

Chicken Joe's Surf Sled 2.0

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Project Description

AmpSurf is an organization that allows physically impaired people an opportunity to surf, in order to rehabilitate from mental health, physical disabilities, and injuries. They need an improved device from a former senior project, Surf Sled 1.0, to transport people with impairments across a beach while lying on a surfboard directly into the water.

Objectives

- Construct a turning system for the Surf Sled to allow volunteers to more easily maneuver the apparatus across the sand
- Use a system that does not damage the surfboards while in use, and that can support a large variety of board sizes
- Small frame to allow for easier transportation and storage
- Lightweight materials for volunteers to more easily load and unload the Surf Sled
- Have the ride capacity set at 600 lbs.

Analysis

- Calculation of bending and shear stress at critical points
- Electrode selection for welds
- Weld calculations for bending stress along with primary, secondary and total shear stresses using worst case loading
- Stress analysis and FMEA of entire system

Calculated loading and safety factors at bunk support welds for a 200 lbf load on each bunk support:

	Stress (ksi)	Safety Factor
Total Shear	1.69	3.95
Bending Stress	7.39	4.99

Equations for shear stresses in welds:

$$\tau' = \frac{V}{A}$$

$$I = 0.707hI_u = 0.707h \frac{bd^2}{2}$$

$$\tau'' = \frac{Mc}{I} = \frac{Md/2}{0.707hbd^2/2} = \frac{1.414M}{bdh}$$

$$\tau = (\tau'^2 + \tau''^2)^{1/2}$$

Manufacturing



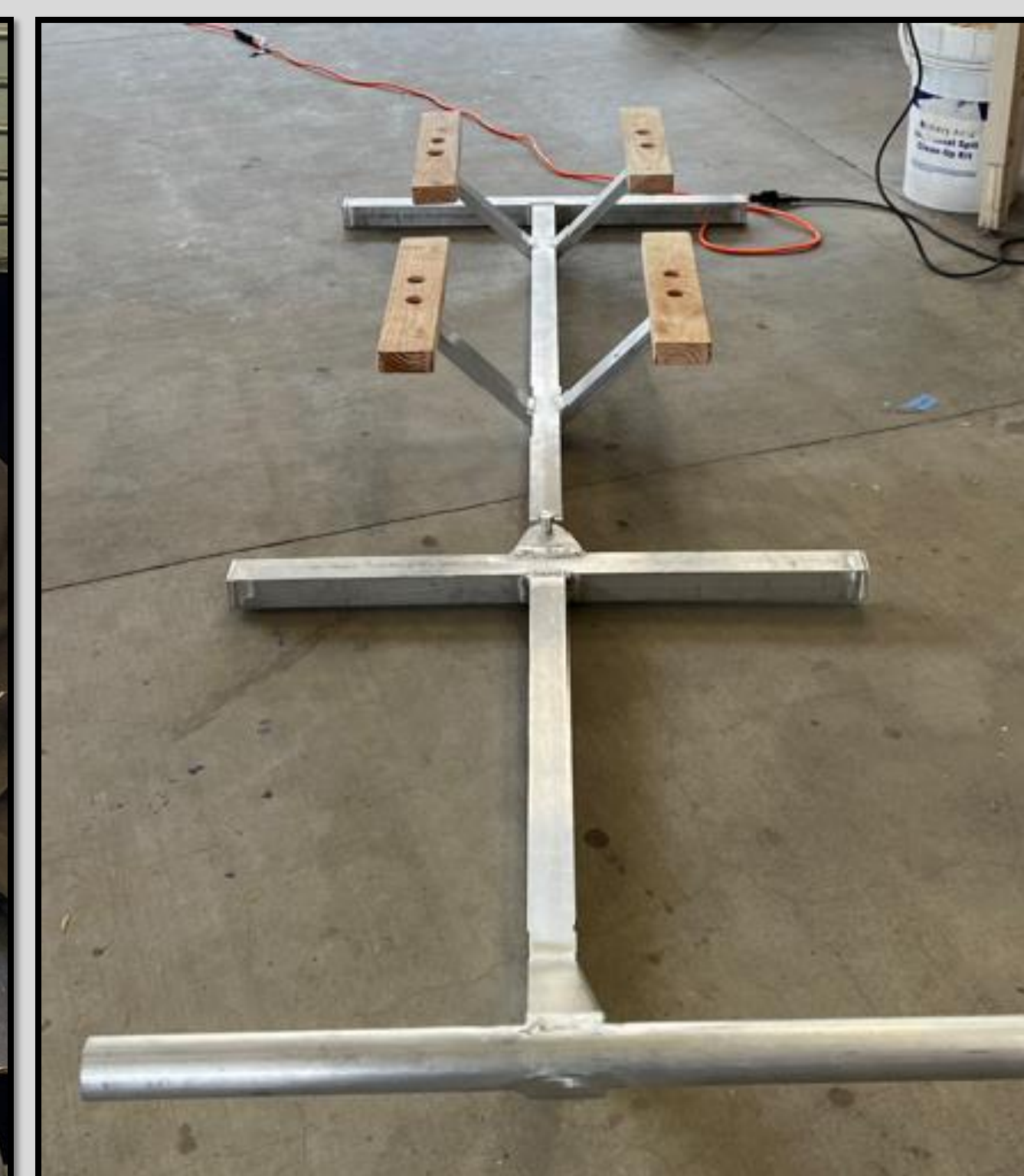
Prepping Stock Material for Cutting



Manual milling for Turning Joint

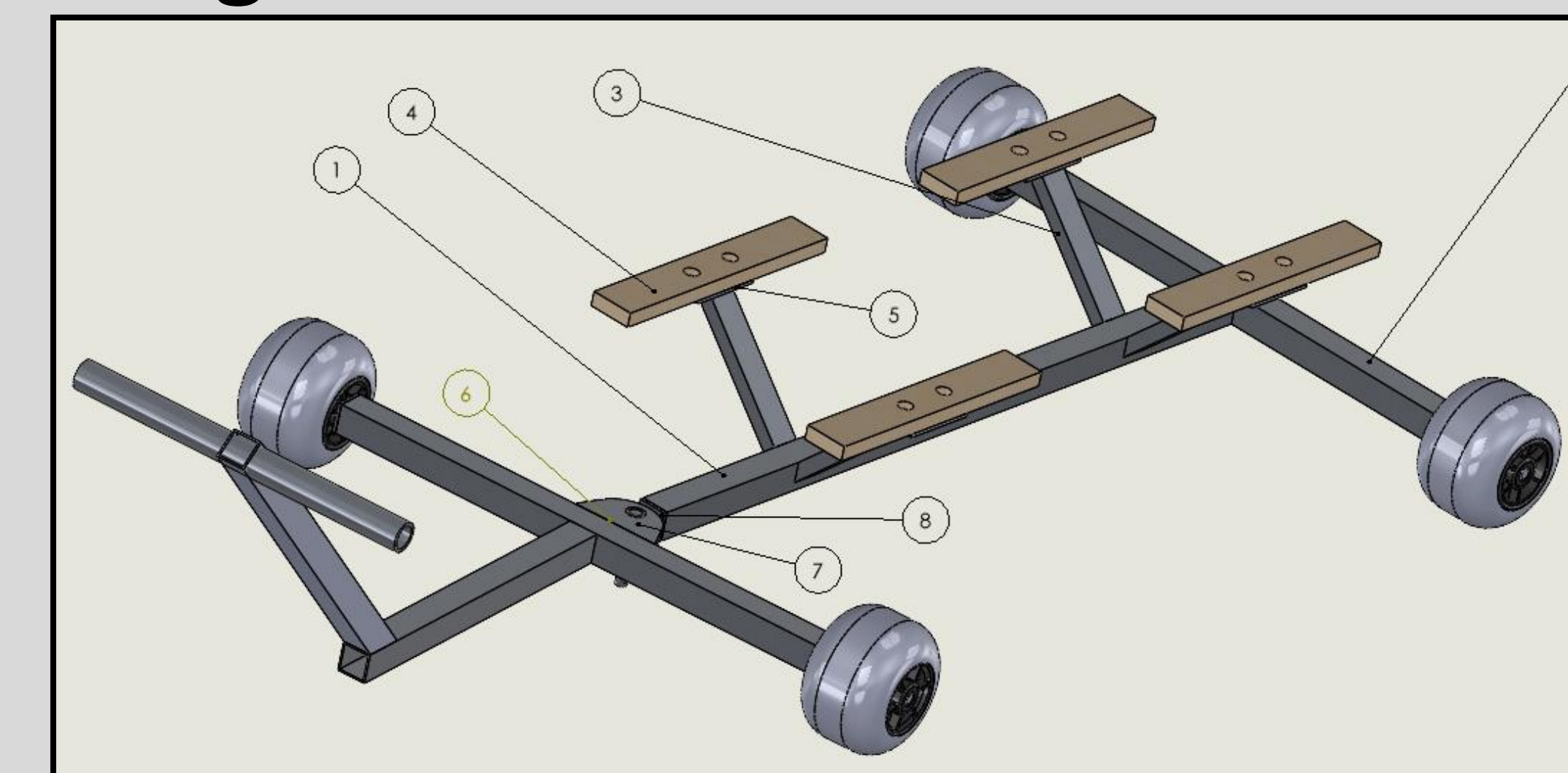


Welding Surf Sled 2.0 Together



Final Welded Frame

Final Design



Concept Cad Model Depicting the Turning Handle, Turning Joint System, Board Supports and the Main Frame



Finished Surf Sled 2.0

Testing

Test	Description	Acceptance Criteria	Result
Turn Radius	Grab the turning handle and measure how many degrees the attached raised beam can rotate in both directions.	Minimum 45 degrees turning for both directions.	Pass - 60 degrees of motion in each direction
Board Width Range	Place a 29" and 35" wide board on the sled's bunks.	Both boards are stable on the bunks. Pass/Fail	Pass - 29" and 35" Boards Fit, along with even smaller boards
Board Length Range	Place long and short boards that are at least 9' and 12' long onto the device.	No fins are touching the device and the board is touching all of the bunks. Pass/Fail	Pass - 9' - 11' ft boards fit without issue.
Compactness	Disassemble the total assembly into what can easily be detached and reattached.	If at least 3 different parts or sections can detach.	Specific - Fail, Practical - Pass: Disassembles into 2 different systems
Weight	Weigh the wheels individually then add that onto the total weight of the CAD model.	The entire system total weight comes is less than 75 lbs. Max 75 lbs	Pass - Total weight 70lbs.
Load-Capacity	Have the board on the device and set 600 lbs worth of weights on top of it.	Max 600lbs. Pass/Fail	Pass - Held 685 lbs., air wheels cannot handle any more weight