

NATIONAL TRANSPORTATION SAFETY BOARD



**NTSB** | 2022 ANNUAL REPORT TO CONGRESS



2022

**NTSB**

National  
Transportation  
Safety Board

ANNUAL REPORT  
TO CONGRESS



# NTSB

National  
Transportation  
Safety Board



## On the Cover

NTSB investigators David Pereira (*left*) and Eric Gregson (*right*) deploy a drone at the site of the January 28, 2022, Fern Hollow Bridge collapse in Pittsburgh, Pennsylvania. At the time of collapse, an articulated bus and four passenger vehicles were on the bridge. A fifth vehicle drove off the abutment following the collapse.

BEST PLACES TO WORK  
IN THE FEDERAL GOVERNMENT



**PARTNERSHIP  
FOR PUBLIC SERVICE**



# Contents







Abbreviations, Acronyms, and Initialisms	4	Office of Railroad, Pipeline and Hazardous Materials Investigations	39
Table of Tables	4	Railroad Investigation Reports	40
On the Cover	5	Ongoing Significant Railroad Investigations	42
Chair’s Message	7	Pipeline Investigation Reports	43
Who We Are and What We Do	8	Ongoing Significant Pipeline Investigations	44
History	8	Hazardous Materials Investigative Reports	44
Role in Transportation Safety	8	Ongoing Significant Hazardous Materials Accident Investigation	45
Our Mission	9	NTSB Safety Summits	45
Our Core Values	9	Other Significant Achievements	45
Legislative Mandate	9	Office of Research and Engineering	46
Strategic Goals and Objectives	9	Safety Research Division	46
Organization and Program Structure	10	Materials Laboratory Division	47
2020–2023 NTSB Most Wanted List of Transportation Safety Improvements	14	Vehicle Recorder Division	47
Office of Aviation Safety	18	Vehicle Performance Division	47
Investigation Reports	19	Program Area: Medical Investigations	48
Ongoing Significant Aviation Accident and Incident Investigations <sup>1</sup>	22	Completed Safety Research Reports	48
International Investigations	22	Other Significant Achievements	48
US Comments on Foreign Accident Reports	23	Office of Safety Recommendations and Communications	49
Other Significant Achievements	24	Safety Recommendations Division	49
Office of Highway Safety	25	Media Relations Division	51
Investigation Reports	26	Government and Industry Affairs Division	51
Ongoing Significant Highway Investigation	29	Safety Advocacy Division	52
Public Roundtables, Safety Summits, Video Series, and Webinars	29	Digital Services Division	52
Other Significant Achievements	30	Office of Administrative Law Judges	53
Office of Marine Safety	31	Office of Human Capital Management and Training	54
Investigation Reports	32	Other Significant Achievements	55
Ongoing Significant Marine Investigations	36	Transportation Disaster Assistance Division	56
International Investigations	38		
Support to Foreign Investigations	38		
Other Significant Achievements	38		

<sup>1</sup> Ongoing investigations are those that, as of December 31, 2022, were not yet completed. Any completed as of June 30, 2023, are noted in this report. Additional updates will be provided in the 2023 Annual Report.

## Abbreviations, Acronyms, and Initialisms

ABA	American Bus Association	GICW	Gulf Intracoastal Waterway	SEPTA	Southeastern Pennsylvania Transportation Authority
ADS-B	automatic dependent surveillance broadcast	HR	vessel registration code for Croatia	SIS	substantially interested State
ALE	Alabama Export Railroad	ICAO	International Civil Aviation Organization	SLD	supercooled large droplet
ANSI	American National Standards Institute	ILI	in-line inspection	SMS	safety management system
BAC	blood alcohol concentration	IM	integrity management	SPV	small passenger vessel
BS	vessel registration code for the Bahamas	IMC	instrument meteorological conditions	SUV	sport utility vehicle
CAS	collision avoidance system	IMO	International Maritime Organization	TV	towing vessel
CFR	<i>Code of Federal Regulations</i>	JST	Junta de Seguridad en el Transporte (Argentine equivalent of the NTSB)	UAV	unmanned aerial vehicle (drone)
CH	vessel registration code for Switzerland	LB	lift boat	UMA	United Motorcoach Association
CMV	commercial motor vehicle	LR	vessel registration code for Liberia	UP	Union Pacific Railroad
CO	carbon monoxide	MAIIF	Marine Accident Investigators' International Forum	USCGC	US Coast Guard cutter
COVID-19	the coronavirus disease of 2019	MBTA	Massachusetts Bay Transportation Authority	US DOT	US Department of Transportation
CP	Canadian Pacific Railway	MH	vessel registration code for the Marshall Islands	V2X	vehicle-to-everything (connected vehicle)
CPUC	California Public Utilities Commission	MV	motor vessel	VC	vessel registration code for St. Vincent and the Grenadines
CSX	CSX Transportation	MWL	NTSB Most Wanted List of Transportation Safety Improvements	VFR	visual flight rules
CTAF	common traffic advisory frequency	NASA	National Aeronautics and Space Administration	VRU	vulnerable road user
CVR	cockpit voice recorder	NHTSA	National Highway Traffic Safety Administration	WMATA	Washington Metropolitan Area Transit Authority
CY	vessel registration code for Cyprus	NL	vessel registration code for the Netherlands		
DUKW	(pronounced "duck") amphibious passenger vessel	NO	vessel registration code for Norway		
EAIB	Ethiopia Accident Investigation Bureau	NTSB	National Transportation Safety Board		
ECS	electronic chart system	OSV	offshore supply vessel		
EPIRB	emergency-position-indicating radio beacon	PHMSA	Pipeline and Hazardous Materials Safety Administration		
FAA	Federal Aviation Administration	PLB	personal locator beacon		
FCC	Federal Communications Commission	PN	vessel registration code for the Philippines		
FDR	flight data recorder	PSMS	pipeline safety management system		
FDM	flight data monitoring	PT	vessel registration code for Portugal		
FHWA	Federal Highway Administration	PTF	Pipeline Task Force		
FMCSA	Federal Motor Carrier Safety Administration	SacRT	Sacramento Regional Transit District		
FRA	Federal Railroad Administration				
FTA	Federal Transit Administration				
FV	fishing vessel				
GAO	Government Accountability Office				

### NTSB on Social Media

-  [www.twitter.com/ntsb](https://www.twitter.com/ntsb)
-  [www.instagram.com/ntsbgov](https://www.instagram.com/ntsbgov)
-  [www.facebook.com/ntsbgov](https://www.facebook.com/ntsbgov)
-  [www.youtube.com/user/ntsbgov](https://www.youtube.com/user/ntsbgov)
-  [www.flickr.com/ntsb](https://www.flickr.com/ntsb)
-  [www.linkedin.com/company/ntsb](https://www.linkedin.com/company/ntsb)

## Table of Tables

1.	2022 NTSB Safety Statistics at a Glance . . . . .	13
2.	Office of Aviation Safety Statistics . . . . .	18
3.	Ongoing Significant Aviation Investigations . . . . .	22
4.	Office of Highway Safety Statistics . . . . .	25
5.	Ongoing Significant Highway Investigations . . . . .	29
6.	Office of Marine Safety Statistics . . . . .	31
7.	Office of Marine Safety Ongoing Significant Investigations . . . . .	36
8.	Support to Foreign Marine Investigations . . . . .	38
9.	Office of Railroad, Pipeline and Hazardous Materials Investigations Statistics . . . . .	39
10.	Ongoing Significant Railroad Investigations . . . . .	43
11.	Ongoing Significant Pipeline Investigations . . . . .	45
12.	Ongoing Significant Hazardous Materials Accident Investigation . . . . .	46
13.	Office of Research and Engineering Safety Statistics . . . . .	47
14.	Office of Safety Recommendations and Communications Statistics . . . . .	50
15.	Safety Recommendations Issued to the US DOT, Modal Agencies, and the US Coast Guard Closed in 2022 . . . . .	51
16.	Open Safety Recommendations Referenced in NTSB Responses to <i>Federal Register</i> Notices from Federal Agencies in 2022 . . . . .	51
17.	NTSB Media Mentions . . . . .	52
18.	Safety Advocacy Division Social Media Followers, Connections, and Subscribers . . . . .	53
19.	Safety Advocacy Division Products and Events . . . . .	53
20.	Office of Administrative Law Judges Statistics . . . . .	54
21.	Career Development and Training Statistics . . . . .	55
22.	Transportation Disaster Assistance Statistics . . . . .	57

## Table of Figures

1.	President Lyndon Johnson signing legislation creating the NTSB . . . . .	8
2.	NTSB Board members . . . . .	10
3.	NTSB organization chart . . . . .	11
4.	NTSB regions . . . . .	12
5.	Separated helicopter tail boom at the accident site . . . . .	19
6.	Detail of horizontal stabilizer actuator of accident airplane in Mutiny Bay . . . . .	20
7.	Parking brake pull knob in a Cessna 560XL . . . . .	20
8.	Piper PA-12 and De Havilland DHC-2 after midair collision in Soldotna, Alaska . . . . .	21
9.	Box truck and SUV following crash in Searchlight, Nevada . . . . .	26
10.	Final resting positions of truck and school bus in Decatur, Tennessee . . . . .	26
11.	3D point cloud depiction of vehicles that collided in Avenal, California . . . . .	27
12.	Arlington, Wisconsin, multivehicle crash . . . . .	27
13.	Multivehicle crash near Mt. Pleasant Township, Pennsylvania . . . . .	28
14.	Capsized <i>SEACOR Power</i> . . . . .	32
15.	<i>Commodore</i> before casualty occurred . . . . .	33
16.	Aerial photo of postcollision derailment . . . . .	33
17.	<i>Blue Dragon</i> underway before fire . . . . .	34
18.	<i>Emmy Rose</i> underway before casualty . . . . .	34
19.	Side scan sonar image of <i>Emmy Rose</i> . . . . .	34
20.	<i>Roger Blough</i> during firefighting efforts . . . . .	35
21.	Damaged <i>Ocean Princess</i> after casualty . . . . .	35
22.	<i>Wenatchee</i> underway before casualty . . . . .	35
23.	Collision between <i>Cheramie Bo-Truck No. 33</i> and <i>Harry Claiborne</i> . . . . .	36
24.	CSX Transportation derailment in Draffin, Kentucky . . . . .	40
25.	Union Pacific Railroad derailment in Tempe, Arizona . . . . .	41
26.	Railcars involved in Baltimore, Maryland, fatality . . . . .	42
27.	Maintenance equipment and striking train involved in Prichard, Alabama, fatal collision . . . . .	42
28.	Caltrain passenger train collision with maintenance trucks in San Bruno, California . . . . .	43
29.	Inspection of Metro track in Arlington, Virginia, tunnel . . . . .	43
30.	Amtrak train derailment near Joplin, Montana . . . . .	43
31.	Ruptured pipeline in Hillsboro, Kentucky . . . . .	44
32.	Containment booms on Cahokia Creek in Illinois . . . . .	45
33.	Pipeline explosion in Coolidge, Arizona . . . . .	45
34.	Farm vehicles and equipment involved in Beach Park, Illinois, gas release . . . . .	45
35.	Firefighters working to close nurse tank valves . . . . .	45
36.	BNSF derailment and fire in Oklaunion, Texas . . . . .	46
37.	Metallurgist documenting damage to bridge legs . . . . .	48
38.	Metallurgist cutting samples from weldment . . . . .	48
39.	Recorder specialist examining avionics . . . . .	48
40.	Public affairs officer recording media briefing . . . . .	52
41.	NTSB staff promoting aviation safety . . . . .	52
42.	Safety Advocacy Division chief at press conference . . . . .	53
43.	Social media graphic . . . . .	53





# Chair's Message



Chair Jennifer Homendy

I am honored to present the *2022 Annual Report to Congress* for the National Transportation Safety Board (NTSB). Since 1967, the agency has been at the forefront of transportation safety and has been recognized internationally for our investigation expertise. All told, the NTSB has conducted more than 153,000 aviation-related investigations and thousands of highway, transit, marine, rail, pipeline, and commercial space investigations, resulting in more than 15,300 safety recommendations.

In 2022, we continued to accomplish our strategic goals of ensuring our preparedness for investigations involving emerging transportation technologies and systems, improving processes and products, and optimizing organizational effectiveness and efficiency.

We reduced the number of open aviation investigations over 2 years old from 442 in February 2022 to 45 by the end of the year and **executed a memorandum of agreement with the FAA on commercial space mishap investigations**. We also issued 1,864 investigation reports, including these:

- **Multivehicle Crash Near Mount Pleasant, Pennsylvania**
- **Collision Between Service Vehicle and School Bus, Decatur, Tennessee**
- **Enbridge Inc. Natural Gas Pipeline Rupture, Danville, Kentucky**
- **Union Pacific Railroad Freight Train Derailment, Hazardous Material Release and Fire, Tempe, Arizona**
- **Collision into Terrain, Safari Aviation Inc., Airbus AS350 B2, Kekaha, Hawaii**
- **Sinking of Commercial Fishing Vessel *Emmy Rose*, Provincetown, Massachusetts**

We completed two safety research reports: *Alcohol, Other Drug, and Multiple Drug Use Among Drivers* and *Micromobility: Data Challenges Associated with Assessing the Prevalence and Risk of Electric Scooter and Electric Bicycle Fatalities and Injuries*. We also released investigation reports addressing our concerns about the lack of carbon monoxide detectors on certain general aviation aircraft and the importance of communication within common traffic advisory frequency areas in Alaska, among other topics.

Once we make safety recommendations, we fight for their implementation. We extended our **Most Wanted List of Transportation Safety Improvements** (MWL) through 2023, identifying 175 such recommendations that, when acted on, will reduce the number and severity of injuries and save lives.

When the National Highway Traffic Safety Administration (NHTSA) requested comments on ways to improve the New Car Assessment Program (NCAP), we laid out **NHTSA's inaction on recommendations to date** and specified needed changes. In all, we responded to 11 notices of proposed rulemakings in 2022, 9 of which affected highway transportation, from NCAP improvements, to speed-limiting devices, to protecting the safety of vulnerable road users at intersections.

We thank Congress for advancing our recommendations **to improve the safety of amphibious vehicles known as DUKW boats**, and for requiring the US Coast Guard to respond within 90 days to new NTSB recommendations.

Internationally, when **US comments** were not reflected in Ethiopia's final report on the crash of an Ethiopian Airlines 737-8 MAX, we published them, because we believe that several aspects of the accident were not sufficiently addressed by the Ethiopian report.

We completed our series of roundtables on the Safe System Approach with events focused on **post-crash care** and **advancing pedestrian safety**. We also held MWL roundtables (**Part 1, Part 2**) on enacting .05 blood alcohol concentration laws and **Collision-Avoidance Technologies and Teen Driver Safety**. In addition, we held a Seafloor Investigations workshop.

We hope you find the NTSB's *2022 Annual Report to Congress* to be an informative presentation of our agency's accomplishments.

Sincerely,

A handwritten signature in blue ink that reads "Jennifer Homendy". The signature is fluid and cursive, written over a white background.

Jennifer Homendy  
Chair

# Who We Are and What We Do

The NTSB is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in the other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable cause of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for any accident or event investigated by the agency. Additionally, we serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

## History

The NTSB's origins can be traced to the Air Commerce Act of 1926, in which the US Congress charged the US Department of Commerce with investigating the causes of aircraft accidents. That responsibility was transferred to the Civil Aeronautics Board's Bureau of Aviation Safety when it was created in 1940. In 1967, Congress consolidated all US transportation agencies into a new US Department of Transportation (DOT) and established the NTSB as an independent agency within the US DOT. In creating the NTSB, Congress envisioned that a single organization with a clearly defined mission could more effectively promote a higher level of safety in the transportation system than the individual modal agencies could working separately. Since 1967, the NTSB has investigated accidents, crashes, and other events in the aviation, highway, marine, pipeline, and railroad transportation modes, as well as those related to the transportation of hazardous materials. In 2022, the investigation of accidents in commercial space transportation was added to our mission.

In 1974, Congress reestablished the NTSB as a separate entity outside the US DOT, reasoning that "no federal agency can properly perform such [investigatory] functions unless it is totally separate and independent from any other . . . agency of the United States."

Because the US DOT has broad operational and regulatory responsibilities that affect the safety and efficiency of the transportation system, and transportation accidents may suggest deficiencies in that system, the NTSB's independence was deemed necessary to provide objectivity in its investigations and recommendations.



**Figure 1.** In 1966, President Lyndon Johnson signed the Department of Transportation Act that created the NTSB.  
SOURCE: US DOT

## Role in Transportation Safety

Since our inception in 1967, the NTSB has investigated more than 153,000 aviation accidents and thousands of surface transportation events. On call 24 hours a day, 365 days a year, our investigators travel throughout the country and to every corner of the world in response to transportation disasters. The NTSB investigates accidents and events to determine their probable cause, examine safety issues, and develop recommendations to prevent similar accidents and events in the future. We have issued more than 15,730 safety recommendations to more than 2,470 recipients in all transportation modes. The recommended action has been implemented for 82 percent of the over 12,700 recommendations that have been closed. Since 1990, we have compiled and published our MWL, which increases awareness of—and support for—the most critical changes needed to reduce transportation accidents and save lives. The agency also develops safety research studies focused on broader safety questions and topic areas, enabling us to better perform our mission.





## OUR MISSION

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

## OUR CORE VALUES

- Integrity
- Transparency
- Independence
- Excellence
- Diversity and Inclusion

## LEGISLATIVE MANDATE

- ✓ **Maintaining** our congressionally mandated independence and objectivity
- ✓ **Conducting** objective, precise accident investigations and safety studies
- ✓ **Performing** fair and objective pilot and mariner certification appeals
- ✓ **Advocating** and promoting safety recommendations
- ✓ **Assisting** victims of transportation accidents and their families

## Strategic Goals and Objectives

### 1. Ensure our preparedness for investigations involving emerging transportation technologies and systems

Objective:

- Prepare the agency for new transportation technologies and systems

### 2. Improve processes and products

Objectives:

- Improve enterprise data governance
- Enhance enterprise risk management
- Improve information technology planning
- Improve the effectiveness of agency processes and products

### 3. Optimize organizational effectiveness and efficiency

Objectives:

- Strengthen human capital planning
- Engage, connect, and protect the workforce
- Develop model supervisors and leaders
- Attract, develop, and retain a diverse and inclusive workforce

## Organization and Program Structure

The NTSB's organizational structure is designed around sound business and management principles. The Board comprises five members, each nominated by the president and confirmed by the US Senate to serve a 5-year term. One of these members is nominated by the president to serve a 3-year term as chair, which requires separate Senate confirmation. Another member, designated by the president to be vice chair, serves in that position for 3 years and as acting chair when the Board has no designated chair.

Our current Board members are pictured in Figure 2. The NTSB currently has one vacant Board member seat.

Figure 3 shows our organizational structure. For more information about our offices and their functions, please visit the [Organization](#) page of our website.

**Figure 2.** NTSB Board Members



Honorable  
**Jennifer Homendy**  
Chair



Honorable  
**Bruce Landsberg**  
Vice Chair

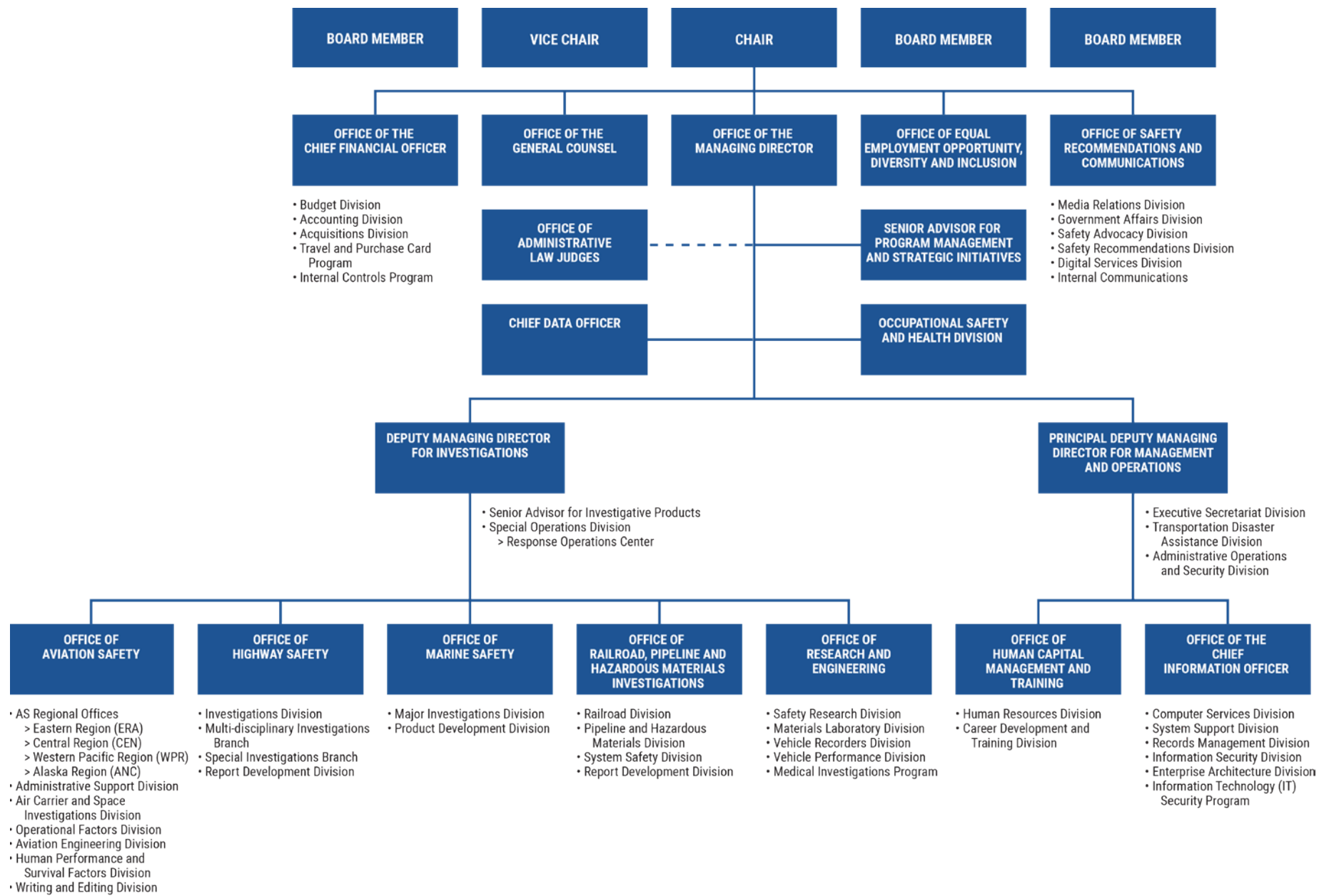


Honorable  
**Michael E. Graham**  
Board Member



Honorable  
**Thomas B. Chapman**  
Board Member

**Figure 3. NTSB organization chart**

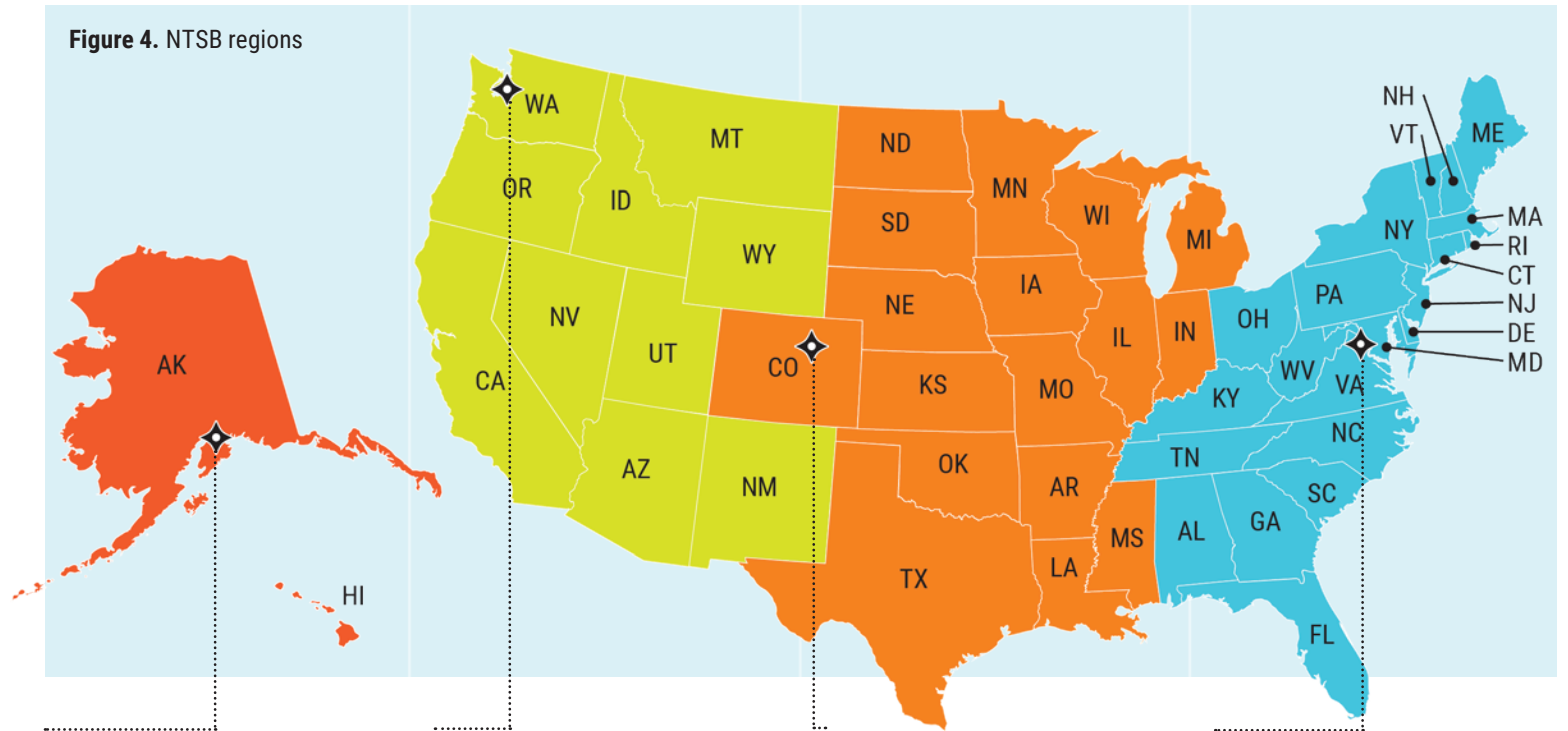




We are headquartered in Washington, DC, where most of our staff work, within the Eastern Region. Others work remotely throughout the country or are assigned to one of the regional offices in Anchorage, Alaska; Federal Way, Washington; or Aurora, Colorado.

The map in Figure 4 depicts the four NTSB regions.

**Figure 4. NTSB regions**



**ANC: Alaska Region**  
Anchorage, Alaska

Alaska  
Hawaii

**WPR: Western Pacific Region**  
Federal Way, Washington

Arizona  
California  
Idaho  
Montana  
Nevada  
New Mexico  
Oregon  
Utah  
Washington  
Wyoming  
.....  
American Samoa

**CEN: Central Region**  
Aurora, Colorado

Arkansas  
Colorado  
Indiana  
Illinois  
Iowa  
Kansas  
Louisiana  
Michigan  
Minnesota  
Missouri  
Nebraska  
North Dakota  
Oklahoma  
South Dakota  
Texas  
Wisconsin

**ERA: Eastern Region**  
Washington, DC

Alabama  
Connecticut  
Delaware  
Florida  
Georgia  
Kentucky  
Maine  
Maryland  
Massachusetts  
North Carolina  
New Hampshire  
New Jersey  
New York  
Ohio  
Pennsylvania  
Rhode Island  
South Carolina  
Tennessee  
Vermont  
Virginia  
Washington, DC  
West Virginia  
.....  
Puerto Rico  
US Virgin Islands

Table 1, below, provides a snapshot of the agency’s activities over the past year<sup>2</sup> and highlights key accomplishments of offices and divisions across the NTSB.

**Table 1. 2022 NTSB Safety Statistics at a Glance**

<b>Safety Recommendations<sup>3</sup></b>		<b>Research and Engineering/Laboratory</b>	
Issued	92	Safety Research Reports Published	2
Urgent Issued	6	Safety Data Analyses Completed	242
Closed <i>Acceptable</i> <sup>4</sup>	269	Readouts of Vehicle Recorders and Other Electronic Devices Completed	399
Urgent Closed <i>Acceptable</i>	2	Material Laboratory Exam Reports Completed	198
Closed <i>Unacceptable</i> <sup>5</sup>	34	Vehicle Performance Reports and Animations Completed	64
<b>Reports and Products</b>		Medical Investigation Reports Completed	240
Board-adopted Investigation Reports	22	Rapid Reports Completed <sup>7</sup>	8
Delegated Investigation Reports	1,842	<b>Advocacy and Outreach<sup>8</sup></b>	
Public Hearings, Roundtables, Seminars, Summits, Symposiums, Video Series, Webinars, and Workshops	14	Publications	7
Safety Actions <sup>6</sup>	164	Advocacy and Outreach Presentations and Events	304
<b>Accident/Event Launches</b>		Testimony to State Legislative Committees	12
Major Launches	5	Family Members and Victims Assisted	3,480
Field or Limited Launches	238	<b>Aviation Certificate Appeals</b>	
International Accident Launches	6	Total Cases Received	247
		Total Cases Closed	303
		Emergency Cases Received	118
		Emergency Cases Closed	25
		Hearings Held	19
		<b>Human Capital Management and Training</b>	
		Courses, Programs, and Seminars Offered by the NTSB	150
		NTSB Employee Attendance at All Training, NTSB and Other	4,920

<sup>2</sup> This annual report reflects NTSB activities from January 1 through December 31, 2022.

<sup>3</sup> In this report, each *recommendation issued* is reported as one recommendation, regardless of the number of recipients. Because some recommendations are issued to more than one recipient, however, *recommendations closed* are reported by the number of recipients for whom a recommendation was closed during the year. For more information, see page 50.

<sup>4</sup> Closed *Acceptable* classifications include *Closed—Acceptable Action*, *Closed—Acceptable Alternate Action*, and *Closed—Exceeds Recommended Action*.

<sup>5</sup> Closed *Unacceptable* classifications include *Closed—Unacceptable Action* and *Closed—Unacceptable Action/No Response Received*.

<sup>6</sup> A safety action is a positive change within the transportation environment brought about by an NTSB investigation or study without our issuing a formal safety recommendation. Safety actions may be initiated either because of an NTSB investigation or independent of one.

<sup>7</sup> If the NTSB decides to launch a Board member with the investigation team to the accident site as the on-scene spokesperson, the Safety Research Division (of the Office of Research and Engineering) and the Safety Recommendations Division (of the Office of Safety Recommendations and Communications) provide a 1- to 2-page summary of background information to support the investigation team during the initial stages of the launch. These “rapid reports” typically include publicly available information related to relevant safety data and statistics on similar crashes and crash trends; a summary of relevant NTSB investigations, studies, or other products; and a summary of relevant safety recommendations.

<sup>8</sup> See Appendix A for additional details about NTSB advocacy and outreach.

# NTSB 2021–2023 MOST WANTED LIST OF TRANSPORTATION SAFETY IMPROVEMENTS

Critical changes needed to reduce accidents, injuries, and fatalities in transportation

Tens of thousands of people die in preventable transportation accidents and crashes every year—our neighbors, coworkers, schoolmates, family members, and other loved ones. With each accident, crash, event, or mishap we investigate, we learn lessons about safety gaps and make recommendations that, if acted upon, could close these gaps.

The NTSB’s MWL highlights transportation safety improvements needed now to prevent accidents, crashes, and other events; reduce injuries; and save lives. We use the list to focus our advocacy efforts during the current MWL cycle. At any given time, our agency has more than 1,100 open, unimplemented safety recommendations. We do not have the authority to require recipients to implement our safety recommendations.

We issued our 2021–2022 MWL on April 6, 2021. While creating the list, we identified 175 open safety recommendations addressing 10 key safety items. Of those recommendations, 25 were classified closed *Acceptable* as of December 31, 2022.<sup>9</sup>

The current list, which serves to focus the agency’s congressionally mandated advocacy efforts, was extended through 2023.

## AVIATION

### Require and Verify the Effectiveness of Safety Management Systems in all Revenue Passenger-Carrying Aviation Operations

Safety management systems (SMS) can improve safety and provide an effective means of ensuring a culture of safety. The FAA should require all 14 *CFR* Part 135 operators; all commercial air tour operators, regardless of their operating rule; and all Part 91 revenue passenger-carrying operators to establish SMS programs.

Operators and states should not wait for a regulatory mandate to act. They can, and should, implement an SMS now that addresses four components: safety policy, safety risk management, safety assurance, and safety promotion. It can be scaled to the size and complexity of operations. Currently, too many operators have either an ineffective SMS or none at all. By establishing an effective SMS and creating a safety culture aimed at making safety a focus first and always, operators will improve aviation safety and reduce the risk of accidents.

In 2015, the FAA required commercial airlines to develop a comprehensive SMS to improve safety for the flying public, but the FAA has not required other revenue passenger-carrying operators to have one. Although we have seen some voluntary adoption of SMS programs, most operators continue operating without an SMS in place.

### Install Crash-Resistant Recorders and Establish Flight Data Monitoring Programs

When planes crash, we need to find out what happened. Technology is available today that can give us the answers; however, the FAA has not mandated that aircraft operators install it, citing privacy, security, cost, or other concerns.

Commercial airliners are required to have flight data recorders (FDR) and cockpit voice recorders (CVR), commonly called “black boxes,” but the NTSB has long called for cockpit image recorders as well. Such video would have been extremely helpful in determining flight crew actions in recent crashes in Texas, Indonesia, and Ethiopia.

The NTSB believes other types of passenger-carrying commercial aircraft, such as charter planes and air tour aircraft, should be equipped with data, audio, and video recording devices and should have programs in place to analyze the data derived from these devices. Recorders and flight data monitoring programs would help investigators identify the causes of accidents and help aircraft operators identify potential vulnerabilities in their operation before they can lead to an accident.

Regardless of the recorder type, it must be able to survive a crash.

<sup>9</sup> In this report, each *recommendation issued* is reported as one recommendation, regardless of the number of recipients. Because some recommendations are issued to more than one recipient, however, *recommendations closed* are reported by the number of recipients for whom a recommendation was closed during the year. For the MWL, the closed recommendations were closed between April 6, 2021, and December 31, 2022. For more information, see page 50.



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

## HIGHWAY

### Implement a Comprehensive Strategy to Eliminate Speeding-Related Crashes

Speeding is typically defined as exceeding a speed limit, but it can also mean driving at the speed limit, though too fast for road conditions. Between 2010 and 2019, speeding-related crashes resulted in over 108,300 fatalities—about one-fourth of all traffic fatalities in the United States.

The true extent of the problem is likely underestimated because the reporting of speeding-related crashes is inconsistent. Speeding can result in a loss of vehicle control, which increases both the likelihood of a crash and the severity of injuries sustained. Higher vehicle speeds lead to greater changes in velocity, which, in turn, lead to increased injury severity.

Intelligent speed adaptation devices on large trucks, automated enforcement (speed safety cameras), expert speed-analysis tools, and education campaigns are underused in our communities. These critical tools and strategies must be implemented to address this safety problem.

### Protect Vulnerable Road Users Through a Safe System Approach

Our roadways were designed to move motor vehicles safely and efficiently, but they often fail to fully meet the needs of pedestrians, bicyclists, and motorcyclists—all vulnerable road users (VRUs). As a result, dangers to this population are increasing. Unlike motor vehicles, VRUs lack an external structure to protect them when crashes occur. Proven, effective countermeasures are being underused at the federal, state, and local levels to protect pedestrians, bicyclists, and motorcyclists. We have long been concerned with the threat to VRUs. In 2018 and 2019, we published three reports on the risks to this population and issued more than 30 new recommendations focused on reducing VRU traffic deaths.

A Safe System approach is needed to address all aspects of traffic safety: road users, vehicles, speeds, roads, and postcrash care. We must make better safety investments, from road treatments, vehicle design, and collision avoidance systems to strong traffic safety laws and robust education efforts to mitigate injury risks for all road users.

### Prevent Alcohol- and Other Drug-Impaired Driving

Driving under the influence of alcohol and other drugs remains a leading cause of highway crashes. In 2020, 11,654 people were killed in alcohol impaired driving crashes, an average of one alcohol-impaired-driving fatality every 45 minutes. These fatalities accounted for 30 percent of all motor vehicle traffic fatalities in the United States in 2020. Many impaired-driving crashes involve drivers impaired by alcohol in combination with other drugs (legal, illicit, or over the counter). Complicating matters, each year, more states are passing laws allowing the use of recreational marijuana and marijuana for medicinal use.

Impaired driving is 100-percent preventable. We know a per se blood alcohol concentration (BAC) of .08 g/dL is too high. States need to lower per se BACs to .05 g/dL, an action only Utah has taken. Too many alcohol-impaired crashes involve drivers who had previously been convicted of drunk driving. All states need to implement laws requiring all drivers convicted of alcohol-impaired driving to use an ignition interlock device to prevent future impaired driving.

We also need to develop better drug tests and drug-testing procedures. Unlike for alcohol, no standardized testing protocols exist for drugs, and there is no established limit or threshold to determine other drug impairment. Additionally, evaluating the impact of other drugs on drivers is challenging because many drugs impair individuals differently than alcohol.

## HIGHWAY

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

Each year, thousands of people are killed and injured in preventable crashes. Collision-avoidance and connected-vehicle technologies can help mitigate the severity of such crashes or even stop them from occurring in the first place.

Collision avoidance technologies include forward-collision warning and automatic emergency braking, which can warn the driver of an upcoming hazard and act to stop the vehicle if the driver fails to respond. Most passenger vehicles and commercial vehicles (such as heavy-duty trucks and school buses) on the road today are not equipped—nor required to be equipped—with such life-saving technologies. Moreover, the National Highway Traffic Safety Administration (NHTSA) has not developed comprehensive performance standards for these technologies, nor does it effectively evaluate them and include this information in its vehicle safety ratings.

Connected vehicle technology, or V2X, relies on direct communication between vehicles, and between vehicles and infrastructure and other vulnerable road users. When compared to vehicle-resident sensor systems, such as forward collision-avoidance systems (CAS), V2X technology can detect conflict at greater distances, can see around corners and through objects, and is unaffected by inclement weather. Although both V2X technology and vehicle-resident sensor systems have the capacity to mitigate and prevent crashes on their own, they can provide greater safety benefits when combined. To achieve this life-saving benefit, we recommended the DOT implement a plan for nationwide connected vehicle deployment and for NHTSA to require connected-vehicle technology in all newly manufactured vehicles.

## Eliminate Distracted Driving

Distraction occurs when drivers divert their attention away from the driving task. Crash data and research indicate that personal electronic devices, such as cell phones and tablets, are among the greatest contributors to driver distraction.

Hands-free is not risk free. Using a device hands-free does not reduce driver distraction; in fact, drivers are still cognitively distracted. Many drivers believe they can multitask and still operate a vehicle safely, but multitasking is a myth. Humans can only focus cognitive attention on one task at a time. The driving task should be the sole focus of all drivers.

Distracted driving is widespread, killing thousands and injuring hundreds of thousands in the United States every year. States are making some progress in addressing this public health problem, but no state has implemented our recommendation calling for a ban on the use of all personal electronic devices while driving except in the case of emergency. Today, 24 states and the District of Columbia prohibit drivers of all ages from using handheld cell phones while driving. Forty-eight states and the District of Columbia have an all-driver text messaging restriction; however, Missouri and Montana have yet to adopt an all-driver text messaging ban, and drivers in Nebraska and Ohio are subject only to secondary enforcement. Thirty-seven states and the District of Columbia restrict the use of cell phones by novice drivers.

## MARINE

## Improve Passenger and Fishing Vessel Safety

Passenger and fishing vessels present distinct safety challenges within the marine transportation industry.

### PASSENGER VESSELS

Passenger vessels range in size from small charter vessels, such as dive boats and amphibious passenger vessels (DUKW, or “duck” boats) to large cruise ships operating in international waters. The number of passengers and crew on these types of vessels varies.

Fires pose a catastrophic threat to small passenger vessels, as we saw in the *Conception* dive boat fire off the coast of California in which 34 people died. Our investigations have revealed that crew training and safety regulations for these vessels vary, increasing the risk to passengers and crew.

To prevent needless deaths and mitigate injuries, passenger vessels should have an SMS, use voyage data recorders, and provide adequate fire-detection and extinguishing systems and enhanced emergency egress options. Operators need to ensure that their crews have advanced training that includes fire drills and firefighting techniques. More roving patrols are needed on our waterways to ensure that passengers are being transported safely.



## MARINE

## COMMERCIAL FISHING

The domestic commercial fishing industry, which remains largely uninspected, is another marine sector of concern. Fishing consistently tops the list of deadliest occupations, due in large part to challenging work environments, such as poor weather and rough waters. These conditions threaten vessel stability and integrity.

New standards are needed to address—and periodically reassess—intact stability, subdivision, and watertight integrity in commercial fishing vessels up to 79 feet long. More than 800 fatalities have occurred on fishing vessels in the past two decades, yet many fishing crews still are not trained in stability management techniques or emergency response. Equally concerning, many vessels do not carry proper life-saving equipment, such as flotation and search-and-rescue locator devices, on board.

The US Coast Guard can improve safety on both passenger and fishing vessels by implementing our recommendations.

## PIPELINE

## Improve Pipeline Leak Detection and Mitigation

All pipelines leak. Leak-detection and mitigation tools are essential and can make the difference between a minor incident and a deadly explosion. Pipeline systems equipped with leak-detection systems and automatic shutoff valves, or remote control valves, can warn operators of an imminent accident and allow for quick mitigation.

The NTSB first identified the need for leak-detection and mitigation methods in natural gas transmission and distribution pipelines nearly 50 years ago, but PHMSA has yet to require operators to use these life-saving measures, and many operators will not act without regulation.

Placing service regulators outside buildings is another mitigation tool, yet many older homes and multifamily structures still have regulators inside, where accumulating gas may become trapped, leading to an explosion. Methane detection also helps mitigate consequences by alerting the public to natural gas leaks, thereby minimizing public exposure.

Every day we wait to enhance our mitigation systems is another day we put the public in danger.

## RAILROAD

## Improve Rail Worker Safety

Too many people working on or around railroad tracks, such as train crews, maintenance-of-way employees, and mechanical workers, have been killed or injured in accidents involving train or equipment movement. Many of these workers were conducting routine maintenance or switching operations when they were struck. Roadway workers—those who protect the track—are being killed in preventable accidents, such as those involving the use of train-approach warning systems. These systems are vulnerable to human errors, such as miscalculating site distance and underestimating the time needed for workers to clear tracks. They lack safety redundancy and should not be used as the primary form of worker protection. The Federal Railroad Administration (FRA) and the Federal Transit Administration (FTA) need to require railroads to implement technology to provide safety redundancy. Industry must also improve roadway worker training and scheduling practices and develop (and routinely audit) procedures for delivering job briefings. Lookouts should also receive proper training and the required equipment. To prevent fatigue, railroads and transit agencies must develop work schedules and limitations based on science. The FRA's Roadway Worker Protection Regulations, issued in 1997, are inadequate, and the FTA needs to establish specific regulations for roadway workers.

Operations crews and mechanical workers have also been at risk of injury in preventable accidents because of inadequate separation between train crews and rail cars carrying hazardous materials. Although PHMSA requires buffer cars, the separation distance the agency has established is inadequate and threatens safety. Railroads should be required to implement a minimum of five cars as a buffer between train crews and highly hazardous flammable materials. PHMSA must issue a regulation on the appropriate separation distance.

# Office of Aviation Safety

**Table 2. Office of Aviation Safety Statistics**

Recommendations Issued <sup>10</sup>	31
Urgent Recommendations Issued	6
Recommendations Closed <i>Acceptable</i> <sup>11</sup>	38
Recommendations Closed <i>Unacceptable</i> <sup>12</sup>	19
Board-adopted Investigation Reports	10
Delegated Investigation Reports	1,798
Major Launches	2
Field Launches	193
International Accident Launches	4
MWL Public Roundtable	1
Safety Actions	161
Journal Publications	2
Advocacy and Outreach	94

The mission of the Office of Aviation Safety is to—

- Investigate all air carrier, commuter, and air taxi accidents and certain serious incidents; fatal and nonfatal general aviation accidents and serious incidents; unmanned aircraft systems and public aircraft accidents and serious incidents; and commercial space launch/reentry accidents.
- Participate in the investigation of aircraft accidents that occur in foreign countries involving US carriers, US-manufactured or -designed equipment, or US-registered aircraft to identify potential safety issues with US products or service providers and fulfill US obligations under International Civil Aviation Organization (ICAO) agreements.
- Investigate safety issues that extend beyond a single accident to examine specific aviation safety problems from a broader perspective.

The Office of Aviation Safety conducts investigative activities through five specialty divisions based in Washington, DC, and a regional investigation management structure consisting of four regions. Investigators are located throughout the country. International aviation activities are coordinated from the Washington, DC, office.

<sup>10</sup> In this report, each *recommendation issued* is reported as one recommendation, regardless of the number of recipients. Because some recommendations are issued to more than one recipient, however, *recommendations closed* are reported by the number of recipients for whom a recommendation was closed during the year. For more information, see page 50.

<sup>11</sup> Closed *Acceptable* classifications include *Closed—Acceptable Action*, *Closed—Acceptable Alternate Action*, and *Closed—Exceeds Recommended Action*.

<sup>12</sup> Closed *Unacceptable* classifications include *Closed—Unacceptable Action* and *Closed—Unacceptable Action/No Response Received*.

## Investigation Reports

From January 1, 2022, through December 31, 2022, the Office of Aviation Safety issued 1,808 investigation reports; 10 of these reports involved safety issues that led to the issuance of 31 safety recommendations.<sup>13</sup>

Below are summaries of some of the aviation investigation reports completed during this period.

### Collision into Terrain, Safari Aviation Inc., Airbus AS350 B2 Kekaha, Hawaii | December 26, 2019

On December 26, 2019, about 4:57 p.m.,<sup>14</sup> an Airbus AS350 B2 helicopter was destroyed when it collided into terrain in a remote, wooded area about 11 miles north of Kekaha, Hawaii, on the island of Kauai. The pilot and all six passengers were fatally injured. Safari Aviation, doing business as Safari Helicopters, operated the flight as a Title 14 *CFR* Part 135 on-demand air tour under visual flight rules (VFR).

We determined that the probable cause of the accident was the pilot's decision to continue flight under VFR into instrument meteorological conditions (IMC), which resulted in the collision into terrain. Contributing to the accident was Safari Aviation's lack of safety management processes to identify hazards and mitigate the risks associated with factors that influence pilots to continue VFR flight into IMC. Also contributing to the accident was the FAA's delayed implementation of a Hawaii aviation weather camera program, its lack of leadership in the development of a cue-based weather training program for Hawaii air tour pilots, and its ineffective monitoring and oversight of Hawaii air tour operators' weather-related operating practices.

We identified the following safety issues during this investigation: (1) factors that may have influenced the pilot's decision to continue the VFR flight into reduced

visibility weather conditions, including Safari's lack of safety management processes and effective cue-based weather training; (2) the limitations of aviation safety infrastructure, including the need for aviation weather cameras and increased radio communications and automatic dependent surveillance-broadcast (ADS-B) coverage; (3) the need for SMS, flight data monitoring programs, and the incorporation of onboard video and ADS-B data reviews into safety assurance processes; (4) the need for improved FAA oversight of air tour operations in Hawaii; (5) the need for crash-resistant flight recorder systems; and (6) the need to implement available helicopter safety technologies to prevent accidents resulting from inadvertent encounters with instrument meteorological conditions.

We issued safety recommendations to the FAA, the Vertical Aviation Safety Team, and the Tour Operators Program of Safety, and we reiterated previously issued safety recommendations to the FAA.

Recommendations: 10 new, 9 reiterated,  
2 classified and reiterated  
Report Date: May 10, 2022

### Require Immediate Inspection of Bell 407 Tail Boom Attachment Fittings

These urgent recommendations were derived from our ongoing investigation of the Kalea, Hawaii, air tour accident involving a Bell 407 helicopter that crashed following an in-flight separation of the tail boom. (See figure 5.) The helicopter's most recent tail boom inspection, which is typically performed at 300-hour intervals, had been performed 114 hours before the accident.

We identified the following safety issues in this report: (1) fractured or missing tail boom attachment hardware, which can lead to the in-flight separation of the tail boom, and (2) the need for a considerably more conservative torque inspection interval to identify any such anomalies with tail boom attachment hardware.

We issued urgent safety recommendations to the FAA and Transport Canada.

Recommendations: 4 new, urgent  
Report Date: December 1, 2022

**Figure 5.** Separated helicopter tail boom on rough, lava rock-covered terrain at the accident site.



<sup>13</sup> Investigation reports are issued for accident or incident investigations and may contain a determination of probable cause and/or safety recommendations, depending upon the scope of the investigation and the safety issues identified. For select, larger scale investigations, the office launches an investigation team and presents a comprehensive investigation report to the Board. Investigations that are limited in scope have the primary purpose of determining probable cause, and the report may be issued by the office director under delegated authority or may be adopted by the Board. A report containing only safety recommendations can be issued at any time during an investigation. If the Board determines that a recommended course of action requires immediate attention to avoid imminent loss of life from a similar occurrence, the safety recommendation is designated "urgent." Investigations are listed here in reverse chronological order by completion date and not in order of priority, impact, scale, or scope.

<sup>14</sup> All times stated are local time.

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

These recommendations were derived from our investigation of the August 5, 2021, accident involving a de Havilland DHC-2 airplane operating as an air tour near Ketchikan, Alaska, as well as others in the region.

We identified the following safety issues in this report: (1) the FAA's lack of operational safety requirements for Ketchikan-area air tours in a geographical area with distinct operational hazards, and (2) the need for improved pilot training on reducing the risk of weather-related accidents for Ketchikan-area air tours.

We issued safety recommendations to the FAA and the National Weather Service.

Recommendations: 3 new, 2 classified  
Report Date: November 16, 2022

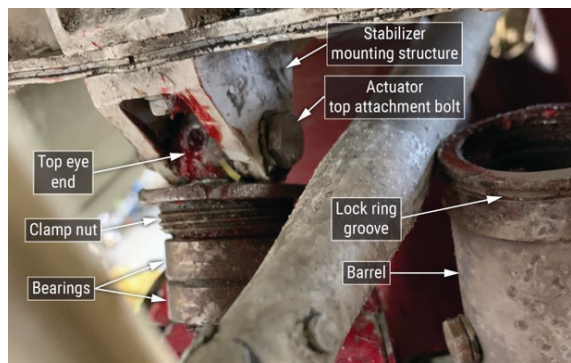
## Require Immediate One-Time Inspection of de Havilland Canada DHC-3 Horizontal Stabilizer Actuator

These urgent recommendations were derived from our ongoing investigation of the September 4, 2022, accident involving a de Havilland Canada DHC-3 airplane that entered a nose-low, near-vertical descent and crashed into the water in Mutiny Bay, near Freeland, Washington, fatally injuring the pilot and nine passengers. During our initial wreckage examination, we discovered that components of the horizontal stabilizer actuator were not connected and that a lock ring that normally helps secure the components together was not present. (See figure 6.)

We identified the following safety issue in this report: A missing or an improperly installed horizontal stabilizer actuator lock ring is an immediate safety hazard because it can result in a reduction or loss of airplane pitch control during flight.

We issued urgent safety recommendations to the FAA and Transport Canada.

Recommendations: 2 new, urgent  
Report Date: October 26, 2022



**Figure 6.** Clamp nut and barrel separation of horizontal stabilizer actuator of de Havilland DHC-3 airplane that crashed into the water in Mutiny Bay, near Freeland, Washington.

## Provide Graphical Forecast of Potential Supercooled Large Droplet Icing Conditions in Alaska

These recommendations address the need to provide pilots operating in Alaska with graphical forecasts of potential supercooled large droplet (SLD) icing areas to prevent flight into those areas. The recommendations derive from the NTSB's investigation of a Cessna 208B airplane that encountered SLD icing conditions after takeoff from Fairbanks, Alaska, and entered an uncommanded right bank followed by a nose-down spiraling descent, from which the pilot was able to recover.

According to FAA Advisory Circular 00-45H, "Aviation Weather Services," SLD icing conditions are outside the icing certification envelopes for many aircraft; therefore, such conditions could be hazardous to those aircraft.

We identified the following safety issue in this report: the need for a graphical forecast depicting potential areas of SLD icing conditions in Alaska to help pilots avoid inadvertent flight into those hazardous conditions.

We issued safety recommendations to the FAA and the National Weather Service.

Recommendations: 2 new  
Report Date: May 24, 2022

## Require Safeguards to Prevent Cessna 560XL Takeoff with Parking Brake Engaged

These recommendations were derived from two investigations involving Cessna 560XL airplanes in which parking brake pressure was not fully released before attempted takeoffs. This condition prevented the airplanes from rotating for takeoff. Once the airplanes reached this point in the takeoff sequence, they were beyond the point where they could be stopped safely, leading to fatal or serious injuries. (See figure 7.)

We identified the following safety issues in this report: (1) the lack of a cockpit indication to alert pilots when the parking brakes are not fully released before takeoff on Cessna 560XL airplanes because the airplane was certified before the standard requiring such an indicator took effect, (2) the certification of and subsequent derivative aircraft to the same standard, and (3) the failure of Cessna 560XL checklists to direct pilots to fully release parking brakes before takeoff.

We issued safety recommendations to the FAA.

Recommendations: 3 new  
Report Date: May 4, 2022

**Figure 7.** Cessna 560XL exemplar airplane (XLS model).

SOURCE: DELTA PRIVATE JETS





### Loss of Engine Power due to Excessive Fuel Flow in Cirrus SR22T Aircraft

The investigations of six accidents involving the Cirrus SR22T identified an issue in which excessive fuel introduced to the engine during takeoff climb led to engine power loss. Although excessive fuel flow was determined to be the cause for the engine failures in all six investigations, the cause for the excessive fuel flow varied (and in three cases was not determined). Therefore, our examination of these investigations suggested a lack of system safety assessments to identify all potential causes of excessive fueling.

We identified the following safety issue in this report: the need for all potential causes and mitigating actions for a loss of engine power due to excessive fuel flow in the SR22T to be identified and the need for the FAA to require the implementation of appropriate mitigating actions to prevent additional accidents.

We issued safety recommendations to the FAA and Cirrus Aircraft.

Recommendations: 2 new  
Report Date: April 12, 2022

### Require Common Traffic Advisory Frequency Areas in Alaska

These recommendations address concerns surrounding the lack of one common traffic advisory frequency (CTAF) in areas with multiple airports or scenic landmarks, and the resulting risk for midair collisions. They also address the lack of communication requirements for areas where one CTAF has been established. The recommendations derive from the NTSB's investigation of a fatal midair collision involving a de Havilland DHC-2 airplane and a Piper PA-12 airplane that collided in uncontrolled airspace near Soldotna, Alaska. (See figure 8.) The pilots of both aircraft and the five passengers on the DHC-2 were fatally injured. The investigation determined there were 21 airports within a 30-mile radius of the collision location, with five different charted communication frequencies, many of which overlapped.



**Figure 8.** Piper PA-12 (top) and De Havilland DHC-2 (bottom) after midair collision in Soldotna, Alaska.

SOURCE: FAA

The creation of additional dedicated CTAF areas in locations where the risk is high for midair collisions would allow pilots to become more aware of nearby traffic and communicate on a single frequency in one area, thereby helping mitigate the risk of midair collisions.

We identified the following safety issue in this report: the need for a requirement for pilots to report their positions on a designated CTAF frequency when operating in CTAF areas to ensure pilot awareness of the presence of other airplanes.

We issued safety recommendations to the FAA.

Recommendations: 2 new  
Report Date: February 22, 2022

### Structural Failure of Piper Part Number 40622 Rudder Posts Made of 1025 Carbon Steel

This recommendation was issued as a result of two investigations involving airplanes designed and built by Piper Aircraft that experienced structural failures of their rudders in flight.

We identified the following safety issues in this report: (1) the susceptibility of the carbon steel rudder posts to fatigue cracking under normal service conditions and (2) the diminished controllability of the airplane following rudder post fracture.

We issued one safety recommendation to the FAA.

Recommendations: 1 new  
Report Date: January 10, 2022

### Require Carbon Monoxide Detectors in Certain General Aviation Aircraft

These recommendations were issued as a result of previous investigations and reports of aircraft accidents in which undetected carbon monoxide (CO) poisoning led to pilot impairment and subsequent fatal or serious injuries due to crashes. In each of these accidents, the pilot was not alerted to CO entering the cabin in enough time to counteract the effects of CO poisoning. The report noted that the FAA does not require CO detectors on enclosed-cabin aircraft.

We identified the following safety issues in this report: the potential for further serious and fatal accidents due to pilot CO poisoning and the continued lack of an FAA requirement for CO detectors in general aviation aircraft.

We issued safety recommendations to the FAA, the Aircraft Owners and Pilots Association, and the Experimental Aircraft Association.

Recommendations: 2 new  
Report Date: December 20, 2021;  
issued January 20, 2022



## Ongoing Significant Aviation Accident and Incident Investigations

As of December 31, 2022, the Office of Aviation Safety had 1,274 open domestic investigations. The following ongoing investigations to which we launched involved significant safety issues. We are devoting significant resources to the investigations listed and anticipate producing a report upon the completion of each investigation.

**Table 3. Ongoing Significant Aviation Investigations**

Location	Date	Description	Fatalities
Dallas, Texas	11/12/2022	Midair collision of two airplanes during air show	6
Freeland, Washington	9/4/2022	In-flight separation of airplane tail control components	10
Amherstdale, West Virginia	6/22/2022	Crash of helicopter during donation flight	6
Miami, Florida	6/21/2022	Collapse of landing gear during air carrier operation	0
Kalea, Hawaii	6/8/2022	Separation of helicopter tail boom during air tour flight	0
Jolon, California	2/16/2022	Component failure during experimental aircraft flight test	0
Brookshire, Texas	10/19/2021	Runway excursion	0
Farmington, Connecticut	9/2/2021	Collision with obstacles shortly after takeoff	6
Truckee, California	7/26/2021	Crash during circling approach to land	6
Honolulu, Hawaii*	7/2/2021	Crash after partial loss of power in both engines was reported	0

\*As of June 30, 2023, this investigation has been completed.

## International Investigations

The United States is a signatory to the Chicago Convention on International Civil Aviation, which is administered by ICAO. The NTSB is charged with fulfilling the US obligation for accident and incident investigations in accordance with Annex 13 of this agreement in full coordination with the US Department of State.



The international investigative process is critical to maintaining aviation safety in the United States and throughout the world. When an aircraft operated by—or designed by, manufactured by, or registered to—a US company has been involved in an accident in a foreign state, NTSB participation in that investigation enables the United States to ensure the airworthiness and operation of its aircraft operated domestically and overseas. ICAO Annex 13 protocols also define the agency's engagement with international authorities whose products or operations are involved in accidents within the United States. This international process of collaboration plays an important role in enabling us to identify safety concerns and issue appropriate recommendations. We have issued numerous safety recommendations that have resulted in safety improvements worldwide as a direct result of our participation in these foreign investigations.

Through December 31, 2022, the Office of Aviation Safety was notified of 989 international investigations and assisted in 98 of them. Of these, investigators launched or traveled in support of four investigations. The following investigations required significant US involvement.

■ **DHL Boeing 757 Runway Excursion  
Costa Rica | April 7, 2022**

On April 7, 2022, a Boeing 757 operated by DHL overran the runway during landing at Juan Santamaria International Airport in Alajuela, Costa Rica. A postcrash fire ensued and the airplane sustained substantial damage. The flight crew was not injured. The accident is being investigated by the Costa Rica General Directorate of Civil Aviation. The NTSB appointed a US-accredited representative in accordance with ICAO Annex 13 because the United States is the state of manufacture and design of the airplane.

■ **China Eastern Boeing 737 Impact with Terrain  
Near Wuzhou, China | March 21, 2022**

On March 21, 2022, China Eastern flight 5735, a Boeing 737-800, crashed into hillside near Wuzhou, China; there were 132 fatalities. The accident is being investigated by the Civil Aviation Administration of China. The NTSB appointed a US-accredited representative in accordance with ICAO Annex 13 because the United States is the state of manufacture and design of the airplane and engines.

■ **Boeing 737-2X6C Collision During Takeoff  
Puerto Carreño, Colombia | February 3, 2022**

On February 3, 2022, a Boeing 737-2X6C airplane collided with trees upon departure from Puerto Carreño Airport in Puerto Carreño, Colombia. The airplane returned to the airport where it landed without further incident; there were no injuries. The event is being investigated by the Colombia Accident Investigation Authority. The NTSB appointed a US-accredited representative in accordance with ICAO Annex 13 because the United States is the state of manufacture and design of the airplane.

## US Comments on Foreign Accident Reports

We completed comments on behalf of the United States on several international investigations in which the United States had significant involvement under Annex 13, including these:

■ **Boeing 737 MAX 8, Ejere, Ethiopia  
Addis Ababa Bole International Airport | March 10, 2019**

On March 10, 2019, Ethiopian Airlines flight 302, a Boeing 737 MAX 8, crashed near Ejere, Ethiopia, shortly after takeoff from Addis Ababa Bole International Airport in Ethiopia. All 157 passengers and crew on board were fatally injured, and the airplane was destroyed. The Ethiopia Accident Investigation Bureau (EAIB) led the investigation, and the NTSB appointed a US-accredited representative in accordance with ICAO Annex 13 because the United States was the state of manufacture and design of the airplane.

The EAIB issued its third draft final report of the investigation in March 2022. The NTSB US-accredited representative and our technical advisors provided comments on this draft, as we had on the earlier final drafts, in May 2022. When the EAIB published its final report in December 2022, it had not appended the NTSB's comments to it, which we had requested, and which is ICAO Annex 13 protocol. Accordingly, we released the comments following the report's publication. As the published report had also introduced new information not included in the draft we reviewed, we released additional comments in January 2023 that addressed the new information.

■ **Boeing 787-9, Dabolim, India  
Goa International Airport | October 31, 2021**

On October 31, 2021, El Al flight LY082, a Boeing 787-9, experienced a shutdown of its left engine about 2.5 hours into the flight. The flight crew diverted to India's Goa Airport rather than continue to the intended destination of Tel Aviv International Airport in Israel. There were 257 passengers and 19 crew members on board. India's investigative authority delegated the serious incident to the State of the Operator, Israel, and it was investigated by the Ministry of Transport and Road Safety's Office of Aviation Accidents and Incidents Investigation. The NTSB appointed a US-accredited representative in accordance with ICAO Annex 13 because the United States was the state of manufacture and design of the airplane. The NTSB US-accredited representative and our technical advisors provided comments on the draft final report in April 2022, and the final report was published in June 2022.

■ **Boeing 737-800, Istanbul, Turkey  
Sabiha Gökçen Airport | February 5, 2020**

On February 5, 2020, Pegasus Airlines flight PC2193, a Boeing 737-800, experienced a runway excursion shortly after landing at Sabiha Gökçen Airport in Istanbul, Turkey. Of the 175 passengers, 2 infants, and 6 crew members on board, 3 passengers were fatally injured, and 4 others were seriously injured. The accident was investigated by the Republic of Turkey Ministry of Transport and Infrastructure Transport Safety Investigation Center. The NTSB appointed a US-accredited representative in accordance with ICAO Annex 13 because the United States was the state of manufacture and design of the airplane. The NTSB US-accredited representative and our technical advisors provided comments on the draft final report February 15, 2022, and the final report was completed February 28, 2022.

## MWL Public Roundtable

### Safeguard Your Flights with Valuable Insights: Practical FDM Solutions for Smaller Operators

On October 20, 2022, Vice Chairman Bruce Landsberg moderated a roundtable discussion with experts from government and industry about the benefits and proven value-added of flight data monitoring (FDM) programs for any sized operation. The emphasis of this NTSB discussion was on smaller operators, who may not have the resources of larger commercial flight departments, and how they can easily, affordably, and practically incorporate FDM into their safety and operational activities.



## Other Significant Achievements

- Executed a memorandum of agreement with the FAA, clarifying each agency’s respective role in investigating commercial space mishaps.
- Created a project status dashboard for tracking and managing investigations, allowing the Office of Aviation Safety’s management team to monitor all ongoing investigations within the office. Status updates provided by first-line managers on investigation products are immediately visible on the dashboard, allowing for timely evaluation and prioritization of resources to meet scheduled milestones.
- Initiated implementation of the second stage of our Aviation Report Timeliness Project—Report Review Process, which involved establishing a plan to improve the office’s report review process to further enhance timeliness and quality. We are developing guidance for the new report review process, as well as training for investigators, analysts, and their chiefs, with implementation planned for 2023.
- Implemented the Cascade Project, a focused, multipart plan to eliminate open investigations more than 2 years old. The project, which reduced the number of cases in this category from a peak of 442 in February 2022 to 45 by the end of the year, involved hiring two retired annuitants to address reduced staffing of report analysts; triaging the completion of investigation reports that were already in review; and prioritizing the completion of investigations for which the investigative tasks were nearly finished. Also, employee performance standards were enhanced to focus on the quality and timeliness of investigations.
- Established two new positions:
  - > **Chief Technical Advisor.** Advises leadership on agency policy in the planning, coordination, oversight, and management of space transportation and advanced aerospace technologies accident investigation, which may include uncrewed aircraft systems, fully autonomous air vehicles, or other nascent and complex experimental aircraft designs.
  - > **Business Process Manager.** Leads and manages the office’s efforts to achieve and improve operational performance through the design, implementation, execution, and control of office processes; this includes evaluating processes and their integration throughout the organization and identifying priorities and strategies for process reengineering and improvement initiatives.

# Office of Highway Safety

**Table 4. Office of Highway Safety Statistics**

Recommendations Issued <sup>15</sup>	32
Recommendations Closed <i>Acceptable</i> <sup>16</sup>	174
Urgent Recommendations Closed <i>Acceptable</i>	1
Recommendations Closed <i>Unacceptable</i> <sup>17</sup>	10
Board-adopted Investigation Reports	4
Delegated Investigation Reports	3
Major Launches	3
Field Launches	5
MWL Public Roundtables, Video Series, and Webinars and Safety Summit	8
Advocacy and Outreach	26

The Office of Highway Safety investigates crashes that have significant safety implications nationwide, highlight national safety issues, involve the loss of numerous lives, or generate high interest because of emerging technologies or the circumstance of the crash. Such investigations may focus on collapses of bridges spanning roadways or tunnel structures, mass casualties and injuries on public transportation vehicles (such as motorcoaches and school buses), and collisions at highway–railroad grade crossings. This office also investigates crashes that involve new safety issues or technologies (such as automated vehicles and alternatively fueled vehicles), and develops reports based on trends emerging from NTSB investigations and from research and data that identify common risks or the underlying causes of crashes, injuries, and fatalities.

The NTSB is the only US organization that performs independent, comprehensive, and transparent multidisciplinary investigations to determine the probable causes of highway crashes, with the goal of making recommendations to prevent similar events and to reduce injuries and fatalities. Our investigations result in recommendations that provide policymakers with unbiased analysis and, if implemented, would reduce or eliminate the safety risks identified in the investigations.

The Office of Highway Safety comprises the Investigations Division and the Report Development Division.

<sup>15</sup> In this report, each *recommendation issued* is reported as one recommendation, regardless of the number of recipients. Because some recommendations are issued to more than one recipient, however, *recommendations closed* are reported by the number of recipients for whom a recommendation was closed during the year. For more information, see page 50.

<sup>16</sup> Closed *Acceptable* classifications include *Closed–Acceptable Action*, *Closed–Acceptable Alternate Action*, and *Closed–Exceeds Recommended Action*.

<sup>17</sup> Closed *Unacceptable* classifications include *Closed–Unacceptable Action* and *Closed–Unacceptable Action/No Response Received*.



## Investigation Reports

From January 1, 2022, through December 31, 2022, the Office of Highway Safety issued 7 investigation reports; 4 of these reports involved safety issues that led to the issuance of 25 new safety recommendations.<sup>18,19</sup>

Below are summaries of the highway investigation reports completed during this period.

### Box Truck Collision with Group of Bicyclists Searchlight, Nevada | December 10, 2020

On Thursday, December 10, 2020, about 9:39 a.m.,<sup>20</sup> a 2019 Isuzu NPR-HD box truck collided with a group of bicyclists and a 2019 Subaru Outback sport utility vehicle (SUV) that were traveling in the rightmost southbound lane of US Highway 95 in Clark County, Nevada. (See figure 9.) Five of the bicyclists died, one bicyclist sustained serious injuries, and one bicyclist and the driver of the SUV sustained minor injuries; the driver of the box truck was uninjured.

We determined that the probable cause of the crash was the box truck driver's impairment and fatigue stemming from his use of methamphetamine. Contributing to the crash was the decision made by the bicyclists to ride in the right travel lane of a 75-mph roadway.

We identified the following safety issues during this investigation: (1) drug-impaired driving and (2) the need to protect vulnerable road users.

Recommendations: None  
Report Date: November 30, 2022



**Figure 9.** Box truck (top) and SUV (bottom<sup>21</sup>) following the crash in Searchlight, Nevada, that took the lives of five bicyclists and seriously injured another.

SOURCE: NEVADA HIGHWAY PATROL

### Collision Between Service Vehicle and School Bus Decatur, Tennessee | October 28, 2020

On October 27, 2020, about 3:45 p.m., a utility service truck was traveling northbound on the two-lane State Route 58 in Decatur, Meigs County, Tennessee. At the same time, a transit-style school bus was traveling south, carrying 33 students home from school. The truck driver reported that he had been looking in his side rear-vision mirrors when the truck's right-side wheels departed the roadway and entered the earthen v-ditch adjacent to the paved rumble-milled shoulder. When the truck driver steered the truck back onto the roadway, the truck yawed counterclockwise and crossed into the southbound lane. The bus collided with the right side of the truck, fatally injuring the bus driver and a 7-year-old passenger seated directly behind

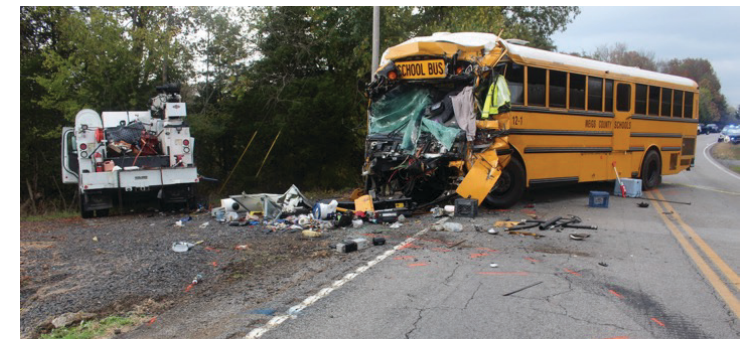
the bus driver. (See figure 10.) Four other school bus passengers sustained serious injuries, 10 sustained minor injuries, and 18 were uninjured or their injury level was unknown. The truck driver was also uninjured.

We determined that the probable cause of the crash was the service truck driver's inattention to the forward roadway because he was looking at a sheriff's vehicle behind him, which resulted in his failure to keep the truck on the roadway. Contributing to the cause of the crash were nonrecoverable and critical foreslopes and the pavement edge drop-off along the state highway, which prevented the truck driver from safely returning the truck to the roadway in a controlled manner. Contributing to the severity of the crash were the lack of passenger lap/shoulder belts on the school bus and the unsafe seating positions of some of the students.

We identified the following safety issues during this investigation: (1) the inadequate roadway design, (2) the lack of lane departure warning and prevention systems for heavy vehicles, and (3) the lack of sufficient passenger protection measures on school buses.

**Figure 10.** Final resting positions of truck and school bus in Decatur, Tennessee, that fatally injured two and seriously injured four others.

SOURCE: TENNESSEE HIGHWAY PATROL



<sup>18</sup> Investigation reports are issued for crash investigations. For select, larger scale investigations, the office launches an investigation team and presents a comprehensive investigation report to the Board. Investigations that are limited in scope have the primary purpose of determining probable cause, and the report may be issued by the office director under delegated authority or may be adopted by the Board. A report containing only safety recommendations can be issued at any time during an investigation. If the Board determines that a recommended course of action requires immediate attention to avoid imminent loss of life from a similar accident, the safety recommendation is designated "urgent." Investigations are listed here in reverse chronological order and not in order of priority, impact, scale, or scope.

<sup>19</sup> The additional seven new safety recommendations listed in Table 4 resulted from safety research reports completed by the Office of Research and Engineering.

<sup>20</sup> All times stated are local time.

<sup>21</sup> Because of sensitivity concerns, the NTSB blurred portions of this photo.



As of result of this investigation, we issued safety recommendations to the National Association for Pupil Transportation, the National Association of State Directors of Pupil Transportation Services, the National School Transportation Association, NHTSA, and multiple states.

Recommendations: 1 new, 4 reiterated  
 Report Date: October 18, 2022

**Sport Utility Vehicle Centerline Crossover Collision with Pickup Truck**  
**Avenal, California | January 1, 2021**

On January 1, 2021, about 8:00 p.m., an SUV, occupied by only the driver, was traveling south on State Route 33 (SR-33) near Avenal, California. SR-33 is a two lane roadway with one lane in each direction and a posted speed limit of 55 mph. The SUV driver had just left a New Year's Day gathering where he had consumed alcohol, and he was driving at a speed between 88 and 98 mph. The SUV partially departed from the paved roadway onto a dirt and gravel shoulder area to the right. The SUV driver then made a steering correction to the left, causing the vehicle to go out of control, crossing the highway centerline and intruding into the northbound lane directly in front of a northbound pickup truck. The truck, traveling between 64 and 70 mph, was occupied by an adult driver and seven passengers ranging in age from 6 to 15 years old. When the vehicles collided head-on, the truck immediately caught fire, and other vehicle operators on SR 33 who stopped at the crash scene had insufficient time to extricate any occupants before fire engulfed the truck. As a result of the crash, the SUV driver and all eight truck occupants died. We determined that the probable cause of the crash was the failure of the SUV driver to control his vehicle because of a high level of alcohol impairment. Contributing to the severity of the crash was the SUV driver's excessive speed. We identified the following safety issues during this investigation: (1) driver impairment, (2) the need for technology to prevent alcohol-impaired driving crashes, (3) the need for technology to prevent speeding-related crashes, and (4) the need to implement a uniform standard for drug toxicology testing.



**Figure 11.** 3D point cloud data collected at the crash scene were analyzed to depict the interaction of the vehicles that collided in Avenal, California, where the SUV driver and all eight truck occupants died.

As of result of this investigation, we issued safety recommendations to NHTSA, the state of California, and the Alliance for Automotive Innovation. We also reiterated and classified safety recommendations to NHTSA and to the Automotive Coalition for Traffic, Safety, Inc.

Recommendations: 3 new, 2 reiterated  
 Report Date: August 22, 2022

**Multivehicle Crash on the Don N. Holt Bridge, Interstate 526**  
**North Charleston, South Carolina | July 1, 2020**

On July 1, 2020, about 9:50 a.m., a 2018 Ford F350 pickup truck with an attached unladen trailer was traveling west in the right lane of Interstate 526 on the Don N. Holt Bridge in North Charleston, South Carolina. The pickup truck collided with the rear of a parked patrol car, which was stopped behind a disabled SUV. The crash resulted in a subsequent collision between the SUV and a tow truck parked in front of it. A sheriff's deputy and a tow truck operator were also struck.

We determined that the probable cause of the crash was the truck driver's inattention to the driving task, likely due to fatigue, which resulted in his failure to respond to stopped vehicles in his travel lane.

We identified the following safety issues during this investigation: (1) driver performance, (2) emergency responder safety, and (3) collision avoidance technology.

Recommendations: None  
 Report Date: May 31, 2022

**Multivehicle Crash**  
**Near the Township of Arlington, Wisconsin | June 12, 2020**

On June 12, 2020, near the Township of Arlington, Wisconsin, a queue of slowed and stopped traffic formed on Interstate 39 because of two previous traffic collisions. About 6:45 a.m., a 2013 Freightliner truck-tractor in combination with a 2017 Utility semitrailer struck the end vehicle in the queue, causing a crash involving eight vehicles. Four vehicle occupants died and three were seriously injured.

We determined that the probable cause of the crash was the truck driver's failure to respond to slow-moving traffic due to fatigue. Contributing to the fatigue was his undiagnosed obstructive sleep apnea.

We identified the following safety issues during this investigation: (1) the need to identify commercial motor vehicle drivers at high risk for obstructive sleep apnea and (2) the need to ensure appropriate evaluation and treatment before drivers are granted unrestricted medical certification.

Recommendations: None  
 Report Date: May 25, 2022

**Figure 12.** View to the north from the shoulder of northbound Interstate 39, showing the final resting positions of some of the vehicles involved in the June 2020 multivehicle crash near the Township of Arlington, Wisconsin.

SOURCE: WISCONSIN STATE PATROL (ANNOTATED BY THE NTSB)



## Roadway Departure and Rollover Pala Mesa, California | February 22, 2020

On February 22, 2020, about 10:23 a.m. in moderate rainfall, a 30-passenger bus left the southbound lanes of Interstate 15 just past a bridge over the San Luis Rey River and overturned in Pala Mesa, California, coming to rest on its roof. The bus was operated by Executive Lines and occupied by a driver and 20 passengers. As a result of the crash, 3 passengers died, 12 passengers sustained serious injuries, and 5 passengers and the driver received minor injuries.

We determined that the probable cause of the crash was the loss of vehicle control due to the combination of the low and substandard tread depth of the rear axle tires, the excessive speed for the wet roadway and vehicle conditions, and the driver's inappropriate inputs before and during the loss-of-control event. Contributing to the crash was Executive Lines' inadequate vehicle inspection process, which permitted the bus to operate in passenger service despite having two tires with treads below the minimum required depth. Contributing to the severity of the injuries were NHTSA's failure to require roof strength standards for buses, Executive Lines' failure to follow California's requirement to inform passengers about the state's mandatory seat belt use law, and the passengers' limited use of the available lap/shoulder belts.

We identified the following safety issues during this investigation: (1) the need to drive at safer speeds on wet roadways, (2) the need to ensure adequacy of tire tread depth standard for commercial vehicles, (3) the need to maintain safe tire tread depths on commercial vehicles, (4) the lack of roof strength standards for certain buses, and (5) the need to increase seat belt usage on buses.

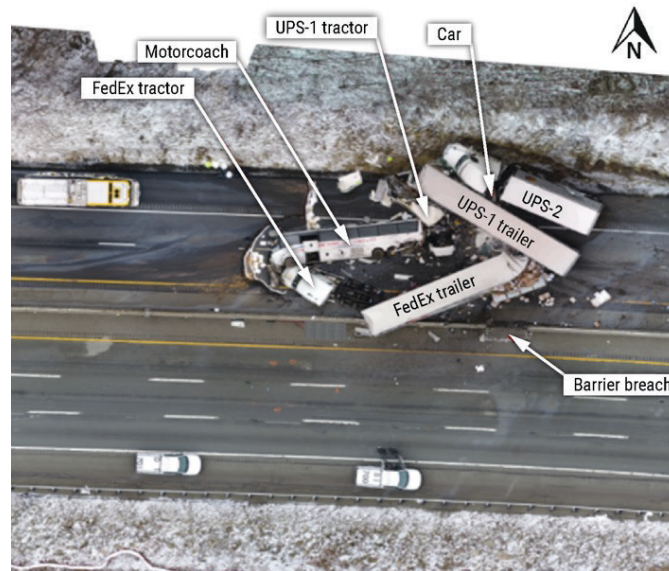
We issued safety recommendations to NHTSA, the Federal Motor Carrier Safety Administration (FMCSA), the state of California, the California Highway Patrol, the American Bus Association (ABA), and the United Motorcoach Association (UMA), and reiterated a previously issued recommendation to NHTSA.

Recommendations: 10 new, 1 reiterated  
Report Date: April 19, 2022

## Multivehicle Crash Near Mt. Pleasant Township, Pennsylvania | January 5, 2020

On January 5, 2020, about 3:30 a.m. in light snow, on the westbound Pennsylvania Turnpike near Mt. Pleasant Township, Pennsylvania, a motorcoach carrying 59 passengers was rounding a curve when it ran off the road and overturned, blocking all westbound lanes. Within seconds, two trucks towing semitrailers that had been following the motorcoach hit it. A westbound car and a third truck drove off the road to avoid the wreckage. (See figure 13.) The motorcoach driver, two passengers, and both occupants of the second truck died in the crash; 49 of the motorcoach passengers and the codriver of the first truck were injured. The driver of the first truck, the occupants of the third truck, and the occupants of the car were uninjured.

We determined that the probable cause of the crash 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. Contributing to the severity of the crash was the high initial and impact speed of the second truck.



**Figure 13.** Final resting positions of all vehicles involved in the multivehicle crash near Mt. Pleasant Township, Pennsylvania.

SOURCE: PENNSYLVANIA STATE POLICE  
(ANNOTATED BY THE NTSB)

We identified the following safety issues during this investigation: (1) the excessive speed of the motorcoach and the two trucks considering the wet road conditions, (2) the lack of standards for commercial vehicle collision avoidance and mitigation systems to enhance safety, and (3) the lack of onboard video event recorder systems on commercial motor vehicles.

We issued safety recommendations to the US DOT, the Federal Highway Administration (FHWA), NHTSA, the FMCSA, the Federal Communications Commission (FCC), the Commonwealth of Pennsylvania, the Pennsylvania Turnpike Commission, the American Trucking Associations, the Owner-Operator Independent Drivers Association, the Commercial Vehicle Safety Alliance, ABA, UMA, the Transport Workers Union of America, the Amalgamated Transit Union, the International Brotherhood of Teamsters, FedEx Ground Package System, and United Parcel Service of America. We also reiterated previously issued recommendations to NHTSA, the Commonwealth of Pennsylvania, the ABA, and the UMA.

Recommendations: 11 new, 7 reiterated  
Report Date: February 8, 2022

## Ongoing Significant Highway Investigation

As of December 31, 2022, the Office of Highway Safety had 16 open domestic investigations. The following ongoing investigations that we launched involved significant safety issues. We are devoting significant resources to the investigations listed and anticipate producing a report upon the completion of each investigation.

**Table 5. Ongoing Significant Highway Investigations**

Location	Date	Description	Fatalities
Williamsburg, Virginia	12/16/2022	Rear-end collision between a combination vehicle and a bus	3
Hamden, Connecticut	7/23/2022	Battery electric bus fire	0
Indianapolis, Indiana	6/15/2022	Battery electric bus fire	0
Dermott, Arkansas	6/6/2022	Crash between a medium-size bus and a combination vehicle	5
Clarendon Hills, Illinois	5/11/2022	Crash at grade crossing	1
Tishomingo, Oklahoma	3/22/2022	Crash between a passenger car and a combination vehicle at intersection	6
Andrews, Texas	3/15/2022	Head-on crash between a pickup truck and a transit van	9
North Las Vegas, Nevada	1/29/2022	Multivehicle collision at a signalized intersection	9
Pittsburgh, Pennsylvania	1/28/2022	Collapse of the Fern Hollow Bridge	0
Monaville, Texas	12/17/2021	Loss of control and rollover crash of a school bus	1
Big Spring, Texas*	11/19/2021	Frontal collision of a wrong-way driver and a motorcoach	3
Greenville, Alabama*	6/19/2021	Multivehicle crash in wet weather conditions	10
Phoenix, Arizona*	6/9/2021	Multivehicle crash involving a traffic queue resulting from previous lane closures	4

\*As of June 30, 2023, this investigation has been completed.

## MWL Public Roundtables, Video Series, and Webinars

### Video Series: V2X: Preserving the Future of Connected Vehicle Technology January 19, 2022

In our four-part interview video series, Board Member Michael Graham talked with experts from government, industry, and academia about the safety benefits and the maturity level of V2X technology, the reasons for its scarce deployment, and the impact of the FCC's recent actions to limit the spectrum available for transportation safety.



### Safe System Approach Roundtable Series: A Safe System— Post-Crash Care February 17, 2022

In 2022, the Office of Highway Safety supported the Office of the Chair and the Office of Safety Recommendations and Communications in continuing the roundtable series about the Safe System approach for road safety. The main objectives for the six-part series were (1) to better understand the Safe System approach, its benefits, and ways that it differs from our current approach to road safety in the United States; (2) to explore the current state of the Safe System approach in the United States and to learn from international partners and from cities across the nation that have moved toward such an approach; and (3) to identify what actions need to be taken to move toward this approach nationwide. The series concluded with a roundtable on postcrash care, which featured presentations from two NTSB staff members and six outside experts on the topic.

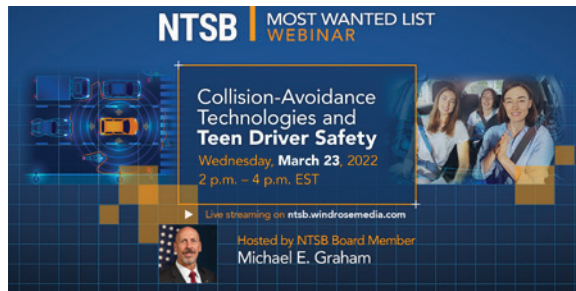




## Webinar: Collision-Avoidance Technologies and Teen Driver Safety

March 23, 2022

During this webinar, hosted by Board Member Michael Graham, we discussed the role of vehicle technology—specifically, collision-avoidance technologies (such as automatic emergency braking and collision warning)—in reducing teen traffic crashes and fatalities. We discussed the Insurance Institute for Highway Safety’s recent research on collision-avoidance technology and teen driver safety, explored perspectives from educators and the automotive industry, and addressed how vehicle technology, if made standard in all vehicles, can contribute to equitable and accessible safe transportation for all.



## Webinar: A Safe System Approach to Motorcycle Safety

May 11, 2022

During this webinar, hosted by Board Member Tom Chapman, we discussed the role of motorcycle safety through the lens of the Safe System approach. We evaluated NTSB crash investigations and safety recommendations, the role of vehicle design and technology for both motorcycles and passenger vehicles, infrastructure needs, driver training, required protective gear, and safe driving and riding practices. Through this webinar, we examined ways we can improve safety for motorcyclists—one group of vulnerable road users.

## Other Significant Achievements

- Developed Automated Vehicle and Connected Vehicle webpages on NTSB.gov. These new Safety Topics webpages serve as collections of highway investigations and lessons learned from the investigative outcomes, and as resources for various material characterizing the NTSB position on vehicle automation, connected vehicle technology, and related topics.
- Submitted a response to the FMCSA’s request for comment on the Medical Examiners Handbook and Medical Advisory Criteria.<sup>22</sup>
- Replied to the FCC regarding waivers on ITS operations 5.9GHz band.
- Submitted a response to NHTSA’s notice of proposed rulemaking on event data recorders.
- Submitted a response to the FMCSA’s advanced notice of supplemental rulemaking for speed-limiting devices on commercial motor vehicles.
- Submitted a response to NHTSA’s request for comments about its new car assessment program.
- Submitted a response to the FMCSA’s advanced notice of supplemental proposed rulemaking addressing speed-limiting devices.

## Safety Summit

### Highway Safety Summit

On May 19, 2022, Chair Jennifer Homendy hosted a Highway Safety Summit where we identified the safety priorities, needs, and concerns of our stakeholders; identified collaboration opportunities for advancing progress on safety recommendations through advocacy efforts; and informed NTSB strategic planning as it relates to preventing transportation casualties, fatalities, and injuries through NTSB investigations and recommendations.



<sup>22</sup> See [Congressional and Regulatory Correspondence \(nts.gov\)](https://www.nts.gov/congressional-and-regulatory-correspondence) for more information on NTSB responses to regulatory actions and requests for comment.

# Office of Marine Safety

**Table 6. Office of Marine Safety Statistics**

Recommendations Issued <sup>23</sup>	13
Recommendations Closed <i>Acceptable</i> <sup>24</sup>	20
Recommendations Closed <i>Unacceptable</i> <sup>25</sup>	2
Board-adopted Investigation Reports	4
Delegated Investigation Reports	25
Field Investigation Launches	28
International Accident Launches	1
Public Roundtable, Workshop, and Safety Summit	3
Journal Publications	2
Advocacy and Outreach Events	26

The Office of Marine Safety investigates and determines the probable cause of major marine casualties in US territorial waters, major marine casualties involving US-flagged vessels worldwide, and accidents involving both US public (federal) and nonpublic vessels in the same casualty. In addition, the office investigates select catastrophic marine accidents and events of a recurring nature.

The US Coast Guard conducts preliminary investigations of all marine accidents and notifies the NTSB when an event qualifies as a major marine casualty, which includes any one of the following:

- The loss of six or more lives.
- The loss of a mechanically propelled vessel of 100 or more gross tons.
- Property damage initially estimated to be \$500,000 or more.
- A serious threat, as determined by the commandant of the US Coast Guard and concurred with by the NTSB chair, to life, property, or the environment by hazardous materials.

The office is also responsible for the overall management of the NTSB's international marine safety program, under which the office investigates major marine casualties involving foreign-flagged vessels in US territorial waters and those involving US-flagged vessels anywhere in the world. Accidents involving foreign-flagged vessels accounted for 29 percent of NTSB marine casualty investigations over the past 5 years. Under the International Maritime Organization (IMO) Code of International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident, the office also participates with the US Coast Guard as a substantially interested State (SIS) in investigations of serious marine casualties involving foreign-flagged vessels in international waters. The

<sup>23</sup> In this report, each *recommendation issued* is reported as one recommendation, regardless of the number of recipients. Because some recommendations are issued to more than one recipient, however, *recommendations closed* are reported by the number of recipients for whom a recommendation was closed during the year. For more information, see page 50.

<sup>24</sup> Closed *Acceptable* classifications include *Closed—Acceptable Action*, *Closed—Acceptable Alternate Action*, and *Closed—Exceeds Recommended Action*.

<sup>25</sup> Closed *Unacceptable* classifications include *Closed—Unacceptable Action* and *Closed—Unacceptable Action/No Response Received*.



international program involves reviewing US administration position papers related to marine investigations and participating in select IMO subcommittee meetings.

As part of the international program, the office coordinates with other US and foreign agencies to ensure consistency with IMO conventions. We also cooperate with other accident investigation organizations worldwide at annual meetings held both virtually and in person, such as the Marine Accident Investigators' International Forum (MAIIF), which has status as a nongovernmental organization with IMO, with Europe MAIIF, and with MAIIF Americas; MAIIF tracks developments related to marine casualty investigations and prevention.

The NTSB is the only federal organization that performs independent, comprehensive, and transparent multidisciplinary investigations to determine the probable cause of marine accidents, with the goal of making safety recommendations to prevent similar events from occurring in the future. The thoroughness and independence of these investigations maintain public confidence in marine transportation systems and provide policymakers with unbiased analysis.

The Office of Marine Safety comprises the Marine Investigations Division and the Product Development Division.

## Investigation Reports

From January 1, 2022, through December 31, 2022, the Office of Marine Safety issued 29 investigation reports; 3 of these reports involved safety issues that led to the issuance of 13 safety recommendations.<sup>26</sup>

Below are summaries of some of the marine investigation reports completed during this period.

### ■ Capsizing of Liftboat *SEACOR Power* | Port Fourchon, Louisiana | April 13, 2021

On April 13, 2021, about 3:37 p.m.,<sup>27</sup> the US-flagged liftboat *SEACOR Power* capsized about 7 miles off the coast of Port Fourchon, Louisiana, in a severe thunderstorm. Eleven crew and eight offshore workers were aboard the liftboat. Vessel operators in the area reported heavy rain, winds exceeding 80 knots, and 2- to 4-foot seas at the time of the capsizing. Search-and-rescue efforts were hampered by 30- to 40-knot winds and seas that quickly built to 10 to 12 feet and persisted throughout the evening and into the next day. Six survivors were rescued by the US Coast Guard and Good Samaritan vessels, and the bodies of six fatally injured persons were recovered. Seven persons were never found and are presumed dead. The vessel, valued at \$25 million, was a total constructive loss.

We determined that the probable cause of the capsizing of the liftboat *SEACOR Power* was a loss of stability that occurred when the vessel was struck by severe thunderstorm winds, which exceeded the vessel's operational wind speed limits. Contributing to the loss of life on the vessel were (1) the speed at which the vessel capsized and the angle at which it came to rest, which made egress difficult, and (2) the high winds and seas in the aftermath of the capsizing, which hampered rescue efforts.



**Figure 14.** *SEACOR Power* capsized on its starboard side on the evening of the casualty. A US Coast Guard RB-M can be seen in the foreground. SOURCE: US COAST GUARD

We identified the following safety issues in this report: (1) gaps in forecasts and communications of weather events, (2) the operation and stability of restricted-service liftboats in severe thunderstorms, (3) the effectiveness of the initial response to the capsizing, and (4) the difficulty in locating survivors in adverse weather and sea conditions.

As a result of this investigation, we issued safety recommendations to the US Coast Guard, the National Weather Service, the FAA, the US Air Force, the Offshore Marine Service Association, and SEACOR Marine.

Recommendations: 8 new  
Report Date: October 18, 2022

<sup>26</sup> Investigation reports are issued for accident or incident investigations and may contain a determination of probable cause and/or safety recommendations, depending upon the scope of the investigation and the safety issues identified. For select, larger scale investigations, the office launches an investigation team and presents a comprehensive investigation report to the Board. Investigations that are limited in scope have the primary purpose of determining probable cause, and the report may be issued by the office director under delegated authority or may be adopted by the Board. A report containing only safety recommendations can be issued at any time during an investigation. If the Board determines that a recommended course of action requires immediate attention to avoid imminent loss of life from a similar accident, the safety recommendation is designated "urgent." Investigations are listed here in reverse chronological order by completion date and not in order of priority, impact, scale, or scope.

<sup>27</sup> All times stated are local time.



**Figure 15.** *Commodore* approaching the East 35th Street New York City Ferry Terminal before the casualty.

SOURCE: SEASTREAK

### Grounding of Passenger Ferry *Commodore* Brooklyn, New York

On June 5, 2021, about 4:08 p.m., the high-speed catamaran passenger ferry *Commodore* was transiting northbound on the East River near Bushwick Inlet off Brooklyn, New York, when the vessel lost primary steering and speed control to both of its port hull water jets and then grounded. One minor injury was reported among the 7 crewmembers and 107 passengers on board. The vessel was later refloated and drydocked for repair. No pollution was reported. Damage to the vessel was estimated at \$2.5 million.

We determined that the probable cause of the grounding of the *Commodore* was the loss of the primary control system for the catamaran's port water jets and propulsion engines due to a flaw in the system manufacturer's software causing a memory card failure. Contributing to the casualty was the company's lack of clear SMS procedures for primary control system failure and ineffective oversight of crew training on failure modes for loss of propulsion and steering control, resulting in the captain's failure to identify the nature of the loss of control and either engaging back-up control or using emergency engine shutdowns to stop the vessel.

We identified the following safety issues during this investigation: (1) the loss of propulsion and steering control while transiting in channels or maneuvering near immediate hazards (grounding, traffic, objects), when response time is critical, (2) the need for SMS to identify potential failure modes and specific responses, and (3) the need for effective company training on the loss of propulsion and steering controls.

Recommendations: None  
Report Date: October 4, 2022

### Engine Room Fire on Board Towing Vessel *Capt. Kirby Dupuis* Bellevue, Kentucky | November 9, 2021

On November 9, 2021, about 7:08 a.m., a fire broke out on the port main diesel engine on board the towing vessel *Capt. Kirby Dupuis*. The vessel was pushing 13 loaded dry cargo barges while transiting upbound on the Ohio River at mile marker 501 near Bellevue, Kentucky, with a crew of six. Crewmembers fought the fire using portable extinguishers and attempted to use the vessel's fixed fire-extinguishing system. The fire was extinguished by local firefighters in the early afternoon, and the vessel was towed to port. No pollution or injuries were reported. Damage to the vessel was estimated at \$1,800,000.

We determined that the probable cause of the engine room fire aboard the towing vessel *Capt. Kirby Dupuis* was a lube oil tube on the port main engine that vibrated out of a joint due to a missing retaining ring and mounting bracket, spraying pressurized oil that contacted a hot exhaust surface and ignited. Contributing to the severity of the fire damage was the crew's unfamiliarity with activation procedures for the fixed fire-extinguishing system, which resulted in an unsuccessful attempt to release the fire suppression fluid and extinguish the fire.

We identified the following safety issues during this investigation: (1) the small confines of the engine room space and the location of fire equipment within that space and (2) the need for crewmembers to train for engine room fires and review extinguishing system instructions.

Recommendations: None  
Report Date: September 29, 2022

### Collision Between *Baxter Southern Tow* and BNSF Coal Train Montrose, Iowa | November 13, 2021

On November 13, 2021, about 11:43 p.m. and after the towing vessel *Baxter Southern* had pushed its tow of four empty barges against the shoreline of the Upper Mississippi River at mile 372 near Galland, Iowa, a BNSF Railway Company coal train, transiting the track along the shoreline, struck the bow rake of a forward

barge that was overhanging the railroad track. Two locomotives and 10 hopper cars (loaded with coal) derailed, and 6 of the derailed hopper cars entered the river. A sheen was observed in the river following the derailment. The two train personnel sustained minor injuries. Damage to the locomotive and freight cars was estimated at \$1.9 million. The barge sustained minor scrapes.

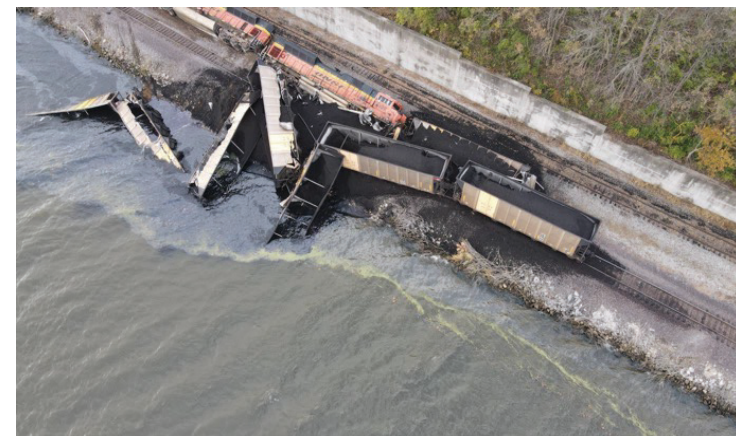
We determined that the probable cause of the collision was the tow's pilot and captain not correctly identifying a caution area on the electronic chart before deciding, due to the high wind's effect on the tow's empty barges, to push the tow up against the riverbank alongside a railroad track.

We identified the following safety issues during this investigation: (1) the need for mariners to understand all symbols and applicable advisories identified in their electronic chart system (ECS) and (2) the need for owners and operators to ensure that their crews are proficient in the use of an ECS.

Recommendations: None  
Report Date: August 25, 2022

**Figure 16.** Aerial photo of the postcollision derailment of the 2 locomotives and 8 of the 10 hopper cars. Two additional cars are submerged in the river.

SOURCE: BNSF





**Fire Aboard Fishing Vessel *Blue Dragon***  
**Monterey, California | November 9, 2021**

On November 10, 2021, about 12:15 a.m., the fishing vessel *Blue Dragon* was under way in the North Pacific Ocean, 350 miles offshore of Monterey, California, engaged in longline fishing operations, when the vessel caught fire. The vessel's six crewmembers and a National Marine Fisheries Service observer attempted to fight the fire but were unsuccessful; they abandoned the *Blue Dragon* and were rescued by a Good Samaritan vessel. The *Blue Dragon* was later towed to San Pedro, California. No pollution or injuries were reported. Damage to the vessel was estimated at over \$500,000.

We determined that the probable cause of the fire aboard the fishing vessel *Blue Dragon* was an unknown source, likely electrical in nature, that ignited the wooden wheelhouse console. Contributing to the extent of the fire damage was the substantial use of combustible materials in the joinery, outfitting, and furnishings in the wheelhouse and accommodation spaces.

We identified the following safety issues during this investigation: (1) substandard electrical installation and outfitting—including bare wires, unsecured wire nuts, overloaded circuits, loose wiring, and household wiring not designed for marine use; (2) the need for vessel operators to ensure that electrical systems are adequately designed, installed, and maintained in accordance with established marine standards to prevent fires; and (3) the need for vessel owners and operators to equip their vessels and crews with personal locator beacons and satellite emergency notification devices to supplement, and help validate the position of, a vessel's emergency-position-indicating radio beacon (EPIRB).

Recommendations: None  
 Report Date: August 23, 2022



**Figure 17. *Blue Dragon* underway before the fire.**  
 SOURCE: KIM BRIDGES

**Sinking of Commercial Fishing Vessel *Emmy Rose***  
**Provincetown, Massachusetts | November 23, 2020**

On November 23, 2020, about 1:29 a.m., the US Coast Guard in Boston, Massachusetts, received a distress signal from the EPIRB registered to the *Emmy Rose*. It was the first distress call from the vessel, which had traveled about 45 miles to the west over the 7 hours since departing the fishing grounds. Weather conditions recorded by a nearby buoy (about 21 miles from the sinking site) at the time of the EPIRB signal were winds from the east-southeast at 17 knots, gusting to 21 knots, and the sea state was 5.6 feet, observed with an easterly sea swell of 5 to 6 feet.

**Figure 18. *Emmy Rose* underway on an unknown date before the casualty.** SOURCE: US COAST GUARD

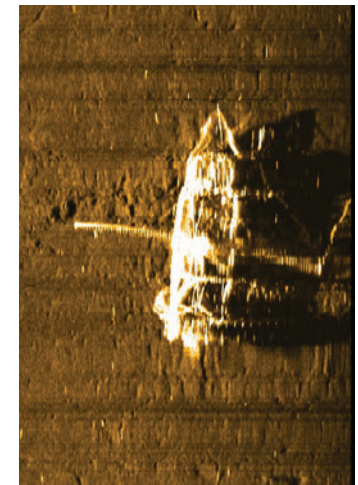


The US Coast Guard search-and-rescue assets were deployed to the area of the EPIRB signal, about 27 miles from Provincetown, Massachusetts. Their efforts continued for 38 hours and covered over 2,200 square miles. During the search, Coast Guard personnel recovered the EPIRB, the life raft, one life ring, and two wooden fish-hold hatch covers from the *Emmy Rose*. None of the four crewmembers were located as of the date of this report, and all are presumed dead. The vessel sank in 794 feet of water and was not recovered. Its estimated value was \$325,000.

We determined that the probable cause of the accident was a sudden loss of stability (capsizing) caused by water collecting on the aft deck and subsequent flooding through deck hatches, which were not watertight or weathertight because they had covers that did not have securing mechanisms, contrary to the vessel's stability instructions and commercial fishing vessel regulations.

**Figure 19. Side scan sonar image of *Emmy Rose* from 246 feet above at 600 kilohertz.**

SOURCE:  
 MIND TECHNOLOGIES



We identified the following safety issues during this investigation: (1) a lack of sufficient vessel stability to meet regulatory criteria, (2) an ineffective freeing port cover design, (3) a lack of securing mechanisms for deck hatches to maintain the vessel's watertight integrity, and (4) the need for personal locator beacons to enhance search-and-rescue efforts.

As a result of this investigation, we issued safety recommendations to the US Coast Guard.

Recommendations: 2 new  
 Report Date: August 23, 2022

**Engine Room Fire Aboard Bulk Carrier *Roger Blough***  
**Sturgeon Bay, Wisconsin | February 1, 2021**

On February 1, 2021, about 1:31 a.m., a fire started in the engine room on the *Roger Blough* during the dry bulk carrier's winter layup at the Fincantieri Bay Shipbuilding facility on Sturgeon Bay, Wisconsin. The cargo-unloading conveyor belts subsequently ignited, causing extensive damage throughout the aft section of the vessel. The shipkeeper on board departed the vessel without injury. Firefighters extinguished the fire later that afternoon, and no pollution was reported. Damage to the *Roger Blough* exceeded \$100 million.



**Figure 20.** Stern of the *Roger Blough* during firefighting efforts. SOURCE: US COAST GUARD

We determined that the probable cause of the accident was likely the repeated removal and reinstallation of the furnace’s burner that led to the failure of its mounting coupling, resulting in the operating burner dropping to the bottom of its enclosure and fracturing its fuel supply line, which allowed diesel fuel to ignite. Contributing to the casualty was the absence of a fire-activated automatic fuel oil shutoff valve on the fuel oil inlet piping before the burner, which would have stopped the fuel feeding the fire shortly after it started and limited the spread of the fire.

We identified the following safety issues during the investigation: (1) the lack of a fire activated valve on the fuel oil piping to the burner on the furnace in the engine room, (2) the lack of regulations governing furnace installation and operation on board certain vessels, and (3) inadequate notification to onboard personnel of a fire.

As a result of this investigation, we issued safety recommendations to the US Coast Guard, the American Bureau of Shipping, and Key Lakes Inc.

Recommendations: 3 new  
Report Date: August 9, 2022

### Contact of Bulk Carrier *Ocean Princess* with Oil and Gas Production Platform SP-83A Gulf of Mexico near Pilottown, Louisiana | January 2, 2021

On January 7, 2021, at 1:22 a.m., the bulk carrier *Ocean Princess*, with a crew of 24, struck the uncrewed/ out-of-service oil and gas production platform SP-83A while operating in the Gulf of Mexico, 24 miles south of Pilottown, Louisiana. No pollution or injuries were reported. Damage to the vessel and platform was estimated at \$1.5 million.

We determined that the probable cause of the accident was poor bridge resource management, which resulted in the bridge team not identifying the platform and recognizing the risk it posed to their safe navigation even though they saw its lights about 10 minutes before the casualty. Contributing was platform SP-83A not being shown on the vessel’s electronic chart display and information system due to a charting error.

We identified the following safety issue during this investigation: overreliance on the electronic chart display and information system.

Recommendations: None  
Report Date: August 9, 2022

**Figure 21.** The damaged *Ocean Princess* after the casualty. BACKGROUND SOURCE: BUREAU OF SAFETY AND ENVIRONMENTAL ENFORCEMENT (ANNOTATED BY THE NTSB)



**Figure 22.** *Wenatchee* underway before the April 2021 casualty in Puget Sound that resulted in an engine room fire. SOURCE: WASHINGTON STATE FERRIES

### Diesel Generator Engine Failure Aboard Ferry *Wenatchee* Seattle, Washington | April 22, 2021

On April 22, 2021, about 1:30 p.m., the no. 3 main engine aboard the passenger and car ferry *Wenatchee* (US) suffered a mechanical failure during a sea trial in Puget Sound near Bainbridge Island, Washington. The failure led to the ejection of components from the engine and resulted in a fire in the no. 2 engine room. The crew isolated the space, and the fire self-extinguished before it could spread throughout the vessel. There were 13 crewmembers aboard, but no passengers, and no injuries nor pollution was reported. Damage to the *Wenatchee* was estimated at \$3,790,000.

We determined that the probable cause of the accident was a connecting rod assembly that had come loose and separated from the crankshaft because of insufficient tightening (torquing) of a lower basket bolt during the recent engine overhaul.

We identified the following safety issue during this investigation: the failure to tighten fasteners on marine engines to the manufacturer’s recommended torque settings.

Recommendations: None  
Report Date: March 2, 2022



## Collision Between Offshore Supply Vessel *Cheremie Bo-Truc No. 33* and US Coast Guard Cutter *Harry Claiborne*

Seattle, Washington | April 22, 2021

On October 11, 2020, at 3:44 p.m., offshore supply vessel (OSV) *Cheremie Bo-Truc No. 33* (US) was traveling with a crew of five bound for sea in Sabine Pass when it collided with the US Coast Guard cutter *Harry Claiborne*, which was servicing a buoy near Texas Point, Texas. The OSV subsequently ran aground. The crew attempted to refloat the vessel, but it broke free, and the current sent it into the stationary cutter, resulting in a second collision. Three of the 24 crewmembers aboard the *Harry Claiborne* suffered minor injuries; none of the OSV crewmembers was injured, and no pollution was reported. Total damage was estimated at \$505,951: for the *Cheremie Bo-Truc No. 33*, damage was estimated at \$65,072, and for the *Harry Claiborne*, \$440,879.

**Figure 23.** Screen capture from VTS camera footage at 1543 (top) and at 1544 (bottom), the time of the collision between the *Cheremie Bo-Truc No. 33* and the *Harry Claiborne*. SOURCE: US COAST GUARD



We determined that the probable cause of the accident was the OSV captain's assumption of the cutter's position, which led to his decision to pass the vessel outside the channel, resulting in a late maneuver toward the cutter to avoid running aground. Contributing to the collision was the cutter crew's failure to question the passing arrangement proposed by the OSV's captain. Causing a second collision was the lack of coordination and communication between the two vessel operators when the OSV refloated their vessel.

We identified the following safety issues during this investigation: (1) failure of the *Cheremie Bo-Truc No. 33* captain to accurately determine with an ECS the position where the *Harry Claiborne* was servicing buoys, and (2) loss of situational awareness.

Recommendations: None  
Report Date: February 16, 2022

## Ongoing Significant Marine Investigations

As of December 31, 2022, the Office of Marine Safety had 34 open domestic investigations. The following ongoing investigations that we launched involved significant safety issues. We are devoting significant resources to the investigations listed and anticipate producing a report upon the completion of each investigation.

**Table 7. Office of Marine Safety Ongoing Significant Investigations**

Location	Date	Description	Fatalities
New York Harbor, New York	12/22/2022	Engine room fire aboard Staten Island Ferry <i>Sandy Ground</i> (US)	0
Gulf of Mexico	11/25/2022	Flooding/hull failure of FV <i>Captain Alex</i> (US)	0
Lake Charles, Louisiana	11/20/2022	Listing/sinking of lift boat LB <i>SEACOR Robert</i> (US)	0
Baton Rouge, Louisiana	11/13/2022	Fire/explosion on bridge of tanker MV <i>S Trust</i> (LR)	0
Seward, Alaska	11/2/2022	Collision of USCGC <i>Mustang</i> (US) and <i>Ari Cruz</i> (US) – public/non-public	0
Chincoteague, Virginia	10/28/2022	Collision of MV <i>MSC Rita</i> (PN) and IFV <i>Tremont</i> (US)	0
Port Bolivar, Texas	10/22/2022	Fire/explosion aboard OSV <i>Ms Monica</i> (US)	0
Newport News, Virginia	10/4/2022	Fire/explosion aboard TV <i>Kokosing V</i> (US)	0
Charleston, South Carolina	9/5/2022	Contact of MV <i>Bow Triumph</i> (US) with Naval Weapons Station Pier B	0
Sabine Outer Channel, Texas	8/20/2022	Collision of MV <i>Damgracht</i> (NL) and MV <i>AP Revelin</i> (HR)	0
Columbia River entrance, Pacific Ocean	8/11/2022	Machinery damage aboard <i>Maunalie</i> (US)	0
4 nm north of Vega Baja, Puerto Rico*	8/8/2022	Collision of USCGC <i>Winslow Griesser</i> and 23-foot fishing boat	1
Ingleside, Texas	8/7/2022	Grounding/stranding of TV/barge <i>CC Portland</i> (US)	0



Location	Date	Description	Fatalities
Nunez, Alaska	8/2/2022	Capsizing/listing of FV <i>Hotspur</i> (US)	0
Seattle, Washington	7/28/2022	Contact of Washington State Ferry <i>Cathlamet</i> (US) with ferry terminal	0
Houston, Texas	7/26/2022	Ship/equipment/cargo damage to MV <i>Thocro Basilisk</i> (CH)	0
Port Fourchon, Louisiana	7/23/2022	Collision of <i>Bunum Queen</i> (LR) and OSV <i>Thunder</i> (US)	0
Gig Harbor, Washington	7/15/2022	Fire/explosion aboard yacht <i>Pegasus</i> (US)	0
Gloucester, Massachusetts	7/8/2022	Flooding/hull failure of FV <i>Grace Marie</i> (US)	0
Freeport, Texas*	6/27/2022	Fire/explosion aboard TV <i>Mary Dupre</i> (US)	0
New Castle, New Hampshire	6/18/2022	Fire/explosion aboard yacht <i>Too Elusive</i> (US)	0
Hampton Roads, Virginia*	6/15/2022	Loss of crane from barge <i>Ambition</i> (US)	0
Hampton Roads, Virginia	6/7/2022	Fire aboard SPV <i>Spirit of Norfolk</i> (US)	0
Shilshole Bay, Seattle, Washington*	5/27/2022	Fire/explosion aboard OSV <i>Ocean Guardian</i> (US)	0
Near Miah Maul Shoal Lighthouse, Delaware Bay, Bowers Beach, Delaware*	5/23/2022	Fire aboard unmanned scrap barge TV <i>Daisy Mae</i> (US)	0
Sitka Sound, Alaska*	5/9/2022	Contact of <i>Radiance of the Seas</i> (BS) with cruise terminal	0
Industrial Canal, New Orleans, Louisiana*	5/3/2022	Fire/explosion aboard paddle wheeler <i>Natchez</i> (US)	0
Raritan Bay, New York City, New York*	4/29/2022	Fire/explosion aboard <i>Endo Breeze</i> (MT)	0
Barbours Cut, Galveston Bay, Texas*	4/4/2022	Contact of <i>MSC Aquarius</i> (CY) and tug <i>George M</i> (US)	0
Pascagoula, Mississippi*	3/12/2022	Contact of <i>Valaris DS-16</i> (MH) and MV <i>Akti</i> (MH)	0
Old Bahama Channel, Atlantic Ocean*	3/8/2022	Flooding/hull failure of <i>Carib Trader II</i> (VC)	0
GICW mile 56, Houma, Louisiana*	3/8/2022	Contact of TV <i>Robert Cenac</i> (US) with CSX railway bridge	0
Hampton Roads, Virginia*	2/8/2022	Loss of mobile crane aboard barge <i>Carolyn Skaves</i> (US)	0
Amelia, Louisiana*	12/23/2021	Contact of TV <i>Miss Mollye D</i> (US) with Bayou Ramos Bridge	0

\*As of June 30, 2023, this investigation has been completed.

## International Investigations

The Office of Marine Safety is responsible for the overall management of the NTSB's international marine safety program, under which the office investigates major marine casualties involving foreign-flagged vessels in US territorial waters.

## Support to Foreign Investigations

January 1, 2022, through December 31, 2022, the Office of Marine safety participated with the US Coast Guard as an SIS in the following ongoing investigations of serious marine casualties involving foreign-flagged vessels in international waters:

**Table 8. Support to Foreign Marine Investigations**

Location	Date	Description	Fatalities
South of Cape Horn, Antarctic Ocean	11/29/2022	Rogue wave damage to <i>Viking Polaris</i> (NO) and US citizen death, SIS investigation	1
Elephant Island, Antarctica	11/18/2022	Capsizing of an inflatable excursion boat on tour from World Explorer (PT), SIS investigation, two US citizen deaths (launch)	2
Bahamas	5/26/2022	Fire/explosion aboard <i>Carnival Freedom</i> (BS), SIS investigation	0
Puerto Plata, Dominican Republic	3/14/2022	Grounding of <i>Norwegian Escape</i> (BS), SIS investigation	0

## Other Significant Achievements

### Seafloor Investigative Workshop—Surveys and Other Related Activities

The NTSB Seafloor Workshop was developed to help retain expertise learned from NTSB investigations at the seafloor, such as the 2015–2016 search for the *El Faro*. The ongoing project shared lessons from current aviation and marine investigations with interested stakeholders who may need to plan future operations.

The office worked with the US Coast Guard on a seafloor survey of the *Emmy Rose*, used for the investigation report released in 2022. This survey consisted of two operations, concluding with a comprehensive sonar and video hull survey. In addition, office staff provided technical assistance to the Office of Aviation Safety in its underwater sonar and video hull survey and recovery of a 737 aircraft wreck off Honolulu.

### NTSB-US Coast Guard Investigators' Roundtable

The Investigators' Roundtable was held September 20–21, 2022, in New Orleans, Louisiana. Meeting attendees included personnel from the US Coast Guard Office of Investigations and Casualty Analysis; representatives of the US Coast Guard National Center of Expertise for Investigations; NTSB managers, investigators, and writers from the Office of Marine Safety; and staff from the NTSB Media Relations Division and the NTSB's Response Operations Center. The meeting provided an opportunity for NTSB and US Coast Guard personnel to discuss current practices for coordinating and conducting marine investigations and to review the memorandum of agreement between the two agencies in detail. The NTSB shared information on the status of current projects, and both agencies discussed common emerging marine issues and ways that our agencies might cooperate to ensure proper coverage during investigations. The roundtable was very successful, and we anticipate holding more of these meetings in the future.

## Safety Summit

### Marine Safety Summit



On May 19, 2022, Chair Jennifer Homendy hosted a Marine Safety Summit to gather feedback from industry stakeholders about the NTSB's

products and communications, industry safety issues and other emerging issues, and a host of other related topics. Eighteen attendees from 13 different industry organizations participated in the virtual discussion. Pressing challenges noted by the industry representatives included illegal

charter boat operations, mariner labor shortages, waterways management, the need to replace aging physical navigation equipment, marine pilot distraction caused by portable electronic device use and excessive equipment alarms, fire dangers posed by the transport of electric vehicles, and the impact of commercial space operations on marine operations and infrastructure. The participants stated that they use and appreciate the Office of Marine Safety's shorter and more frequent reports and are interested in opportunities to exchange information with other transportation modes. They also encouraged the NTSB's participation in industry meetings, conferences, and ride-along events.

# Office of Railroad, Pipeline and Hazardous Materials Investigations

**Table 9. Office of Railroad, Pipeline and Hazardous Materials Investigations Statistics**

Recommendations Issued <sup>28</sup>	16
Recommendations Closed <i>Acceptable</i> <sup>29</sup>	37
Urgent Recommendation Closed <i>Acceptable</i>	1
Recommendations Closed <i>Unacceptable</i> <sup>30</sup>	2
Board-adopted Investigation Reports	4
Delegated Investigation Reports	16
Field or Limited Launches	12
International Accident Launches	1
Safety Actions	3
Safety Summits	2
Journal Publication	1
Advocacy and Outreach	37

The Office of Railroad, Pipeline and Hazardous Materials Investigations comprises four divisions: Railroad, Pipeline and Hazardous Materials, System Safety, and Report Development. The office investigates accidents involving railroads, pipelines, and hazardous materials, and evaluates the associated emergency response. Based on the findings of these investigations, the NTSB may issue safety recommendations to federal and state regulatory agencies, unions, industry and safety standards organizations, carriers and pipeline operators, equipment and container manufacturers, producers and shippers of hazardous materials, and emergency response organizations. The office may also issue safety alerts to industry.

<sup>28</sup> In this report, each *recommendation issued* is reported as one recommendation, regardless of the number of recipients. Because some recommendations are issued to more than one recipient, however, *recommendations closed* are reported by the number of recipients for whom a recommendation was closed during the year. For more information, see page 50.

<sup>29</sup> Closed *Acceptable* classifications include *Closed—Acceptable Action*, *Closed—Acceptable Alternate Action*, and *Closed—Exceeds Recommended Action*.

<sup>30</sup> Closed *Unacceptable* classifications include *Closed—Unacceptable Action* and *Closed—Unacceptable Action/No Response Received*.

## Railroad Investigation Reports

From January 1, 2022, through December 31, 2022, the Office of Railroad, Pipeline and Hazardous Materials Investigations issued 15 railroad investigation reports; 3 of these involved safety issues that led to the issuance of 14 safety recommendations.<sup>31</sup>

Below are summaries of some of the railroad investigation reports completed during this period.

### CSX Transportation Derailment with Hazardous Materials Release and Fire Draffin, Kentucky | February 13, 2020

On February 13, 2020, about 6:54 a.m.,<sup>32</sup> a high-hazard flammable train carrying denatured ethanol derailed on a CSX Transportation railroad track that runs between a hillside and the Russell Fork River near Draffin, Kentucky, as a result of a mudslide that had covered the track with mud and debris immediately before the derailment. Three leading locomotives, a buffer car, and four tank cars located at the front of the train derailed, and 38,400 gallons of denatured ethanol were released. The ethanol combined with the leaking diesel fuel and ignited. The locomotives were destroyed by the ensuing fire; the train crew was able to evacuate through the river and sustained only minor injuries.

We determined that the probable cause of the accident was the loose mud, vegetation, sand, soil, and rock that obstructed the track following excessive rain accumulation over several weeks. Contributing to the derailment was CSX Transportation's use of a weather alert system in which notifications that were developed and implemented did not account for the impact of the unusual increases and accumulation of precipitation. Contributing to the severity of the derailment was a fire resulting from the release of hazardous materials from breached US DOT-111 tank cars damaged in the derailment. Also contributing

to the severity of the derailment was PHMSA's failure to withdraw regulatory interpretation 06 0278, which pertains to Title 49 *CFR* 174.85, allowing the use of a single buffer railcar between the locomotives and the first tank car containing hazardous materials if no other nonhazardous materials cars are available in the consist.

We identified the following safety issues in this investigation: (1) the lack of weather alert criteria for train operators that included such dynamic weather conditions as current, persistent, and long-term historical weather data and (2) the inability of a single buffer car to provide sufficient separation distance for the protection of train crews when the head end of a high-hazard flammable train becomes involved in a derailment.

As a result of this investigation, we issued three safety recommendations to

Class I Railroads, Amtrak, the American Short Line and Regional Railroad Association, and the American Public Transportation Association.

We also reiterated safety recommendations to the American Short Line and Regional Railroad Association, the American Public Transportation Association, Renewable Fuels Association, and PHMSA.

Recommendations: 3 new, 3 reiterated  
Report Date: August 18, 2022

**Figure 24.** Aerial view following the CSX Transportation derailment with hazardous materials release in Draffin, Kentucky. SOURCE: PIKE COUNTY OFFICE OF EMERGENCY MANAGEMENT (ANNOTATED BY THE NTSB)



<sup>31</sup> Investigation reports are issued for accident or incident investigations and may contain a determination of probable cause and/or safety recommendations, depending upon the scope of the investigation and the safety issues identified. For select, larger scale investigations, the office launches an investigation team and presents a comprehensive investigation report to the Board. Investigations that are limited in scope have the primary purpose of determining probable cause, and the report may be issued by the office director under delegated authority or may be adopted by the Board. A report containing only safety recommendations can be issued at any time during an investigation. If the Board determines that a recommended course of action requires immediate attention to avoid imminent loss of life from a similar accident, the safety recommendation is designated "urgent." Investigations are listed here in reverse chronological order by completion date and not in order of priority, impact, scale, or scope.

<sup>32</sup> All times stated are local time.



## Union Pacific Railroad Freight Train Derailment, Hazardous Material Release and Fire Tempe, Arizona | July 29, 2020

On July 29, 2020, about 6:06 a.m., a northbound Union Pacific Railroad (UP) mixed freight train consisting of 3 locomotives and 97 railcars derailed 12 railcars at the south end of the railroad bridge over Tempe Town Lake on UP's Phoenix Subdivision in Tempe, Arizona. One of the derailed railcars struck the bridge, and part of the bridge collapsed, dropping railcars and bridge structure onto Rio Salado Parkway below and temporarily shutting down the road. Five of the derailed railcars were DOT-111 tank cars carrying various hazardous materials,<sup>33</sup> and two of these, both carrying UN1915 cyclohexanone, a flammable hazardous material, fell from the bridge.<sup>34</sup> One of the fallen cars released about 2,200 gallons of cyclohexanone, creating a pool of hazardous material below the damaged bridge, and derailed lumber cars on the bridge caught fire. Some lumber fell onto and near the road, where it burned for several hours. There were no fatalities; one firefighter was treated for smoke inhalation at the scene. UP estimated the damages to be about \$485,000 for railroad equipment, \$435,000 for track and structures, and \$10 million for the bridge.

We determined that the probable cause of the derailment and subsequent bridge collapse was a broken rail located on the ballast deck portion of the wooden trestle approach, about 30 feet from the steel bridge. Contributing to the severity of the derailment was the absence of an inner guard rail preceding the bridge structure, which allowed the derailed equipment to move laterally into the structure and cause its collapse.

We identified the following safety issue in this investigation: the absence of an inner guard rail in the area of track preceding the steel bridge structure.

**Recommendations:** None  
**Report Date:** June 2, 2022



**Figure 25.** Aerial view of the Union Pacific Railroad derailment scene in Tempe, Arizona.

SOURCE: UNION PACIFIC RAILROAD

## Sacramento Regional Transit District Collision Between Light Rail Vehicles Sacramento, California | August 22, 2019

On August 22, 2019, at 9:38 p.m., a northbound Sacramento Regional Transit District (SacRT) passenger train traveling at 32 mph collided head-on with a stopped southbound nonrevenue test train on the blue line in Sacramento, California. The northbound train had one operator and 27 passengers on board; the test train had one operator and two contractors on board. Thirteen people were transported to area hospitals with non life-threatening injuries. Neither train derailed, and both trains experienced minimal structural damage. SacRT estimated total damage to be \$242,450.

We determined that the probable cause of the collision was SacRT's weak administrative controls that allowed the transportation supervisor to authorize a high-speed test train to enter the mainline without knowing the location of the passenger train on the same track. Contributing to the collision was senior management's failure to assess the transportation supervisor's competency in the combined role of both controller and dispatcher on the evening shift.

We identified the following safety issues in this investigation: (1) the performance deficiencies of the transportation supervisor as a controller, (2) SacRT's failure to monitor the transportation supervisor's performance to ensure competency, (3) the irregular reporting of train delays by the train operator to Metro Control, (4) SacRT's undefined testing practices on the mainline tracks, (5) the

<sup>33</sup> The rest of the 12 derailed railcars were mixed freight.

<sup>34</sup> Cyclohexanone is classified as a Class 3 flammable liquid, packing group III. The safety data sheet listed cyclohexanone by its trademark name Nadone and described the material as a clear, colorless liquid with a "mint-like acetone-like" odor.

impact of the California Public Utilities Commission's (CPUC's) instruction to test vehicles during nonrevenue hours, and (6) a lack of transmission-based train control technology use on SacRT train lines.

We issued safety recommendations to the CPUC and SacRT. We also reiterated one previously issued recommendation to the FTA.

Recommendations: 5 new, 1 reiterated  
Report Date: April 14, 2022

### Norfolk Southern Corporation Conductor Fatality Baltimore, Maryland | February 7, 2019

On February 7, 2019, about 7:00 a.m., a Norfolk Southern Corporation railroad conductor was fatally injured while performing switching operations at the President Street intermodal tracks section of the Bayview Yard of the Baltimore Consolidated Terminal in Baltimore, Maryland. The conductor was riding on the side of the leading railcar of train 38A during a reverse movement when he was pinned between the railcar he was riding and a stationary railcar on an adjacent track.

### Figure 26. Norfolk Southern Railroad railcars involved in the February 7, 2019, fatality in Baltimore, Maryland.

SOURCE: FEDERAL RAILROAD ADMINISTRATION



We determined that the probable cause of the fatality was the conductor's riding on the side of a railcar for unknown reasons as the moving train approached stored railcars on an adjacent track, which resulted in decreased clearance, in a section of the Bayview Yard where Norfolk Southern Corporation's terminal instructions and operating rules specifically prohibited riding railcars in the close-clearance restriction areas.

We identified the following safety issues in this investigation: (1) poorly written terminal instructions, and (2) training and testing gaps on close-clearance areas and location-specific hazards.

We issued safety recommendations to the Norfolk Southern Corporation.

Recommendations: 2 new  
Report Date: April 8, 2022

### Alabama Export Railroad Fatal Collision with Maintenance-of-Way Equipment Prichard, Alabama | November 17, 2020

On November 17, 2020, about 2:26 p.m., a Canadian National train operated by an Alabama Export Railroad (ALE) engineer collided with on-track maintenance equipment belonging to a Continental Rail maintenance-of-way work group on the Beauregard track in Prichard, Alabama. ALE had contracted Continental Rail to install railroad ties. The on-track maintenance equipment included a full-sized, heavy-duty flatbed truck equipped with a telescopic crane and a backhoe designed to operate on the rails. As a result of the collision, one contractor was killed and three were injured. Material damage was estimated to be \$52,000.

In response to this collision, ALE implemented over 25 managerial and operational changes, including updating and implementing safety plans that corrected issues related to on-track safety, operational communication, and internal oversight for electronic device usage and train operations. Additionally, ALE decided it would no longer use contractors for track maintenance. The ALE employee who was operating the train was decertified as an engineer and terminated.

### Figure 27. On-track maintenance equipment and striking train involved in the fatal collision in Prichard, Alabama.

SOURCE: FEDERAL RAILROAD ADMINISTRATION



We determined that the probable cause of the collision was the failure of the engineer to operate his train in accordance with restricted speed requirements and to stop before colliding with the equipment because he was engaged in the prohibited use of a personal electronic device. Contributing to the collision was ALE's track protection, which did not meet the minimum safety standards specified in Title 49 CFR Part 214. Also contributing to the collision was the Continental Rail roadway work group's removal of portable derails used for on-track safety protection before the work group cleared the track.

We identified the following safety issues in this investigation: (1) the distraction of the train engineer from operating the train because of his use of a personal electronic device, and (2) the failure of ALE to use track protection that complied with federal regulations.

Recommendations: None  
Report Date: April 4, 2022



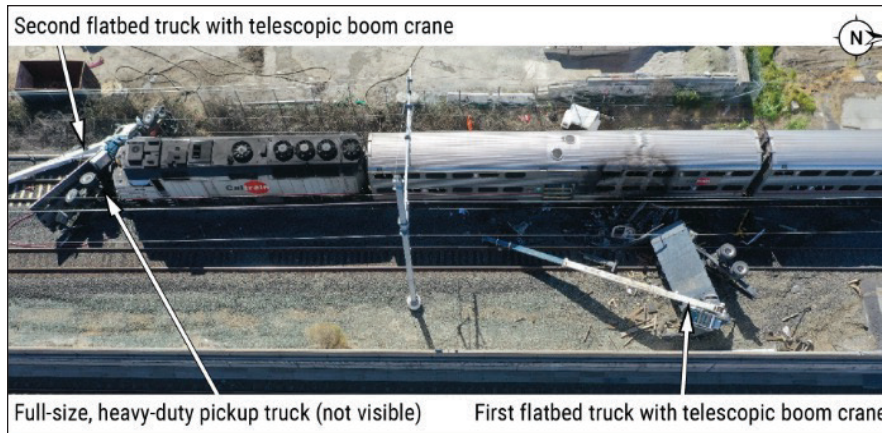
## Ongoing Significant Railroad Investigations

As of December 31, 2022, the Office of Railroad, Pipeline and Hazardous Materials Investigations had 22 ongoing railroad investigations. The following ongoing investigations on which we launched involved significant safety issues. We are devoting significant resources to the investigations listed and anticipate producing a report upon the completion of each investigation.

**Table 10. Ongoing Significant Railroad Investigations**

Location	Date	Description	Fatalities
Boston, Massachusetts	4/10/2022	Dragging of MBTA passenger who had arm caught in door	1
San Bruno, California	3/10/2022	Striking of on-track maintenance trucks by Caltrain passenger train	0
Denver, Colorado	2/9/2022	Fatality of BNSF remote control locomotive operator employee	1
Westerly, Rhode Island*	1/15/2022	Fatality of Amtrak conductor	1
Darby, Pennsylvania	12/9/2021	Striking of SEPTA trolley by CSX freight train, resulting in injuries to 7	0
Arlington, Virginia	10/12/2021	Derailment of WMATA commuter train and evacuation of passengers	0
Joplin, Montana	9/25/2021	Derailment of Amtrak passenger train, with injuries and fatalities	3
Saint Paul, Minnesota*	8/25/2021	Sideswipe collision between UP and Canadian Pacific trains	0

\*As of June 30, 2023, this investigation has been completed.



**Figure 28.** (Top) Caltrain passenger train collision with maintenance trucks in San Bruno, California, on March 10, 2022. SOURCE: SAN BRUNO FIRE DEPARTMENT (ANNOTATED BY THE NTSB)

**Figure 29.** (Left) NTSB staff inspect a track in a tunnel in Arlington, Virginia, following the October 12, 2021, derailment of a Metro commuter train.



**Figure 30.** Aerial view of the Amtrak train derailment with passenger fatalities near Joplin, Montana, September 25, 2021.

SOURCE: BILLINGS GAZETTE (USED BY PERMISSION)

## Pipeline Investigation Reports

From January 1, 2022, through December 31, 2022, the Office of Railroad, Pipeline and Hazardous Materials Investigations issued four pipeline investigation reports. One of these reports involved safety issues that led to the issuance of six safety recommendations.

Below are summaries of two of the pipeline investigation reports completed during this period.

### Enbridge Inc. Natural Gas Transmission Pipeline Rupture and Fire Danville, Kentucky | August 1, 2019

On August 1, 2019, at 1:23 a.m., an Enbridge Inc. 30-inch natural gas transmission pipeline ruptured in Danville, Kentucky, releasing about 101.5 million cubic feet of natural gas, which ignited. The accident resulted in 1 fatality, 6 injuries, and the evacuation of over 75 people. Five residences were destroyed by resulting structure fires, and an additional 14 were damaged. A nearby railroad track was also damaged, and over 30 acres of land were burned. Numerous local emergency response agencies were dispatched to the accident; the fire department and other emergency responders focused on evacuations and medical transport while Enbridge crews worked to isolate and shut down the pipeline.

We determined that the probable cause of the accident was the combination of a preexisting hard spot (a manufacturing defect), degraded coating, and ineffective cathodic protection that had been applied following a 2014 gas flow reversal project, which had resulted in hydrogen-induced cracking at the outer surface of Line 15 and the subsequent failure of the pipeline. Contributing to the accident was the 2014 gas flow reversal project, which had increased external corrosion and hydrogen evolution. Also contributing to the accident was Enbridge's integrity management program, which had not accurately assessed the integrity of the pipeline nor estimated the risk from interacting threats.

We identified the following safety issues in this investigation: (1) the nonconservative assumptions used

to calculate the potential impact radius, (2) an incomplete evaluation of the risks caused by a change of gas flow direction, (3) the limitations in data analysis related to in-line inspection (ILI) tool usage, (4) an incomplete assessment of threats and threat interactions, and (5) missed opportunities in training and requalification practices.

As a result of this investigation, we issued safety recommendations to PHMSA and Enbridge Inc.

Recommendations: 6 new  
Report Date: May 31, 2022

**Figure 31. Ruptured Enbridge Inc. pipeline in Hillsboro, Kentucky, following the release and ignition of natural gas.** SOURCE: BGC ENGINEERING USA INC.



### Enbridge Inc. Natural Gas Pipeline Rupture Hillsboro, Kentucky | May 4, 2020

On May 4, 2020, about 4:36 p.m., a 30-inch-diameter interstate natural gas transmission pipeline owned and operated by Enbridge ruptured about 3 miles east northeast of Hillsboro, Kentucky, resulting in a fire. The rupture occurred at a girth weld on a hillside previously identified by Enbridge for geotechnical monitoring because of an active landslide. At the time of the rupture, the line's operating pressure was about 674 pounds per square inch, gauge. There were no fatalities or injuries, and Enbridge estimated the cost of property damage and emergency response at \$11.7 million.

As a result of the accident, Enbridge issued new procedures for estimating tensile strain capacity, conducting multidisciplinary reviews, and determining appropriate response actions. Enbridge reported that the new procedures would result in a reduced tensile strain capacity threshold.<sup>35</sup> PHMSA took enforcement action against Enbridge and issued an advisory bulletin on damage to pipeline facilities from earth movement in rugged, steep terrain, citing the Hillsboro accident among recent land movement events.

We determined that the probable cause of the pipeline rupture was Enbridge's analysis of an active landslide that had not fully addressed uncertainties associated with pipeline defects, landslide movement, or corresponding pipeline response.

We identified the following safety issue in this investigation: the need for pipeline analyses of land movements to fully address uncertainties associated with pipeline defects, landslide movement, and the corresponding pipeline response.

Recommendations: None  
Report Date: May 31, 2022

<sup>35</sup> Tensile strain is the deformation or elongation of a solid body due to the application of a tensile force or stress. In other words, tensile strain is produced when a body increases in length as applied forces try to "stretch" it.



## Ongoing Significant Pipeline Investigations

As of December 31, 2022, the Office of Railroad, Pipeline and Hazardous Materials Investigations had two ongoing pipeline investigations. Both involved significant safety issues. We are devoting significant resources to these investigations and anticipate producing a report upon the completion of each investigation.

**Table 11. Ongoing Significant Pipeline Investigations**

Location	Date	Description	Fatalities
Edwardsville, Illinois	3/11/2022	Rupture of hazardous liquid pipeline, resulting in spill of crude oil	0
Coolidge, Arizona*	8/15/2021	Rupture of natural gas transmission pipeline, gas release, and subsequent fire, which impacted residential structure nearby	2

\*As of June 30, 2023, this investigation has been completed.



**Figure 32.** Containment booms on Cahokia Creek, a tributary of the Mississippi River. About 7 miles of the creek were impacted by the March 11, 2022, oil spill near Edwardsville, Illinois.

**Figure 33.** Aerial image of accident scene following a pipeline explosion that destroyed a nearby home in Coolidge, Arizona, on August 15, 2021, resulting in two fatalities and one injury. SOURCE: PINAL COUNTY FIRE INVESTIGATION TASK FORCE (ANNOTATED BY THE NTSB)



## Hazardous Materials Investigation Report

From January 1, 2022, through December 31, 2022, the Office of Railroad, Pipeline and Hazardous Materials Investigations issued one hazardous materials investigation report; no new safety recommendations were issued. Below is a summary of the report.

### Hazardous Material Release Anhydrous Ammonia Beach Park, Illinois | April 25, 2019

On April 25, 2019, about 4:20 a.m., two 1,000-gallon nurse tanks (tank unit 200) on a trailer towed by a farm tractor released about 650 gallons of anhydrous ammonia gas on a public road near John Kevek Farms, Inc. in Beach Park, Illinois. The farm tractor, operated by an independent contractor, was towing a fertilizer applicator and trailer carrying tank unit 200 from one agricultural field to another when the applicator coupling disconnected, releasing the gas through the adapter. In the 24 hours following the release, 83 people, including first responders and residents, were treated at local hospitals. Fourteen of the 83 were admitted; of those, 8 were admitted to the intensive care unit.



**Figure 34.** The farm tractor, fertilizer applicator, and nurse tank trailer involved in the anhydrous ammonia gas release in Beach Park, Illinois, that sent 83 people to the hospital. SOURCE: PHMSA

We determined that the probable cause of the accident was the unscrewing of the applicator coupling from the anhydrous ammonia tank unit. Contributing to the severity of the release was Conserv FS's configuration of the multiple tank unit piping, which restricted the flow rate such that the excess flow valves did not close when the applicator coupling unscrewed, which allowed both tanks to release anhydrous ammonia until empty.

We identified the following safety issues in this investigation: (1) the disconnection of the applicator coupling from the nurse tank trailer, which had open liquid withdrawal valves, and (2) the restriction of the flow rate of the dual tank configuration, which prevented the excess flow valves from closing when the coupling disconnected.

Recommendations: None  
Report Date: August 29, 2022

**Figure 35.** Beach Park, Illinois, firefighters work to close tank valves on two nurse tanks that had released anhydrous ammonia.

SOURCE: BEACH PARK FIRE DEPARTMENT



## Ongoing Significant Hazardous Materials Accident Investigation

As of December 31, 2022, the Office of Railroad, Pipeline and Hazardous Materials Investigations had one ongoing hazardous materials investigation, which involved significant safety issues. We are devoting significant resources to this investigation and anticipate producing a report upon its completion.

**Figure 36.** Aerial view of the BNSF derailment and fire that occurred at Oklaunion, Texas, on January 8, 2022.

SOURCE: BNSF (ANNOTATED BY THE NTSB)



**Table 12.** Ongoing Significant Hazardous Materials Accident Investigation

Location	Date	Description	Fatalities
Oklaunion, Texas	1/8/2022	Derailment of 31 BNSF rail cars in train carrying denatured ethanol and subsequent fire	0

## Safety Summits

The Office of Railroad, Pipeline and Hazardous Materials Investigations held two virtual summits, hosted by Chair Jennifer Homendy.

### Railroad Safety Summit

The July 21, 2022 summit was attended by railroad operators, unions, and members of emergency response organizations. It focused on actions

needed to reduce casualties, partnerships needed to improve safety, and what the NTSB can do to help the stakeholders and organizations present with their efforts to promote rail safety.



### Pipeline Safety Summit

The June 24, 2022

summit was attended by pipeline operators and stakeholders. It addressed new technologies, integrity management (IM) data collection, third-party damage and vandalism concerns, geohazards, slow state and federal permitting processes, and marine pipeline safety gaps.



## Other Significant Achievements

• **Safety Actions: Atmos, Farmersville.** The following safety actions were taken: (1) Atmos revised its pigging procedure, which standardized the launcher design. (2) Atmos established a new covered task for pigging operations and developed associate training and training evaluation. (3) PHMSA clarified that pig loading and launching is a covered task, as documented in PHMSA's Interpretation Response #PI-22-0008 to the NTSB.

- **Safety Actions: Enbridge, Danville.** Enbridge created and implemented the framework and processes needed to execute a 3- to 5-year plan to transform its approach to IM. (1) IM staff increased from 50 to 124, with specialists added in the fields of reliability and geohazards. (2) Enbridge created a new group focused on clarifying accountabilities and work processes and applying IM program elements to address Dynamic Risk's recommendations. The company also increased the frequency of its integrity-related activities to include (1) increased ILI tool runs from 86 to 371 and (2) increased anomaly digs from 655 to 980. In addition, Enbridge independently hired an engineering firm to study the area surrounding the rupture to gain information on the roles of environment, coatings, and cathodic protections and the abundance of sulfate present in the environment as well as restricting pressure on 146 pipeline segments.
- **Safety Actions: Beach Park, Illinois.** The following safety actions and accomplishments resulted from NTSB staff efforts: (1) PHMSA agreed to initiate a rulemaking that would explicitly require the closure of liquid withdrawal valves with a public outreach effort to the agricultural community, possibly in the form of a safety alert or safety advisory. (2) The state of Illinois revised its regulations to explicitly require the closure of liquid withdrawal valves and to ensure the appropriate rating of all excess flow valves, in addition to one that is added on the downstream side of the nurse tank trailer. (3) ANSI/G-2.1, "Requirements for the Storage and Handling of Anhydrous Ammonia" has been revised to address the safety issues identified in the Beach Park incident, such as plumbing configuration, annual inspection of nurse tank fittings, and the closure of liquid withdrawal valves. (4) The Gurnee Communications Center upgraded its guide card system and required annual fresher training on the hazardous materials guide card for dispatchers.
- **Publication:** A. Garcia. "The Importance of Safety Equity in Transportation System Safety." *Journal of System Safety* (2022).

# Office of Research and Engineering

**Table 13. Office of Research and Engineering Safety Statistics**

Safety Research Published	2
Safety Data Analyses Completed	242
Readouts of Vehicle Recorders and Other Electronic Devices Completed	399
Materials Laboratory Exam Reports Completed	198
Vehicle Performance Reports and Animations Completed	64
Medical Investigation Reports Completed	240
Rapid Reports Completed	8
Journal Publications	2
Advocacy and Outreach	60

The Office of Research and Engineering is an investigative office providing scientific and technical expertise for NTSB accident investigations in all modes of transportation. The office, which comprises four divisions and one program area, conducts safety research, generates periodic statistical reviews of aviation accidents, conducts readouts of vehicle recorders and other electronic devices, conducts materials failure analysis and fire investigations, determines vehicle performance, develops animations, and provides medical and toxicology expertise for investigations in all modes.

## Safety Research Division

The Safety Research Division examines transportation accidents, accident trends, and technological changes to identify problems and associated remedial actions that will reduce risk and improve the safety of the transportation system. Division staff includes transportation safety researchers, data analysts, and statisticians who conduct systematic examinations of (1) risks or hazards in the transportation environment that may influence accidents or injury, (2) the techniques and methods of accident investigation, and (3) the effectiveness of various safety countermeasures, such as policies, programs, or technologies. The division also provides data science, data visualization, and statistical expertise to support accident launches and investigations; assists in the development of safety recommendations; and publishes annual statistical reviews for the NTSB, Congress, and the public.

In 2022, the division completed two safety research reports. The first study examined data challenges associated with assessing the prevalence and risk of electric scooter (e-scooter) and electric bike (e-bike) fatalities and injuries, and the second evaluated passenger vehicle driver use of alcohol, other drugs, and multiple drug combinations in the United States. These research efforts resulted in 18 new safety recommendations.





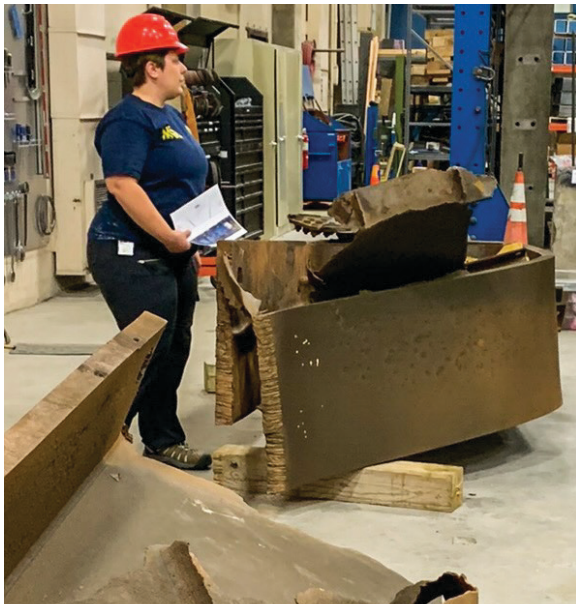
In addition, staff published the agency's official annual review of aviation accident statistics, issued 8 rapid reports, and completed 242 data, geospatial, and statistical analysis requests to support accident investigations in aviation, highway, marine, rail, and pipeline.

## Materials Laboratory Division

The Materials Laboratory Division performs expert multidisciplinary engineering and scientific analyses to determine whether the performance of materials and structures is related to the cause or severity of an accident. Engineers also analyze wreckage to determine the causes of fires and explosions. The division provides chemical and forensic science expertise, as well as technical advice and resources for experimental testing and research in the physical sciences.

In 2022, the division completed 198 reports for 147 investigations, launched to two accident sites, and supported numerous NTSB reports and recommendations. The division supported the investigation of the Fern Hollow highway bridge collapse in Pittsburgh, Pennsylvania, through on-scene documentation and evidence selection and through laboratory evaluation of the wreckage pieces.

**Figure 37.** Metallurgist Adrienne Lamm documents corrosion damage to steel bridge legs following the collapse of the Fern Hollow Bridge.



**Figure 38.** Metallurgist Matt Fox uses a bandsaw to cut samples from a weldment taken from one of the tank cars involved in the Oklaunion, Texas, derailment.

The division also supported the investigation of the crash of a de Havilland Canada DHC-3 turbine Otter into Mutiny Bay, Washington, by conducting a metallurgical evaluation of a horizontal stabilizer actuator (the "trim jack assembly"). This work resulted in the issuance of safety recommendations to the FAA and Transport Canada.

## Vehicle Recorder Division

The Vehicle Recorder Division extracts, formats, and analyzes data from aircraft FDRs and CVRs, and from recorders installed in locomotives, large ships, and some highway vehicles. Engineers also examine recorded electronic audio and video information captured by aircraft, ship, train, and support communication systems; provide electronic engineering expertise for all accident investigation modes by examining communication and control systems; provide time synchronization to correlate voice, data, and video recorder outputs; use advanced digital and analog filtering and signal representation techniques to extract critical recorder information; and perform forensic examinations of personal electronic devices and other computer hardware.



**Figure 39.** Recorder Specialist Deven Chen examines avionics recovered from the wreckage of a B-17G and P-63F midair collision during the November 2022 Wings Over Dallas air show.

In 2022, division staff received 420 devices; completed reports, transcripts, and studies for 399 devices to support aviation, railroad, marine, and highway investigations; and launched to support five investigations. Of the recorders received, 49 were from foreign accidents and 14 were from US military or other US government agency investigations. Among the devices, staff downloaded and analyzed a fire-damaged restraint control module from a Tesla Model S involved in a crash in Spring, Texas, and the fire-damaged FDR and CVR from a China Eastern 737 crash in Wuzhou, China.

## Vehicle Performance Division

The Vehicle Performance Division provides specialized aeronautical, mechanical, structural, and biomechanical engineering expertise; three dimensional laser scanning and accident reconstruction; photogrammetry and video analysis; and animation and graphics development for all modes. Engineers use computational and visualization technology to provide accurate time-motion histories of the sequence of events and to evaluate data from multiple sources to determine vehicle and occupant motion and the underlying causes of that motion. Engineers also develop video animations of accident scenarios, evaluate occupant injury mechanisms, and participate in and direct research into special projects as required.



In 2022, division staff completed 64 products in support of investigations (aircraft and surface vehicle performance studies, laser scanning reports, biomechanics studies, video/ photograph studies, animations, and video compilations). Staff used computer simulations and evaluated on-board video to investigate a crash involving a motorcoach, three combination vehicles, and a passenger vehicle near Mt. Pleasant Township, Pennsylvania, which was the topic of a Board meeting in February 2022. Staff began to evaluate video evidence from eight trains that had passed through the location of the derailment of an Amtrak train near Joplin, Montana, and to develop an animation for the upcoming Board meeting. Staff also began to correlate the flightpaths of seven airplanes with air traffic control communications in the investigation of a midair collision of World War II vintage airplanes in Dallas, Texas.

## Program Area: Medical Investigations

NTSB medical officers evaluate the medical aspects of investigations, including medical fitness, pathology, toxicology, and injury causation. Examples of medical issues they address include operator incapacitation, injury prevention, vision deficiency, hypoxia, substance impairment, obstructive sleep apnea, and use of prescription and over-the-counter medications as well as illicit substances.

In 2022, the agency's physicians participated in more than 140 investigations and completed 240 reports in all transportation modes. This included evaluating and addressing medical issues through formal factual and analytical reports, safety recommendations, coordination with other agencies, and formal presentations to the Board and external audiences.

## Completed Safety Research Reports

### Alcohol, Other Drug, and Multiple Drug Use Among Drivers

Impairment from alcohol and other drugs is a major transportation safety issue. The agency's concern about this issue has increased over the past decade, particularly in the highway mode. The NTSB has documented

substance impairment in numerous highway crash investigations, many of which involved a driver's use of more than one drug.

This safety research examined the crash risk associated with different drugs, including alcohol, and the prevalence of their use among drivers. The research also evaluated countermeasures to reduce crashes involving drivers impaired by a single drug and by multiple drugs. Safety issues addressed included (1) the need to implement proven countermeasures for alcohol-impaired driving; (2) the growing problems of cannabis, other drug-, and multiple-drug-impaired driving; (3) the need to strengthen drug-impaired driving laws and facilitate enforcement; (4) the need to ensure that driving safety is considered in the evaluation of prescription and over the counter drugs; and (5) the need to improve systems for documenting and tracking the incidence of drug use and driving.

We issued safety recommendations to NHTSA, the US Food and Drug Administration, the 50 states, the District of Columbia, and the Commonwealth of Puerto Rico.

Recommendations: 12 new  
Report Adopted: December 13, 2022

### Micromobility: Data Challenges Associated with Assessing the Prevalence and Risk of Electric Scooter and Electric Bicycle Fatalities and Injuries

Protecting vulnerable road users, such as pedestrians, motorcyclists, and bicyclists, through a Safe System approach is a priority for the NTSB. Successfully implementing a Safe System approach requires the collection and analysis of quality crash and exposure data to understand the unique risks that vulnerable road users face. Recently, emergent transportation modes in the form of electric micromobility devices have expanded the list of people considered to be vulnerable road users, specifically e-scooter and e-bike riders. Although safety data are often collected and analyzed to craft safety initiatives for pedestrians, motorcyclists, and bicyclists, less is known about road users who use such emergent modes of transportation as e-scooters and e-bikes.

This research evaluated how limitations in available e-scooter and e-bike crash and exposure data present challenges for assessing the safety of these micromobility devices, including the prevalence and risk of fatalities and injuries. Safety issues addressed included (1) the current lack of complete, consistent, and reliable safety data; (2) inadequate data coding leading to difficulty in correctly identifying crashes involving e-scooter and e-bike riders; and (3) poor quality trip data, which makes meaningful assessments of risk nearly impossible.

We issued safety recommendations to NHTSA, the Governors Highway Safety Association, the FHWA, the US Consumer Product Safety Commission, and the National Center for Health Statistics.

Recommendations: 6 new  
Report Adopted: November 14, 2022

## Other Significant Achievements

- A. Berning, R. Smith, M. Drexler, and K. Wochinger. "Drug Testing and Traffic Safety: What You Need to Know (DOT HS 813 264)." Washington, DC: NHTSA (2022).
- F. Zakar. "Multiple-Site Fatigue Cracking of Fuselage Structure due to Improper Rivet Installation." Submitted to *Engineering Failure Analysis* (2022).
- Provided NTSB comments on the FMCSA's proposed regulatory guidance Qualifications of Drivers: *Medical Examiner's Handbook and Medical Advisory Criteria*.
- Provided NTSB comments on the FMCSA's Agency Information Collection Activities, *Renewal of an Approved Information Collection: 391.41 CMV Driver Medication Form*.
- Provided NTSB comments on NHTSA's *Barriers and Solutions for Submitting Toxicology Data to the Fatality Analysis Reporting System Pursuant to Recommendations for Toxicological Investigation of Drug-Impaired Driving and Motor Vehicle Fatalities*.

# Office of Safety Recommendations and Communications

**Table 14. Office of Safety Recommendations and Communications Statistics**

Safety Recommendations Closed <i>Acceptable</i> <sup>36</sup>	269
Testimony or Legislative Support to State Legislative Committees	12
Media Mentions (Print, Broadcast, and Online)	180,800
Advocacy and Outreach	61

The Office of Safety Recommendations and Communications releases information on NTSB investigations, activities, and safety recommendations to the public across multiple communication channels. The office engages a range of stakeholders, including safety recommendation recipients; members of the transportation industry; transportation workers; federal, state, and local government officials; transportation safety advocates; and the public.

The office's work spans an investigation's lifecycle, providing the transparency that supports the NTSB's independence while building public trust in, and support for, the agency's mission. Following an investigation, office staff focus on advocating for and monitoring safety recommendation implementation. The office comprises five divisions: Safety Recommendations, Media Relations, Government and Industry Affairs, Safety Advocacy, and Digital Services.

## Safety Recommendations Division

NTSB safety recommendations address specific issues uncovered during investigations and specify actions to help prevent similar accidents and crashes from occurring in the future. These safety recommendations are the agency's most important products because they alert government, industry, and the public to the critical changes that are needed to prevent transportation accidents and crashes, to reduce injuries, and to save lives.

The NTSB issues recommendations to the organizations best able to take corrective action, such as the US DOT and its modal administrations, the US Coast Guard, other federal and state agencies, manufacturers, operators, labor unions, and industry and trade organizations. When applicable, the same recommendation may be issued to multiple recipients. The Safety Recommendations Division helps investigative offices craft recommendations that will encourage recipients to take the corrective action needed.

In this report, each *recommendation issued* is reported as one recommendation, regardless of the number of recipients. Because some recommendations are issued to more than one recipient, however, *recommendations closed* are reported by the number of recipients for whom a recommendation was closed during the year. For more information, see page 50. Closed *Acceptable* classifications include *Closed—Acceptable Action*, *Closed—Acceptable Alternate Action*, and *Closed—Exceeds Recommended Action*.

Once the Board issues a recommendation, the Safety Recommendations Division handles the ongoing correspondence between the agency and each recipient, tracking and analyzing the recipient's responses and determining a classification—*Acceptable* or *Unacceptable*—for the Board members to consider. The division monitors the progress of action to implement each recommendation until it is closed (which usually takes several years), maintains a database of all recommendations, compiles monthly statistics, and responds to data queries from other offices.

When the same recommendation is issued to multiple recipients, that recommendation is counted (and reported) only once, as a single recommendation. However, there is frequently considerable variation among the responses of individual recipients, and a recommendation may be closed for one or more recipients based on those responses, while it remains open for other recipients. Therefore, in this report, recommendation closures indicate closure for individual recipients separately. For example, a single recommendation issued to all 50 states, the District of Columbia, and Puerto Rico that, in 2022, was classified closed *Acceptable* to 32 states based on their individual responses is reported as 32 closed *Acceptable* classifications.

During 2022, the division contacted numerous recommendation recipients who had not updated the NTSB on their actions for some time. In many cases, the recipient had completed the recommended action but had not informed the agency. This follow-up effort added to the number of closures the agency achieved.

In total, 269 open recommendations were closed *Acceptable* in 2022; 29 of these were issued to DOT modal agencies or the US Coast Guard (see Table 15).<sup>37</sup>

**Table 15. Safety Recommendations Issued to the US DOT, Modal Agencies, and the US Coast Guard Closed in 2022**

	Safety Recommendations Closed <i>Acceptable</i>	Safety Recommendations Closed <i>Unacceptable</i>
Federal Aviation Administration	16	17
Federal Highway Administration	1	0
Federal Transit Administration	3	0
National Highway Traffic Safety Administration	1	1
Pipeline and Hazardous Materials Safety Administration	2	0
US Coast Guard	6	0

Also in 2022, the NTSB referenced related open safety recommendations in our responses to several notices issued by the US DOT and other federal agencies in the *Federal Register*.

Table 16 summarizes these actions.

**Table 16. Open Safety Recommendations Referenced in NTSB Responses to Federal Register Notices from Federal Agencies in 2022**

	Federal Register Notices	Open Safety Recommendations Referenced
Department of Transportation	1	16
Federal Aviation Administration	1	0
Federal Communications Commission	1	7
Federal Motor Carrier Safety Administration	4	14
National Highway Traffic Safety Administration	3	19

<sup>37</sup> In addition, 33 safety recommendations were closed *Unacceptable* in 2022; of these, 18 were issued to DOT modal agencies or the US Coast Guard.



## Media Relations Division

The Media Relations Division is responsible for providing accurate and timely information to the media and public about NTSB activities.

The division provides information about accident, crash, and incident investigations and coordinates the release of investigation reports, safety research reports, safety recommendations, safety alerts, and other agency investigative products. The division also amplifies the lessons learned from NTSB investigations, responds to media inquiries, arranges media interviews of agency personnel, and serves as the on-scene public affairs contact, supporting Board members when they launch on an accident investigation. The division supports deployed regional investigators and investigators-in-charge, and trains NTSB and transportation industry personnel in successful media engagement.

Division staff traveled on every major launch in 2022, including a deadly Amtrak derailment in Missouri; the crash of a de Havilland DHC-3 into Mutiny Bay, Washington; the midair collision between a Boeing B-17G and a Bell P-63F in Texas; and the fatal highway collision between a pickup truck and a transit van in Texas.

**Figure 40.** Public Affairs Officer Keith Holloway (left) from the Media Relations Division records Chair Homendy’s media briefing about the Mendon, Missouri, grade-crossing collision and derailment.



In addition, staff provided remote media relations support for every NTSB investigation, and conducted 10 virtual and in-person media relations training sessions for transportation industry and agency staff.

As shown above in Table 14, the division helped the NTSB garner more than 180,800 print, broadcast, and online news mentions in 2022.

**Table 17. NTSB Media Mentions**

News Releases and Media Advisories	89
Tweets	670

**Figure 41.** Michael Portman of the Office of Aviation Safety (left) and Beverley Drake from the Government and Industry Affairs Division joined other NTSB staff to promote aviation safety during the Experimental Aircraft Association’s Airventure in Oshkosh, Wisconsin, July 2022.



## Government and Industry Affairs Division

The Government and Industry Affairs Division is the NTSB’s primary liaison with Congress, the White House, the Government Accountability Office (GAO), other federal agencies, and state and local governments. The division informs Congress, governors, and state legislatures about NTSB activities, including launches, investigations, Board meetings, and the issuance and current implementation status of safety recommendations. It also manages inquiries from federal, state, and local governments. The division communicates with the transportation industry about agency initiatives and works with the Safety Advocacy Division to support programs and legislation consistent with our safety recommendations and to monitor relevant state legislative activity.

In 2022, staff supported launches from headquarters and responded to hundreds of requests for information in each mode of transportation. The division initiated agency outreach to congressional, state, and local officials who expressed an interest in improving transportation safety and provided them with technical assistance as they drafted legislation. Staff helped develop the Board’s reauthorization proposal to Congress and coordinated Board members’ testimony before Congress regarding the agency’s reauthorization, freight rail safety, and maritime safety. In addition, staff supported Board member and senior official testimonies and legislative advocacy efforts before state legislatures in Kentucky, Maryland, Massachusetts, Missouri, New York, South Carolina, Tennessee, and Washington.





## Safety Advocacy Division

The Safety Advocacy Division leads the agency’s advocacy efforts and promotes the implementation of safety recommendations related to the NTSB’s MWL. The division relays safety messages and lessons learned from NTSB investigations through print, digital, and social media channels, and delivers presentations at national conferences and meetings with state and local lawmakers and other stakeholders. The MWL is the agency’s primary advocacy focus, and the division leads the list’s biennial development, working with Board members, representatives from the Office of Research and Engineering, and modal office directors to identify safety items to include on the list.

Throughout 2022, the division continued advocating for issues included on the current MWL and coordinated the agency’s response to the annual US DOT Report to Congress. Staff also facilitated meetings with modal offices to respond to the GAO’s MWL audit, which recommended improved transparency about how items are selected for the list and how that rationale is explained to the public. The division continued using social and digital media in 2022, hosting virtual meetings to relay information to stakeholders and posting hundreds of social media messages on the NTSB blog, Twitter, Facebook, LinkedIn, Instagram, and YouTube. Staff also hosted Twitter chats to call attention to risks to the safety of the transportation system and expanded the agency’s use of virtual meeting and webcasting tools, hosting meetings with stakeholders to advance the agency’s mission and to advocate the safety items highlighted on the MWL. (See tables 18 and 19 below.)

**Table 18. Safety Advocacy Division Social Media Followers, Connections, and Subscribers**

Twitter Followers	168,200
Instagram Followers	13,700
LinkedIn Followers	28,750
E-Mail Subscribers	7,221

**Table 19. Safety Advocacy Division Products and Events**

Behind-the-Scene @NTSB podcasts	6
YouTube Videos	19
Advocacy Spotlight Newsletters	1
Safety Compass Blogs	22
Events (Conference Exhibits, Advocacy Events, Presentations, Roundtables, Coalition Meetings, Testimony, and Workshops)	61



**Figure 42.** On April 6, 2022, Nicholas Worrell, chief of the Safety Advocacy Division, joined stakeholders at the Pennsylvania State Capitol for a press conference on distracted driving.

## Digital Services Division

The Digital Services Division supports the NTSB’s internal and external strategic communications goals. Staff manages agency communications on ntsb.gov and designs and develops graphics and audiovisual products that optimize the agency’s ability to communicate investigation findings and safety messages and to facilitate employee engagement. The division also establishes visual style and branding standards for the agency and advises internal stakeholders on how best to use visual information to enhance their products.

In 2022, the division completed a comprehensive revision of the NTSB branding and style guidelines, updating style elements to a contemporary design and standardizing the design of NTSB products. Several items have been updated, notably the investigation report template, and division staff are working with other offices to progressively update their materials.

The division implemented a digital asset management system to better collect, store, and categorize imagery and other digital files created or used by the Digital Services Division and other divisions within our office. The new system greatly increases the organizational efficiency of these files, and significantly improves the accessibility and usefulness of the agency’s digital collections.

**Figure 43.** The Digital Services and the Safety Advocacy divisions generated this social media graphic to illustrate the high number of traffic fatalities.



# Office of Administrative Law Judges

**Table 20. Office of Administrative Law Judges Statistics**

Total Cases Received	247
Total Cases Closed	303
Emergency Cases Received	118
Emergency Cases Closed	25
Challenges to Emergency Determinations	13
Hearings Held	19
Board Opinions and Orders	22

The NTSB serves as the court of appeals for pilots, aircraft mechanics, air traffic controllers, air carriers, repair facilities, and any other individual or entity against whom the FAA has taken a certificate action, and for mariners against whom the US Coast Guard has taken a certificate action.

The judges within the agency's Office of Administrative Law Judges hear and consider the cases of, and issue initial decisions on, administrative appeals of FAA aviation enforcement actions. Under the Equal Access to Justice Act, the judges also adjudicate claims from certificate holders for legal fees and expenses incurred in defending against FAA certificate actions and adjudicate appeals from civil penalty actions assessed against any individual by the FAA. The certificate holder, the person being assessed, or the FAA may appeal an administrative law judge's decision. The Board's review of such an appeal is based on the record of the proceeding, which includes the transcript of the hearing testimony, exhibits, the judge's decision, and appeal briefs submitted by the parties. Marine certificate actions are heard first by Coast Guard administrative law judges and may be appealed to the Vice Commandant of the Coast Guard. The Vice Commandant's ruling may then be appealed to the NTSB. The same appellate process is followed for marine certificate actions as that for aviation certificate actions.

We currently have one judge assigned to headquarters in Washington, DC; one assigned to the circuit that includes Denver, Colorado; and one assigned to the circuit that includes San Antonio, Texas. In the past, our judges held hearings in their circuits, but since the pandemic required a transition to virtual hearings, they are now an option for judges to consider when determining a hearing's venue.

# Office of Human Capital Management and Training

**Table 21. Career Development and Training Statistics**

Courses, Programs, and Seminars Offered by the NTSB	150
Training Center/Virtual Attendance NTSB Courses (All Attendees)	460
Attendance at Off-site NTSB Course (Media Relations) <sup>38</sup>	144
Total Attendance at NTSB Courses, Programs, and Seminars (Open Enrollment)	604
Total NTSB Employee Attendance at All Training, NTSB and Other	4,920

In April 2022, the NTSB moved its training function from the Office of the Managing Director to the new Office of Human Capital Management and Training, formerly the Office of Administration. The new division was named the Career Development and Training Division. These changes align the agency's human resources management goal of employee development and training with its goal of employee recruitment and retention.

Historically, the NTSB Training Center, based in Ashburn, Virginia, provided training for agency investigators and others in the wider transportation community to improve their investigation capabilities. But with the chair's mission-first vision and the closure of the NTSB Training Center facility in July 2023, the NTSB has set a new course for the agency training program.

The Career Development and Training Division is responsible for developing training plans, overseeing the development and implementation of workforce development programs, and training NTSB staff. The division provides agency employees with course selections and training opportunities to ensure that they are equipped for the transportation and leadership challenges of the future.

The division continues to evaluate its courses, further refine the offerings, and improve instruction in all areas of technical, investigative, supervisory, and leadership development, as well as other aspects of mission support. It offers course content in investigative skills that target processes, procedures, and technical issues critical to the agency's mission of accident investigation and adds new courses and initiatives in response to the strategic priorities for the agency's workforce identified by senior leadership. These courses are generally open only to NTSB investigative and support staff.

<sup>38</sup> The NTSB provided the media relations course "Managing Communications Following a Transportation Accident" to transportation stakeholders, including operators and facilities, at their locations.

## Other Significant Achievements

- **Conducting the final courses at the NTSB Training Center.** During 2022, the NTSB conducted 12 accident investigation and mission-related courses for 604 attendees, including 39 NTSB personnel. The participants included 283 federal employees whose duties include conducting accident investigations. Twenty-two students from 16 countries outside the United States also attended. Nine of the 12 courses were held in person in Ashburn, Virginia.
- **Expanding workforce development for all NTSB staff.** The division continued to expand the course offerings for NTSB career professionals through an innovative curation strategy that maximizes the number and variety of courses available. The division continued participating in the Federal Small Agency Council's training cooperative, sharing excess course capacity among member agencies. In addition, the division extended interagency agreements with the US Department of Interior University and the Treasury Executive Institute to provide essential training in acquisitions, federal supervision, project management, and leadership and managerial development topics for staff, supervisors, senior executives, and aspiring leaders. Expanded offerings included new courses through private sector training sources, as well as one-on-one executive coaching, yielding targeted career development support tailored to individual needs. The workforce development curriculum addressed important cross-functional technical, administrative, and leadership competencies at the agency. During 2022, staff collected and evaluated utilization data on various offerings and began exploring ways to collect trainee satisfaction data to ensure that programs are the best they can be and to help staff prioritize programs as the division explores new innovative options.
- **Implementing Career Development Road Maps.** During 2022, the division implemented a career development roadmap based on the Office of Personnel Management's executive competencies. The roadmap matches the competencies to developmental opportunities that are available to employees at all levels, enabling them to plan their career development more easily. To better meet employees' needs, specialized tracks were added to further guide employees seeking training in areas of critical importance to the agency's success.
- **Strongly emphasizing technical training for NTSB investigators.** The division continued to upgrade and refine investigators' skills by creating or redesigning such courses as Interviewing Techniques for Accident Investigators, Investigating Human Fatigue Factors, and Accident Site Photography, which was updated to illustrate the use of unmanned aerial vehicles (UAVs, or drones) for capturing precision aerial imagery to aid in our investigations. UAVs have been identified as an emerging transportation technology, impacting both our investigative tools and the types of accidents and incidents we investigate. This update has led to a four-pronged UAV training goal: (1) to provide initial and (2) refresher training for the UAV pilots who support the NTSB's UAV program, (3) to provide training for all NTSB investigators across all modes on the appropriate uses of UAVs as a scene documentation and investigative tool, and instruction in how to request UAV support for their investigations, and (4) to prepare agency investigators who may be called upon to investigate UAV accidents or incidents under the NTSB's authority, ensuring a thorough investigation that promotes the future safety of this new transportation domain and its interaction with traditional aviation.



# Transportation Disaster Assistance Division

**Table 22. Transportation Disaster Assistance Statistics**

Family Members and Victims Assisted	3,480
Outreach Events	72
Agencies/Organizations Supported	356

The Transportation Disaster Assistance Division coordinates federal government resources to support local and state governments, disaster relief organizations, and transportation carriers to offer services and information to family members and survivors as needed following aviation and rail accidents. Division staff also serve as the primary source of investigative information for family members and survivors for any accident investigated by the NTSB.<sup>39</sup>

To support both our investigative and family assistance efforts at accident sites, we maintain formal agreements with the American Red Cross; the US Departments of Homeland Security, Defense, Health and Human Services, and State; and the Federal Bureau of Investigation.

During 2022, division staff participated in 9 launches and provided nonlaunch family assistance support for an additional 859 investigations in all modes of transportation, interacting with 3,480 victims and family members.

Staff engaged with family members associated with 74 different accidents, on average, each week; these encounters ranged from a single phone call or e-mail to several hours of work over multiple days with numerous family members from a single accident.

In addition, staff interfaced with 356 federal, state, and local agencies; transportation industry organizations; and other nongovernmental organizations that have a role in family assistance operations, with an average of 25 engagements per week requiring either travel or remote interaction. We also supported 72 outreach events, directly interfacing with approximately 4,453 stakeholders.

<sup>39</sup> In 1996, Congress enacted the Aviation Disaster Family Assistance Act (Title 49 *United States Code [U.S.C.]* sections 1136 and 41113), charging the NTSB with assisting victims of aviation disasters and their families, and coordinating with federal agencies, domestic air carriers, and state and local authorities to ensure that the fundamental concerns of families are met. In 1997, the Foreign Air Carrier Family Support Act (Title 49 *U.S.C.* section 41313) required foreign air carriers operating flights to and from the United States to meet similar victim assistance standards as their US counterparts. The Rail Safety Improvement Act of 2008 (Title 49 *U.S.C.* sections 1139 and 24316) gave similar responsibilities to the NTSB, Amtrak, and other interstate and intercity high-speed passenger rail operators following rail passenger accidents. Finally, in 2018, Congress further expanded the Board's responsibilities to provide information regarding NTSB investigative processes and products to the families of individuals involved in any accident investigated by the NTSB to the maximum extent practicable in advance of the media (Title 49 *U.S.C.* section 1140).

