Drowsy Driver Detection and Warning System
For Commercial Vehicle Drivers:
*Field Operational Test Design, Analysis, and Progress*

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Heavy Vehicle/Driver Interaction Division
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Estimated Total Problem Size

- Approximately 100,000 drowsy-related crashes per year.
- Approximately 1,357 drowsy-related fatal crashes resulting in 1,544 fatalities.
- Approximately 71,000 drowsy-related crashes involved non-fatal injuries.
- Estimated annual monetary loss is about $12.5 Billion.
# Drowsy Driver Technology Program

## Problem Size

<table>
<thead>
<tr>
<th></th>
<th>Passenger Vehicles</th>
<th>Heavy Trucks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Est. Drowsy Crashes</td>
<td>96,000</td>
<td>3,300</td>
</tr>
<tr>
<td>Total Est. Involvement</td>
<td>95.9%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Drowsy Related Fatalities</td>
<td>1,429</td>
<td>84</td>
</tr>
<tr>
<td>Fatalities Outside Vehicle</td>
<td>12%</td>
<td>37%</td>
</tr>
<tr>
<td>Drowsiness Cited by Police</td>
<td>.52%</td>
<td>.82%</td>
</tr>
<tr>
<td>Miles/Year Exposure</td>
<td>11k</td>
<td>60k</td>
</tr>
<tr>
<td>Years Operational Life</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>Primary Driving Period</td>
<td>Day</td>
<td>Night</td>
</tr>
</tbody>
</table>

*Estimates based on 5-year period 1989-1993 (Knipling & Wang, 1995)*
Program Justification

- Previous trucking summit meetings identify drowsiness as the #1 driving problem.
- Drivers are often unaware of their deteriorating condition.
- Drivers are often motivated to keep driving.
- Incipient drowsiness can be observed and measured.
Program Objectives

- Reduce the injuries, deaths, and costs associated with drowsiness.

- Develop, test, and evaluate a prototype continuous/drowsiness detection and warning system for commercial vehicle drivers.
Coherence Over Bouts between 20 Minute Visual PVT Lapse Duration and PERCLOS 1 Score Subject 6109

Coherence = 0.97
Field Operational Test

- **Performance Period:** October 2002 – October 2005.
- FOT Conductor – *Virginia Tech. Transportation Institute (VTTI).*
- FOT Independent Evaluator – *Volpe Center.*
Research Questions

1. What is the distribution of drowsiness in the population of heavy vehicle drivers, and how do these groups differ in their performance with or without the warning system?

2. What are the effects of independent factors such as driver age, health, sleep patterns, road conditions, and type of trucking operation?

3. What is the effect of the warning system and independent factors on conflict driving, near collisions and severe near collisions?

4. What are the fleet acceptance and deployment prospects?
Experimental Design

Subjects

- 102 drivers, 34 single-unit heavy trucks.
- Long haul operations:
  • Howell’s Trucking Company – 51 drivers.
- Overnight express operations:
  • Pitt-Ohio Express (PA Turnpike) - 6 drivers.
  • J.B. Hunt (Virginia Interstate) – 45 drivers.
<table>
<thead>
<tr>
<th>Alert</th>
<th>Alert Enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disabled</td>
<td></td>
</tr>
<tr>
<td>A A A</td>
<td>B B B B B B B</td>
</tr>
<tr>
<td>Experimental Group</td>
<td>34 Drivers/ Op.Type</td>
</tr>
<tr>
<td>A A A A A A A A A A A A</td>
<td>Control Group</td>
</tr>
<tr>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
<td>17 Drivers/ Op.Type</td>
</tr>
</tbody>
</table>

Week
Safety Benefits

- DDWS Effect on Drowsiness
  - Drowsy level w/ or w/o the DDWS.
  - Drowsiness varying by independent factors – age, health, sleep patterns, road conditions, type of trucking operation, etc.

- Driving Performance
  - Performance level w/ or w/o the DDWS.
  - Performance varying by independent factors – age, health, sleep patterns, road conditions, type of trucking operation, etc.
Analysis

Conflict Driving
- Conflict level w/ or w/o the DDWS.
- Conflicts varying by independent factors – age, health, sleep patterns, road conditions, type of trucking operation, etc.

Causal Analysis
- Video Coding – Intervening variables.

Crash Estimation
- Monte Carlo Simulation
Status

Whereas, the process of data collection, reduction, and transfer has begun, there are no results to report at this time.

The final report is due October 30, 2005.
Further Information

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