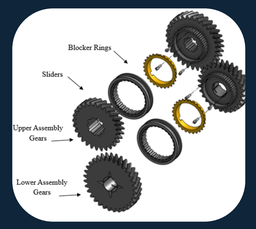
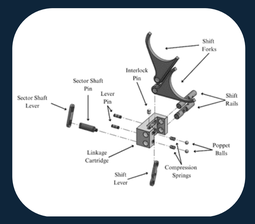
DESIGN DESCRIPTION

SYSTEM OVERVIEW

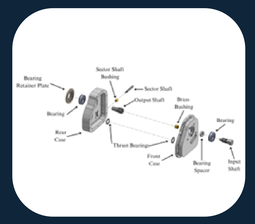
The final design is a self-contained overdrive unit with gears on two parallel shafts. The unit is installed between the original transmission and the transfer case. The three main subsystems are the Gears, the Linkages, and the Case. The gear train generates a 25% overdrive. The linkages switch the system between direct drive and overdrive. The case contains the gears, shafts, and oil. Each subsystem is connected mechanically



GEAR SUBSYSTEM



LINKAGES SUBSYSTEM



CASE SUBSYSTEM

GEAR SUBSYSTEM

The gear subsystem has 4 helical gears; one on the input shaft, two on the cluster shaft, and one on the output. The two pinions both have a tooth count of 28 teeth, and both gears have a tooth count of 32 teeth. When shifting, the linkages move the sliders, which mesh with the blocker rings and change the gear's speed.

LINKAGES SUBSYSTEM

The linkage subassembly is what allows the user to shift between overdrive and direct drive. The main components are two shift forks, two shift rails, a pivoting mechanism, detent system, and a cartridge to contain it all. The entire subassembly is self-contained and fully assembled before being installed into the case.

CASE SUBSYSTEM

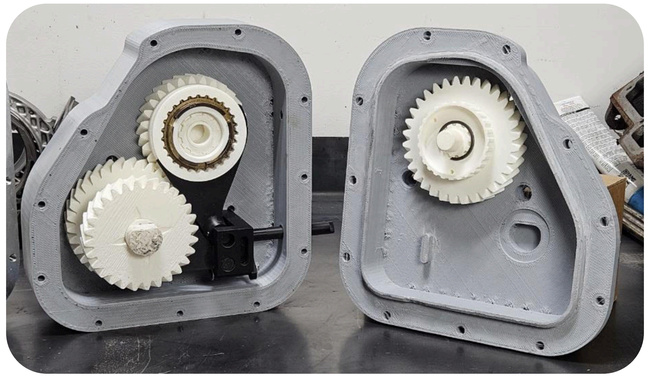
The case subsystem includes the front and back halves of the case, as well as the shafts, bearings, and retaining plates. The purpose of the case is to support the gears, contain the oil and to protect the gears and oil from dirt and grime. The bolt patterns are modular to allow for different transmissions.

Alex Palmer, Amy Stamps,
Nate Merrill, Ladd Lundquist

alex.r.palmer@outlook.com, amystamps13@gmail.com,
natemerrill2000@gmail.coml, laddlundquist@gmail.com

FIVE SPEED TRANSMISSION OVERDRIVE UNIT

Thanks to Novak Conversions and USU for their support!



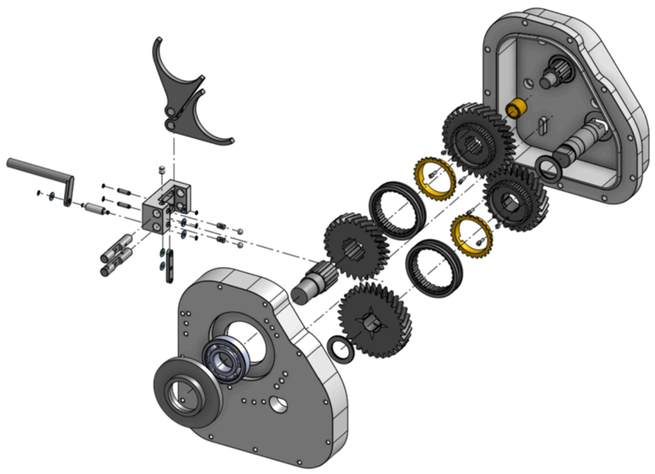
PROJECT DESCRIPTION

Off-road enthusiasts often require a strong transmission system capable of handling high torque loads while also providing efficient performance to reach trailheads quickly. The overdrive unit currently in production that can handle 600 ft-lbs. of torque only works for one transmission. We want to develop an overdrive adapter unit that can work for multiple different transmissions.

REQUIREMENTS AND CONSTRAINTS

- 25% Overdrive Capabilities
- Compatible with T 18, T 19, T 98, SM465
- Handles 600 ft-lbs. of Torque
- Complies with AGMA 9 Standards
- All Parts Machined in House or OTS
- Width under 6 inches, Height under 14 inches

FINAL DESIGN EXPLODED VIEW



PERFORMANCE REVIEW

This design needs further analysis to meet all customer functional requirements. The requirements with numerical values are shown in the table below. The torque rating and gear ratio values were found using computational analysis. The lifetime is estimated based on existing gear and transmission designs. The overall size and weight of the overdrive is too large to bolt a transfer case to it at the proper angle to be installed in a vehicle. Scaling down the size of the unit will also reduce the dry weight.

	Torque Rating	Gear Ratio	Lifetime	Dry Weight	Width	In house
Target	600 ft lb.	0.700 : 1	300k mi	40 lb.	4.0 in	100%
Threshold	450 ft lb.	0.790 : 1	200k mi	50 lb.	5.5 in	75%
Predicted	500 ft lb.	0.750 : 1	200k mi	50 lb.	5.1 in	90%
Actual	600 ft lb.	0.765 : 1	200k mi	70 lb.	5.3 in	95%

CONCLUSIONS

HOW WELL DESIGN MEETS REQUIREMENTS

The design meets the majority of the requirements in the problem description. It generates a 25% overdrive and can be completely manufactured at Novak Conversions. Additional testing is still necessary to determine the strength and lifetime of the unit. The design exceeds the weight and size requirements.

LESSONS LEARNED

This senior design project has taught our team valuable lessons about project planning, team collaboration, and design principles.. When working on design projects it's important to plan for unexpected things to happen and be willing to adapt to continuous change. We learned to design with manufacturing and assembly in mind while we collaborated with machinists.

FUTURE WORK

The next step in the design process is thorough testing of the prototype. Rapid design iteration and testing will reveal any flaws and lead to informed design decisions. We also recommend scaling down the size of the unit. The linkage subsystem is a new concept. Novak Conversions could spend more time researching automotive linkages to improve the effectiveness of the subsystem.