23	11/20/23
Tasks leading up to 100% build				
Cad adjustments of third bumper	Team	0%	11/16/23	11/22/23
Finalize Third Bumper	Team	0%	11/23/23	11/30/23
Final Poster	Team	0%	11/23/23	11/29/23
Final Presentation	Team	0%	11/26/23	12/2/23
Final Website Check	Team	0%	11/25/23	12/1/23
Final Project Deliverables				

References

- [1] NAMoulton, "My Custom Bumper Build Thread," *Jeep Enthusiast Forums*, 17-Aug-2021. [Online]. Available: <https://www.jeepforum.com/threads/my-custom-bumper-build-thread.2360761/>. [Accessed: 25-Apr-2023].
- [2] "Metalsdepot® - buy A36 Steel Plate Online!," *MetalsDepot® - Buy A36 Steel Plate Online!* [Online]. Available: <https://www.metalsdepot.com/steel-products/steel-plate>. [Accessed: 25-Apr-2023].
- [3] "Carbon Steel Sheet/Plate," *Carbon Steel Sheet/Plate | Custom Cuts | Online Metals*. [Online]. Available: <https://www.onlinemetals.com/en/buy/carbon-steel-sheet-plate?q=%3Aprice-asc&page=2&pagesize=25&sort=price-asc>. [Accessed: 25-Apr-2023].
- [4] A. R. T. H. U. R. D. E. K. K. E. R. SAVAGE, "DP," *Amazon*, 2016. [Online]. Available: https://www.amazon.com/dp/B07ZFCVHP5/ref=sspa_dk_detail_1?psc=1&pd_rd_i=B07ZFCVHP5&pd_rd_w=zQFFw&content-id=amzn1.sym.a53ea610-e450-44d1-897e-68c0c718bf50&pf_rd_p=a53ea610-e450-44d1-897e-68c0c718bf50&pf_rd_r=V7M0FHC6Q7E90E5AY2VB&pd_rd_wg=wVC4q&pd_rd_r=d3dbe783-69c0-4543-96da-5705f1ca3503&s=automotive&sp_csd=d2lkZ2V0TmFtZT1zcF9kZXRhaWxhdGhlfWF0aWM&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEzRExERk1VMEc1T1ZVJmVuY3J5cHRIZEikPUEwMDkwNjE4MINTMVZRQ09MUkdEVSlbmNyeXB0ZWRBZEikPUEwMTAxODQ1MUY3UUUzV0gxS0JFViZ3aWRnZXROYW1lPXNwX2RldGFpbF90aGVtYXRpYyZhY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0NsaWNrPXRydWU. [Accessed: 25-Apr-2023].
- [5] "Amazon.com: Stainless Steel Straight Exhaust Pipe (2.25' inch OD 5 ..." [Online]. Available: <https://www.amazon.com/Stainless-Steel-Straight-Exhaust-Pipe/dp/B074XF4ZXB>. [Accessed: 26-Apr-2023].
- [6] "Amazon.com: Nilight - 70003C-a 22' 120W led light bar flood spot combo ..." [Online]. Available: <https://www.amazon.com/Nilight-Driving-Offroad-Lighting-Warranty/dp/B012CGFOOQ>. [Accessed: 26-Apr-2023].



Questions