Engineers R Us: Adaptive Land Yacht

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Land Yachting for Paraplegics

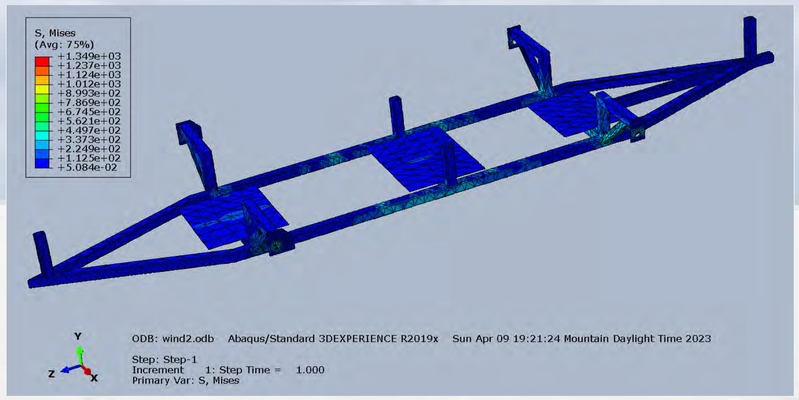
- Land yachting is traveling in a sail-powered vehicle over land.
- The Technology Recreation Access Independence Lifestyle Sports (TRAILS) designs recreational equipment for paraplegic patients.
- TRAILS designed the TetrAdapt Watercraft that lets patients control a Hobie Tandem Island sail craft via sip/puff or joystick controls.
- Our goal was to build a wheeled frame that adapts the TetrAdapt Watercraft for land yachting.

Sea → Land

Design Constraints	Metric
Must be safe for passengers	Tipping wind speed shall exceed 18 mph Vehicle speed shall be less than 15 mph Acceleration shall be less than 2 G's Control systems shall have manual overrides
Must be operable on land	Frame shall withstand 800 lbs Battery life should exceed 3 hrs Vehicle speed should exceed 10 mph
Must be towable	Vehicle shall be less than 8 ft wide Vehicle shall be less than 750 lbs
Must adapt quickly	Conversion to land should be under 15 min

Computer Modeling

- CAD models assisted in the initial design.
- FEA software simulated the design's structural limits.



Finite Element Analysis (FEA) simulations of the frame

Drive Subsystem

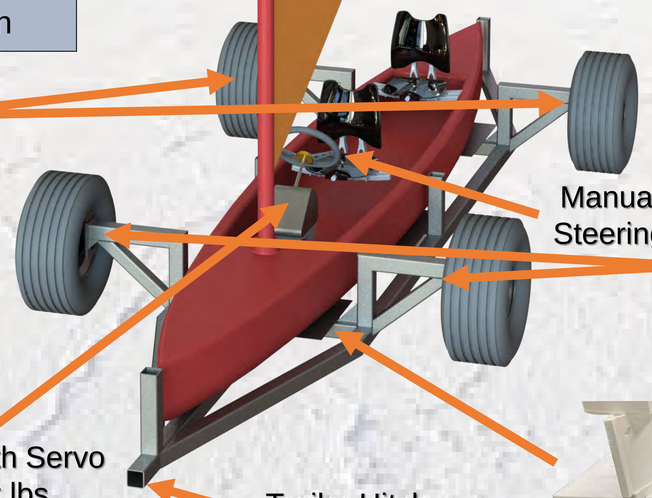
- Electric hub motors for power without wind
- Regenerative and disc braking for safety

Frame Subsystem

- Welded A513 steel with gussets for strength
- Foam-padded to protect the boat
- Capable of being hitched/towed

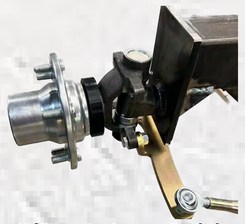
QS205 Hub Motor
75 ft lbs, 700 RPM
48V, 1500W
Disc Brakes

Clearpath Servo
9.5 ft lbs,
840 RPM
48V, 250W



Trailer Hitch Mount

Manual Steering



Chevy Assembly

Polaris Assembly

Controls Subsystem

- Arduino Uno microcontroller
- 24V Sinusoidal Wave hub motor controllers
- 48V eBike batteries

Steering Subsystem

- Polaris RZR steering assembly
- 1954 Chevy spindle assembly
- Clearpath SDSK stepper servo motor
- Custom 3D-printed servo mount

Completed Land Yacht