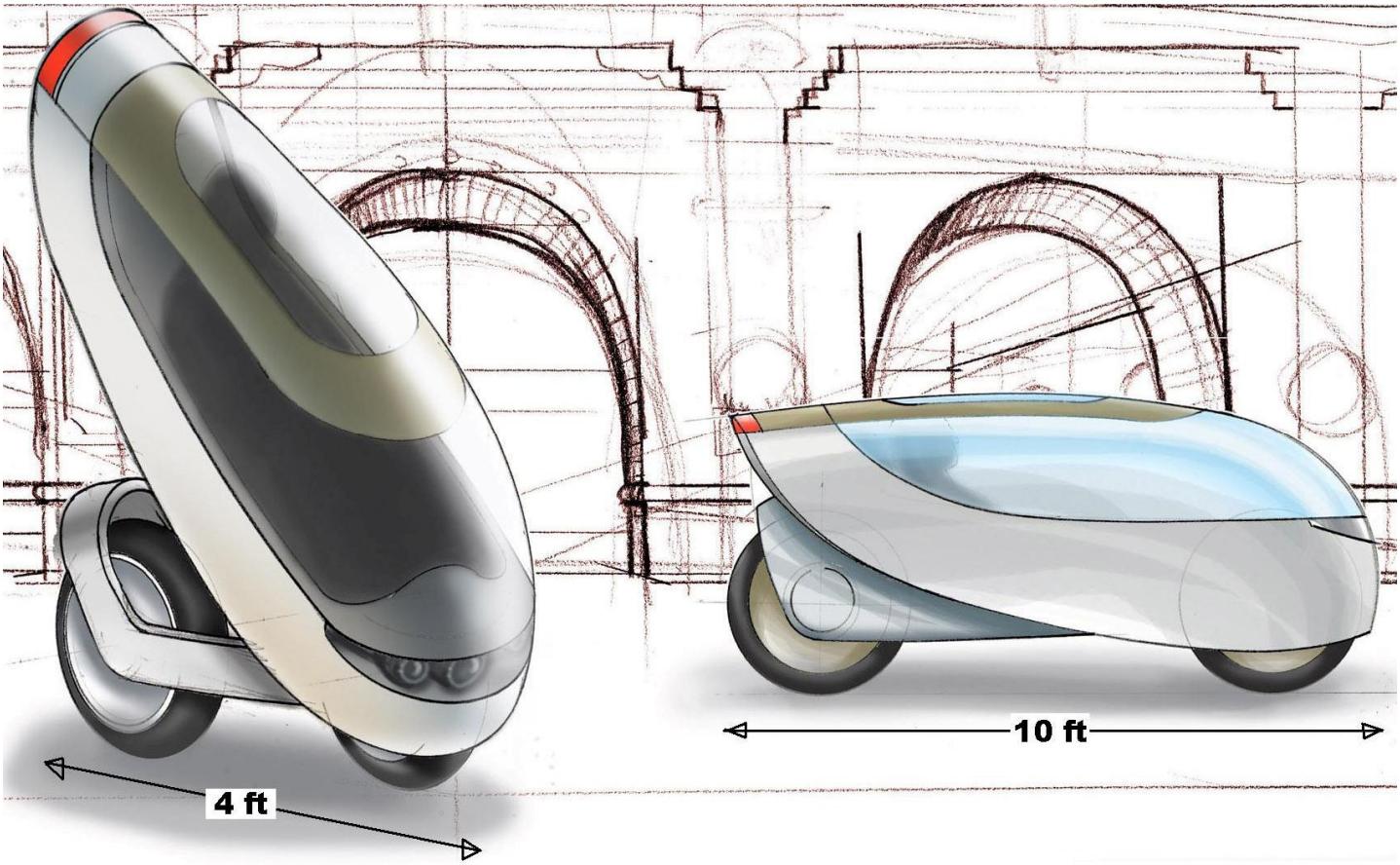
Twill Tech Inc

as an entry in

The Buckminster Fuller Challenge

November 2008



At high speed Twills are long and low. While parked they fit in a 1 m square.
Illustrations by Nelson Au

Summary

Solo drivers commuting to and from work consume 21% of America's energy budget. At one end of the transportation spectrum, this suggests we need to invest in mass transit and re design our cities. Such projects are decades in the making and are not applicable to the developing world. Domestically, there is a rush to build electric cars to eliminate pollution. But this does not solve the congestion problems and merely shifts the energy production out of the city. At the other end of the transportation spectrum, many have proposed small three wheel electric vehicles. Since these are uncomfortable, unsafe, and have poor performance they will not achieve popular acceptance. So they will never hit the price point necessary for mass adoption.

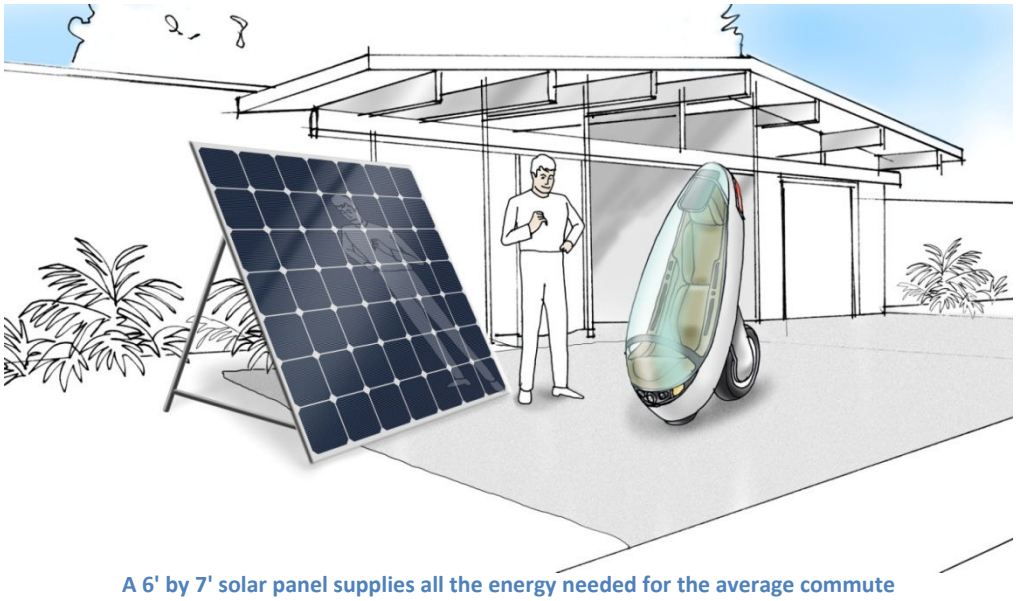
True to the spirit of Buckminster Fuller, Twill Tech solves these problems with a collection of radical departures from the norm resulting in nothing less than the safest, most comfortable, and most efficient vehicles ever; and they are a blast to drive. Light weight and mechanical simplicity make them truly affordable and applicable to world-wide markets.

The highest aerodynamic efficiency requires a low profile shape with small frontal area. Even more important is eliminating appendages such as out rigger wheels. Twill achieves this goal by supporting the passenger compartment by just Two-Wheels-In-Line along the center line of the vehicle. At speed, small changes to the steering angle maintain

balance, just as in a bicycle or motorcycle. But like a rider on a fixed-gear bicycle, balance is achieved by computer control of the steering angle and wheel position. While stopped, small motions forward and backward result in small sideways motions of the tire patch on the road to maintain balance. No training wheels or kick stands are needed. Smooth transitions are provided by the advanced control system.

A small motor transforms of the wheel base providing a taller stance at low speeds. At the extreme, a parking position leaves the Twill standing vertically parked in a 1 m square. This makes it easy to get in and out.

Safety and comfort are provided by an easy chair profile seat element that is structural. The seat cushions conform to the driver and lock into position securing the driver with support from head to toe.



A 6' by 7' solar panel supplies all the energy needed for the average commute

Current stage of our initiative

We have invested the last year building simulations and functional prototypes. A detailed dynamic model has been developed and the control laws have been created. Working prototypes balance with great delight. The first ride-on machinery is complete and is awaiting electronics and software completion. A series of prototypes have been planned culminating in a complete production design within three years.

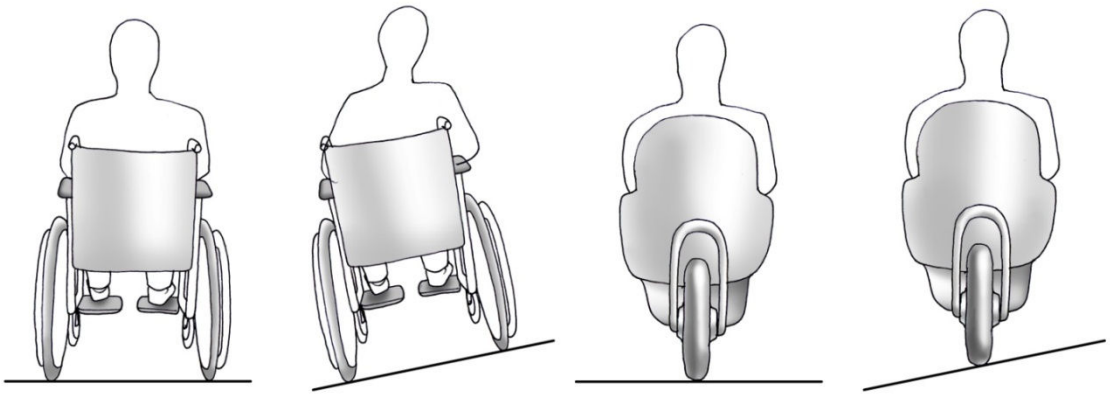
We have also invested heavily in promoting the project within the Venture Capital community. Without exception, we were received with enthusiasm. For example, the CEO of Virgin Galactic responded with, *"I love it!"* But each group has asked us to come back when we have a working prototype.

Any funds that may be awarded will be applied directly to the completion of a demonstrable prototype. The executive staff will continue without salaries as necessary. Much of the labor will be provided by an army of students that are anxious to participate on the project.

Alternative funding sources are being considered for other Twill applications. These include compact electric

Twill robots stand tall as a man and can traverse dirt trails at high speeds

wheel chairs that are narrow enough for all doorways and can easily traverse thresholds and curbs. Numerous robotic applications are also possible, including efficient, fast, human-scale robots, without the complexity of walking mechanisms.

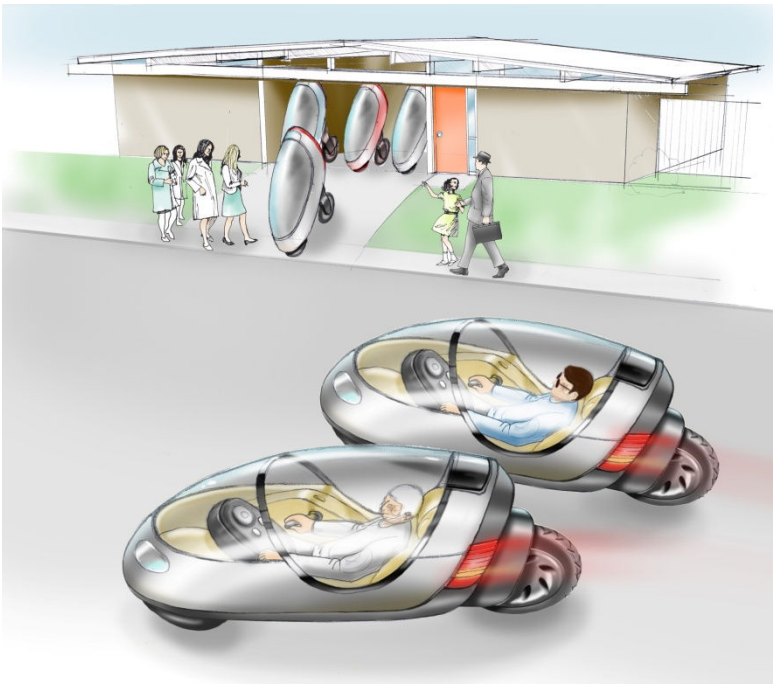


Conventional wheelchairs require a level surface. Twill wheelchairs stay plumb on all surfaces.

The novelty of the Segway personal transporter has inspired a variety of balancing robots, motorcycles and even cars. But two-wheel-adjacent vehicles are inherently unsafe at speed. We fully expect that Twill will be a trim tab in transportation technology inspiring a huge variety of new practical solutions in many fields.

Just What You're Looking For

Congestion, pollution and vehicular danger plague every city, large and small. Mass transit helps in many markets, but requires huge investments. Twills are poised to transform our cities, one car at a time. They also compliment mass transit by providing fleets of rental vehicles that park with 10 times the density of conventional cars.



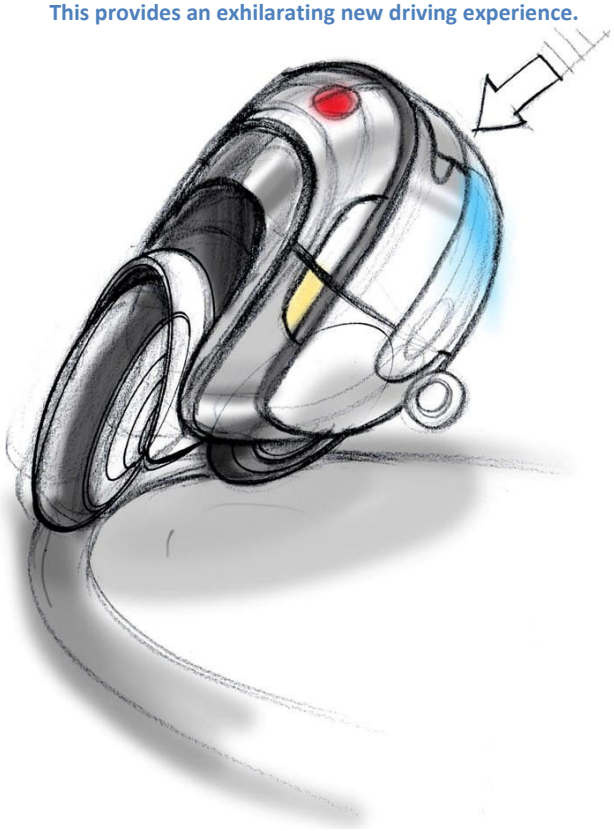
Twills fit into existing infrastructure, including your garage. They can traverse on any surface, even single-track trails.

Twills are all electric, quiet and can go anywhere people go. This includes single track trails and paths. This greatly reduces the need for wide, level paved roads. The similarity to bicycles and scooters invokes a familiarity that will help adoption in developing markets.

The technology required has already been demonstrated in other products. Balancing has been demonstrated in the Segway product. The balancing of Twills is much more robust at speed, since it balances like a bicycle. Extensive lab and field testing of the control algorithms will enable safe use on all surfaces far beyond what would be possible for a motorcycle. Special versions for each market will reflect local requirements and may be locally manufactured with low tooling cost.

The team

Twills bank perfectly into every turn.
This provides an exhilarating new driving experience.



Chris Tacklind, President
Benjamin Tigner, VP Engineering
Madhavan Thirumalai, VP Software
Nelson Au, designer
Mat Garcia, aerodynamics and controls intern
Krystine Thoroughman, engineering intern
Cameron Tacklind, engineering intern
Daniel Shaffer, business development intern
Sebastian Bertsch, intern
Nick Clayton, software intern
Blake Tacklind, design intern

The lead team is comprised of design and engineering professionals, each an accomplished expert in their respective fields with formal academic training. Chris Tacklind holds degrees in Mathematics, Physics, and a MS in Mechanical Engineering from Stanford. He holds about 50 patents including the first three patents on HP's ink jet. Ben Tigner is a Stanford PhD in Physics. He was chief engineer on the Hummingbird UAV now being produced by Boeing. He was principle engineer in a variety of NASA projects in advanced controls systems. Madhavan Thirumalai holds computer science degrees from IIT, Bombay and the University of California at Santa Cruz and was lead engineer at SGI and Nuance and other Silicon Valley firms. Nelson Au's passion for automotive design stems from his training in Design at San Jose State University. He was a founding member of what is now IDEO, one of the most influential design firms in the world. The professional team is augmented by the finest interns selected from championship robotics teams.

We have also been honored by the participation of our extended community of designers and engineers. World renowned in their fields, our board of advisers includes an incredible list of talent. Even though each of them is completely committed to other projects, when they heard what we are up to, they could not turn down the opportunity to help.