Self-driving Tricycles

Tyler Folsom, PhD, PE
QUEST Integrated Inc.
and
Brandyn Lacourse
Transportation Revolution

Once in a century opportunity

- electric vehicles
- autonomous road vehicles
- scarcity of oil
- congestion
- concern for climate change
- pollution
Transforming infrastructure is hard. How about changing the bicycle instead? This talk is not about building more bike lanes, but about taking over urban freeway lanes. An automated hybrid HPV can be the backbone of urban mobility.
Self-drive can be far more than an improved automobile

Automated road traffic produces an entirely new transportation mode

- Convenience of the automobile
- Public access of the bus
- Size of the motorcycle
- Energy efficiency of the bicycle
- Safety of the train
- No congestion
Human Powered Vehicles

- Aerodynamic devices have been banned from bicycle racing since 1938.
- Current record for 200m flying start is 82.33 mph.
- European companies produce HPVs.
- Often available with electric helper motor.
- Use less energy than bicycle.
Light Electric Vehicles

- Electrathon is a race for home-built electric vehicles.
- Cars use 2 standard lead-acid batteries.
- Winner is vehicle going farthest in an hour.
- Typically about 40 miles.
- World record:
  - 62 mile = 2200 MPGe

www.electrathonamerica.org
Light gasoline vehicles

3145 mpg at low speed

157 mpg on freeway


http://students.sae.org/competitions/supermileage
Personal Rapid Transit (PRT)

- Driverless light vehicle carrying 1 to 6 passengers.
- Available on demand 24/7.
- No stops between origin and destination.
- Operates on reserved guideway.
- Low energy consumption.

Rethinking Transportation, www.advancedtransit.net
## Typical urban speeds

<table>
<thead>
<tr>
<th>Location</th>
<th>Mode</th>
<th>Mi/h</th>
<th>Km/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seattle</td>
<td>Light rail</td>
<td>22</td>
<td>35</td>
</tr>
<tr>
<td>Vancouver, BC</td>
<td>Light rail</td>
<td>28</td>
<td>45</td>
</tr>
<tr>
<td>Tokyo</td>
<td>Subway</td>
<td>16</td>
<td>26</td>
</tr>
<tr>
<td>Japanese city</td>
<td>Auto</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>USA city EPA</td>
<td>Auto</td>
<td>19</td>
<td>31</td>
</tr>
<tr>
<td>USA average commute</td>
<td>Auto</td>
<td>28</td>
<td>45</td>
</tr>
</tbody>
</table>
TECHNOLOGY

NO RAILS

USE EXISTING INFRASTRUCTURE

LOW COST

FEW ACCIDENTS

ALL VEHICLES MIX

VEHICLE CHARGES ITSELF

HPV SIZED VEHICLES

%10 OF ENERGY

SMALL BATTERY SIZE

REFUEL BY BATTERY SWAP

BANKS OF BATTERIES

WIND AND SOLAR

USE EXISTING INFRASTRUCTURE
Individual autonomy does not reduce congestion

Freeway lane capacity increases by 3 – 8 times when vehicles drive in tight platoons.

External Traffic Control Computers improve traffic flow.

Need lanes reserved for automated vehicles.

Dual mode: enable external control of vehicle.

Hybrid electric / human power is possible. Rider pedals to charge one battery, while other battery drives the vehicle.
How does first self-drive car get onto the road?

- What is enough testing?
- Road trains on highways with lead vehicle professionally driven
- City road trains = modular busses.
- PRT-like systems on converted HOV lanes; similar to light rail.
Implementation

New transportation mode based on autonomous dual mode public pods.

Result: Bicycle-sized vehicle that outperforms automobiles in the city

Pods are technically more advanced than auto, safer, faster and more convenient.

Highly fuel efficient:

1000 Mi/gal 0.25 L / 100 km equivalent.
Elcano Project

Total cost < $10,000
Open source autonomy
https://github.com/elcano/elcano
www.ElcanoProject.org
https://kerika.com/m/Fbm6
Contact: tyler@enviroteach.com