National Transportation Safety Board

PAY ATTENTION!
WHAT ACCIDENT INVESTIGATIONS *REALLY* REVEAL ABOUT DRIVER AND PILOT ALERTNESS

Robert Sumwalt, FRAeS

December 5, 2019


CBS THIS MORNING
DEADLY LIMO CRASH
20 KILLED IN ACCIDENT IN UPSTATE NY


231909
R


CONCEPTION

Potential Sources of Information

72-Hour History

Other Sources

Physical Evidence

Autopsies

Hotel Records

Interviews

Cell Phone Records

AME Records

Toxicological Tests

Other Medical Records

Verizon 1:20 AM 38%

AA en.m.wikipedia.org

WIKIPEDIA

Alertness

Alertness is the state of active attention by high sensory awareness such as being watchful and prompt to meet danger or emergency, or being quick to perceive and act. It is related to psychology as well as to physiology. A lack of alertness is a symptom of

Verizon 1:17 AM 38%

alertness

er stewards alertness

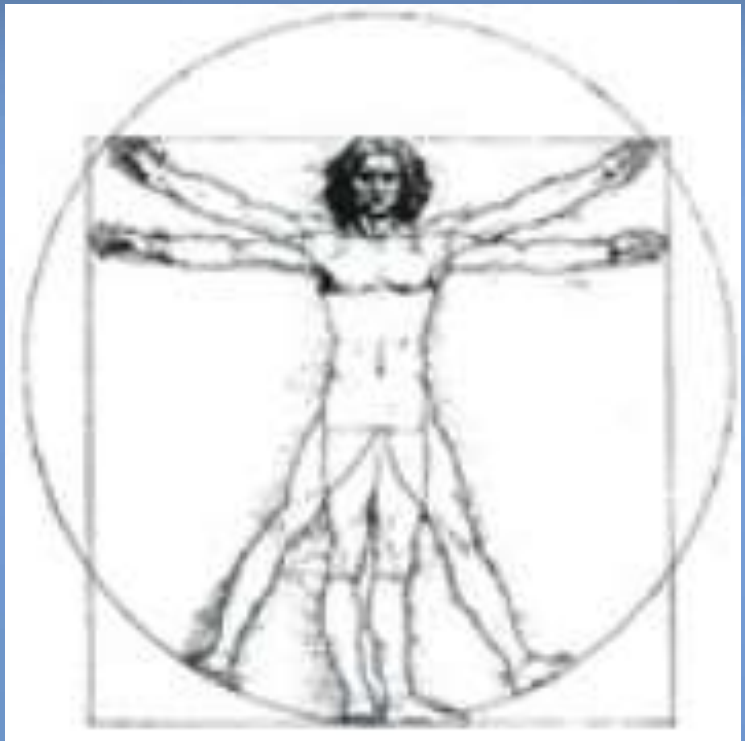
alert

adjective ə-ˈlərt

1 **a** : watchful and prompt to meet danger or emergency
• an *alert* guard • trying to stay *alert* to possible problems
b : quick to perceive and act
• mentally *alert*

A few Human Factors that Affect Alertness

- Fatigue
- Automation reliance/automation complacency



- Change blindness
- Inattention blindness

Birmingham, Alabama. 2013

Port Arthur, Texas. 2010

Palm Springs, CA. 2016

Fatigue

Fatigue

Chicago. 2015

New York City. 2013

Hoboken, New Jersey. 2016

- "…some investigations have found that alerters were likely reset by reflex action with no increase in crew alertness…"
  - NTSB Safety Recommendation R-15-004

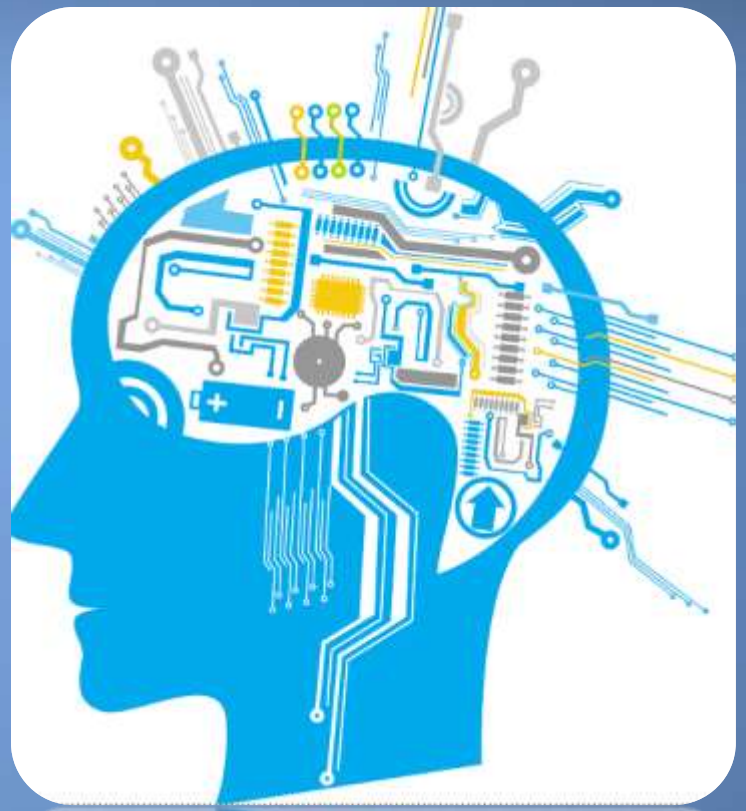
NTSB

NTSB is calling for a comprehensive approach to combatting fatigue in transportation, focusing on:

- research
- education and training
- technology
- sleep disorder treatment
- hours-of-service regulations
- and on and off-duty scheduling policies and practices.

Alertness and Automation

- Humans are not wired to monitor highly reliable, highly automated systems for extended periods of time.




DEVELOPING STORY
NTSB: AMTRAK ENGINEER "FULLY COOPERATIVE"
LIVE
CNN

NTSB

“Once you put pilots on automation, their manual abilities degrade and their flight path awareness is dulled: flying becomes a monitoring task, an abstraction on a screen, a mind-numbing wait for the next hotel.”

- William Langewiesche, *Vanity Fair*, October 2014

Automation's Role in Potentially Dulling Alertness

- "The changing role of the human operator from active controller to passive monitor, as exemplified by the modern airline pilot, has not eliminated the vigilance problem, but merely changed it."
  - Parasuraman, 1987
- "The microprocessor revolution has demanded, not less, but more of the human monitor."
  - Wiener, 1987

- “Automation is a double-edged sword. It gives us lots of advantages. It can reduce workload. It can fly the plane more precisely, but it puts us a step away from the system, and that makes monitoring even more challenging.”

  – Key Dismukes

Who or what first detected the flight path deviation?

Deviation first detected by:	Number of Incident Reports
ATC	49
Cockpit alerting system	22
Jumpseat rider	1
Crewmember	32

72

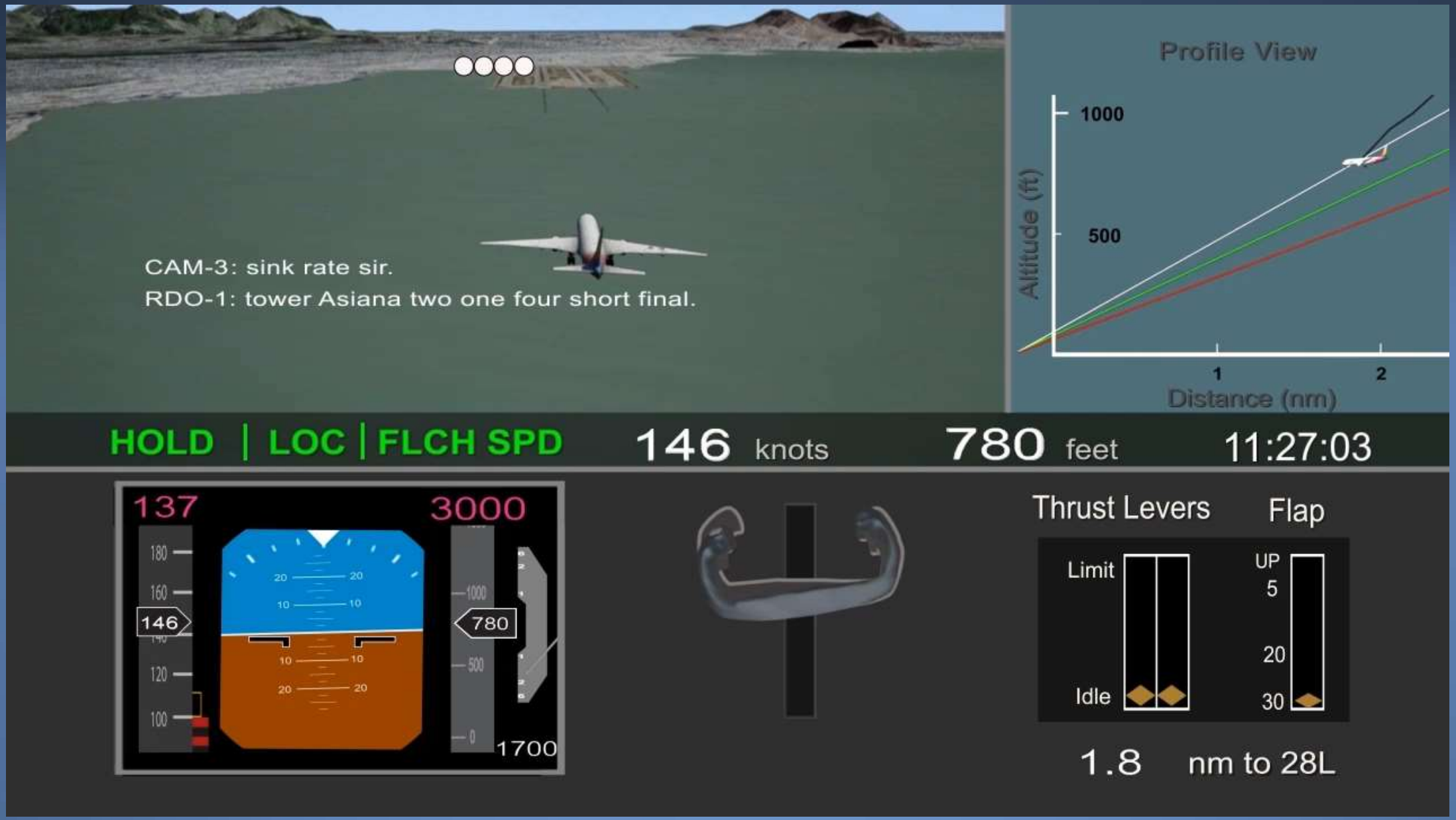
Someone or something other than the operating crew first detected the flight path deviation in 72 of 104 reports.

$\chi^2 = 15.39$, $df = 1$, $p < 0.001$.

Asiana flight 214

- July 6, 2013
- San Francisco, California
- 3 Fatalities


CAM-3: sink rate sir.
RDO-1: tower Asiana two one four short final.
Profile View
1000
500
Altitude (ft)
1
2
Distance (nm)
HOLD | LOC | FLCH SPD
146 knots
780 feet
11:27:03
137
3000
146
780
1700
Thrust Levers
Flap
Limit
Idle
UP
5
20
30
1.8 nm to 28L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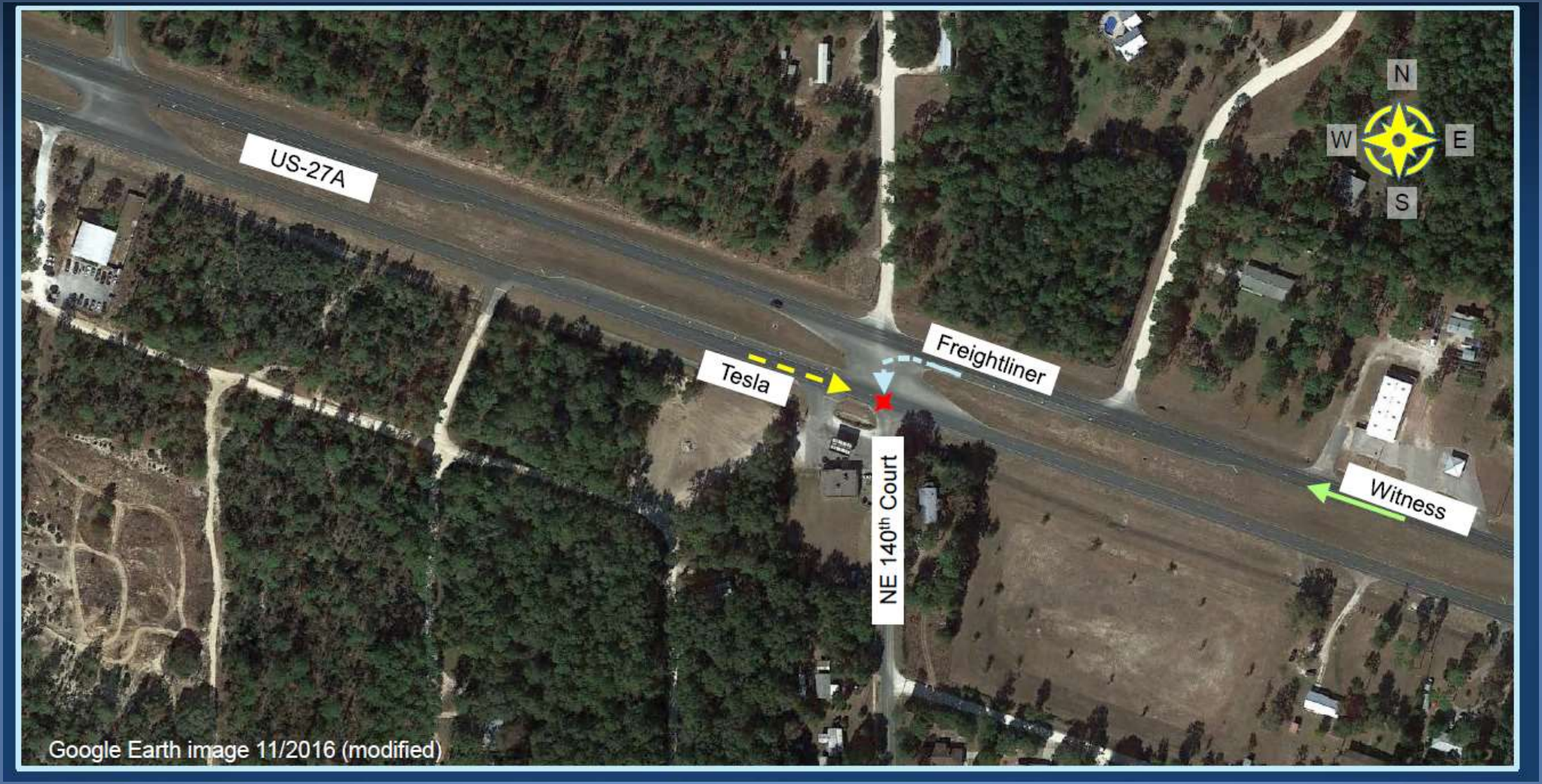
1.8 nm to 28L

From the NTSB Accident Report:

- "Human factors research has demonstrated that system operators often become complacent about monitoring highly reliable automated systems when they develop a high degree of trust in those systems and when manual tasks compete with automated tasks for operator attention."

  — (Parasuraman and Manzey 2010, 381-410).

Williston, Florida. May 7, 2016



NTSB

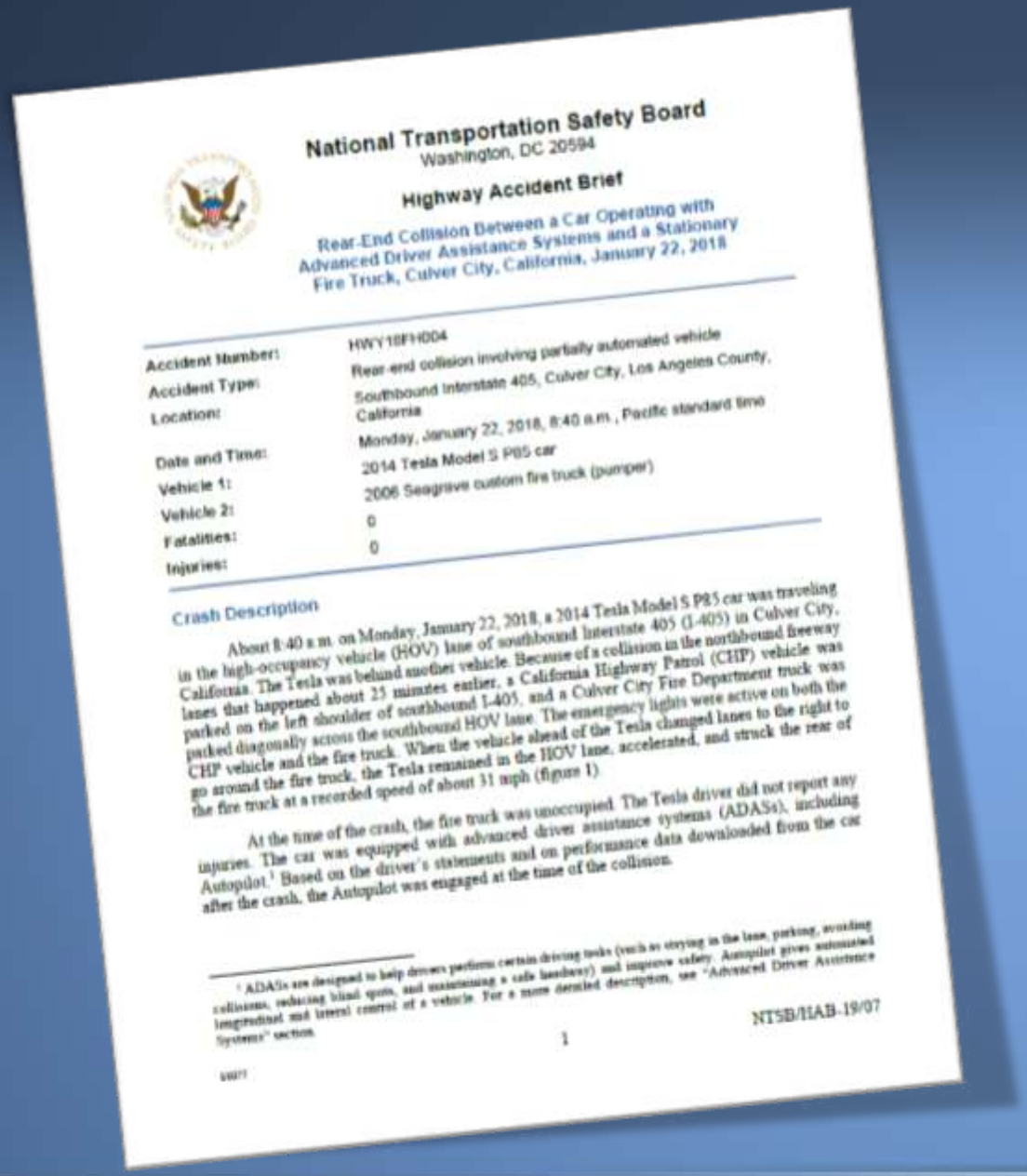
"… the car driver's inattention due to overreliance on vehicle automation."

“Monitoring steering wheel torque provides a poor surrogate means of determining the automated vehicle driver’s degree of engagement with the driving task.”

– NTSB report of Williston, Florida crash

Culver City, California. January 22, 2018

NTSB



National Transportation Safety Board
Washington, DC 20594

Highway Accident Brief

Rear-End Collision Between a Car Operating with Advanced Driver Assistance Systems and a Stationary Fire Truck, Culver City, California, January 22, 2018

Accident Number:	HWY18FH004
Accident Type:	Rear-end collision involving partially automated vehicle
Location:	Southbound Interstate 405, Culver City, Los Angeles County, California
Date and Time:	Monday, January 22, 2018, 8:40 a.m., Pacific standard time
Vehicle 1:	2014 Tesla Model S P85 car
Vehicle 2:	2006 Seagrave custom fire truck (pumper)
Fatalities:	0
Injuries:	0

Crash Description

About 8:40 a.m. on Monday, January 22, 2018, a 2014 Tesla Model S P85 car was traveling in the high-occupancy vehicle (HOV) lane of southbound Interstate 405 (I-405) in Culver City, California. The Tesla was behind another vehicle. Because of a collision in the northbound freeway lanes that happened about 25 minutes earlier, a California Highway Patrol (CHP) vehicle was parked on the left shoulder of southbound I-405, and a Culver City Fire Department truck was parked diagonally across the southbound HOV lane. The emergency lights were active on both the CHP vehicle and the fire truck. When the vehicle ahead of the Tesla changed lanes to the right to go around the fire truck, the Tesla remained in the HOV lane, accelerated, and struck the rear of the fire truck at a recorded speed of about 31 mph (figure 1).

At the time of the crash, the fire truck was unoccupied. The Tesla driver did not report any injuries. The car was equipped with advanced driver assistance systems (ADASs), including Autopilot.[1] Based on the driver's statements and on performance data downloaded from the car after the crash, the Autopilot was engaged at the time of the collision.

[1] ADASs are designed to help drivers perform certain driving tasks (such as staying in the lane, parking, avoiding collisions, reducing blind spots, and maintaining a safe headway) and improve safety. Autopilot gives automated longitudinal and lateral control of a vehicle. For a more detailed description, see "Advanced Driver Assistance Systems" section.

1

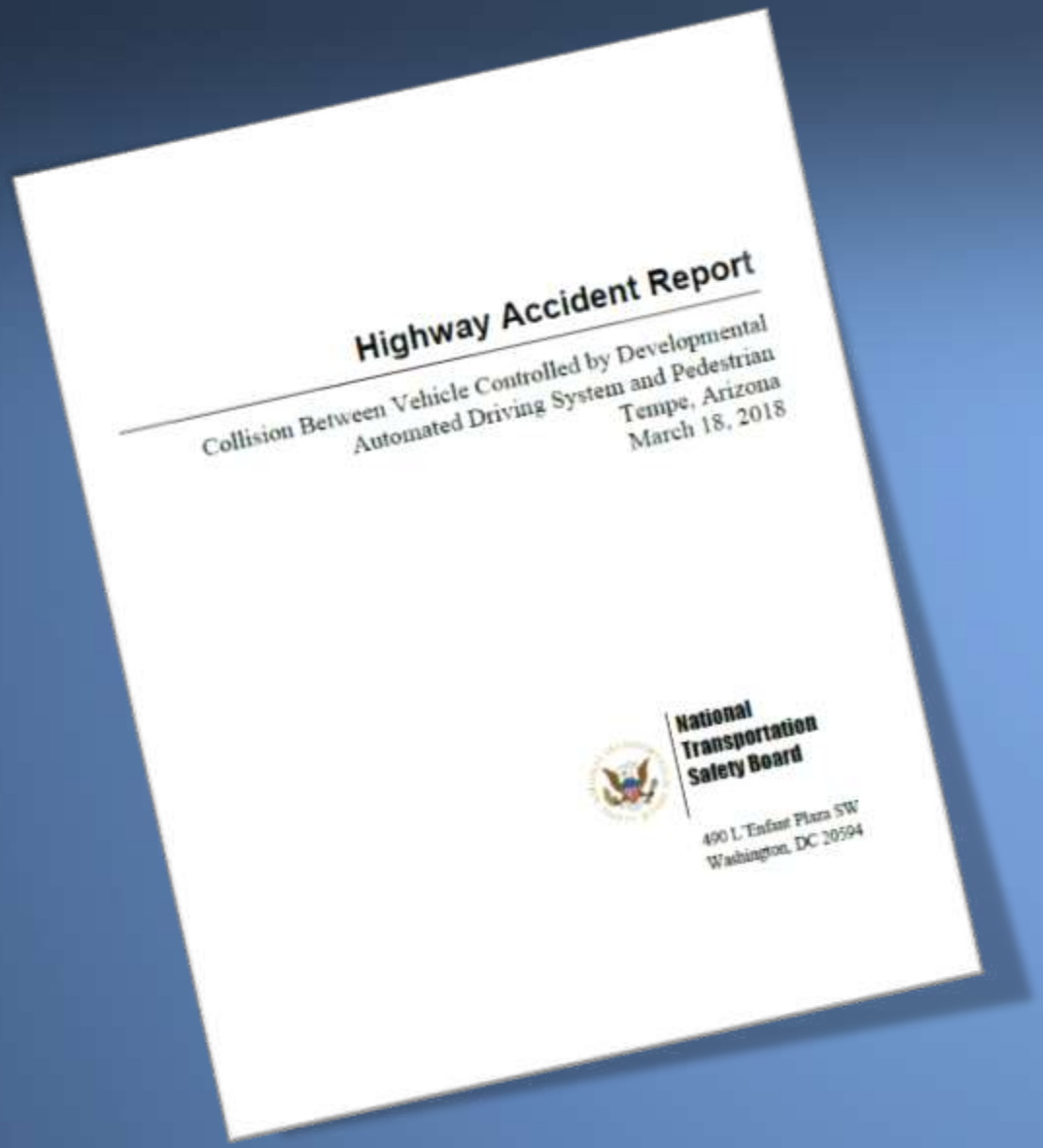
NTSB/HAB-19/07

Probable Cause

- The Tesla driver's lack of response to the stationary fire truck due to his inattention and overreliance on the vehicle's advanced driver assistance system;
- The Tesla Autopilot design, which permitted the driver to disengage from the driving task;
- The driver's use of the system in ways inconsistence with guidance and warnings from the manufacturer.

NTSB

Automation Complacency


Highway Accident Report

Collision Between Vehicle Controlled by Developmental Automated Driving System and Pedestrian
Tempe, Arizona
March 18, 2018

National Transportation Safety Board

490 L'Enfant Plaza SW
Washington, DC 20594

- "Across domains, automation complacency has been identified as a critical consequence of automation -- a decrement in performance that results from less-than-adequate monitoring of an automated system by a human operator."

- “Detection of automation failure is poorer for systems that have a low failure rate.
- “In other words, the better the automation system, the more likely the operator is to become complacent and not detect its failure.”

NTSB Finding

"The vehicle operator's prolonged visual distraction, a typical effect of automation complacency, led to her inability failure to detect the pedestrian in time to avoid the collision."

Change Blindness

- “People are surprisingly poor at detecting even gross changes in a visual stimulus if they occur in objects that are not the focus of attention.”

  - S. Palmer, 1999, *Vision Science*.


MACH
ALT CRZ
NAV
AP1
1FD2
A/THR
280
260
240
220
375
365
37000
20
80
10
10
10
10
.80
STD
4
5
6
7
8

NTSB


MACH
ALT CRZ
NAV
1FD2
A/THR
280
260
240
220
375
365
37000
20
80
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10
.80
STD
4
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NTSB

Inattentional Blindness

Closing Thoughts

- Automation can provide many benefits, but the possibility of over-reliance on automation and automation complacency is real.
- To counter these tendencies, we need effective means of determining and ensuring driver and pilot alertness and engagement.
- Today should provide many great thoughts on where to go from here.

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