Powered Litter

Authors: Lain Geisler, Jayden Key, Erica Bender, Scott Martin
Grand Canyon University College of Engineering

What is the Powered Litter?

Major rescue operations that are in desolate and rugged areas require great effort to save the patient. When a rescue helicopter is not available or not needed, teams of about 18 rescuers must carry the person out safely on a litter. Current wheel-frame technology can be used to carry litters and assist the rescuers. The process is still very strenuous and dangerous for the rescue team.

WE Reduced ALL of THAT

The idea of the Powered litter project is to add powered assistance to the wheel so rescuers do not need to work as hard to carry or push the loaded litter. Instead, their efforts go towards balance, speed, safety, and rescue efficiency. And overall, the required rescue team size is now . . .

ONLY 6 to 8 RESCUERS

Functional Requirements

Design Concept	Requirement
Lightweight	Customer requires weight to remain around 50-pounds.
Speed	Function at pace close to walking speed 1.4m/s
Durable	The system is able to support a 500-pound passenger. The frame must also be structurally tested at a 11 kN load (NFPA-1983)
Collapsible	Reduce size to fit in a Custom backpack that is easily carried by a rescuer
Easy to control	To reduce the amount of persons needed to drive the system, it must have simple and effective controls like brake and throttle
Balance	With a product where the weight is distributed and easily controlled, safety is increased
Portable	Lightweight, Collapsible, able to fit into a bag, wheel size: 20x4 inches for low profile

Meet The Team

Lain Geisler - B.S. Mechanical Engineering

Jayden Key - B.S. Mechanical Engineering

Scott Martin- B.S. Mechanical Engineering

Erica Bender - B.S. Biomedical Engineering

Faculty Mentor - Emmy Tomforde

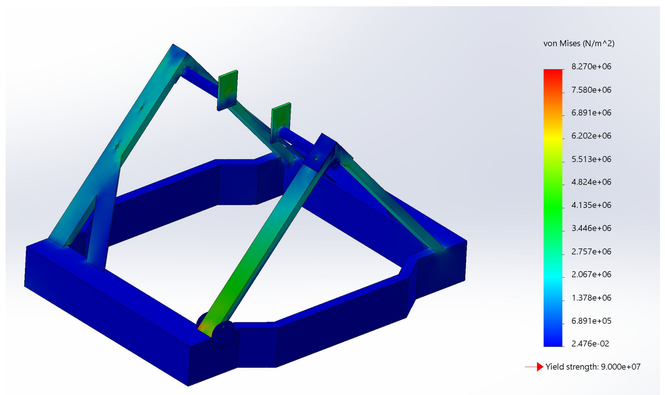
Design Process

Donated Mule Litter II System

- Collapsible
- Lightweight
- Free

Final CAD Modeling

- Add extra support
- Able to withstand 500lb dynamic load
- FOS of about 10



Finished Welded Frame

Engineering Standards

Designation	Engineering Standard	Application
NFPA-1983	No part of the litter or weight bearing accessories can deflect more than 50 mm under a 11 kN load	Will be tested using an impact force testing with dynamic load
F1772 - 17	Specification for harnesses	A standardized litter and harness were bought that have already been tested to the standard
F2491 - 05(2015)	Related to determining load ratios for technical rescue systems and equipment	Load ratio during testing will be determined
F2751 - 16	Training land search and rescue teams	Procedures of standard search and rescue teams observed during testing

Including The Motor

- Motor torque (80Nm) > Required torque (60Nm)
- In-hub motor system
- Thumb throttle
- Electronic controller

Fat-Tire Bicycle Tire

- Reduces weight
- 4” x 20”
- Fits into frame
- Works with motor

Testing and Data Collection

- No formal data was collected due to COVID-19
- Main tests to be conducted
  - Lightweight (40-55lbs)
    - Rescuer should be able to easily carry system to patient and maneuver
    - Test using scale
  - Velocity (1.4m/s)
    - Preliminary test on computer system

#	Speed Met	Weight
1	5 mph	0
2	25 mph	0
3	3 mph	120
4	1.5 m/s	120

    - Field test not completed
  - Easy to control
    - Field test not performed
  - Balance (6 people total)
    - Field test not performed
  - Durability (withstand 500 lb load)
    - Simulation performed successfully (see final CAD modeling)
    - Field test not performed