Keeping Our Minds and Eyes on the Road (and hands on the steering wheel, also)

Robert L. Sumwalt
Presentation to the National Road to Zero Coalition
October 13, 2017
• NTSB is an independent federal agency
  - investigate transportation accidents and crashes
  - determine probable cause
  - issue safety recommendations
The Board

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The National Transportation Safety Board will meet on October 31, 2017 to determine the probable cause of a motorcoach collision with a truck-tractor combination vehicle that occurred on Interstate Highway 10 near Palm Springs, California, on October 23, 2016.

Read More
Presentation Outline

• Discussion of two recent Board products
  – 2016 Tesla crash
  – Speeding study
• NTSB Most Wanted List
Discussion of two recent Board products
  - 2016 Tesla crash
  - Speeding study

NTSB Most Wanted List
Partially Automated Vehicle Crash Near Williston, Florida

May 7, 2016
Highway Eastbound (Tesla)
Highway Westbound (Truck)
Driver Engagement During the Crash Trip

- The crash trip lasted 41 minutes
  - Autopilot was engaged for 37 minutes

- Hands on steering wheel for a total of 25 seconds.
- Lack of responsiveness indicates overreliance on automation
### SAE/NHTSA Levels of Automation

<table>
<thead>
<tr>
<th>SAE level</th>
<th>Name</th>
<th>Narrative Definition</th>
<th>Execution of Steering and Acceleration/Deceleration</th>
<th>Monitoring of Driving Environment</th>
<th>Fallback Performance of Dynamic Driving Task</th>
<th>System Capability (Driving Modes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Automation</td>
<td>the full-time performance by the human driver of all aspects of the dynamic driving task, even when enhanced by warning or intervention systems</td>
<td>Human driver</td>
<td>Human driver</td>
<td>Human driver</td>
<td>n/a</td>
</tr>
<tr>
<td>1</td>
<td>Driver Assistance</td>
<td>the driving mode-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task</td>
<td>Human driver and system</td>
<td>Human driver</td>
<td>Human driver</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>2</td>
<td>Partial Automation</td>
<td>the driving mode-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task</td>
<td>System</td>
<td>Human driver</td>
<td>Human driver</td>
<td>Some driving modes</td>
</tr>
<tr>
<td></td>
<td>Automated driving system (“system”)</td>
<td>monitors the driving environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Conditional Automation</td>
<td>the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene</td>
<td>System</td>
<td>System</td>
<td>Human driver</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>4</td>
<td>High Automation</td>
<td>the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, even if a human driver does not respond appropriately to a request to intervene</td>
<td>System</td>
<td>System</td>
<td>System</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>5</td>
<td>Full Automation</td>
<td>the full-time performance by an automated driving system of all aspects of the dynamic driving task under all roadway and environmental conditions that can be managed by a human driver</td>
<td>System</td>
<td>System</td>
<td>System</td>
<td>All driving modes</td>
</tr>
</tbody>
</table>

Source: SAE International J3016
Warning: Autosteer is intended for use only on highways and limited-access roads with a fully attentive driver. When using Autosteer, hold the steering wheel and be mindful of road conditions and surrounding traffic. Do not use Autosteer on city streets or in areas where bicyclists or pedestrians may be present. Never depend on Autosteer to determine an appropriate driving path. Always be prepared to take immediate action. Failure to follow these instructions could cause serious property damage, injury or death.

Restricted Roads

Autosteer is intended for use on freeways and highways where access is limited by entry and exit ramps. When using Autosteer on residential roads, a road without a center divider, or a road where access is not limited, Autosteer limits the driving speed. The maximum driving speed is calculated based on the detected speed limit plus 5 mph (10 km/h). In situations where the speed limit can not be detected, speed is limited to 45 mph (70 km/h). When Autosteer is engaged on a restricted road, it reduces the speed to be within these limits, even if the set cruising speed is higher. The instrument panel displays a message indicating that you are driving on a restricted road. You can manually accelerate to exceed the limited speed, but when you release the accelerator pedal, Autosteer slows Model S to the limited speed. When you leave the restricted road, or disengage Autosteer by using the steering wheel, Model S resumes cruising at the set speed.
Probable cause

• Truck driver’s failure to yield right of way, combined with...
• The car driver’s inattention due to overreliance on vehicle automation, which resulted in the car driver’s lack of reaction to the presence of the truck.
• Contributing to the car driver’s overreliance on the vehicle automation was its operational design, which permitted his prolonged disengagement from the driving task and his use of the automation in ways inconsistent with guidance and warnings from the manufacturer.
Recommendations

• Manufacturers: A better way to measure driver engagement than torque on the steering wheel

• Manufacturers: only allow use of vehicle control systems in conditions they’re designed for

• NHTSA (reiterated): Develop standards for/require connected vehicle technology

• DOT/NHTSA: Develop parameters/collection data for use by investigators
• From 2005 – 2014, speeding related crashes accounted for over 112,000 fatalities.

• That’s around 31% of all traffic fatalities.
Speeding increases crash risk

- Increased likelihood of being involved in a crash
- Increased severity of injuries by all road users
• Setting speed limits to match 85th percentile speed can result in unintended consequences.
  – Can lead to higher operating speeds

• No strong evidence that the 85th percentile speed equates to the speed with the lowest crash involvement rate
Automatic Speed Enforcement (ASE)

- ASE is an effective countermeasure to reducing speeding related crashes, fatalities, and injuries.
  - Used only in 14 states and D.C.
  - Many states prohibit it
19 safety recommendations

- DOT (1)
- NHTSA (8)
- FHWA (4)
- GHSA (1)
- IACP (1)
- National Sheriff’s Association (1)
- Various states (3)
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• Discussion of two recent Board products
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  – Speeding study
• NTSB Most Wanted List
➢ Improve Rail Transit Safety Oversight
➢ Ensure the Safe Shipment of Hazardous Materials
➢ Increase Implementation of Collision Avoidance Technologies
➢ Strengthen Occupant Protection
➢ Prevent Loss of Control In Flight In General Aviation

➢ Eliminate Distractions
➢ Require Medical Fitness
➢ Expand Recorders Use to Enhance Safety
➢ Reduce Fatigue-Related Accidents
➢ End Alcohol and Other Drug Impairment
Act to End Deadly Distractions

2nd Roundtable on Distractions

Presented by the National Transportation Safety Board and StopDistractions.org

Wednesday, April 26, 2017
9:00 AM - 4:30 PM | Washington, DC
NTSB Boardroom & Conference Center

Facilitated by NTSB Board Member
The Honorable Robert Sumwalt

NTSB 50
Making Transportation Safer
Yesterday • Today • Tomorrow
Increase implementation of collision avoidance technologies
Strengthen occupant protection
Restraint Use on Limos/Buses/Motorcoaches

Cranbury, NJ

Orland, CA
Good News: Lap-Shoulder Belts in All New Buses > 26,000 lbs.

Davis, OK
Reduce fatigue-related accidents
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Read More
End alcohol and other drug impairment in transportation

NTSB 2017-2018

Most Wanted List

of Transportation Safety Improvements

NTSB

NTSB 50
Making Transportation Safer
YESTERDAY ★ TODAY ★ TOMORROW