Technologies for Safe and Efficient Transportation
National University Transportation Center

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T-SET Administration

• Carnegie Mellon University Partnered with University of Pennsylvania
• T-SET managed jointly with Traffic21 Institute, Mobility21 UTC and Metro21 Institute.
• Emphasis on multi-disciplinary research, agency and corporate partnerships and technology deployments.
Thrust Areas

• Vehicle automation technologies
• In-vehicle technologies and human-computer interaction
• Connected vehicle technologies
• Mobility data analytics
• Infrastructure based technologies
• Pedestrian safety technologies
• Transportation policy
Carnegie Mellon University
30 Years of Self-Driving Car Research

1984
• The Terregator’s top speed was a few centimeters per second; it could avoid obstacles.
• NavLab launched. Its goal: apply computer vision, sensors and high-speed processors to create vehicles that drive themselves.

1986
Humans or computers controlled NavLab1, a Chevy van. Top speed: 20 mph.

1990
NavLab 2, a US Army HMMWV, wrangled rough terrain at 6 mph. Highway speed: 70 mph.

1995
NavLab 5, a Pontiac Trans Sport, traveled from Pittsburgh to San Diego in the “No Hands Across America Tour.”

2000
NavLab 11, a Jeep, was equipped with Virtual Valet.

2005
Sandstorm and Highlander placed 2nd and 3rd in the DARPA Grand Challenge.

2007
Carnegie Mellon’s “Boss” won the DARPA Grand Urban Challenge by outmaneuvering other vehicles along the 55-mile course.

2014
Carnegie Mellon’s 14th self-driving vehicle is a Cadillac SRX that:
• avoids pedestrians and cyclists
• takes ramps and merges
• recognizes and obeys traffic lights
• looks like other Cadillac SRXs

www.engineering.cmu.edu
Bringing greater intelligence to vehicles

2007

2012
Cost-Benefit Analysis of Early Automation Features

- Observed insurance data from the Insurance Institute for Highway Safety (IIHS).
- 2012 FARS and GES used to estimate related fatal and non-fatal crashes, respectively.
- Co-authors: Corey Harper and Costa Samaras
Injury Crashes Addressed by Each Technology

- Blind Spot Monitoring: Lane Change...
- Lane Departure Warning: Lane Departure Crashes...
- Forward Collision Warning: Rear-end Collisions 14%
- All Other 2012 Crashes: 75%
Three Existing Level 1 Technologies Will Dramatically Improve Safety

<table>
<thead>
<tr>
<th>Technology</th>
<th>All Crashes</th>
<th>Injury Crashes</th>
<th>Fatal Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blind Spot Monitoring</td>
<td>267,000</td>
<td>17,000</td>
<td>280</td>
</tr>
<tr>
<td>Lane Departure Warning</td>
<td>262,000</td>
<td>58,100</td>
<td>9,000</td>
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<tr>
<td>Forward Collision Warning</td>
<td>795,000</td>
<td>58,000</td>
<td>750</td>
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<tr>
<td>Total</td>
<td>1,320,000</td>
<td>133,100</td>
<td>10,100</td>
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<tr>
<td>Percent of Total Crashes</td>
<td>23.5%</td>
<td>8.2%</td>
<td>32.6%</td>
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Lower Bound Observed Net-Benefit About $4B

Benefits
- Private Insurers
- Third-Parties
- QALYs

Costs
- Households
- Public Revenue

Net-Benefit

Annual Lower Bound Costs and Benefits ($Billion)

Benefits

Costs

Net-Benefit

($5)

($10)

($15)
Upper Bound Potential Net-Benefit is About $200B

<table>
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- Private Insurers
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- Public Revenue

Upper Bound Potential Net-Benefit is About $200B

($50)