NTSB | National Transportation Safety Board

NTSB Investigative Process
Office of Highway Safety

Shawn Currie

September 19, 2023

NTSB – Who We Are & Mission

Independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in other modes of transportation – railroad, transit, highway, marine, pipeline, and commercial space.

- Determine probable cause of accidents and issue safety recommendations aimed at preventing future accidents.
- Carry out special studies concerning transportation safety and coordinate resources of the federal government and other organizations to provide assistance to victims and their family members.

Mission

Making transportation safer by conducting independent accident investigations, advocating safety improvements, and deciding pilots' and mariners' certification appeals.

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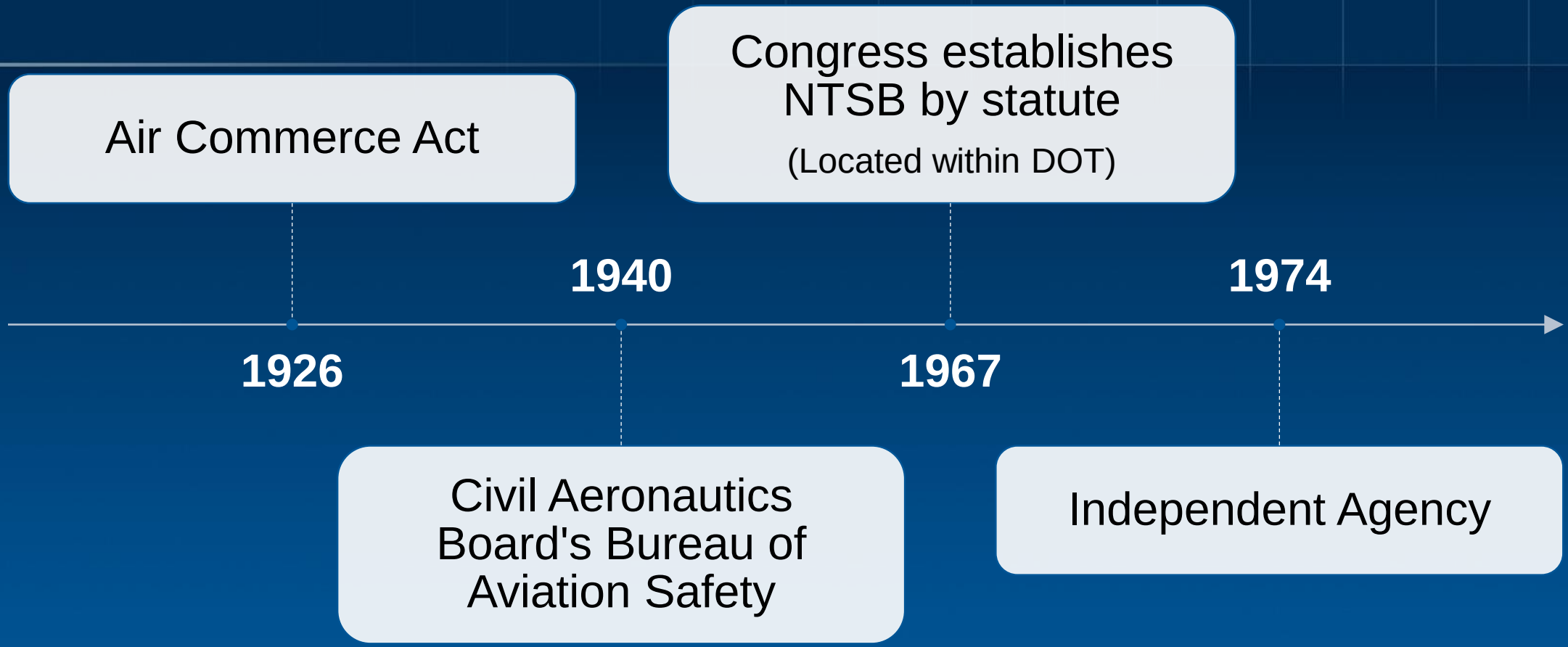
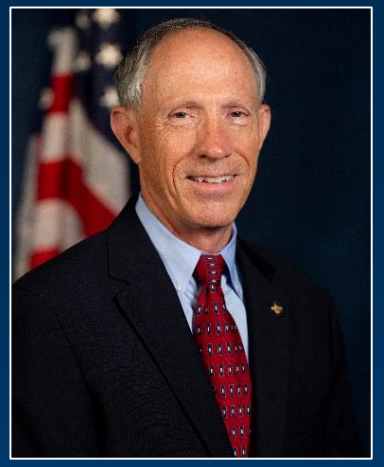


NTSB Board Members

Chair Homendy



Vice Chair Landsberg

Member Graham

Member Chapman

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Office of Highway Safety

- Total Staff of 38
  - Managers, investigators, writers, support staff
  - Investigations Division
    - Multi-disciplinary Investigations Branch
    - Special Investigations Branch
  - Report Development Division

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NTSB Authority

- The National Transportation Safety Board shall investigate or have investigated (in detail the Board prescribes) and establish the facts, circumstances, and cause or probable cause of—
  - (B) a highway accident, including a railroad grade crossing accident, the Board selects in cooperation with a State;
  - (F) any other accident related to the transportation of individuals or property when the Board decides—
- (i) the accident is catastrophic;
- (ii) the accident involves problems of a recurring character; or
- (iii) the investigation of the accident would carry out this chapter.

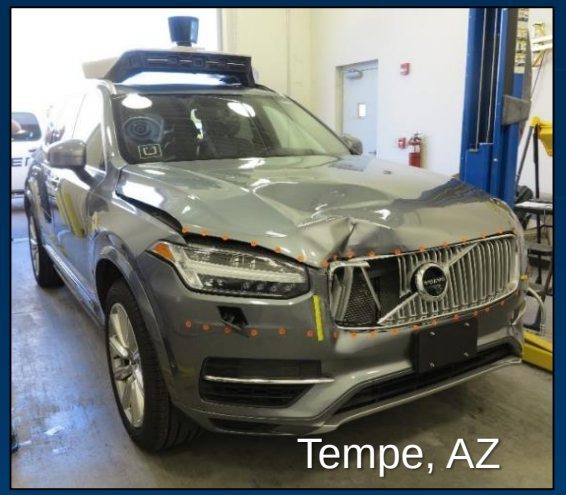
49 U.S.C. § 1131(a)

Authority in Highway Investigations

The NTSB is responsible for the investigation of selected highway accidents (e.g., collisions, crashes and explosions), including at railroad grade-crossing accidents. Such investigations will be conducted in cooperation with the designated authorities of the state or local jurisdiction in which the accident occurred.

49 *CFR* § 831.30

Crashes We Investigate



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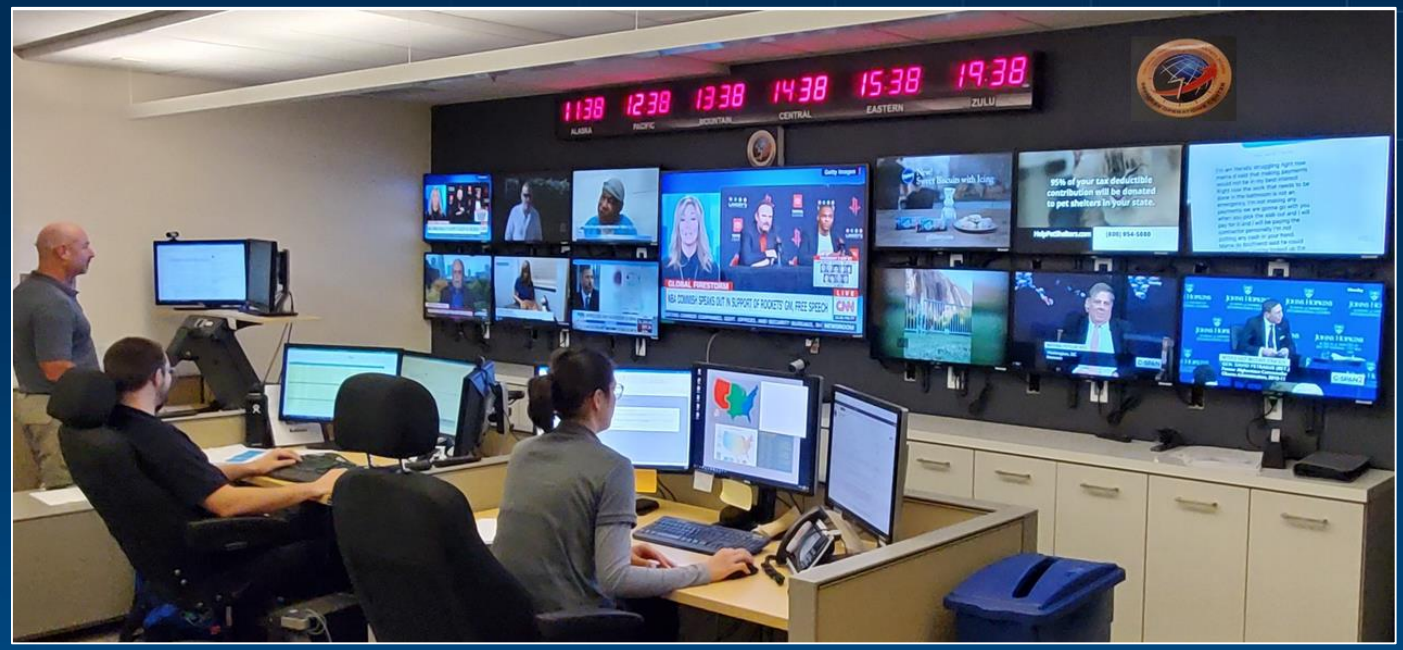
Highway Crash Notification

Criteria: (examples)

- Tier 1: urgent notification
  - CMV crash with 3+ fatalities
  - Bus crash with 1+ fatalities
  - Fatal AV/EV crash
- Tier 2: watch list
  - Grade crossing crash with bus
  - Crash during AV testing
- Tier 3: discretionary notification
  - Crash with highway issues and another mode



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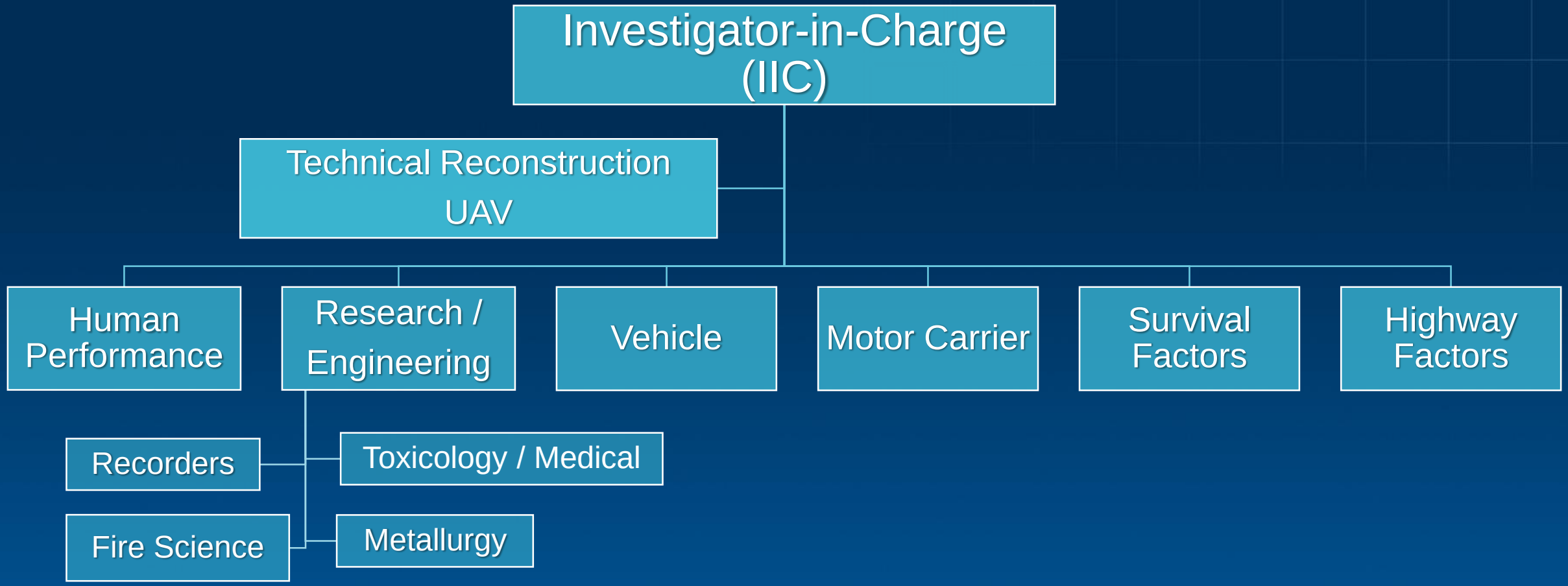
Multi-disciplinary Team Approach



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Parallel Safety Investigation

NTSB

- Safety investigation
- Party system
- Multidisciplinary team
- Subpoena authority
- Factual reports
- Board meeting
- Safety recommendations

Law Enforcement

- Criminal investigation
- State Attorney
- Reconstruction team
- Search/arrest warrants
- Criminal reports
- Court
- Prosecution

Authority

- An officer or employee of the NTSB may
  - Enter property where a transportation accident has occurred or wreckage from the accident is located and do anything necessary to conduct an investigation.
  - Inspect any record, process, control, or facility related to an accident investigation under this chapter.

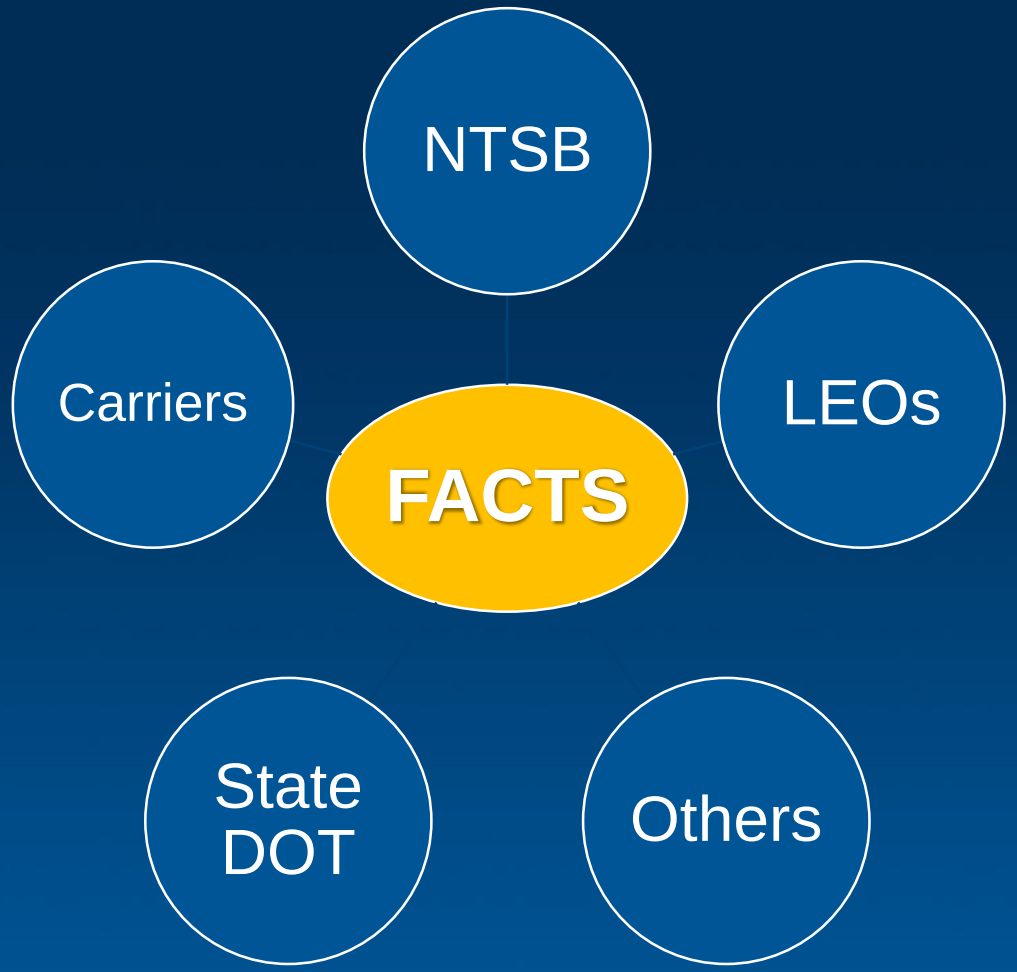
49 *CFR* §1134(a)(1) & (2)

False statement, concealment

- …Knowingly and willfully – falsifies, conceals, or covers up by any trick, scheme, or device a material fact…

18 *USC* § 1001

The Party Process



Typical parties

- Law enforcement (LEOs)
- State highway organizations
- Motor carriers
- Vehicle and component manufacturers
- Other federal agencies

NTSB Party System

- **Benefits**
- Technical expertise in proposed investigative area
- Participation in fact-finding phase (on-scene and post-on-scene)
- Opportunity to ensure complete and accurate factual record
- Access to factual information and ability to quickly initiate preventative or corrective actions
- Ability to submit proposed findings of facts, conclusions, and recommendations
- Knowledge of ongoing activities

NTSB Party System

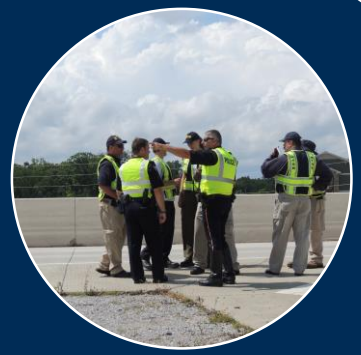
- **Responsibilities**
- Review of factual reports
- Sharing of information pertinent to the investigation
- Limitation on release of investigative information
- **Choice not to be a party**
- Possible access to very limited factual information
- Still must share pertinent information

Investigator-In-Charge (IIC)

Post-“on-scene” through end of investigation

- Primary contact for all aspects of investigation
- Overall coordination of investigation
- Preliminary report, Board Member briefing
- Work planning meeting
- Follow-up trips, component testing, tear-downs/exams
- Technical review of factual reports
- Public docket release
- Work with Project Manager on completion of final report and board meeting, if applicable

NTSB Investigative Process



On-scene Investigation

Organizational meeting

Groups and parties

Progress meetings

Press briefings

Preliminary Report

Within 10 days

Factual information

Technical Review

About 8 months

Group Chairmen factual reports reviewed by the parties

Docket Release

1 year

Party submissions

Board Meeting

Up to 2 years

Draft Report is presented

Findings adopted

Probable Cause

Safety Recommendations

Party submissions

Government in the Sunshine Act

NTSB

Highway Product Types

- Preliminary reports
- Investigative hearings
  - Example: East Palestine, OH – June 2023
- Highway Investigation Reports (HIR)
  - Board-adopted (sunshine meeting or electronic vote)
  - Director-approved, if delegated meeting or electronic vote
- Safety Alerts
- Meetings, roundtables, webinars
- Petition for reconsideration (49 *CFR* § 845.32)

Board Meeting

Public meeting in Washington, DC

Webcast

Staff presentations

Board deliberations

Official adoption of

- Report
- Findings
- Probable cause
- Recommendations

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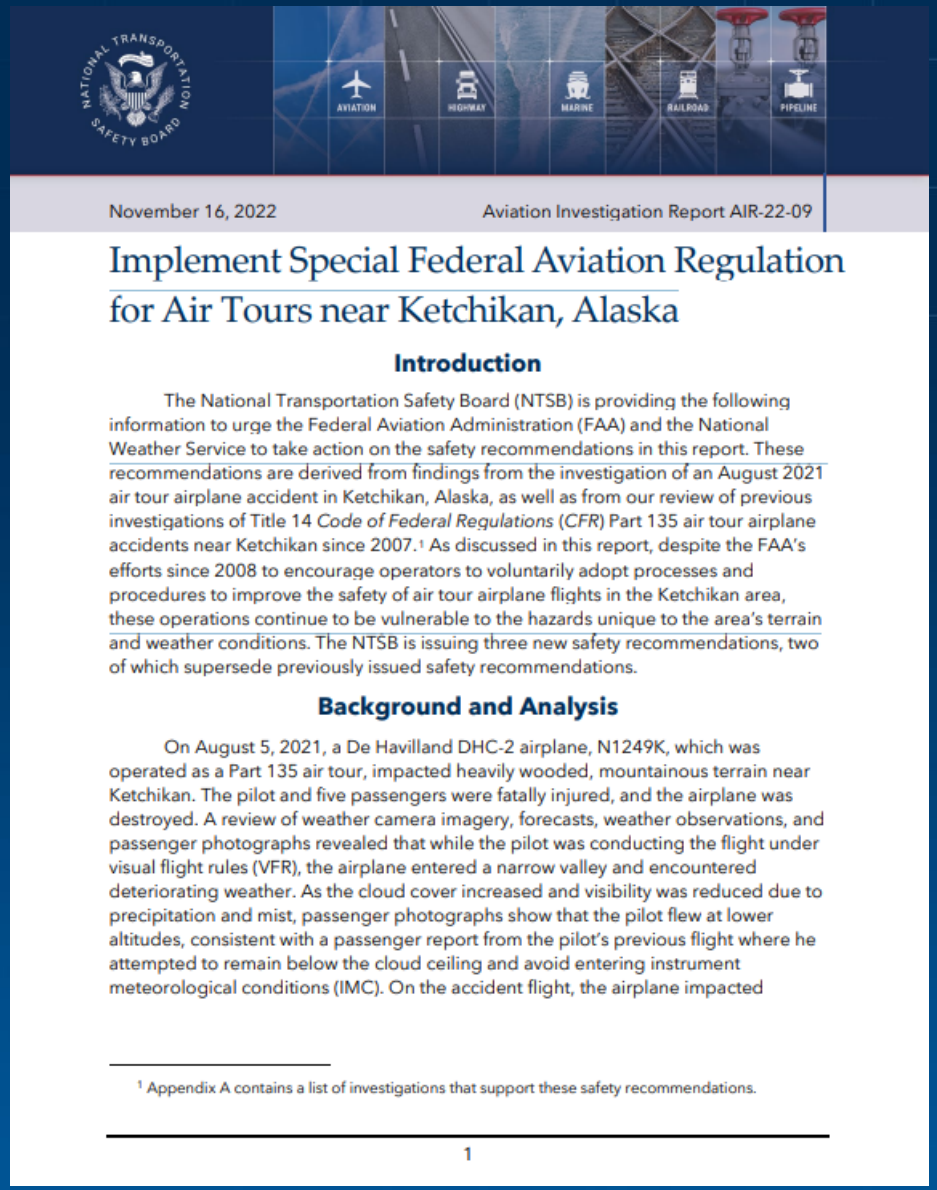
What Are Safety Recommendations?

- NTSB's most important product
- Based on findings from NTSB investigations
- Suggest a course of action to improve vehicle design and maintenance, operational procedures, policy, training, or any other safety issue identified
- Each recommendation's language, recipient, and justification are approved by the Board
- NTSB's "official" position on needed action



November 16, 2022 Aviation Investigation Report AIR-22-09

Implement Special Federal Aviation Regulation for Air Tours near Ketchikan, Alaska

Introduction

The National Transportation Safety Board (NTSB) is providing the following information to urge the Federal Aviation Administration (FAA) and the National Weather Service to take action on the safety recommendations in this report. These recommendations are derived from findings from the investigation of an August 2021 air tour airplane accident in Ketchikan, Alaska, as well as from our review of previous investigations of Title 14 *Code of Federal Regulations* (*CFR*) Part 135 air tour airplane accidents near Ketchikan since 2007.[1] As discussed in this report, despite the FAA's efforts since 2008 to encourage operators to voluntarily adopt processes and procedures to improve the safety of air tour airplane flights in the Ketchikan area, these operations continue to be vulnerable to the hazards unique to the area's terrain and weather conditions. The NTSB is issuing three new safety recommendations, two of which supersede previously issued safety recommendations.

Background and Analysis

On August 5, 2021, a De Havilland DHC-2 airplane, N1249K, which was operated as a Part 135 air tour, impacted heavily wooded, mountainous terrain near Ketchikan. The pilot and five passengers were fatally injured, and the airplane was destroyed. A review of weather camera imagery, forecasts, weather observations, and passenger photographs revealed that while the pilot was conducting the flight under visual flight rules (VFR), the airplane entered a narrow valley and encountered deteriorating weather. As the cloud cover increased and visibility was reduced due to precipitation and mist, passenger photographs show that the pilot flew at lower altitudes, consistent with a passenger report from the pilot's previous flight where he attempted to remain below the cloud ceiling and avoid entering instrument meteorological conditions (IMC). On the accident flight, the airplane impacted

[1] Appendix A contains a list of investigations that support these safety recommendations.

1

Two Parts to a Recommendation Classification

1. Action Completed?
   - In progress: Open
   - Completed: Closed
2. Did the action address the recommendation?
   - For both Open and Closed
     - **Acceptable**: Action fully addresses the recommendation
     - **Acceptable Alternate**: Achieves intent in an alternate manner
     - **Exceeds**: Goes beyond the intent of the recommendation
     - **Unacceptable**: Action does not fully achieve intent, or it is taking an unacceptably long time

2021–2023 NTSB MOST WANTED LIST OF TRANSPORTATION SAFETY IMPROVEMENTS

Require Collision-Avoidance and Connected-Vehicle Technologies on all Vehicles

Implement a Comprehensive Strategy to Eliminate Speeding-Related Crashes

Prevent Alcohol- and Other Drug-Impaired Driving

Eliminate Distracted Driving

Protect Vulnerable Road Users Through a Safe System Approach

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Promote Transportation Safety

- Investigators often present at
  - Conferences
  - Symposiums/roundtables
  - NTSB training classes
  - Peer training

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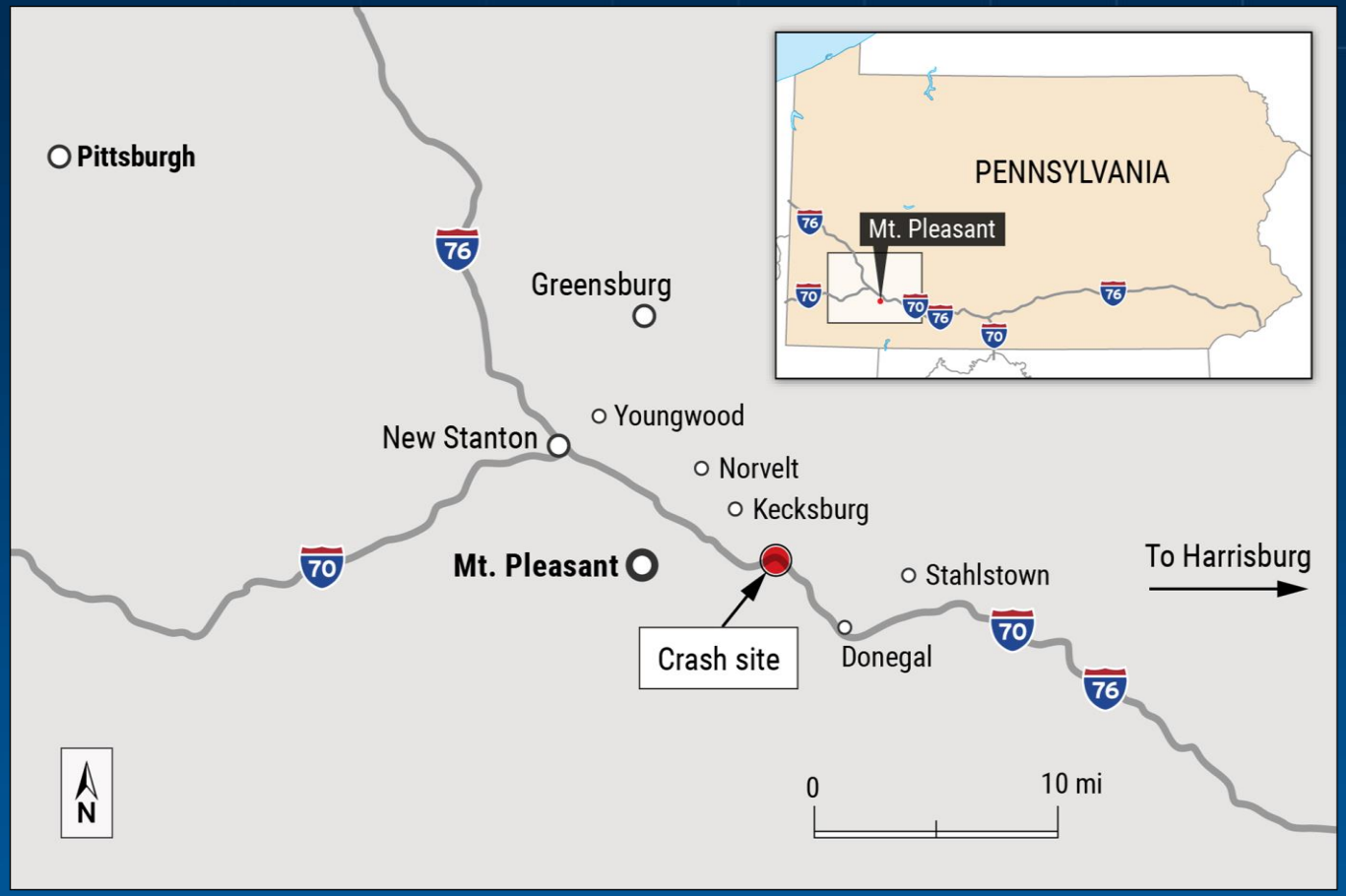
Multivehicle Crash
Mt. Pleasant Township, Pennsylvania

Crash Information and Location

- Interstate 70/76
  - Pennsylvania Turnpike
  - Curving mountainous section
  - 36 miles southeast of Pittsburgh
  - Mt. Pleasant Township



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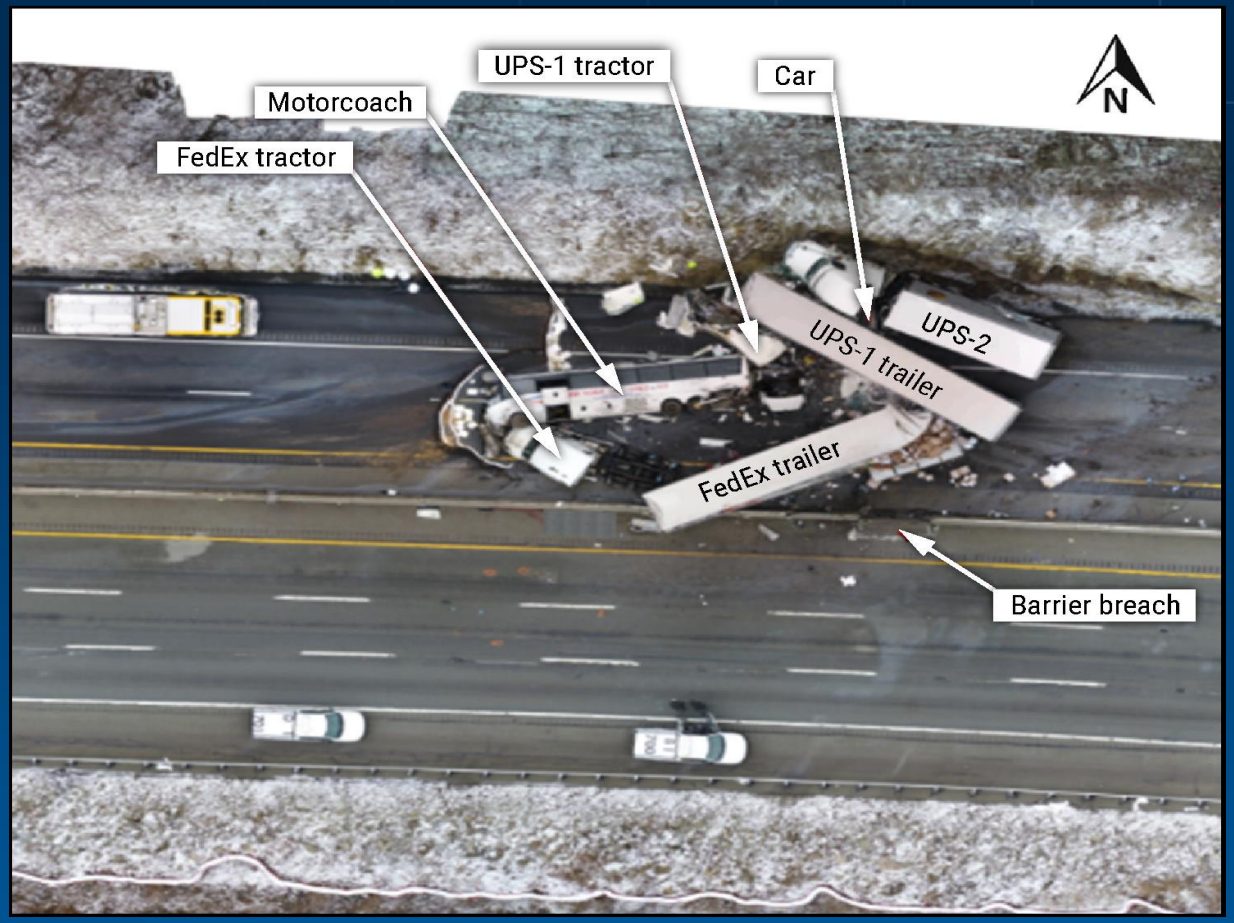
Crash Vehicles

- Final rest positions of vehicles
  - Motorcoach
  - FedEx tractor & trailer
  - UPS-1 tractor & trailer
  - Passenger car
  - UPS-2 tractor & trailer



Source: Pennsylvania State Police – NTSB overlay

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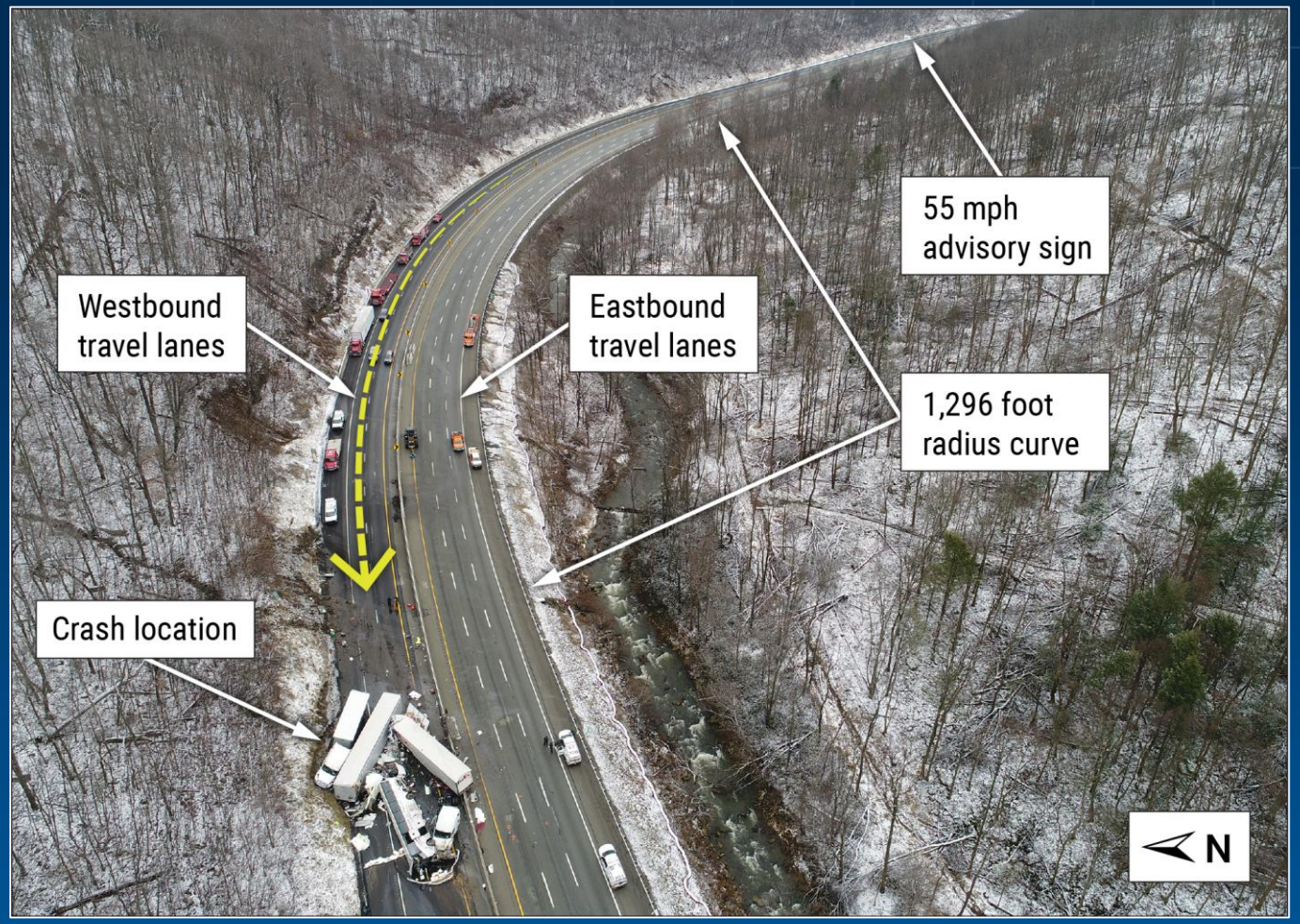
Crash Scene

- Vehicles at final rest
- Left-hand curve
- East and westbound lanes
- 55-mph warning sign



Source: Pennsylvania State Police – NTSB overlay

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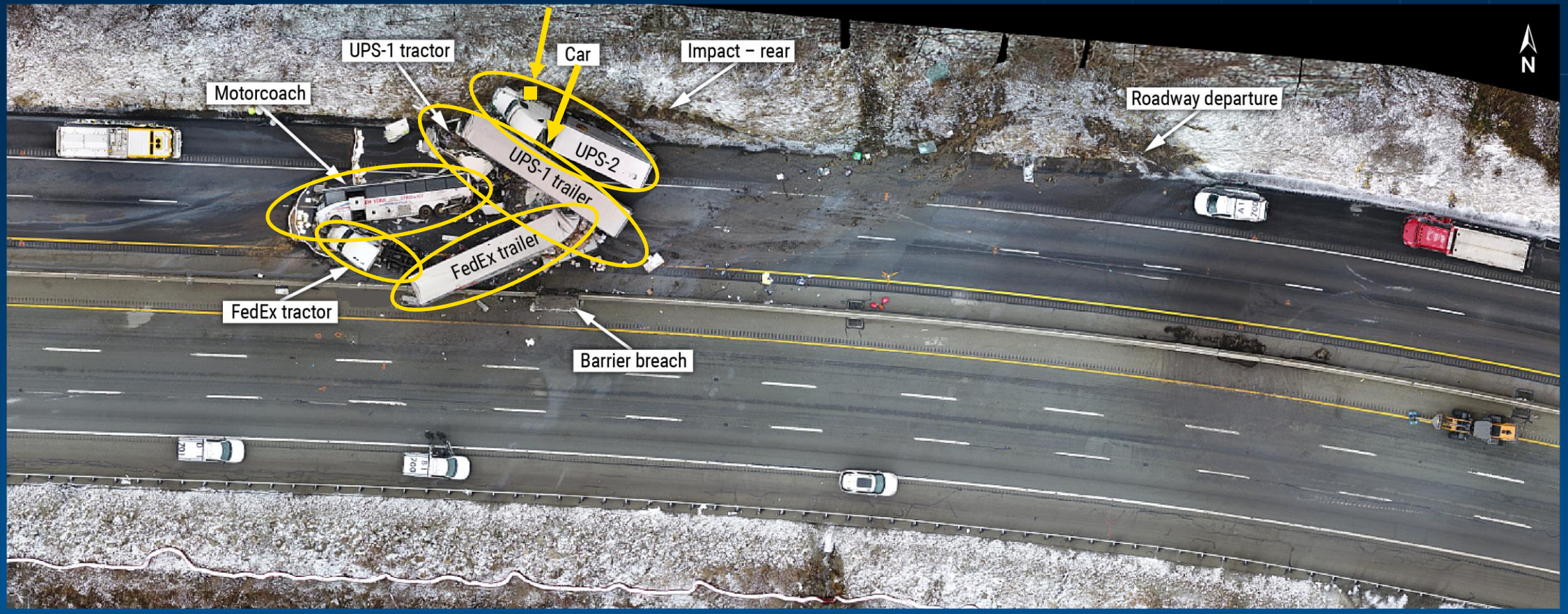
Vehicle Positions at Final Rest



Source: Pennsylvania State Police

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Parties to the Investigation

Federal Motor Carrier Safety Administration (FMCSA)

Pennsylvania State Police (PSP)

Pennsylvania Turnpike Commission (PTC)

United Parcel Service, Inc. (UPS)

FedEx Ground Package System, Inc. (FedEx)

Daimler Trucks North America

Injury Table

Occupants	Fatal	Injured	None	Unknown	Total
Motorcoach driver	1	--	--	--	1
Motorcoach passengers	2	49	2	6	59
FedEx driver	--	--	1	--	1
FedEx codriver	--	1	--	--	1
UPS-1 driver	1	--	--	--	1
UPS-1 codriver	1	--	--	--	1
UPS-2 driver	--	--	1	--	1
UPS-2 codriver	--	--	1	--	1
Car driver	--	--	1	--	1
Car passengers	--	--	2	--	2
TOTAL	5	50	8	6	69

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Safety Issues

- Commercial drivers' speeds while driving in wet conditions
- Forward collision avoidance systems and connected vehicle technology
- Onboard video event recorder systems

2005 Van Hool c2045 Motorcoach

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Overturned Motorcoach

Source: FedEx forward-facing video, annotated by NTSB

- Initial position of rest was blocking both travel lanes and shoulders
- Entered curve at 77 mph
- Light braking upon entering curve decreased speed to 70 mph
- After brakes released vehicle speed changes not associated with braking or throttle occurred
- Speed changes consistent with vehicle yawing from excessive steering inputs
- Sufficient roadway traction existed for normal travel

Motorcoach Crash Trip

- Departed NYC at 10:00 p.m.
- Scheduled arrival 4:15 a.m.
- 10 miles from destination
- Driving for 7 hours
- Unable to determine sleep

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Motorcoach Driver Background

- Experienced and properly licensed
  - 11 years of commercial driving experience
  - Class “A” commercial license, passenger endorsement, no restrictions
  - 2-year medical certification
- Previous excessive speed citation (September 2019)
- 2 previous minor crashes

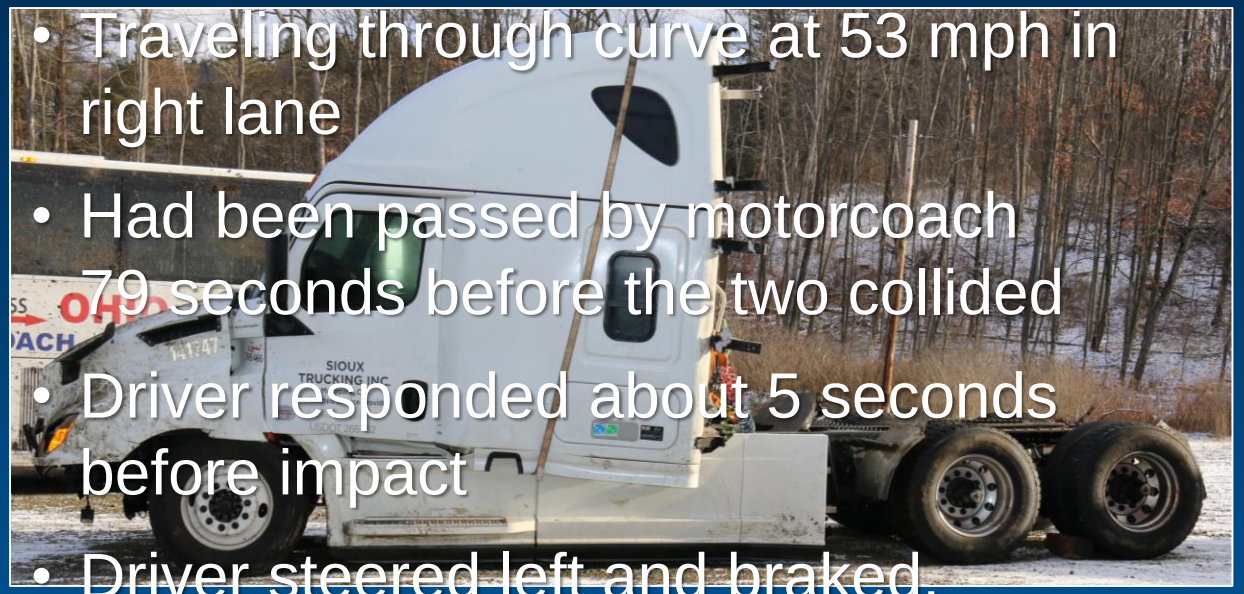
What We Found: *Motorcoach Driver*

- Traveling at excessive speed on wet roadway in descending curve
- Excessive speed, roadway conditions contributed to loss of control
- Driver likely made excessive steering inputs
- Likely use of engine brake contributed to loss of traction

FedEx Combination Unit

2018 Freightliner Cascadia

2019 53’ Hyundai Translead semitrailer



- Traveling through curve at 53 mph in right lane
- Had been passed by motorcoach 79 seconds before the two collided
- Driver responded about 5 seconds before impact
- Driver steered left and braked, impacted motorcoach at about 21 mph

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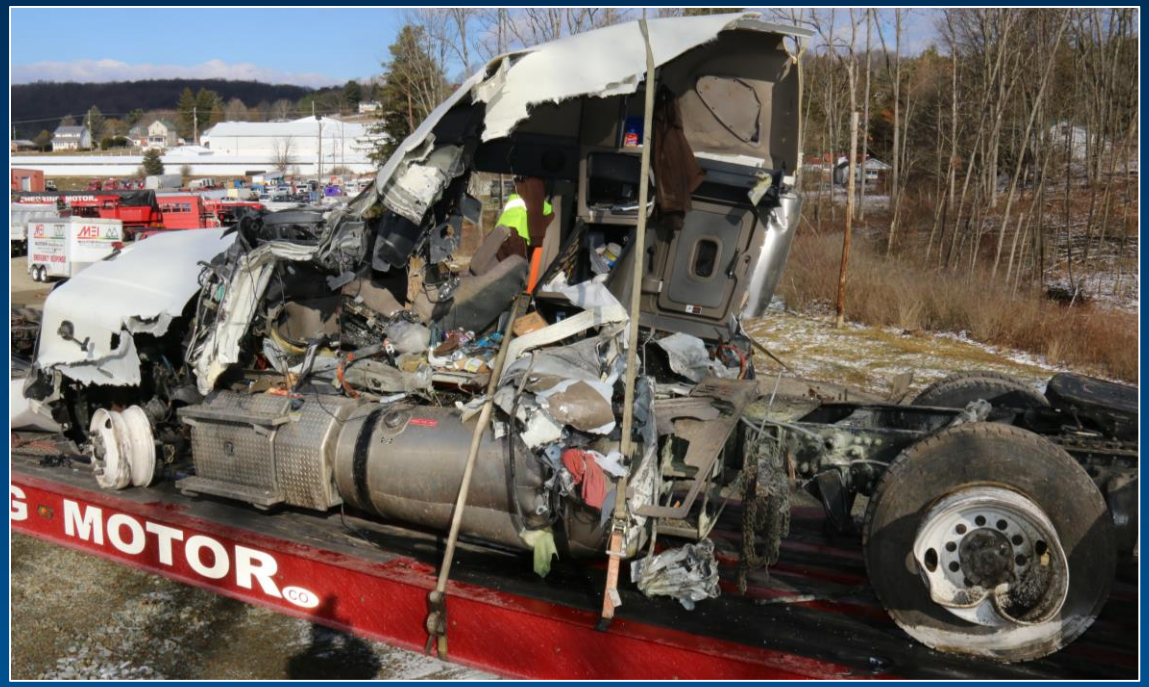
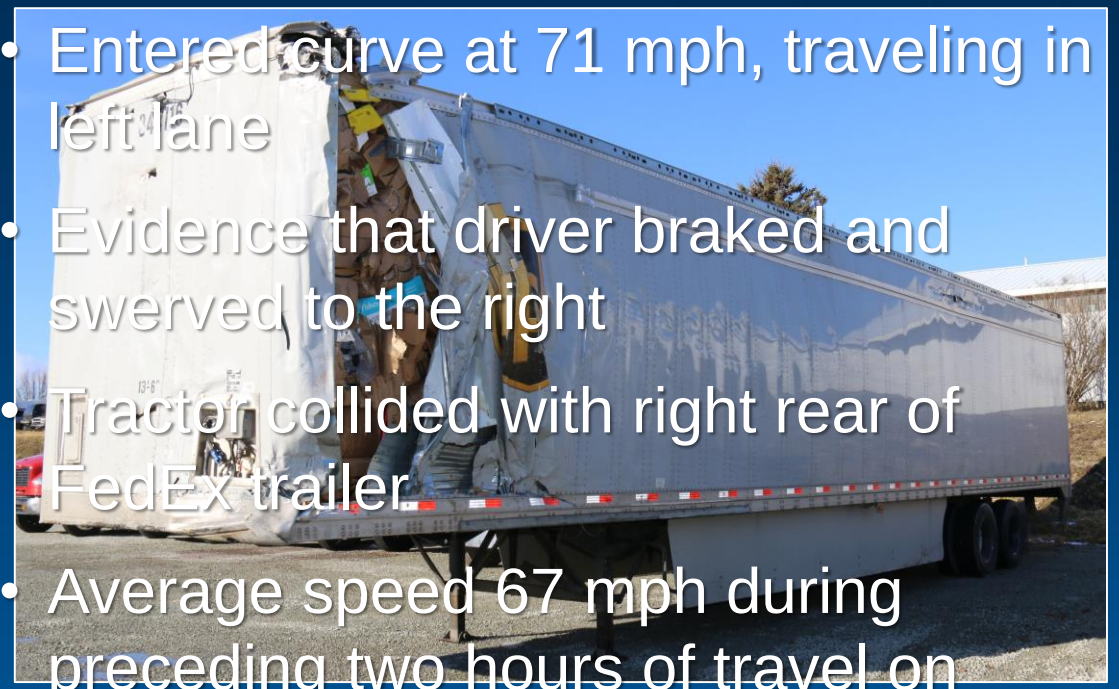
UPS-1 Combination Unit

2018 Freightliner Cascadia

2018 53’ Stoughton semitrailer





- Entered curve at 71 mph, traveling in left lane
- Evidence that driver braked and swerved to the right
- Tractor collided with right rear of FedEx trailer
- Average speed 67 mph during preceding two hours of travel on turnpike

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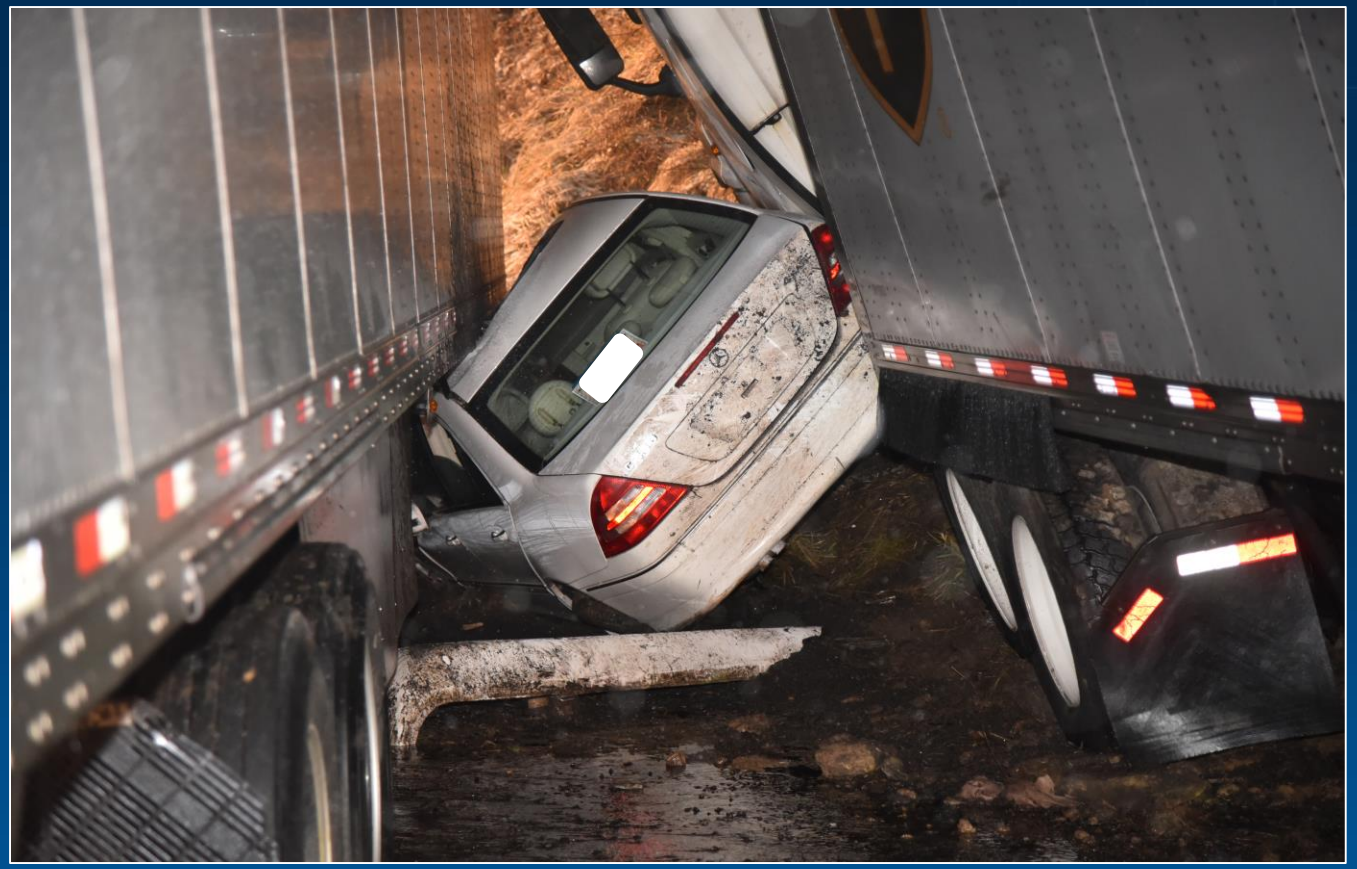
2007 Mercedes Benz C280



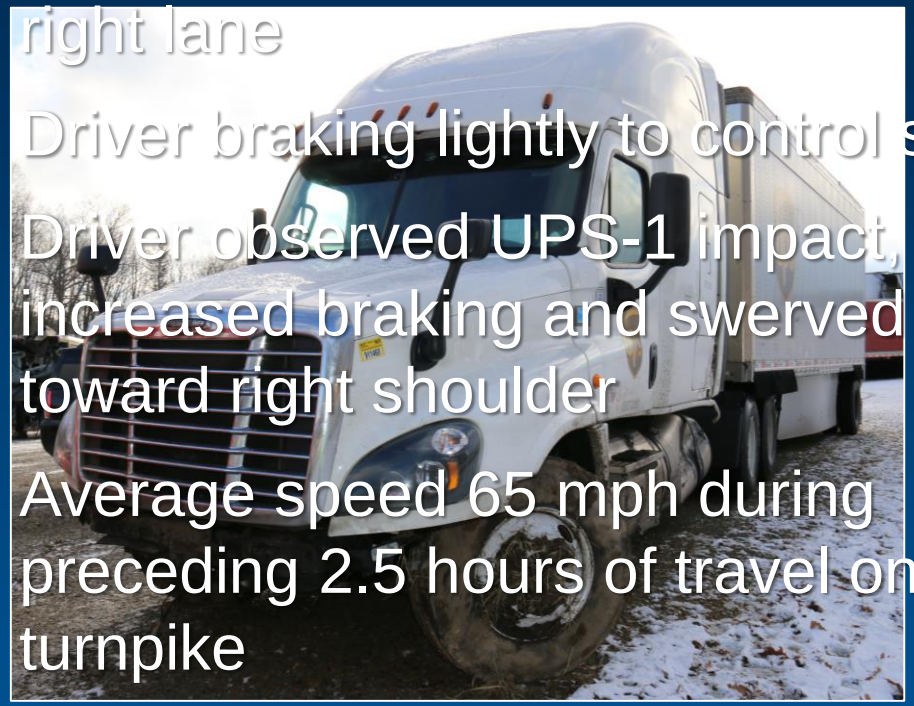
Source: Pennsylvania State Police

UPS-2 Combination Unit

2018 Freightliner Cascadia

2020 28.5’ Stoughton semitrailer

- Entered curve at 69 mph, traveling in right lane
- Driver braking lightly to control speed
- Driver observed UPS-1 impact, increased braking and swerved toward right shoulder
- Average speed 65 mph during preceding 2.5 hours of travel on turnpike



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Onboard Video Event Recorders

- FedEx truck video system provided key information:
  - Motorcoach speed and lane position when passing
  - Position and visibility of overturned motorcoach on roadway
  - FedEx driver reacted quickly to hazard
  - FedEx truck speed and crash severity

Source: FedEx forward-facing video

Lack of Data on Motorcoach

- Cause of motorcoach initial loss of control
- Driver performance including steering inputs and fatigue
- Engagement of engine brake

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What We Found: *Onboard Video Event Recorders*

- Forward- and inward-facing video event recorder system on the FedEx truck provided valuable information
- Video event recorder systems can provide key safety information about crash circumstances
- Video event recorder systems can be proactively used to improve driver performance
- What we propose:
  - One recommendation to the National Highway Traffic Safety Administration
  - One recommendation to the Federal Motor Carrier Safety Administration
  - One reiteration to the American Bus Association, United Motorcoach Association

Environmental Conditions

Source: Pennsylvania State Police

Driving in Adverse Weather Conditions

- 25% of speeding-related large-truck fatalities occurred in adverse weather (FARS)
- Adjust speed to safely match weather conditions
- Increase following distance
- Take curves at slower speeds and do not brake while in curves
- Avoid using engine brakes

FedEx Driver Response

- FedEx truck entered curve at 53 mph
- Driver steered to left, applied brake
- Driver reacted within 0.3 seconds
- FedEx truck slowed to 21 mph

Source: FedEx truck forward-facing video, annotated by NTSB

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UPS-1 Driver Response

- UPS-1 entered curve at 71 mph
- FedEx truck had begun slowing
- Driver applied brakes, steered right
- UPS-1 collision occurred at 56 mph

Source: Pennsylvania State Police, annotated by NTSB

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UPS-2 Driver Response

- UPS-2 entered curve at 69 mph
- UPS-2 3–5 seconds behind UPS-1
- Driver observed UPS-1 collision
- Driver applied brakes, steered right
- UPS-2 came to rest next to sedan

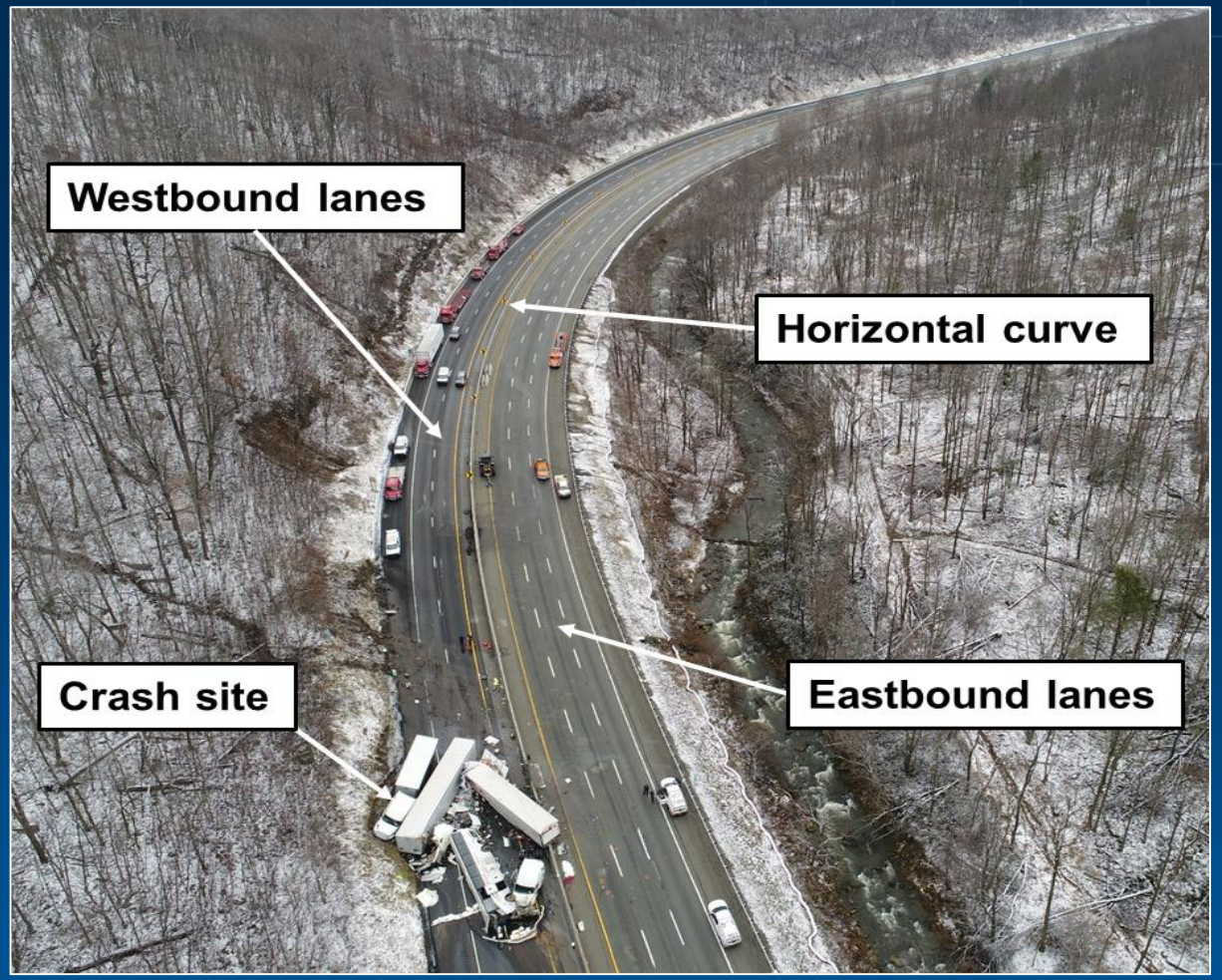
Source: Pennsylvania State Police, annotated by NTSB

What We Found: *FedEx and UPS Drivers' Responses*

- FedEx driver reduced speed on wet roadway, reduced crash severity
- UPS-1 driver's initial speed too fast for wet roadway conditions
  - Driver's braking attempt failed to reduce speed before impact
  - Contributed to severity of crash from impact speed
- UPS-2 driver had visual cues to warn of collisions ahead

Highway Characteristics

- Turnpike
  - Built in 1940
  - Numerous horizontal curves
  - Crash occurred in westbound lanes
- Horizontal curve
  - Downgrade slope of 3 percent
- Grooved rumble strips
- Resurfaced in September 2019



Source: Pennsylvania State Police

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Signage

- 38 signs installed along westbound lanes
- 5 dynamic message signs
- “Curves ahead” advisory speed sign with flashing beacons
  - Warn motorists to reduce speed to 55 mph, particularly at night
- Connected vehicle technology
  - Harrisburg Connected Project

Source: PTC

Source: PTC

NTSB

Speed Limits

- Regulatory 70 mph speed limit
  - Maximum speed on highway section, established by law, and is enforceable
  - 1,054 miles of straight sections
- Advisory 55 mph speed sign
  - Recommended safe speed for all vehicles, not enforceable
  - 150 horizontal curves (51 miles) for advisory speeds of 55, 60, 65 mph

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NTSB Investigations of Speeding-Relates Crashes

- Long history of investigating crashes involving speeding
  - 2003 motorcoach crash in Hewitt, Texas
  - 2017 safety study *Reducing Speeding-Related Crashes Involving Passenger Vehicles*
- NTSB's Most Wanted List
  - Critical safety issue since 2019
- Safe System Approach
  - Infrastructure solutions, behavioral solutions, vehicle-based solutions, and advanced technological solutions

What We Found: *Excessive Speeding*

- Excessive speeding near horizontal curves
- Variable speed limit signs are consistent with safe system approach of providing safe speeds
- De-emphasize 85th percentile speed used in FHWA's tools, USLIMITS2 and NCHRP 966, to set appropriate speed limits

Z&D Tour Inc. (USDOT 2313334)

- Rockaway, New Jersey
- Owned 8 motorcoaches, employed 8 drivers
- No alerts in Behavior Analysis and Safety Improvement Categories (BASICs)
- 58-year-old male driver, Class A New York CDL

FedEx Ground Package System Inc. (USDOT 265752)

- Moon Township, Pennsylvania
- Leases about 66,500 vehicles, 91,800 drivers
- Sioux Trucking
  - 35-year-old male, California Class A CDL
- Alerts in BASICs for Hours of Service and Driver Fitness

United Parcel Service Inc. (USDOT 21800)

- Atlanta, Georgia
- About 126,000 trucks, 118,000 drivers
- UPS-1 Driver: 52-year-old male, Pennsylvania Class A CDL
- UPS-2 Driver: 62-year-old male, New Jersey Class A CDL

Maintenance Issues

- UPS Truck 1 – misaligned radar sensor
- Error code and warning since June 2019
  - Detected by Penske in July 2019
  - Noted several times on maintenance records
  - No Driver Vehicle Inspection Report (DVIR) entry by driver

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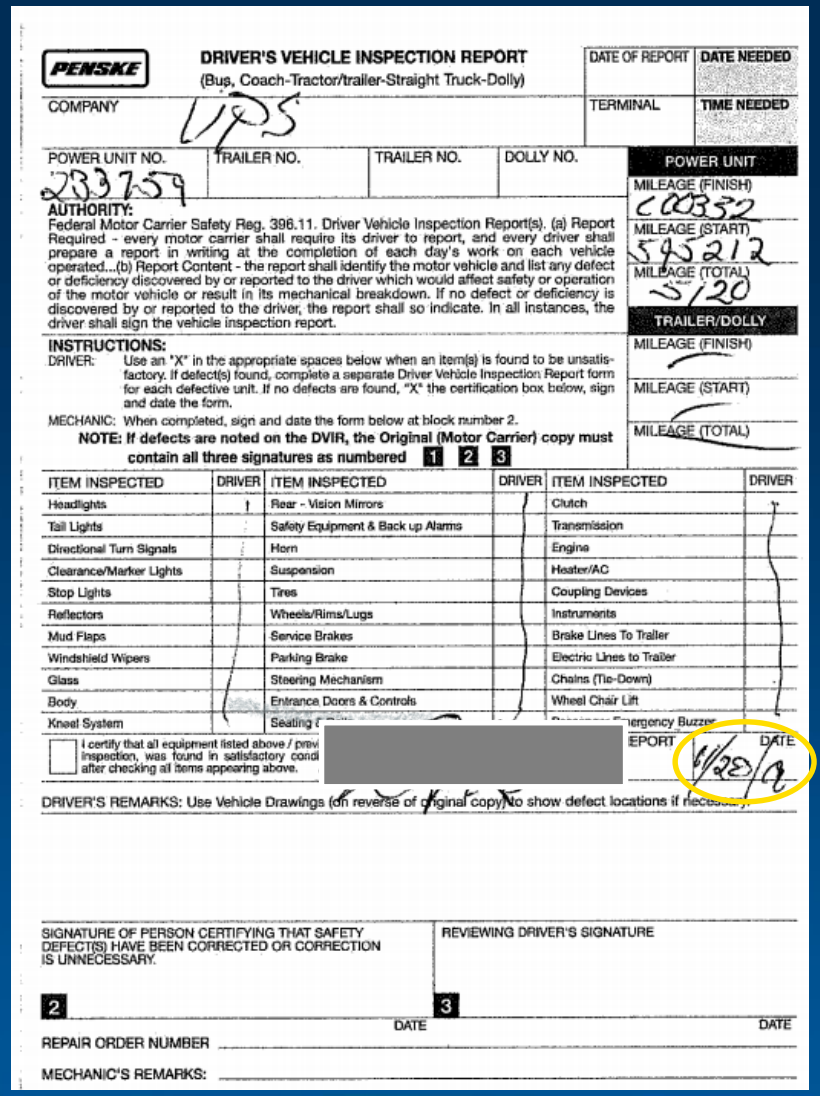
Driver Vehicle Inspection Reports from UPS Truck 1



PENSKE

DRIVER'S VEHICLE INSPECTION REPORT
(Bus, Coach-Tractor/trailer-Straight Truck-Dolly)

DATE OF REPORT	DATE NEEDED
TERMINAL	TIME NEEDED

COMPANY: UPS

POWER UNIT NO.	TRAILER NO.	TRAILER NO.	DOLLY NO.
233759			

AUTHORITY:
Federal Motor Carrier Safety Reg. 396.11. Driver Vehicle Inspection Report(s). (a) Report Required - every motor carrier shall require its driver to report, and every driver shall prepare a report in writing at the completion of each day's work on each vehicle operated...(b) Report Content - the report shall identify the motor vehicle and list any defect or deficiency discovered by or reported to the driver which would affect safety or operation of the motor vehicle or result in its mechanical breakdown. If no defect or deficiency is discovered by or reported to the driver, the report shall so indicate. In all instances, the driver shall sign the vehicle inspection report.

INSTRUCTIONS:
DRIVER: Use an "X" in the appropriate spaces below when an item(s) is found to be unsatisfactory. If defect(s) found, complete a separate Driver Vehicle Inspection Report form for each defective unit. If no defects are found, "X" the certification box below, sign and date the form.
MECHANIC: When completed, sign and date the form below at block number 2.
NOTE: If defects are noted on the DVIR, the Original (Motor Carrier) copy must contain all three signatures as numbered 1 2 3

POWER UNIT	
MILEAGE (FINISH)	600352
MILEAGE (START)	595212
MILEAGE (TOTAL)	5120

TRAILER/DOLLY	
MILEAGE (FINISH)	
MILEAGE (START)	
MILEAGE (TOTAL)	

ITEM INSPECTED	DRIVER	ITEM INSPECTED	DRIVER	ITEM INSPECTED	DRIVER
Headlights	✓	Rear - Vision Mirrors		Clutch	
Tail Lights		Safety Equipment & Back up Alarms		Transmission	
Directional Turn Signals		Horn		Engine	
Clearance/Marker Lights		Suspension		Heater/AC	
Stop Lights		Tires		Coupling Devices	
Reflectors		Wheels/Rims/Lugs		Instruments	
Mud Flaps		Service Brakes		Brake Lines To Trailer	
Windshield Wipers		Parking Brake		Electric Lines to Trailer	
Glass		Steering Mechanism		Chains (Tie-Down)	
Body		Entrance Doors & Controls		Wheel Chair Lift	
Kneel System		Seating / [redacted]		[redacted]ergency Buzzer	

☐ I certify that all equipment listed above / prev[redacted] inspection, was found in satisfactory cond[redacted] after checking all items appearing above. [redacted] EPORT DATE 4/28/15

DRIVER'S REMARKS: Use Vehicle Drawings (on reverse of original copy) to show defect locations if nec[redacted]

SIGNATURE OF PERSON CERTIFYING THAT SAFETY DEFECT(S) HAVE BEEN CORRECTED OR CORRECTION IS UNNECESSARY.

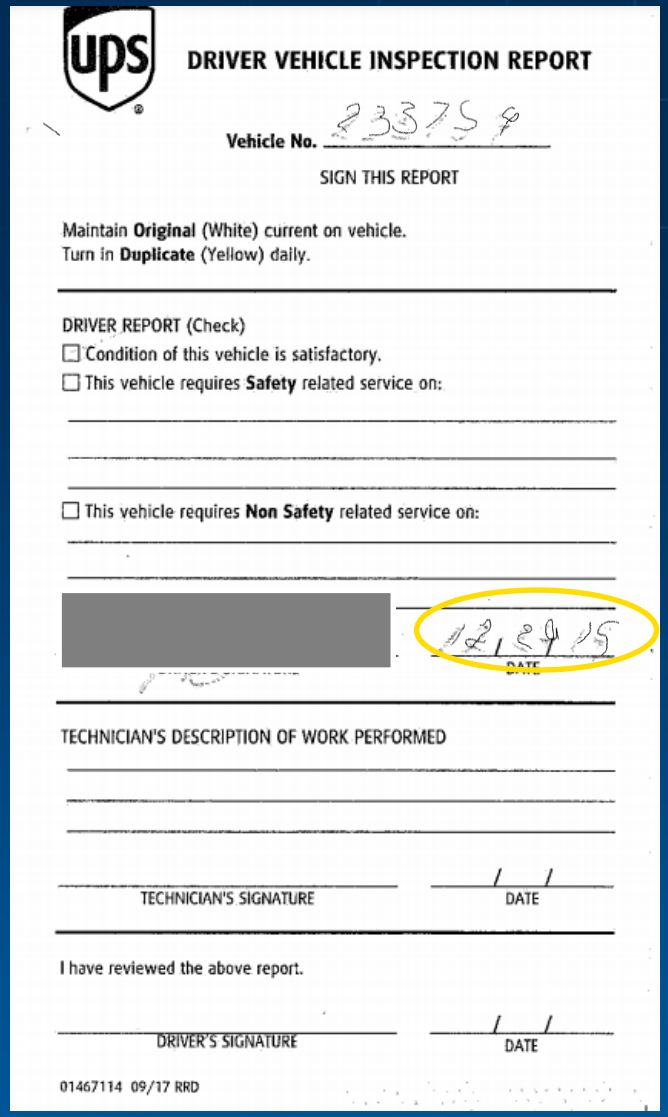
2 _____ DATE

REVIEWING DRIVER'S SIGNATURE

3 _____ DATE

REPAIR ORDER NUMBER _____

MECHANIC'S REMARKS: _____



ups

DRIVER VEHICLE INSPECTION REPORT

Vehicle No. 233759

SIGN THIS REPORT

Maintain **Original** (White) current on vehicle.
Turn in **Duplicate** (Yellow) daily.

DRIVER REPORT (Check)

☐ Condition of this vehicle is satisfactory.

☐ This vehicle requires **Safety** related service on:

☐ This vehicle requires **Non Safety** related service on:

[redacted] 4/28/15
DATE

TECHNICIAN'S DESCRIPTION OF WORK PERFORMED

TECHNICIAN'S SIGNATURE _____ DATE / /

I have reviewed the above report.

DRIVER'S SIGNATURE _____ DATE / /

01467114 09/17 RRD

NTSB

Postcrash Actions

- Penske
  - Places vehicle with Forward Collision Avoidance System defects out of service
  - Lessor receives notification email
  - Between May 2020 and December 2021, over 6,300 vehicles affected
- UPS
  - Changed driver training
  - Changed check ride form to account for advanced safety systems

What We Found: *Reporting Nonfunctional Safety Systems*

- Maintaining the full functionality of installed collision avoidance systems is critical to vehicle safety
- If drivers report defects or faults in collision avoidance system, repairs can be made more readily, improving safety

Forward Collision Avoidance Systems (CAS)

- Three Freightliner truck-tractors were equipped with forward CAS
  - Not functioning on UPS-1
  - FedEx and UPS-2 did not activate precrash
- CAS: audible warning, automatic emergency braking (AEB)
- Designed to mitigate or prevent rear-end crashes
- Performance affected by
  - Generational capabilities
  - Roadway and crash parameters

Forward CAS: Standards and Testing

- No federal performance standards for CAS in heavy vehicles
- NHTSA proposed testing protocols in 2019
  - No pass/fail criteria
  - Maximum tested speed of 45 mph
  - Straight roadway, clear weather
  - Rear of a passenger vehicle as the only target
- Parameters of this crash were likely beyond NHTSA's proposed testing protocols

What We Found: *Collision Avoidance Systems*

- Parameters in the Mt. Pleasant Township crash beyond proposed system capabilities and proposed federal test procedures
- Voluntary installation and use of forward CAS and AEB in heavy vehicles by manufacturers and operators

Probable Cause

The National Transportation Safety Board determines that the probable cause of the crash near Mt. Pleasant Township, Pennsylvania, was the motorcoach driver's loss of control due to the motorcoach's unsafe speed on the wet curve and the driver's likely excessive steering inputs, which caused the motorcoach to run off the road, strike an embankment, and subsequently roll over across the roadway, which led to two commercial trucks colliding with the motorcoach. Contributing to the severity of the crash was the high initial and impact speed of the second truck.

NTSB Lessons Learned

- Have a quality hiring process
  - Background check
  - Long license look back
- Have policies
  - Follow them
  - Hold people accountable
- How much are you willing to risk?

- Talk about issues
  - Review videos
  - Coach
  - Reward/Punish

- Fatigue
- Speed
- Unsafe Driving
- Video

At the end of the day, you can have all the policies and procedures in the world. But it comes down to your driver when they are all alone…

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