UTV Flip Seat Team

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ABSTRACT

American Landmaster is a utility vehicle (UTV) maker that produces a vehicle accessory kit to convert a two seat UTV to a four-seater. Approximately 190 of these kits are sold annually. The original unit can rotate the seats out of the way to gain use of the cargo bed. However, the current design limits the functionality of the UTV by blocking the hitch when installed, reduces the tilt of the dump bed, has a generally low weight capacity, and is very difficult to assemble.

Figure 1 : Original Flip Seat

The design team was tasked with redesigning the flip seat kit to resolve as many of these issues as possible. The novel flip seat must meet the needs provided by American Landmaster while maintaining a competitive cost structure. Using concept generation, testing, and iteration the design team created a new flip seat design that met all the customers specifications. The new system combines the tailgate and footrest as one and can rotate the assembly into the bed allowing use of full range of tilt and access to the hitch.

CUSTOMER NEEDS/SPECS

American Landmaster is looking for a flip seat design that is comfortable and produces less noise than the original design. ALM is also looking for the design to be cost effective and be easily accessible for a single user. Tables 1 and 2 provide details of the needs and specifications required for the design.

Table 1 : Needs

Customer Needs
Comfortability
Noise
Not Expensive
Ease of Assembly
Safety
Ability to use Features

Table 2 : Specifications

Specifications
Tubing Style : Square or Round
Assembly Process : Reduced Damages $
Tubing Material : Steel
Seat Weight Capacity : Minimum of 400lbs
Material Expense : Around $300

DESIGN CONCEPTS

The design process began with each team member producing 2-4 potential design options. A design matrix was created which acted as a catalogue for choosing specific functions and materials. Each member created a design based on the matrix and presented each design to the sponsor to identify which to pursue. Table 3 shows the design matrix used and Figures 3-6 show the concepts presented to the sponsor.

Table 3: Design Matrix

	Least wanted		Neutral		Most wanted		
Bottom Step	1	2	3	4	5		Total
Folds up				X	XXX		19
Bolted solid	XX	XX					6
Swinging gate	X	X	X	X			10
Notched for hitch	X	X	XX				9
Telescoping			X	X	XX		17
Other							
Tubing Style	1	2	3	4	5		Total
Round	X	XX		X			9
Square				X	XXX		19
Rectangular		X		X	XX		16
Other							
Seating Type	1	2	3	4	5		Total
Bucket seats			XX	X	X		15
Bench seat			X	XX	X		16
Other							
Bottom Seat Stored	1	2	3	4	5		Total
Rotate down	X		X	XX			12
Into sides of bed		X	XXX				11
Underneath bed		XX		X	X		13
Bottom of seat is tailgate				XXXX			16
Other							
Backrest Seat Stored	1	2	3	4	5		Total
Swinging gate		X	XX	X			12
Rotates down to original position	X	X		XX			11
Rotates forward towards driver		X		X	XX		16
Folds down onto bottom seat		X	X		XX		15
Other							

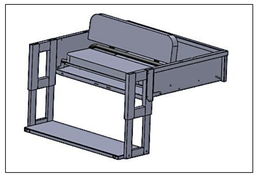

Figure 3 : Concept 1

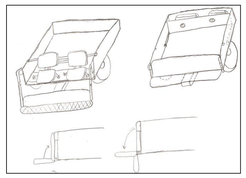

Figure 4 : Concept 2

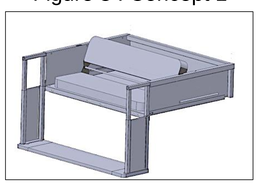

Figure 5 : Concept 3

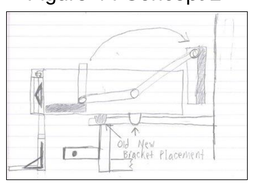

Figure 6 : Concept 4

The team met with the sponsor to discuss the current design and any changes that needed to be made, which included a suggestion for a new bench movement mechanism that changed the design from a sliding function to a 4-bar linkage. Figure 7 depicts the design featuring the sliding function shown to the sponsor during the meeting.

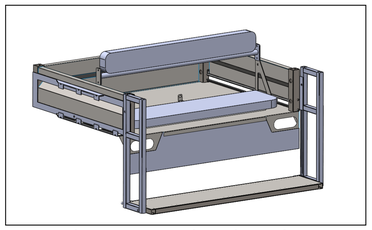

Figure 7 : Updated Design

TEST RESULTS

SolidWorks was used to perform all the testing using the FEA analysis tool to find the FOS of the load bearing components of the assembly. The first test shown in Figure 8 had an application of 1500 lb.-ft of force applied to the top of the tailgate. The structure withstood significantly more weight than what the bed would be able to take before breaking meaning the test was successful. The second test, which is shown in Figure 9 had an application of 1000 lb.-ft of force applied, which is a significantly high load as it is only being applied to one side and in total there will be two so this means it could withstand a force of 2000lb.ft being applied to the tailgate itself if these items were all connected.

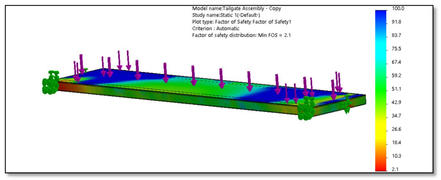

Figure 8 : Factor of Safety Test of Tailgate/Footrest

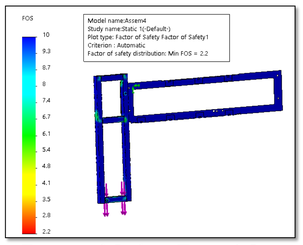

Figure 9 : Factor of Safety Test of Support Rails

FINAL DESIGN

After speaking with the sponsor regarding the new seat mechanism and final changes that needed to be made regarding the side panels, these changes were made based on this information. A physical artifact of this design was not possible due to the global situation that began near the end of this project. Figure 10 and 11 depict the final design in both orientations of the flip seat.

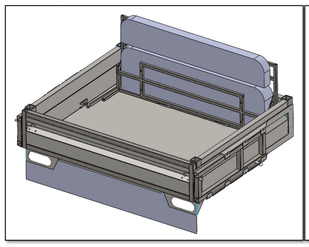

Figure 10 : Final Design in Cargo Position

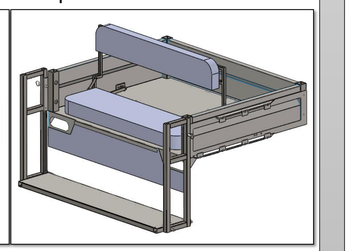

Figure 11 : Final Design in Rider Position

CONCLUSION

The team designed a flip seat that, based on the FEA analysis conducted on key parts of the design, fits the sponsors needs and specifications. The design incorporates a pivoting system for the leg guards that will pivot up and slide around the bed frame allowing the mechanism to be stowed outside of the beds frame. The seat portion will fold together in a vertical manner before the whole mechanism then pivots to the rear of the bed allowing room for storage and use of the bed. These two mechanisms allow the flip seat convert between a rear bench model to then stow away and allow for a usable bed in the rear of the UTV. The team expects that this product will be easier to assemble, maintain, and meet more customer needs.

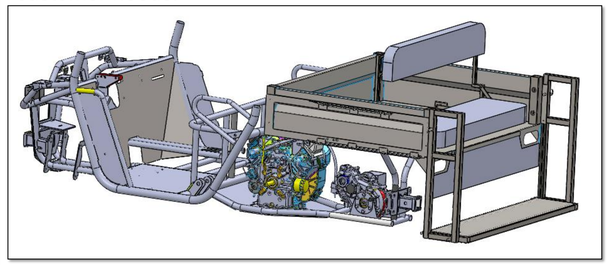

Figure 12 : Final Design Mounted on Frame

LESSON LEARNED

Throughout this project, the team learned:

- The importance of time management
- Communication is essential to the success of a team-based project
- The design process is always evolving
- It is important to pay close attention to specific details related to the project

ACKNOWLEDGEMENTS

Joseph Thompson II, Lab Technician, Trine University
Victor Riedman, Primary Contact, Engineer at American Landmaster
Bryan King, Director of Engineering at American Landmaster