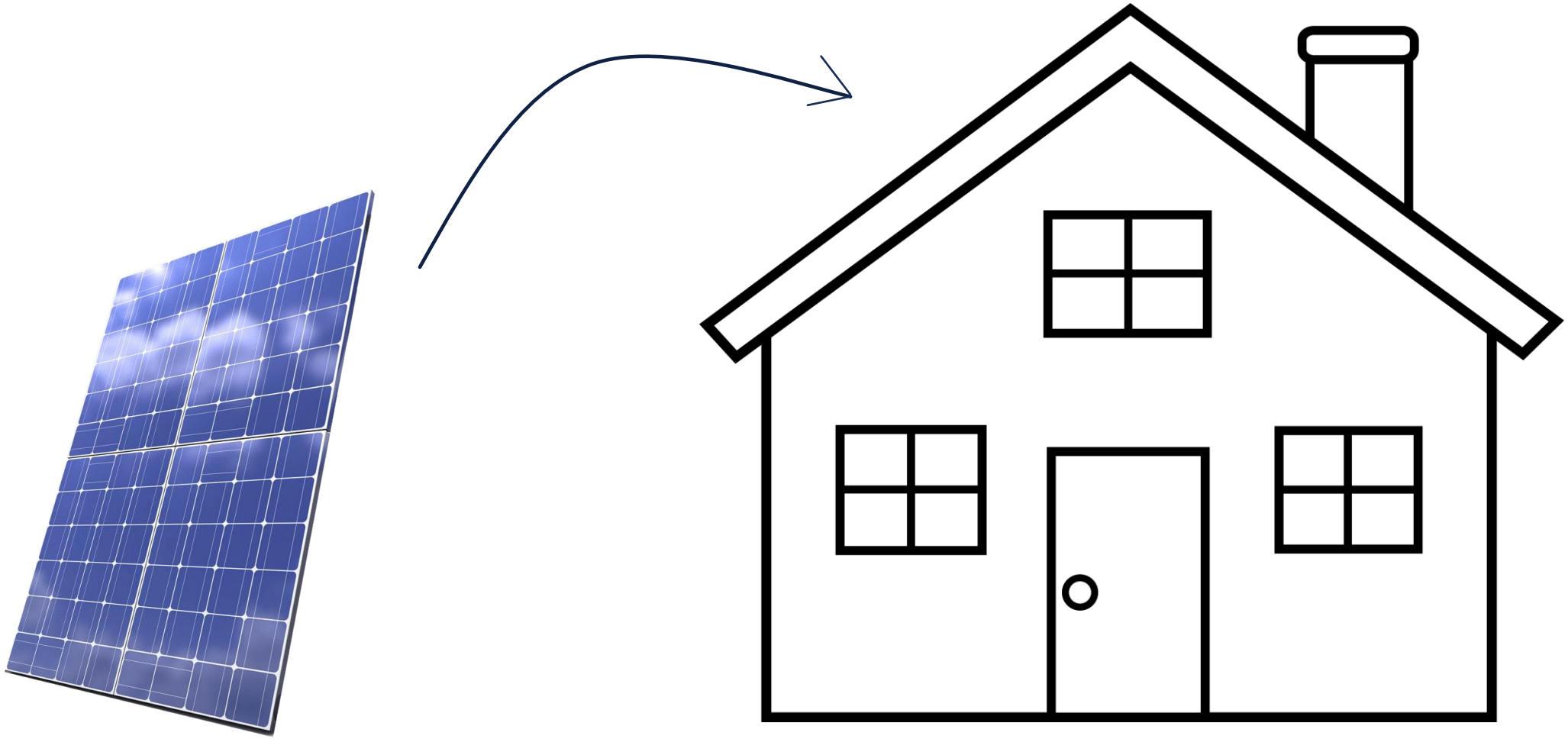
TRANZVOLT 2.0

SURVANCE | JIA | JANG | BUNNER | BAEK | YERRAMILLI

INTERDISCIPLINARY CAPSTONE DESIGN | DR. COLLINS | CAPSTONE TEAM

DESIGN PROBLEM

LIFTING HEAVY LOADS



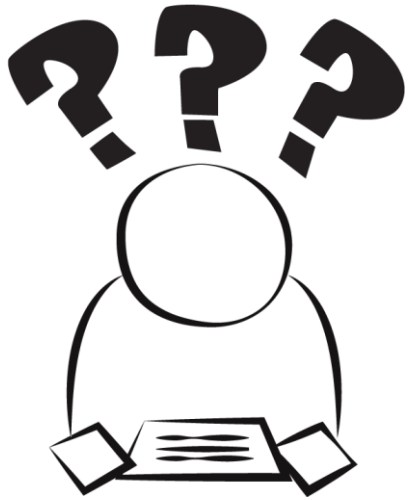
ORIGINAL TRANZVOLT

THREE MAJOR IMPROVEMENTS

Reduce Deadload

Emergency System

Simple U.I.



MAIN DESIRED FUNCTIONS

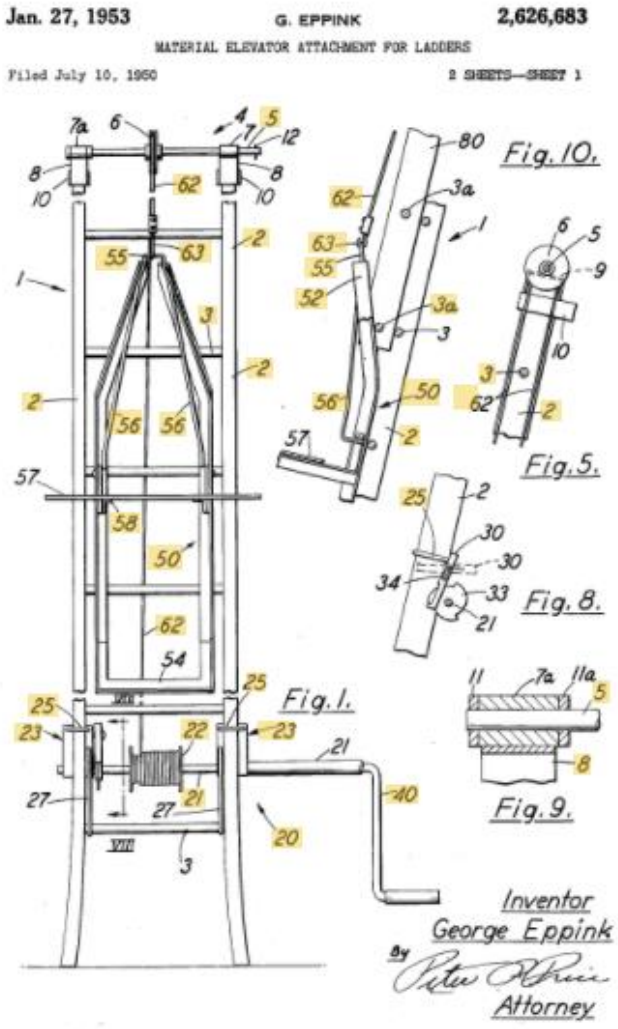
- Quickly and efficiently bring materials up to a roof for easy load/unload
- Support and secure a payload of at least 275lbs
- Access a variety of roof heights, minimum 32 ft
- Emergency system to ensure safety of payload and users if rope breaks
- The entire system is easy to transport and set up
- The user-interface is easy to learn and to use

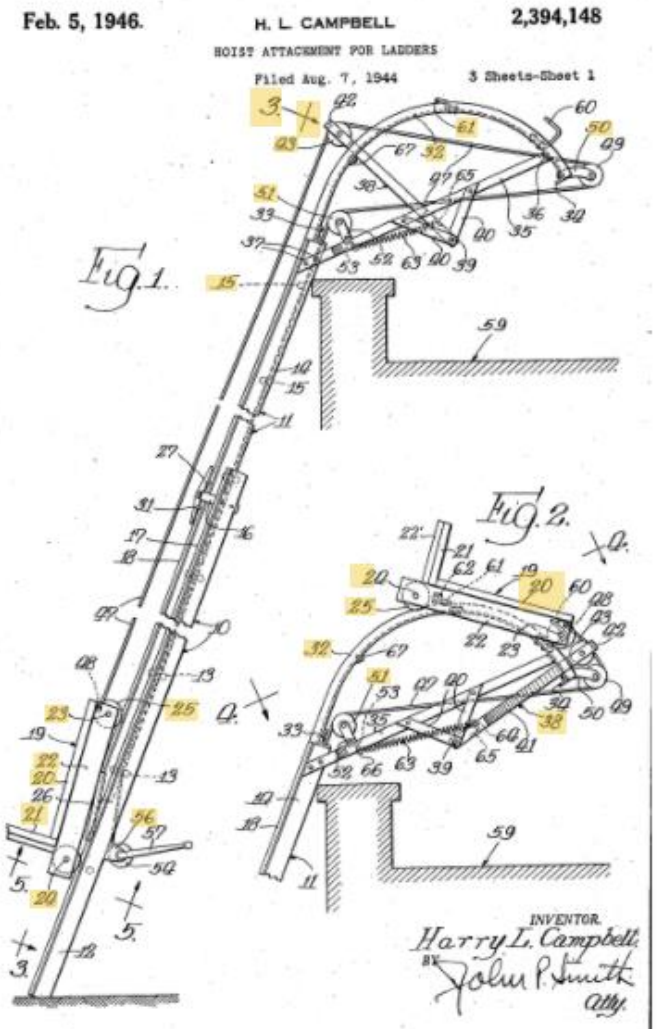
IMPACTS ON DESIGN

EXISTING PRODUCTS

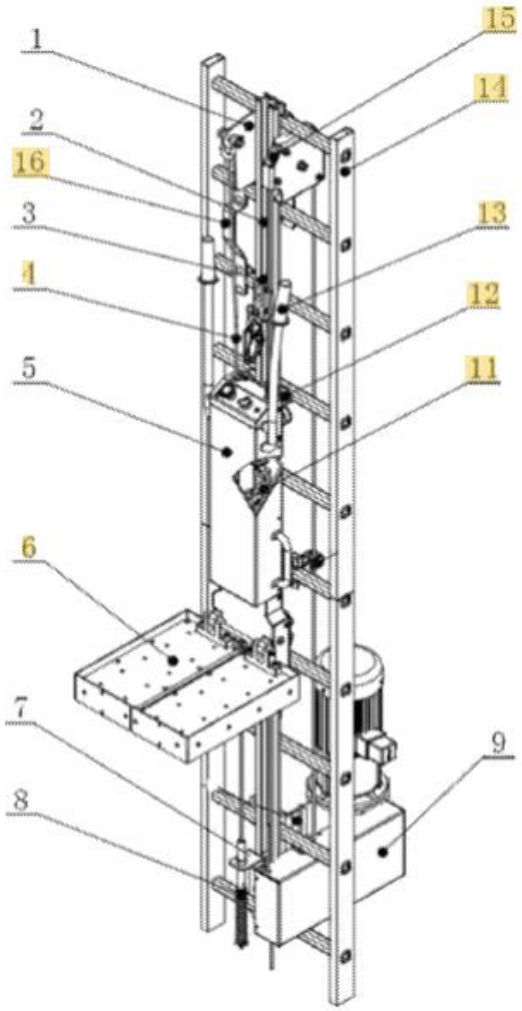
- Main Competitor: GEDA Solarlift
  - $3000-$4000 wholesale
    - **Pros:**
      - Safer than gas powered alternatives
      - Quiet
      - Quick ROI compared to Boom truck, crane etc.
    - **Cons:**
      - Too much training required
      - Setup time is too long, averaging 15 minutes
      - Cable needs too much maintenance – replacements, ensure level-wind, sensitive to fraying etc.

PRIOR ART


Jan. 27, 1953
G. EPPINK
2,626,683
MATERIAL ELEVATOR ATTACHMENT FOR LADDERS
Filed July 10, 1950
Fig. 10.
Fig. 5.
Fig. 8.
Fig. 1.
Fig. 9.
Inventor
George Eppink
Attorney


Feb. 5, 1946.
H. L. CAMPBELL
2,394,148
HOIST ATTACHMENT FOR LADDERS
Filed Aug. 7, 1944
3 Sheets-Sheet 1
Fig. 1.
Fig. 2.
INVENTOR
Harry L. Campbell
Atty.

PATENTS



1. Hoisting device for working in heights (US10415309B2)
   - Load and speed not stated
   - Dependent on traction rope with electric motor separate from the platform
   - Controlled by collapsible pedal connected to the platform to carry goods/people
   - Length not specified
   - Has a guide rail so that the assembly can be installed without changing the structure of an original safety ladder
   - A fall arrester installed on the sliding rail
   - Seems excessively complicated to set up and tear down

CODES AND STANDARDS

1. **1C - AIEE Test Code for Evaluation of Systems of Insulating Materials for Random-Wound Electric Machinery**
   - Ensures temperature regulations for electric machines
2. **C2-2017 - 2017 National Electrical Safety Code(R) (NESC(R))**
   - Includes guidance for construction applications
3. **27A-1941 - AIEE Switchgear Assemblies**
   - Standards for controls and interrupting devices with associated supporting structures
4. **4-2013 - IEEE Standard for High-Voltage Testing Techniques**
   - Codes for proper testing and measurement of uncertainty of high-voltage systems

STAKEHOLDER MATRIX

Stakeholder	Interests	Impact/Effect	Importance	Influence
Dr. Collins	Performance of the team as a whole as well as individual participation and contribution.	Determines what grade everyone gets in the class. Provides assistance to team design decisions.	Each of us will be trying to showcase what we have done for the team for our grade.	Influences HOW tasks are carried out.
Mohammed Aamir	Provides direction and guidance for the project. Interested in providing the team with Tie Down information and specifications so that the team functions optimally.	Determines the direction that the project takes. We need to create a product that works for him.	Important that his requirements are met.	Influences WHAT tasks are carried out.
Dr. MacNair	Interested in assisting the team with ME matters.	Helps the team with ME desgin decisions.	Important that the ME side of things is done properly.	Influences how ME decisions are made.
Georgia Tech	Interested in making a great class of engineers who have experience solving real-world design problems. Attract future sponsors for the program as well as future students.	Our team will follow the Senior Desgin curriculum.	Important that our team represents our univerity well.	Influences how our team interacts with the sponsors/faculty.
Tie Down	Interested in receiving a product that fits their business needs.	Impacts how our team makes project decisions.	Our team must deliver a product design that Tie Down is satisfied with.	Influences the overall product that we create.

DESIGN PLANNING

REQUIREMENTS AND SPECIFICATIONS

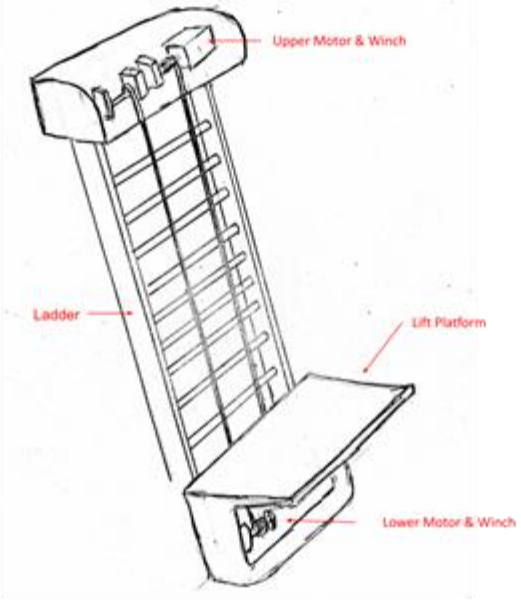
Specification Sheet - TranzVolt 2.0

			* specific numeric values are subject to change	Issued: 1/24/2022		Page: 1
			For: Tranzvolt 2.0			
No.	Date	D/W	Specification Requirements	Responsible	Source	Validation
General						
1	1/24/2022	D	Must be able to transport a minimum of 500 times	TBD	Sponsor Requirement	TBD
2	1/24/2022	D	Operating manual can be understood in less than 10* min	TBD	Sponsor Requirement	TBD
3	1/24/2022	D	Must be able to operate a minimum of 500 cycles	TBD	Sponsor Requirement	TBD
4	1/24/2022	D	Must be able to set up in less than 10* min	TBD	Sponsor Requirement	TBD
Physical Characteristics						
5	1/24/2022	D	Total apparatus must weigh less than 50* lb	TBD	Sponsor Requirement	The loads will be lifted along a ladder-like track
Electrical						
6	1/24/2022	W	Product can detect battery life and display it by some means	TBD	Self-imposed	Test battery capacity after use
7	1/24/2022	W	Must be able to lift materials at least 60 times from a fully charged battery	TBD	Self-imposed	Test in factory with arbitrary loads
8	1/24/2022	D	The product can detect the operation angle between 90 and 15 degrees	TBD	Sponsor Requirement	Test in factory with changing ladder angles
9	1/24/2022	W	The product can detect when the weight of off balance by more than 20* lbs per side	TBD	Self-Imposed	Test in factory with changing load distributions
Mechanical						
10	1/24/2022	W	The payload shall not shift more than 1 inch in any direction while travelling up or down	TBD	Self-imposed	Test in factory with arbitrary loads
Performance						
11	1/24/2022	D	Must engage an emergency braking system that brakes loads in free fall if the rope snaps within 0.05* second of rope breaking.	TBD	Sponsor Requirement	Test in factory with arbitrary loads
12	1/24/2022	D	Must have a user-friendly user interface that the average user can learn to use in less than 5* minutes	TBD	Sponsor Requirement	Survey users who have interacted with the new UI
13	1/24/2022	D	Must meet or exceed 275lbs. lift capacity	TBD	Sponsor Requirement	Test in factory with arbitrary loads
14	1/24/2022	D	Must meet or exceed 1.5ft/sec average lifting speed	TBD	Sponsor Requirement	Test in factory with arbitrary loads
15	1/24/2022	D	Must meet or exceed 32 ft lift height	TBD	Sponsor Requirement	Test in factory with provided ladder
16	1/24/2022	D	Must have deadload weight less than 20lbs	TBD	Sponsor Requirement	Test in factory with scale

Main requirements:

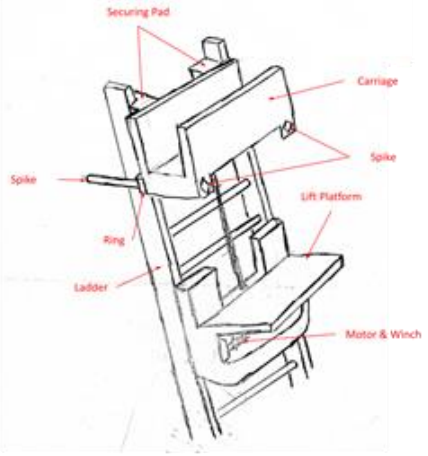
- Total apparatus must weigh less than 50 lb
- Must meet or exceed 1.5ft/sec average lifting speed
- Must have a deadload weight less than 20 lb
- Must meet or exceed 275 lb lift capacity
- Setup must take less than 10 minutes

DESIGN IDEATION



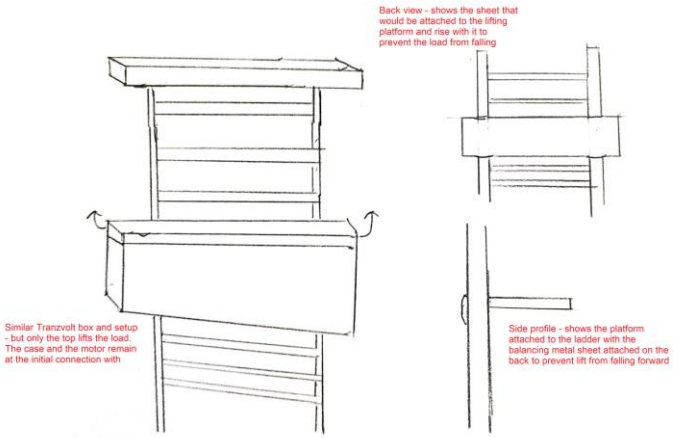
Idea 1: Dual Motors

- Double lift
- Fail-proof
- Longer setup time
- Price
- No deadload reduction



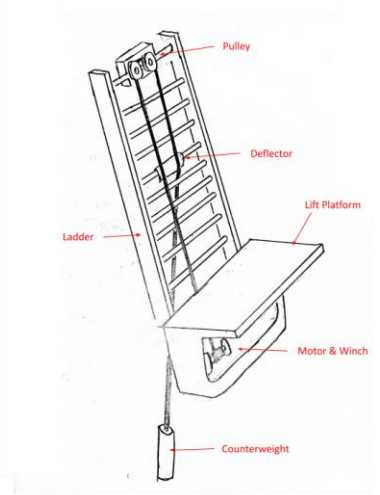
Idea 2: Detachable Carriage

- Decrease deadweight
  - Increases load potential/speed
- Mildly complicates controls



Idea 3: Tranzvolt Remodel

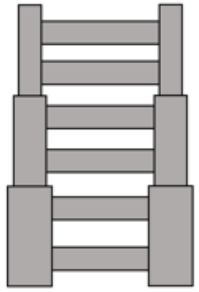
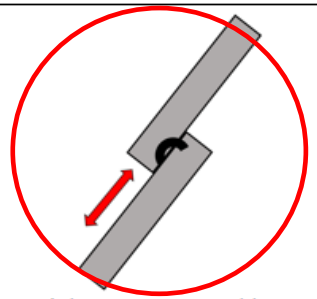
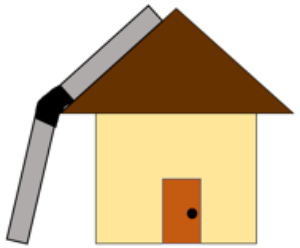
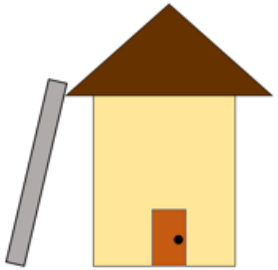
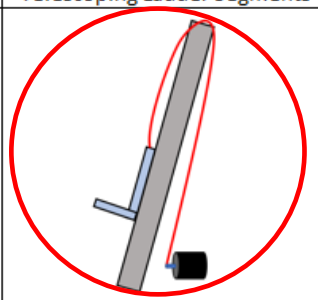
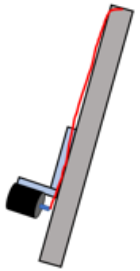
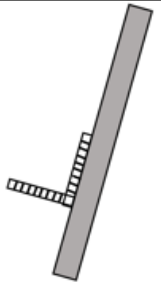
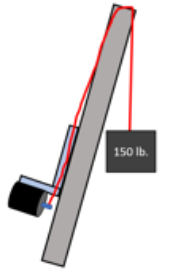
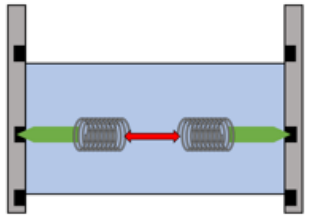
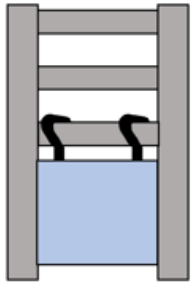
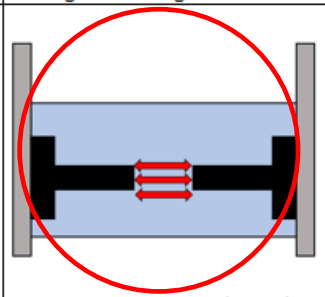
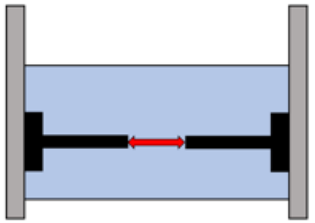
- Decrease deadweight
- Maintain familiarity with the current market



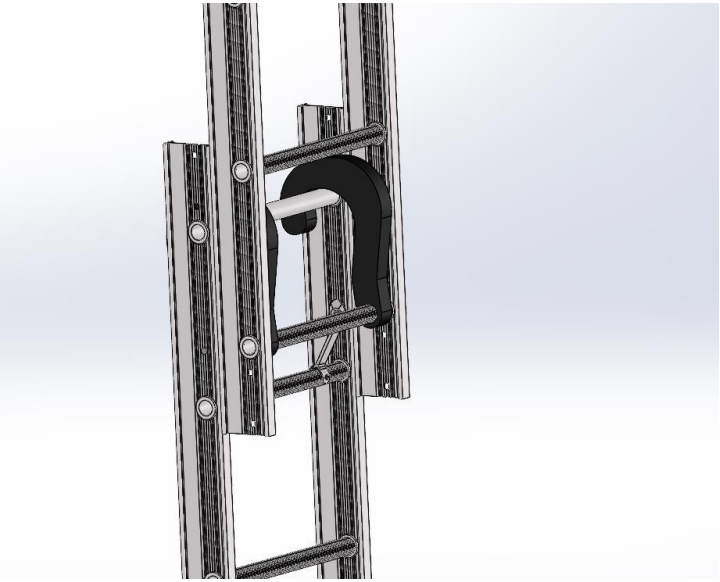
Idea 4: Counterweight

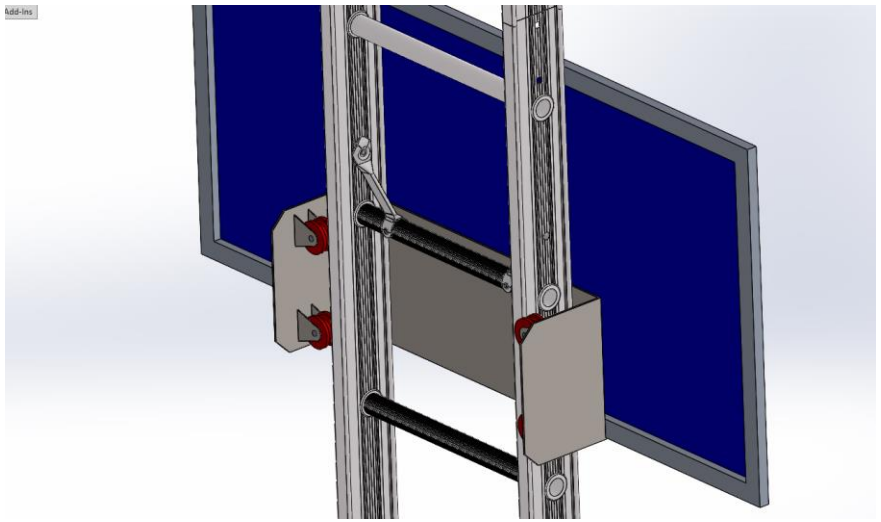
- Faster ascent/slower descent
- Extended battery life
- Longer setup
- Increased risk

PRELIMINARY DESIGN SELECTION

Function \ Idea	1	2	3	4
Reach Different Roof Heights	 Telescoping Ladder Segments	 Sliding Extension Ladder	 Angled Roof Extension	 Single Track
Improve Load Movement Speed	 Ground Motor	 Stronger Motor	 Lighter Casing Materials	 Counterweight
Control Emergency Descent	 Pins in Side	 Claw Hooking Mechanism	 Emergency Stop Brake Pads	 Friction Descent Brake Pads

PRELIMINARY DESIGN SELECTION





FUTURE WORK

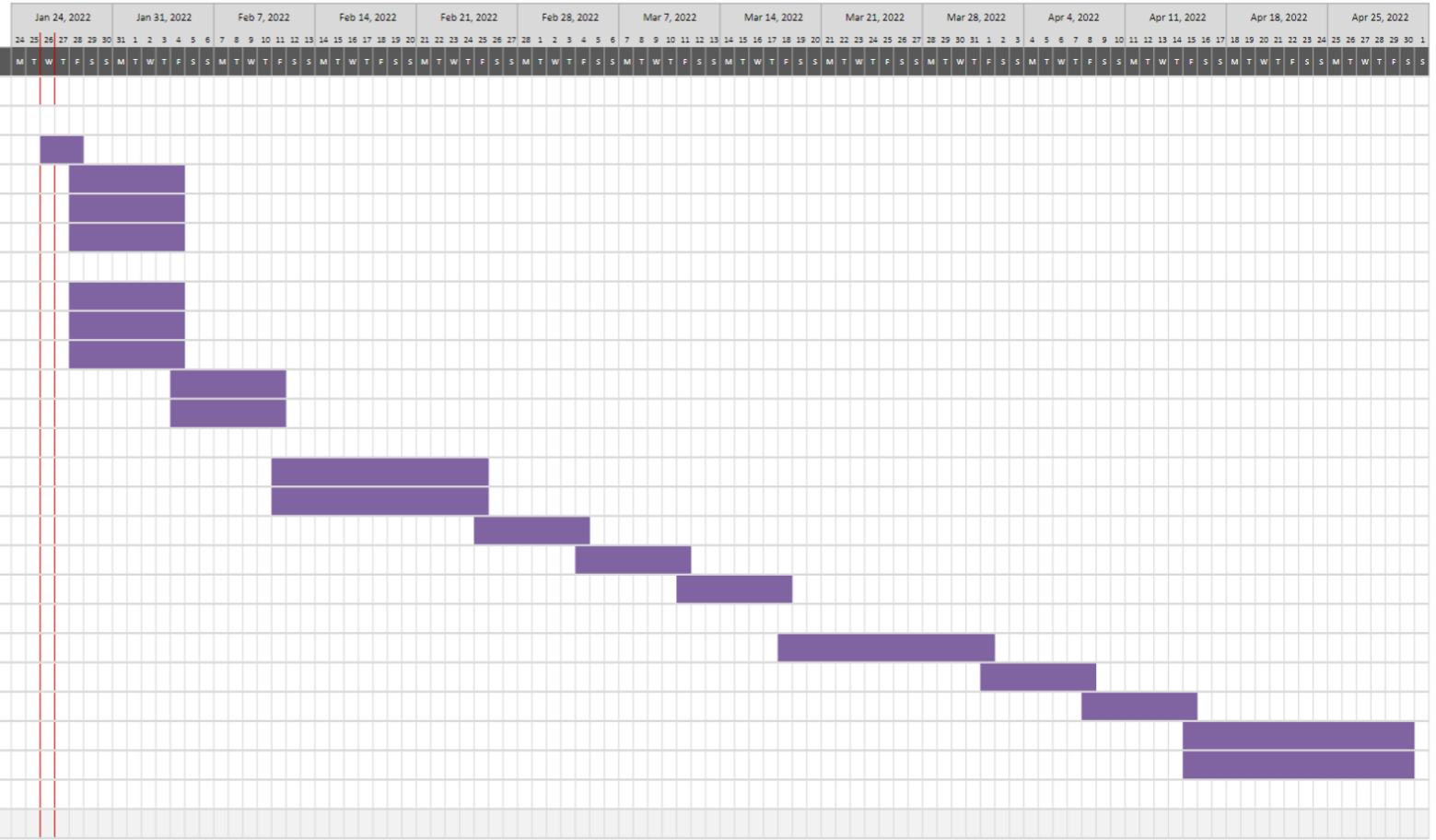
TranzVolt 2.0

Company: Tie Down
Project Leader: Dakota Survance

SIMPLE GANTT CHART by Vertex42.com

Project Start: Wed, 1/26/2022
Display Week: 1

TASK	ASSIGNED TO	PROGRESS	START	END
Pre-Report Deliverables				
Task Assignments	Dakota		1/26/22	1/26/22
Problem Statement and Organization	Oliver		1/26/22	1/28/22
User Needs	Raymond		1/28/22	2/4/22
Specifications	Su		1/28/22	2/4/22
Codes and Standards	Sri		1/28/22	2/4/22
Report 1				
Market Research	Solomon		1/28/22	2/4/22
Prior Art	Dakota		1/28/22	2/4/22
Primary Ideation Report	Oliver		1/28/22	2/4/22
Concept Selection and Justification	Raymond		2/4/22	2/11/22
Team Presentation	Su		2/4/22	2/11/22
Report 2				
Engineering Feasibility Analysis	Sri		2/11/22	2/25/22
CAD Updates	Solomon		2/11/22	2/25/22
Prototyping Updates	Dakota		2/25/22	3/4/22
Risk Analysis	Oliver		3/4/22	3/11/22
Team Presentation	Raymond		3/11/22	3/18/22
Final Report and Fabrication Package				
Industrial Design	Su		3/18/22	4/1/22
Detailed Technical Analysis and experimentation	Sri		4/1/22	4/8/22
Design Performance Prediction	Solomon		4/8/22	4/15/22
Fabrication Package	Dakota		4/15/22	5/1/22
Final Design, Mockup and Presentation	Oliver		4/15/22	5/1/22
Insert new rows ABOVE this one				



THANK YOU