NTSB 2018 Annual Report to Congress
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Abbreviations

AD airworthiness directive
ALJ Office of Administrative Law Judges
ANPRM advance notice of proposed rulemaking
APA The American Pilots’ Association
ARNG Army National Guard
AS Office of Aviation Safety
BMA Bahamas Maritime Authority
CFIT controlled flight into terrain
CFR Code of Federal Regulations
CRM crew resource management
CVR cockpit voice recorder
DGAC Directorate General of Civil Aeronautics
DOT Department of Transportation
DS Digital Services Division
DSA draft safety advisory
FAA Federal Aviation Administration
FHWA Federal Highway Administration
FMCSA Federal Motor Carrier Safety Administration
FRA Federal Railroad Administration
HPT high-pressure turbine
IMO International Maritime Organization
GA Government and Industry Affairs Division
GAO General Accounting Office
ICAO International Civil Aviation Organization
LIRR Long Island Rail Road
MAIIF Marine Accident Investigators’ International Forum
MS Office of Marine Safety
MR Media Relations Division
MWL Most Wanted List of transportation safety improvements
NHTSA National Highway Traffic Safety Administration
NOTAM notice to airmen
NPIC notice of proposed information collection
NPRM notice of proposed rulemaking
NTSB National Transportation Safety Board
PHMSA Pipeline and Hazardous Materials Safety Administration
PTC positive train control
RE Office of Research and Engineering
RRAIC revision and renewal of an approved information collection
SA Safety Advocacy Division
SEPTA Southeastern Pennsylvania Transportation Authority
SIS substantially interested state
SR Safety Recommendations Division
SRC Office of Safety Recommendations and Communications
SSFA Safe Skies for Africa
sUAS small unmanned aircraft system
SUV sport utility vehicle
TDA Transportation Disaster Assistance Division
TRB Transportation Research Board
TxDOT Texas Department of Transportation
UP Union Pacific Railroad
USCG United States Coast Guard
USC United States Code
VDR voyage data recorder

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Figure 1: NTSB Go-Team launches to an accident scene.
I am pleased to present the 2018 Annual Report to Congress for the National Transportation Safety Board (NTSB). Since our inception in 1967, the agency has been at the forefront of transportation safety, and we are recognized internationally for our accident investigation expertise. We have investigated more than 147,000 aviation accidents, as well as thousands of highway crashes and accidents elsewhere in surface transportation. We have issued more than 14,800 safety recommendations as a result.

In 2018, we were again recognized as one of the Best Places to Work in the Federal Government for Small Agencies. This report showcases our outstanding work over the last year and provides details about our completed and ongoing investigations, safety recommendations, transportation disaster assistance activities, and emerging safety-related issues.

The NTSB responded to both longstanding and leading-edge challenges in 2018 as we continued to advance our transportation safety mission. We completed several major and significant safety investigations, such as the crash of a Hageland Aviation (Ravn Connect) commuter flight near Togiak Village, Alaska; a Roswell, New Mexico, rail accident; the collision between a freight train and charter motorcoach at a high-profile highway–railroad grade crossing in Biloxi, Mississippi; a fire aboard the passenger vessel Caribbean Fantasy; the collision between a pick-up truck and a 13-passenger bus in Concan, Texas; and the derailment and hazardous materials release of a Union Pacific railroad unit ethanol train. We also completed two special investigative reports on pedestrian safety and school bus transportation safety.

In addition to deploying teams to accident and crash sites, we promoted the exchange of safety information by holding investigative hearings, roundtables, safety seminars, and safety webinars.

- Investigative Hearings: Managing Safety on Passenger Railroads and CFM International Engine Failure on Southwest Airlines Flight 1380
- Roundtable: Preventing Inflight Loss of Control in General Aviation Through Training and Technology
- Safety Seminars: Inspection Authorization Renewal and Night Flying
- Safety Webinar: Reducing CMV Crashes Through the Use of Video Recorders

In addition to the agency’s domestic work, we fulfilled our safety role abroad by providing technical expertise to our international partners and participating in accident investigations. These activities helped drive further safety improvements in US products and services, and encourages reciprocal support from our foreign partners when either foreign equipment or a foreign carrier is involved in an accident in the United States.

We hope you find our 2018 Annual Report to Congress to be an informative presentation of the agency’s accomplishments.

Sincerely,

Robert L. Sumwalt, III
Chairman
About the National Transportation Safety Board

The NTSB is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in other modes of transportation—railroad, highway, marine, and pipeline. We determine the probable cause of the accidents we investigate and issue safety recommendations aimed at preventing future accidents. In addition, we conduct transportation safety studies and coordinate the resources of the federal government and other organizations to assist victims and their family members who have been impacted by major transportation disasters.

History

The origin of the NTSB 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 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 could the individual modal agencies working separately. Since 1967, the NTSB has investigated accidents in the aviation, highway, marine, pipeline, railroad, and public transportation modes, as well as accidents related to the transportation of hazardous materials.

In 1974, Congress reestablished the NTSB as a separate entity outside of the 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 DOT has broad operational and regulatory responsibilities that affect the safety, adequacy, and efficiency of the transportation system, and transportation accidents may suggest deficiencies in that system, the NTSB’s independence was deemed necessary to providing proper oversight.

The NTSB, which has no authority to regulate, fund, or oversee any mode of transportation, strives for objectivity in its investigations and recommendations.

Role in Transportation Safety

Since our inception in 1967, we have investigated more than 147,000 aviation accidents and thousands of surface transportation accidents. 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.

We investigate accidents to determine the probable cause, examine safety issues, and devise recommendations to prevent recurrence. We have issued more than 14,800 safety recommendations to more than 2,400 recipients in all transportation modes, over 82% of which have been implemented. Since 1990, we have compiled and published an annual or biennial Most Wanted List of transportation safety improvements, which increases awareness of, and support for, the most critical changes needed to reduce transportation accidents and save lives.

We also develop safety studies focused on broader safety questions and topic areas, enabling us to better perform our mission. 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 (USCG), and we adjudicate appeals of civil penalty actions taken by the FAA.
## MISSION
Making transportation safer by conducting independent accident investigations, advocating safety improvements, and deciding pilots’ and mariners’ certification appeals.

## LEGISLATIVE MANDATE
Maintaining our congressionally mandated independence and objectivity;
Conducting objective accident investigations and safety studies;
Performing fair and objective pilot and mariner certification appeals;
Advocating for safety recommendations;
and,
Assisting victims of transportation accidents and their families.

## CORE VALUES
Integrity ★ Transparency ★ Independence ★ Excellence

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### Strategic Goals and Objectives

#### SAFETY LEADERSHIP
Serve as a global leader in conducting independent accident investigations, producing studies, and creating products essential to transportation safety.

**Objectives:**
- **IMPROVE TRANSPORTATION SAFETY:** Promote and enhance transportation safety through response, products, proactive approaches, and actions
- **EVLING TECHNOLOGY:** Increase agency awareness and implementation of emerging technologies in agency operations and investigations
- **DATA ANALYTICS:** Broaden the use of data and analysis to improve agency operations and investigations
- **ENTERPRISE RISK MANAGEMENT:** Establish an enterprise risk management program that is integrated with strategic planning and budgeting processes to improve agency operations and investigations

#### ENGAGEMENT
Engage external stakeholders to advance transportation safety.

**Objective:**
- **STAKEHOLDER ENGAGEMENT:** Inform and influence external stakeholders

#### SYNERGY
Promote employee teamwork, innovation, and engagement to optimize operations.

**Objectives:**
- **EMPOWERMENT:** Cultivate creativity and innovation across the agency through effective leadership
- **INCLUSIVE AND ENGAGED WORKFORCE:** Promote an inclusive and engaged workforce to eliminate barriers to equal employment opportunity
Organization & Program Structure

Our organizational structure is designed around sound business and management principles. We are authorized five Board members, each nominated by the President and confirmed by the Senate to serve 5-year terms. One member is nominated by the President and confirmed by the US Senate as chairman and another is designated by the President as vice chairman, each for a 3-year term. The chairmanship requires separate Senate confirmation. When there is no designated chairman, the vice chairman serves as acting chairman. Currently, we have four board members (Figure 3).

Figure 4 shows our organizational structure. For more information about our offices and their functions, visit the organization page of our website.

We are headquartered in Washington, DC, and have staff working remotely throughout the country and in regional offices in Ashburn, Virginia; Denver, Colorado; Anchorage, Alaska; and Federal Way, Washington (Figure 5 shows the NTSB’s US regional presence).

Figure 3: NTSB Board Members

- Honorable Robert L. Sumwalt, III
  Chairman
- Honorable Bruce Landsberg
  Vice-Chairman
- Honorable Earl F. Weener, Ph.D.
  Board Member
- Honorable Jennifer Homendy
  Board Member

Figure 4: NTSB Organization Chart
Figure 5: NTSB Regional Field Offices

ANC: Alaska Region
Anchorage, Alaska
Alaska

WPR: Western Pacific Region
Federal Way, Washington
Arizona
California
Hawaii
Idaho
Montana
Nevada
Oregon
Washington
American Samoa
Guam
Northern Mariana Islands

CEN: Central Region
Denver, Colorado
Arkansas
Colorado
Indiana
Illinois
Iowa
Kansas
Louisiana
Michigan
Minnesota
Missouri
Nebraska
New Mexico
North Dakota
Ohio
Oklahoma
South Dakota
Texas
Wisconsin
Wyoming

ERA: Eastern Region
Ashburn, Virginia
Alabama
Connecticut
Delaware
Florida
Georgia
Kentucky
Maine
Maryland
Massachusetts
Mississippi
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
### Safety Statistics At-A-Glance

#### Table 1: 2018 NTSB Safety Statistics At-A-Glance

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<td>Urgent Recommendations Closed Acceptably(^1)</td>
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<td>Urgent Recommendations Closed Unacceptably</td>
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<td>Recommendations Closed Acceptably</td>
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<td>Readouts of Vehicle Recorders and Other Electronic Devices Completed</td>
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<td>Material Laboratory Exam Reports Completed</td>
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<td>Vehicle Performance Reports and Animations Completed</td>
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<td>Medical Investigation Reports Completed</td>
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<td>Testimony or Legislative Support to State Legislative Committees</td>
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<td>Earned Media Mentions (print, broadcast, online)</td>
<td>234,900</td>
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<td>Family Members and Victims Assisted</td>
<td>1,741</td>
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<td>Journal Publications(^2)</td>
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<td>Total Cases Received</td>
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<td>Total Cases Closed</td>
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<td>Emergency Cases Received</td>
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<td>Emergency Cases Closed</td>
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<td>Federal Partnerships</td>
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<td>External Participants</td>
<td>1,324</td>
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\(^1\) Acceptable status include “Closed—Acceptable Action,” “Closed—Acceptable Alternative Action,” and “Closed—Exceeds Recommended Action.”

\(^2\) Some publications are co-authored with staff from two offices. These publications are only counted once for the agency.
The Office of Safety Recommendations and Communications (SRC) publicly releases information across multiple communication channels to engage a range of stakeholders regarding NTSB investigations, activities, and safety recommendations. These stakeholders include victims of transportation accidents and their families; recipients of NTSB recommendations; the transportation industry; federal, state, and local government officials and agencies; transportation safety advocacy organizations, and the public our agency serves.

SRC’s mission spans an investigation's lifecycle, providing the transparency that supports our independence while building public trust and support. After an investigation concludes, SRC efforts focus on advocating for the implementation of our safety recommendations. Through proactive communication, SRC tells the NTSB story to gain support for the agency and understanding of its mission and its people.

SRC includes six divisions:

- Safety Recommendations (SR)
- Transportation Disaster Assistance (TDA)
- Media Relations (MR)
- Government and Industry Affairs (GA)
- Safety Advocacy (SA)
- Digital Services (DS)

Table 2: Office of Safety Recommendations and Communications Statistics

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendations Issued</td>
<td>216</td>
</tr>
<tr>
<td>Recommendations Closed Acceptably</td>
<td>74</td>
</tr>
<tr>
<td>Recommendations Closed Unacceptably</td>
<td>31</td>
</tr>
<tr>
<td>Urgent Recommendations Closed Acceptably</td>
<td>5</td>
</tr>
<tr>
<td>Urgent Recommendations Closed Unacceptably</td>
<td>1</td>
</tr>
<tr>
<td>Testimony to Congressional Committees</td>
<td>6</td>
</tr>
<tr>
<td>Testimony or Legislative Support to State Legislative Committees</td>
<td>10</td>
</tr>
<tr>
<td>Earned Media Mentions (print, broadcast, online)</td>
<td>234,900</td>
</tr>
<tr>
<td>Family Members and Victims Assisted</td>
<td>1,741</td>
</tr>
<tr>
<td>Advocacy and Outreach Events Conducted</td>
<td>53</td>
</tr>
</tbody>
</table>
Safety Recommendations Division

Safety recommendations are the primary product of our investigations. They address specific issues uncovered during investigations and specify actions to help prevent recurrence.

The SR division helps our investigative offices develop recommendations and the recommendation transmittal letters that result from their investigations. Recommendation letters are sent to the organizations best able to take corrective action. Typical recipients include the DOT and its modal administrations, the USCG, other federal and state agencies, manufacturers, operators, and industry and trade organizations, among others.

Once a safety recommendation is issued, SR helps develop and coordinate strategies to encourage recommendation recipients to implement the recommendations. SR also tracks and analyzes the recipients’ responses and suggests a classification for the Board members to consider and vote upon. Each recommendation is tracked and evaluated until it is closed, and each closed recommendation is designated with a notation, such as “acceptable action” or “unacceptable action.” SR also maintains the NTSB safety recommendation database, compiles monthly statistics, and supports NTSB staff on recommendation data queries.

In 2018, the NTSB saw the acceptance of 74 safety recommendations by recipients. Over the last 5 years, the number of recommendations closed following acceptable action by recipients has ranged from 149 in 2014 to 74 in 2018 (see figure at right).

In response to our safety recommendations, in 2018, federal agencies issued, via Federal Register notices, important notices of proposed rulemaking to include, advance notices of proposed rulemaking, airworthiness directives, draft safety advisories, notices of proposed information collection, and revisions and renewals of an approved information collection. Table 3 provides a summary of these actions.

Table 3: Safety Recommendations Addressed by Federal Agencies through Federal Register notices

<table>
<thead>
<tr>
<th>Agency</th>
<th>Number of Federal Register Notices</th>
<th>Number of Safety Recommendations Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Aviation Administration</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Federal Motor Carrier Safety Administration</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Federal Railroad Administration</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>National Highway Traffic Safety Administration</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>United States Coast Guard</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Advocacy efforts among the NTSB, the DOT, and the USCG led to the closure of 65 recommendations issued to those agencies.

Table 4: Safety Recommendations Issued to the DOT, DOT Modal Agencies, and the USCG Closed During 2018

<table>
<thead>
<tr>
<th>Agency</th>
<th>Number of Recommendations Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States Department of Transportation</td>
<td>4</td>
</tr>
<tr>
<td>Federal Railroad Administration</td>
<td>3</td>
</tr>
<tr>
<td>Federal Aviation Administration</td>
<td>47</td>
</tr>
<tr>
<td>Federal Motor Carrier Safety Administration</td>
<td>4</td>
</tr>
<tr>
<td>Pipeline and Hazardous Materials Safety Administration</td>
<td>6</td>
</tr>
<tr>
<td>National Highway Traffic Safety Administration</td>
<td>0</td>
</tr>
<tr>
<td>Federal Transit Administration</td>
<td>1</td>
</tr>
<tr>
<td>Federal Highway Administration</td>
<td>0</td>
</tr>
<tr>
<td>United States Coast Guard</td>
<td>0</td>
</tr>
</tbody>
</table>

3 Acceptable statuses include “Closed—Acceptable Action,” “Closed—Acceptable Alternate Action,” and “Closed—Exceeds Recommended Action.”
Transportation Disaster Assistance Division

TDA coordinates federal government resources to support local and state governments, disaster relief organizations, and transportation carriers to meet the needs of family members and survivors following major aviation and rail accidents, as defined in Title 49 United States Code (USC) sections 1136 and 1139. TDA staff also serve as the primary source of investigative information for family members and survivors for any accident investigated by the NTSB (49 USC 1140).

To support both our investigative and family assistance efforts at major accidents, we have 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 2018, TDA staff participated in 12 accident launches, one of which (a tour helicopter accident in Peach Springs, Arizona) met the requirements of the Aviation Disaster Family Assistance Act (Title 49 USC sections 1136 and 41113). Staff also provided nonlaunch family assistance support for an additional 390 accident investigations in all modes of transportation, interacting with over 1,741 accident victims and family members. TDA staff were involved with an average of 38 cases per week. TDA staff supported family members attending 12 Board meetings and investigative hearings, supported 53 outreach events, and coordinated two training courses at the NTSB Training Center, resulting in direct contact with approximately 4,392 participants.

Staff interfaced with 325 federal, state, and local agencies, transportation industry organizations, and other nongovernmental organizations that have a role in family assistance operations, with an average of 20 engagements per week requiring either travel or remote interaction.

Media Relations Division

MR is responsible for developing and maintaining mutually beneficial relationships with the media to tell the NTSB story and to communicate information to external audiences that promotes transparency and accountability. MR is the primary conduit through which the NTSB releases information to the media about accident and incident investigations and other newsworthy agency activities, including the release of reports, safety alerts, safety studies, and safety recommendations. MR staff respond to media inquiries, arrange and support media interviews of our personnel, and are the on-scene public affairs officers supporting Board members during major accident investigations. MR also supports deployed regional investigators and investigators-in-charge, and provides training to both NTSB and transportation industry personnel to prepare them for successful media engagement. MR staff supports NTSB events that are open to the media, such as Board meetings, media briefings, and safety advocacy events of media interest.

MR helped the NTSB garner more than 234,900 print, broadcast, and online news articles in 2018. Special projects included media relations support for three episodes of the Cineflex production Mayday, (Reno Air races, Continental Airlines flight 1404, and Fine Air); a documentary for the Smithsonian Channel (US) and the Discovery Channel (Canada) about the sinking of the cargo vessel El Faro; a 60 Minutes story on positive train control (PTC), a

Figure 8: Media Relations specialist Keith Holloway captures images at the scene of the fatal uncontainted engine failure accident on Southwest Airlines flight 1380 on April, 2018, in Philadelphia, Pennsylvania.

TDA Operating Authority

In 1996, Congress enacted the Aviation Disaster Family Assistance Act (Title 49 USC sections 1136 and 41113), which charged the NTSB with assisting victims of aviation disasters and their families; and coordinating among federal agencies, domestic air carriers, and state and local authorities to ensure that families’ fundamental concerns are addressed. In 1997, Congress enacted the Foreign Air Carrier Family Support Act (Title 49 USC section 41313) to require foreign air carriers operating flights to and from the United States to meet similar victim assistance standards as their US counterparts. In 2008, the Rail Passenger Disaster Family Assistance Act (Title 49 USC sections 1139 and 24316) gave similar responsibilities to the NTSB, Amtrak, and other interstate/intercity high-speed passenger rail operators following rail passenger accidents. In 2018, Congress 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 USC section 1140).
PBS News Hour story on railroad safety in America; a Men’s Journal story on helicopter emergency medical service crashes and helicopter fuel system recommendations; and three World Media Production episodes for National Geographic TV and Discovery Networks (Emery Worldwide flight 17, US Airways 1549, Asiana Airlines flight 214).

MR made significant contributions to the agency’s media relations capabilities in 2018, with the Board’s approval of an updated media relations policy and by providing media relations training to personnel expected to serve as spokespersons for the agency. This training was previously delivered by a contractor at a cost of $6,000 per session. The resumption of MR-delivered training saves the agency money and improves working relationships between investigators and the MR staff while ensuring NTSB staff are prepared to keep our stakeholders informed during stressful and high-visibility media engagements.

MR teamed up with our SA division to develop our 2019–2020 MWL. MR’s involvement helped better integrate, coordinate, and synchronize communications support for the MWL rollout. MR’s media analysis helped ensure key messages were developed with both news value and the desired end state (recommendation implementation) in mind. These efforts led to a list that answered the media’s question of “what does the NTSB want to see happen?” and built in a call to action for each of the issue areas. Applications of outcome-based media analytics like this helped the MR division chief earn PR News’s 2018 Data Dynamo award—one of six recipients of the inaugural award.

Building on past success, MR continued to emphasize the use of imagery in its news releases and tweets as a means of telling our story, increasing audience engagement, and garnering greater earned-media coverage. More than 60 percent of news releases issued in 2018 contained imagery. The MR staff issued 1,864 tweets via @NTSB_Newsroom, generating more than 61,580 clicks, 9,464 retweets, and 10,168 likes. The MR staff issued 91 news releases and media advisories, which generated 234,900 online, print, and broadcast news mentions of the NTSB. NTSB media advisories and news releases had a 27.4 percent open rate (6 points above the accepted 21 percent average for government communications), while the click-to-open rate remained well below the accepted 18 percent standard, with a 10.5 percent average. Unique URLs used in MR products yielded more than 165,600 link clicks, driving online traffic to our products on our website, YouTube channel, and Flickr account. The resultant earned-media coverage and online engagement speaks to the power of the our story and its relevance to our audiences.

MR launched staff on every major investigation or Go Team launch in 2018, supporting regional investigators remotely and, in some cases, with on-scene media relations support. MR staff provided media relations training to more than 1,292 people in 2018 at 25 training events.

Figure 9: MR staff with incoming NTSB Board Members at the conclusion of a two-day media course at the NTSB Training Center. From left to right: Keith Holloway, Vice Chairman Bruce Landsberg, Peter Knudson, Chris O’neil, James Anderson (Digital Services), Board Member Jennifer Homendy, Terry Williams, and Eric Weiss.

Government and Industry Affairs

GA is the NTSB’s primary liaison with Congress, the White House, the Government Accountability Office (GAO), other federal agencies, and state and local governments. Division staff inform Congress, governors, and state legislatures about NTSB activities, including accident launches, investigations, Board meetings, and recommendations, and manages inquiries from these groups. GA supports interaction with the transportation industry regarding agency initiatives. GA staff work with the SA division to support programs and legislation consistent with safety recommendations and to monitor state legislative activity relevant to our recommendations.

In 2018, GA provided on-scene support to Board members and investigators for eight accident launches and responded to hundreds of requests for information in each mode of transportation. GA also initiated outreach to congressional, state, and local officials who expressed an interest in improving transportation safety. GA staff prepared Board members to testify before Congress at six hearings regarding the investigation into the sinking of the El Faro and our resultant recommendations (two hearings), PTC implementation oversight (two hearings), the state of aviation safety, and pipeline safety in the Merrimack Valley, Massachusetts. GA also filed 10 statutorily required reports to Congress, and coordinated responses to nine engagements from the GAO. GA also supported the Senate confirmation process for two new Board members.

At the state level, GA staff also supported
Board member and senior official testimonies and legislative advocacy efforts before state legislatures, including regarding primary seat belt enforcement in Massachusetts and Virginia, rear seat belts in Connecticut, distracted driving in Virginia and Pennsylvania, and school bus safety in New Jersey. Division staff also arranged briefings for congressional, state, and local officials on ongoing investigations and recommendations, including our investigations into the July 7, 2017, overflight taxiway approach at San Francisco International Airport; the April 17, 2018, Boeing 737 uncontained engine failure at Philadelphia, Pennsylvania; the July 19, 2018, Duck Boat capsize and sinking in Branson, Missouri; and the October 6, 2018, limousine crash in Schoharie, New York.

### Safety Advocacy

SA leads the agency’s advocacy efforts and promotes the implementation of our safety recommendations, especially those related to issue areas on the NTSB’s Most Wanted List (MWL). SA relays our safety messages and lessons learned through print, digital media, and social media communications, including the Safety Compass blog on ntsb.gov and our accounts on Instagram, LinkedIn, Facebook, YouTube, and Twitter. SA distributes agency products and information to stakeholders and advocacy groups.

SA’s primary advocacy focus is the MWL, leading development of the list biennially and working with Board members and modal office directors to identify issues for the list. SA, working with MR, creates an overall campaign strategy for the MWL and strategic communications plans for each issue area.

SA identifies and coordinates speaking opportunities for Board members and staff to promote MWL topics and NTSB recommendations, and tracks agency-wide advocacy efforts related to the MWL. SA produces all MWL-related materials (such as fact sheets, briefing memos, and legislative testimony) directed toward a range of interested stakeholders.

In 2018, SA began a new process for creating and releasing the MWL. The division facilitated meetings with modal offices and NTSB’s Office of Research and Engineering (RE) to identify topics to be included on the list; wrote and coordinated a notation memo requesting Board member approval of the list; developed MWL products such as fact sheets, key messages, and brochures; and planned a press conference at the National Press Club to announce the new list. SA also helped coordinate a response to Congress regarding the new appropriations language related to the MWL.

Additionally in 2018, SA helped the agency significantly increase use of its social media platforms, posting 761 tweets and increasing the number of @NTSB followers by 7,000 to 128,644. SA posted 48 blogs, which received more than 3,100 views, and 124 items on Instagram, where its followers increased by 72%. SA posted 119 items on Facebook, reaching more than 338,570 people. And connections on the NTSB LinkedIn account increased by 1,184 in 1 year to 8,884.

SA developed and released new advocacy and agency promotion products via social and digital media, such as the “Chairman’s Message” and the “I Am NTSB” video to highlight investigators and accomplishments of NTSB employees. SA also launched a podcast, “Behind the Scene @ NTSB,” and released 14 episodes. SA developed four YouTube videos, receiving more than 13,668 total views. Of particular note related to our social media activity, the SA team drew national attention to the issue of highway distraction via our blog and media discussion on the trending #InMyFeelings Challenge.

SA hosted a roundtable in the NTSB Board Room and a special panel at an industry event on loss of control in general aviation, an MWL topic. The events attracted more than 1,000 attendees combined, including pilots and aviation association groups. A follow-up video highlighting the issue was viewed by hundreds. Closing out the year, SA hosted a webinar on the benefits of video cameras in trucks, which was attended by more than 400 industry representatives.

In 2018, advocacy funds supported 70 agency staff member trips to promote MWL issue areas. In addition, SA participated in or supported 116 advocacy outreach activities in coordination with Board members and agency staff, which reached more than 20,609 people.

SA created original print and digital content in 2018, as well, including a motorcoach safety tip card that was shared with major motorcoach industry associations. The division developed and released three Advocacy Spotlight newsletters to thousands of advocacy groups and other interested stakeholders.

SA continued to effectively use an e-mail content management platform and distribution service to share NTSB investigative reports, safety alerts, advocacy updates, MWL materials, event-related information, and news releases with transportation stakeholders, regulators, policymakers, and other interested

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**Figure 10:** SA creates customized graphics to relay our key safety messages on social media.

**Figure 11:** In 2018, SA laid the groundwork for the NTSB Most Wanted List for 2019–2020.

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**National Transportation Safety Board 2018 ANNUAL REPORT TO CONGRESS**

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2018 ANNUAL REPORT TO CONGRESS
subscribers (as of September 2018, we had approximately 4,000 regular subscribers). The NTSB released 151 reports and information products to more than 248,699 stakeholder subscribers in 2018—an increase of nearly 200% over 2017.

Digital Services

DS is responsible for public and stakeholder engagement via digital media. DS plans and implements digital strategies to highlight the NTSB’s investigative and safety advocacy messages, and manages the agency’s digital communications programs (web, social media, visual media).

In 2018, DS completed more than 2,000 requests for information release via the web, social media, or visual media (graphics, publications, video). DS staff supported 9 major accident investigation launches, 13 Board meetings, and 8 public forums, symposia, or other events. DS staff also provided graphics and video support for the launch of the 2019–2020 MWL.

DS managed outgoing agency communications on the public website as well as on the agency’s social media platforms, increasing engagement with the public and other stakeholders, and developed an editorial calendar to consistently produce informational content for the agency’s digital platforms.

DS staff, in collaboration with SRC writers and Office of Marine Safety (MS) subject matter experts, created a first-of-its-kind illustrated digest based on the agency’s investigation of the sinking of the US Cargo Vessel El Faro. This award-winning publication condenses the 500-page accident report and thousands of pages of supplemental information into a 16-page summary in plain language and uses graphics to tell the story of the accident voyage, the sequence of events leading to the sinking, and the subsequent voyages to find and recover the voyage data recorder (VDR) from 15,000 feet below the Atlantic Ocean. Staff also collaborated with MS to produce a companion video to the El Faro investigation. This video described the event and the agency’s investigation of the sinking, and highlighted the safety recommendations arising from our findings. Office of Marine Safety investigators use this video in presentations and to share the investigation findings with the marine industry in a more engaging format, complementing the illustrated digest and the accident report.

Figures 12 and 13: DS staff James Anderson and Chrsty Spangler (with cameras) assisting investigators at the scene of a pedestrian bridge collapse in Miami, Florida.

The El Faro Illustrated Digest took the first place award in the Adobe Government Creativity Awards in the Visual Communications–Print Communication, Graphic Design and Illustration category. The Adobe Government Creativity Awards is the world’s premier digital media competition for government professionals. The award recognizes talent and creativity in government. It celebrates and showcases how the organization’s mission is supported through creativity and design.

The six divisions described above are charged with providing information to Congress, industry, the general public, and the families of victims of transportation disasters. From the day of an accident through the day that measures are implemented to help prevent a recurrence, SRC plays a crucial role to the NTSB’s mission.
Table 5: 2018 SRC Accident Launch Support by Mode

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Accident Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RAIL &amp; PIPELINE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>February 4</td>
<td>Cayce, South Carolina</td>
<td>Amtrak train traveled through open switch and struck stationary CSX train, causing derailment</td>
</tr>
<tr>
<td>February 23</td>
<td>Dallas, Texas</td>
<td>Single-family residence explosion</td>
</tr>
<tr>
<td>May 19</td>
<td>Alexandria, Virginia</td>
<td>CSX derailed and struck bridge</td>
</tr>
<tr>
<td>September 13</td>
<td>Lawrence, Massachusetts</td>
<td>Over-pressure of Columbia Gas low-pressure natural gas distribution system resulting in multiple fires and explosions</td>
</tr>
<tr>
<td><strong>HIGHWAY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>January 31</td>
<td>Crozet, Virginia</td>
<td>Chartered Amtrak train struck a refuse truck at a protected highway-railroad grade crossing</td>
</tr>
<tr>
<td>March 13</td>
<td>Loxley, Alabama</td>
<td>Motorcoach with high school band departed elevated I-10 roadway and fell into ravine below</td>
</tr>
<tr>
<td>March 15</td>
<td>Miami, Florida</td>
<td>An under-construction elevated pedestrian walkway collapsed onto several vehicles on the roadway below</td>
</tr>
<tr>
<td>August 30</td>
<td>Thoreau, New Mexico</td>
<td>An eastbound truck tractor crossed the center median of I-40 and collided with a motorcoach</td>
</tr>
<tr>
<td>October 10</td>
<td>Schoharie, New York</td>
<td>A limousine drove through a T-intersection and collided with a parked car in a parking lot</td>
</tr>
<tr>
<td>October 30</td>
<td>Rochester, Indiana</td>
<td>Children crossing a high-speed roadway to board a school bus were struck by a pickup truck</td>
</tr>
<tr>
<td><strong>MARINE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 19</td>
<td>Branson, Missouri</td>
<td>An amphibious passenger vessel capsized and sank</td>
</tr>
<tr>
<td><strong>AVIATION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>February 10</td>
<td>Peach Springs, Arizona</td>
<td>Tour helicopter collided with rocky terrain in the Grand Canyon</td>
</tr>
<tr>
<td>March 11</td>
<td>Flushing, New York</td>
<td>Airbus helicopter crashed into the East River after the pilot reported engine trouble</td>
</tr>
<tr>
<td>April 2</td>
<td>Marion, Indiana</td>
<td>Cessna 150, departing runway, struck the tail section of a Cessna 525</td>
</tr>
<tr>
<td>April 9</td>
<td>Scottsdale, Arizona</td>
<td>Piper PA-24 Comanche crashed on golf course shortly after takeoff</td>
</tr>
<tr>
<td>April 17</td>
<td>Philadelphia, Pennsylvania</td>
<td>SWA flight 1380 experienced uncontained engine failure of #1 engine, punctured window</td>
</tr>
</tbody>
</table>
The mission of the Office of Aviation Safety (AS) is to:

- investigate all air carrier, commuter, and air taxi accidents; in-flight collisions; fatal and nonfatal general aviation accidents; and certain public aircraft accidents.
- participate in the investigation of major airline crashes in foreign countries that involve US carriers, US-manufactured or designed equipment, or US-registered aircraft, to fulfill US obligations under International Civil Aviation Organization agreements.
- conduct investigations concerning safety issues that extend beyond a single accident to examine specific aviation safety problems from a broader perspective.

AS investigates over 1,300 domestic aviation accidents and incidents annually and proposes probable causes for the Board’s approval. Working with other offices within the NTSB, AS develops recommendations to prevent the recurrence of similar accidents and incidents and to otherwise improve aviation safety.

AS conducts investigative activities through four specialty divisions based in Washington, DC, and through a regional investigation management structure based in four regional offices. Investigators are located throughout the country. International aviation activities are coordinated from the Washington, DC, office.

Table 6: Office of Aviation Safety Statistics

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendations Issued</td>
<td>31</td>
</tr>
<tr>
<td>Urgent Recommendations Issued</td>
<td>1</td>
</tr>
<tr>
<td>Urgent Recommendations Closed Acceptably</td>
<td>1</td>
</tr>
<tr>
<td>Recommendations Closed Acceptably</td>
<td>37</td>
</tr>
<tr>
<td>Recommendations Closed Unacceptably</td>
<td>21</td>
</tr>
<tr>
<td>Major Reports</td>
<td>3</td>
</tr>
<tr>
<td>Accident Briefs</td>
<td>969</td>
</tr>
<tr>
<td>Major Investigation Launches</td>
<td>3</td>
</tr>
<tr>
<td>Regional Investigation Launches</td>
<td>197</td>
</tr>
<tr>
<td>International Accident Launches</td>
<td>6</td>
</tr>
<tr>
<td>Public Safety Hearings, Roundtables, Seminars, and Workshops</td>
<td>4</td>
</tr>
<tr>
<td>Safety Alerts and Videos</td>
<td>5</td>
</tr>
<tr>
<td>Journal Publications</td>
<td>2</td>
</tr>
<tr>
<td>Advocacy and Outreach Presentations</td>
<td>21</td>
</tr>
</tbody>
</table>
Completed Major Investigations

Uncontained Engine Failure and Subsequent Fire, American Airlines Flight 383, Boeing 767-323
Chicago, Illinois (0 fatalities and 21 injured)
On October 28, 2016, American Airlines flight 383, a Boeing 767-323, N345AN, had started its takeoff ground roll at Chicago O'Hare International Airport in Chicago, Illinois, when an uncontained engine failure in the right engine and subsequent fire occurred. The flight crew aborted the takeoff and stopped the airplane on the runway, and the flight attendants initiated an emergency evacuation. Of the 2 flight crewmembers, 7 flight attendants, and 161 passengers on board, 1 passenger received a serious injury and 1 flight attendant and 19 passengers received minor injuries during the evacuation. The airplane was substantially damaged from the fire. The airplane was operating under the provisions of 14 CFR Part 121. Visual meteorological conditions prevailed at the time of the accident.
We determined that the probable cause of this accident was the failure of the high-pressure turbine (HPT) stage 2 disk, which severed the main engine fuel feed line and breached the right main wing fuel tank, releasing fuel that resulted in a fire on the right side of the airplane during the takeoff roll. The HPT stage 2 disk failed because of low-cycle fatigue cracks that initiated from an internal subsurface manufacturing anomaly that was most likely not detectable during production inspections and subsequent in-service inspections using the procedures in place. Contributing to the serious passenger injury was (1) the delay in shutting down the left engine and (2) a flight attendant’s deviation from company procedures, which resulted in passengers evacuating from the left overwing exit while the left engine was still operating.

Figure 14: Right side of airplane after uncontained engine failure and subsequent fire.

Contributing to the delay in shutting down the left engine was (1) the lack of a separate checklist procedure for Boeing 767 airplanes that specifically addressed engine fires on the ground and (2) the lack of communication between the flight and cabin crews after the airplane came to a stop.
As a result of this investigation, we issued seven new safety recommendations to the FAA and one new safety recommendation each to Boeing and American Airlines. We also reiterated two safety recommendations previously issued to the FAA and reclassified one safety recommendation.

Collision with Terrain, Hageland Aviation Services, Inc. dba Ravn Connect Flight 3153, Cessna 208B
Togiak, Alaska (3 fatalities, 0 injured)
On October 2, 2016, Ravn Connect flight 3153, a turbine-powered Cessna 208B Grand Caravan airplane, N208SD, collided with steep, mountainous terrain about 10 nautical miles northwest of Togiak Airport in Alaska. The commercial pilots and the passenger were killed, and the airplane was destroyed. The scheduled commuter flight was operated under visual flight rules by Hageland Aviation Services, Inc., Anchorage, Alaska, under the provisions of 14 CFR Part 135. The NTSB’s investigation determined that instrument meteorological conditions were likely in the vicinity of the accident site at the time of the accident. The flight departed Quinhagak Airport in Alaska at 1133 and was en route to Togiak.
We determined that the probable cause of this accident was the flight crew’s decision to continue the visual flight rules flight into deteriorating visibility and their failure to perform an immediate escape maneuver after entry into instrument meteorological conditions, which resulted in controlled flight into terrain (CFIT). Contributing to the accident were (1) Hageland’s allowance of the routine use of the terrain inhibit switch for inhibiting the terrain awareness and warning system alerts and inadequate guidance for uninhibiting the alerts, which reduced the margin of safety, particularly in deteriorating visibility; (2) Hageland’s inadequate crew resource management (CRM) training; (3) the FAA’s failure to ensure that Hageland’s approved CRM training
contained all the required elements of 14 CFR 135.330; and (4) Hageland’s CFIT-avoidance ground training, which was not tailored to the company’s operations and did not address current CFIT-avoidance technologies.

As a result of this investigation, we issued five new safety recommendations to the FAA, two new safety recommendations to the Medallion Foundation, and one new safety recommendation to Hageland Aviation Services, Inc. In addition, we reiterated eight safety recommendations that were previously issued to the FAA.

**Taxiway Overflight, Air Canada Flight 759, Airbus A320-211**
San Francisco, California (0 fatalities; 0 injured)

On July 7, 2017, Air Canada flight 759, an Airbus A320-211, was cleared to land on runway 28R at San Francisco International Airport (SFO) in California, but instead lined up with parallel taxiway C. Four air carrier airplanes (two Boeing 787s, an Airbus A340, and a Boeing 737) were on taxiway C awaiting clearance to take off from runway 28R. The incident airplane descended to an altitude of 100 ft above ground level and overflew the first airplane on the taxiway. The incident flight crew initiated a go-around, and the airplane reached a minimum altitude of about 60 ft and overflew the second airplane on the taxiway before starting to climb. None of the 5 flight crewmembers and 135 passengers aboard the incident airplane was injured, and the incident airplane was not damaged. The incident flight was operated by Air Canada under 14 CFR Part 129 as an international scheduled passenger flight from Toronto/Lester B. Pearson International Airport in Toronto, Canada. An instrument flight rules flight plan had been filed. Night visual meteorological conditions prevailed at the time of the incident.

We determined that the probable cause of this incident was the flight crew’s misidentification of taxiway C as the intended landing runway, which resulted from the crewmembers’ lack of awareness of the parallel runway closure due to their ineffective review of notice to airmen (NOTAM) information before the flight and during the approach briefing. Contributing to the incident were (1) the flight crew’s failure to tune the instrument landing system frequency for backup lateral guidance, expectation bias, fatigue due to circadian disruption and length of continued wakefulness, and breakdowns in crew resource management and (2) Air Canada’s ineffective presentation of approach procedure and NOTAM information.

As a result of this incident, we issued six new safety recommendations to the FAA and one new safety recommendation to Transport Canada.

### Investigative Hearing

**CFM International Engine Failure on Southwest Airlines Flight 1380**

As part of our ongoing investigation of the April 17, 2018, CFM International CFM56-7B engine failure on Southwest Airlines flight 1380, which resulted in one fatality, we held an investigative hearing on November 14, 2018, to take sworn testimony from Boeing, CFM International, the FAA, Southwest Airlines, and United Technologies Aerospace Systems regarding the facts and circumstances of the accident and related issues.

The hearing focused on the following safety issues:

- CFM International CFM56-7-series engine fan blade design and development history
- CFM International CFM56-7-series engine fan blade inspection methods and procedures
- Engine containment design and certification criteria.

The hearing included two panels:

(1) CFM56-7B Fan Blades: Design and Certification, Consequences of the Fan Blade Out, Inspection Intervals and Procedures; and (2) B737/CFM56-7B Inlet and Fan Cowl: Design and Certification, Structural Capability following a Fan Blade Out Event.
Completed Accident or Incident Briefs

Investigations resulting in accident or incident briefs are more limited in scope than those leading to major investigation reports and are primarily intended to determine probable cause. These briefs may be adopted by the AS office director under delegated authority or may be adopted by the Board. These briefs can be found on our website’s Aviation Accident Database & Synopses page. AS completed a total of 969 briefs in calendar year 2018, and over 145,000 since the NTSB was created. The example below is an accident brief that was adopted by the Board.

**FedEx MD-10 Main Landing Gear Collapse and Postimpact Fire**
**Ft. Lauderdale, Florida (0 fatalities, 1 injured)**

On October 28, 2016, FedEx Express flight 910, a McDonnell Douglas MD1010F, N370FE, experienced a left main landing gear collapse after landing on runway 10L at Ft. Lauderdale/Hollywood International Airport, and the left wing subsequently caught fire. The airplane came to rest off the left side of the runway. The two flight crewmembers evacuated the airplane. The captain reported a minor cut and abrasions from the evacuation, and the first officer was not injured. The airplane sustained substantial damage. The cargo flight, which had originated at Memphis International Airport, Memphis, Tennessee, was operating on an instrument flight plan under the provisions of 14 CFR Part 121.

We determined that the probable cause of this accident was the failure of the left main landing gear due to fatigue cracking that initiated at a corrosion pit. The pit formed in the absence of a required protective cadmium coating the cause of which could not be determined from available evidence. Contributing to the failure of the left main landing gear was the operator’s overhaul limit, which exceeded that recommended by the airplane manufacturer without sufficient data and analysis to ensure crack detection before it progressed to failure.

No safety recommendations were issued as a result of this investigation.

Completed Safety Recommendation Reports

**Use of Recording Devices During Experimental Flight Test Activities**

These recommendations address the need for recording devices during flight test activity and were derived from our investigation of the July 6, 2016, accident involving an experimental research and development Bell 525 helicopter, N525TA, which broke up in flight and impacted terrain near Italy, Texas. The two test pilots were killed, and the helicopter was destroyed. The helicopter was being operated under the provisions of 14 CFR Part 91 as a developmental flight test.

As a result of this investigation, we issued one new safety recommendation each to the Flight Test Safety Committee and Bell Helicopter Textron.

**Guidance on the Issuance of Turbulence Products and Training for Low-Level Turbulence Identification and Forecasting for National Weather Service Forecasters**

These recommendations address guidance and training for certain weather products and were identified during our ongoing investigation of a fatal accident involving a Pilatus PC-12 airplane, N933DC, that impacted terrain near Rick Husband Amarillo International Airport, Amarillo, Texas.

As a result of this investigation, we issued two new safety recommendations to the National Weather Service.

**Extended-Duration Cockpit Voice Recorders**

These recommendations address the need to install cockpit voice recorders (CVRs) with a minimum 25-hour recording capability on all newly manufactured airplanes required to have a CVR, and retrofit these CVRs on existing aircraft required to have flight recorders. These recommendations are derived from the NTSB’s experiences with investigations that lacked access to relevant CVR data.

As a result of this investigation, we issued two new safety recommendations to the FAA.

**International Accident Investigations**

The NTSB participates in investigations of aviation accidents and serious incidents outside the United States in accordance with the Chicago Convention of the International Civil Aviation Organization (ICAO) and the Standards and Recommended Practices provided in Annex 13 to the convention.

If an accident or serious incident occurs in a foreign state, that state is responsible.
The following are ongoing major international investigations that occurred in 2018.

- On December 24, 2018, an Agusta 109S helicopter, crashed about 8 minutes after takeoff from a private residence in Puebla, Mexico. The two pilots and three passengers onboard were fatally injured and the helicopter was destroyed. The accident is being investigated by the government of Mexico. The NTSB appointed a US-accredited representative to support the investigation.

- On November 9, 2018, Fly Jamaica Airways flight 256, a Boeing 757, overran the runway during landing at Georgetown-Cheddi Jagan International Airport, Georgetown, Guyana. Of the 128 passengers and crew onboard, 1 passenger was fatally injured and 5 others received minor injuries. The airplane was substantially damaged. The accident is being investigated by the government of Guyana. 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.

- On October 29, 2018, Lion Air flight 610, a Boeing 737MAX, crashed into the sea shortly after takeoff from Jakarta-Soekarno-Hatta International Airport, Jakarta, Indonesia. All 189 passengers and crew onboard were fatally injured, and the airplane was destroyed. The accident is being investigated by the Indonesia Komite Nasional Keselamatan Transportasi. 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.

- On September 28, 2018, Air Niugini flight 73, a Boeing 737, crashed into the sea on final approach to Chuuk International Airport, Chuuk, Micronesia. One of the 47 passengers and crew onboard was fatally injured, and the airplane was substantially damaged. The accident is being investigated by the government of the Federated States of Micronesia. 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.

- On July 31, 2018, Aeroméxico Connect flight 2431 crashed shortly after takeoff from General Guadalupe Victoria International Airport, Durango, Mexico. Forty-nine of the 105 passengers and crew onboard were seriously injured, and the airplane was destroyed. The accident is being investigated by the Mexico DGAC. 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 engines.

If an accident or serious incident occurs in a foreign state not bound by the provisions of ICAO Annex 13, if a foreign state delegates all or part of an investigation by mutual consent to the NTSB, or if the accident or serious incident involves a public aircraft, the conduct of the investigation shall be in consonance with any agreement entered into between the United States and the foreign state.

The following are ongoing major international investigations that occurred in 2018.

- On January 7, 2018, the NTSB and FAA hosted an interactive workshop consisting of two 80-minute panel discussions. The panels addressed distinct yet complementary areas of focus to provide a comprehensive look at the role of data analytics in aviation safety. Panel 1, “Data Analytics—Methodology and Techniques,” presented contemporary approaches to organizing, analyzing, and interpreting large amounts of aviation safety data from accident investigations and incident reports to identify emergent safety issues and support decision-making in aviation safety efforts. Panelists and audience discussion focused on techniques and methodology—ways to consolidate, evaluate, and present data to make informed judgments. Panel 1 was moderated by the FAA and panelists included representatives from the NTSB, the FAA, and Mitre Corporation. Panel 2, “Data Analytics in Safety Risk Management and Safety Assurance—Applications and Outcomes,” focused more on applications and case studies resulting from the use of data in safety risk management and safety assurance (two components of safety management systems that rely on effective data use). Panelists and audience discussion focused on applying data analytics in safety risk manage and assurance with an eye toward case studies and demonstrated outcomes. Panel 2 was moderated by the NTSB and panelists included representatives from the National Aeronautics and Space Administration, Alaska Airlines, the Allied Pilots Association, General Electric, Airlines for America, and the Transportation Safety Board of Canada.
Safety Roundtable: Preventing In-flight Loss of Control in General Aviation Through Training and Technology

On April 24, 2018, we held a safety roundtable on preventing in-flight loss of control in general aviation. More general aviation pilots and passengers die from accidents involving in-flight loss of control than any other single factor. The roundtable focused on fixed-wing general aviation aircraft and pilots operating under visual flight rules. Greater pilot situational awareness—both in the cockpit and during flight training—can make a difference. Industry and government experts were in attendance to discuss the current state of the problem, highlight available technologies and training, and explore the challenge of implementing current technologies to reduce these largely preventable accidents. The roundtable was moderated by Chairman Robert Sumwalt.

Safety Seminar: Night Flying

On December 15, 2018, we held a safety seminar on night flying safety designed for pilots, mechanics, and other members of the general aviation community. The seminar explored the benefits and risks of night flying, some of the causes of night flying accidents, and resources available to the pilot community. Attendees heard from NTSB investigators about the investigative process and lessons learned from our investigations. Board Member Earl Weener was a featured presenter. This seminar was the 15th in a series of safety seminars hosted by the NTSB that focused on general aviation accidents.

Safety Alerts

- **Minding Weight, Maintaining Balance: Improper or Unperformed Calculations Can be Fatal (SA-072)**
  
  This safety alert provides information on how improper or unperformed calculations can lead to deadly accidents.

- **Pilots: Ensure Your Fuel Selector Works (SA-075) and Mechanics: Be Wary of Worn Fuel Selectors (SA-076)**
  
  These safety alerts provide information on how worn components can lead to fuel starvation and sudden loss of engine power.

Safety Videos

These safety videos accompany the above-mentioned Safety Alerts.

- **Minding Weight, Maintaining Balance—Improper and Unperformed Calculations Can be Fatal (SA-072)**

- **Pilots: Ensure Your Fuel Selector Works (SA-075)**

- **Mechanics: Be Wary of Worn Fuel Selectors (SA-76)**
Journal Publications


Advocacy and Outreach Presentations

- M. Bauer and W.R. English. *Use of sUAS in Developing Photogrammetric Model for Wind Simulation*, International Society of Air Safety Investigators 2018 Annual Seminar, Dubai, United Arab Emirates, October 30, 2018
- M. Bauer. *Use of a Small UAS-Based Photogrammetry 3D Model in CFD Wind Simulation*, Association for Unmanned Vehicles Systems International Xponential 2018, May 1, 2018
- M. Bauer. *NTSB Drone Utilization and Accident Case Study*, Experimental Aircraft Association Air Venture 2018, July 23, 2018
- W. Bramble. *Human Factors in Aircraft Accident Investigations*. DOT’s Safe Skies for Africa (SSFA) Aviation Safety Symposium, Johannesburg, South Africa, July 31–August 3, 2018
- C. Crookshanks. *Airworthiness in Aircraft Accident Investigations*. DOT’s SSFA Aviation Safety Symposium, Johannesburg, South Africa, July 31–August 3, 2018
- C. Crookshanks. *Controlled Flight into Terrain*. DOT’s SSFA Aviation Safety Symposium, Nairobi, Kenya, September 11–13, 2018
- C. Crookshanks. *Accident Classification and Substantial Damage*. DOT’s SSFA Aviation Safety Symposium, Nairobi, Kenya, September 11–13, 2018
- D. Hogenson. *General Aviation Aspects*. DOT’s SSFA Aviation Safety Symposium, Johannesburg, South Africa, July 31–August 3, 2018
- D. Hogenson. *Challenges in Aviation Investigations*. DOT’s SSFA Aviation Safety Symposium, Nairobi, Kenya, September 11–13, 2018
- D. Hogenson. *Airworthiness*. DOT’s SSFA Aviation Safety Symposium, Nairobi, Kenya, September 11–13, 2018
- W.R. English. *NTSB Accident Investigation Using sUAS*, Pix4D Public Safety Workshop, August 27, 2018
- W.R. English. *Investigative Process*, FAA UAS Symposium, March 10, 2018
- W.R. English, *Drone Mapping*, Drone University, August 3, 2018
- L. Schiada. *Human and Operational Performance*. DOT’s SSFA Aviation Safety Symposium, Johannesburg, South Africa, July 31–August 3, 2018
- C. Shin, *Helicopter Investigations*. DOT’s SSFA Aviation Safety Symposium, Johannesburg, South Africa, July 31–August 3, 2018
- D. Schulze, *Lithium Battery Safety*, Aviation Insurance Association Conference, April 29, 2018
- L. Groff and D. Schulze, *Mining the NTSB Aviation Accident and Incident Data*, Aviation Infoshare, March 19, 2018
The Office of Highway Safety (HS) investigates accidents that have a significant impact on public confidence in highway transportation safety, that highlight national safety issues, or that generate high public interest and media attention. Such accidents may include collapses of highway bridge or tunnel structures, mass casualties and injuries on public transportation vehicles (such as motorcoaches and school buses), collisions at highway–rail grade crossings, and accidents that involve new safety issues or technologies. In addition, HS conducts safety reports based on trends emerging from NTSB accident investigations and from other research and accident data to identify common risks or underlying causes of accidents. To accomplish these tasks, HS is organized into two primary units: the Investigations Division and the Report Development Division.

### Table 7: Office of Highway Safety Statistics

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</table>

4 These publications are co-authored with another office. Each office will be counted separately, but the over agency statistic will only count the publications once.
Completed Major Investigation Reports

Special Investigation Report: Pedestrian Safety

This special investigation report discusses the public forum and previous NTSB investigations related to pedestrian safety, including 15 fatal pedestrian crashes, and makes recommendations to improve pedestrian safety. Special investigation reports combine the work of a similar set of cases to address a particular safety issue. This report and the related public forum represent our first full examination of pedestrian safety since the 1970s.

In May 2016, we hosted a forum intended to begin a public conversation about pedestrian safety. After the forum, we began investigating a series of 15 fatal crashes in which vehicles on public highways killed pedestrians. In 2016, during the project design phase, the 15 investigative cases represented the average number of pedestrian fatalities every day in the United States. By the time the project was complete, the average had increased to 16 a day.

The report is organized into sections on vehicle-based changes, infrastructure improvements, and data needs for improving pedestrian safety. Given that the poor visibility of people walking in and around moving vehicles is a serious problem, the report considers improvements to vehicle lighting systems that are being developed but are not yet in place. The report also considers other vehicle safety systems that can improve pedestrian safety and recognizes the needs of local transportation planning work to improve pedestrian safety. Several recommendations target data needs to better guide the implementation of countermeasures and to gauge the effectiveness of programmatic efforts. The report focuses on issues common to all pedestrians, without separating out subgroups (such as the circumstances under which a pedestrian was struck). The report makes recommendations to the National Highway Traffic Safety Administration (NHTSA), the Federal Highway Administration (FHWA), and the Centers for Disease Control and Prevention.

Collision Between Freight Train and Charter Motorcoach at High-Profile Highway–Railroad Grade Crossing

Biloxi, Mississippi (4 fatalities; 38 injured)

On Tuesday, March 7, 2017, a 2016 Van Hool motorcoach, operated by ECHO Transportation and occupied by a 60-year-old driver and 49 passengers ranging in age from 50 to 88, was traveling northbound on Main Street in Biloxi, Mississippi, having departed that afternoon from a casino in Bay St. Louis, Mississippi, en route to a casino in Biloxi. The motorcoach stopped in advance of a highway–railroad grade crossing on Main Street that had a high vertical profile.

The grade crossing was marked with a crossbuck, warning lights that would activate at a train’s approach, a gate arm that would lower at a train’s approach, and a low ground clearance grade crossing warning sign with a “LOW GROUND CLEARANCE” plaque below it on the signpost. The crossing warning system was not active when the motorcoach approached, stopped, and then moved onto the railroad tracks. As the driver attempted to proceed over the crossing, the frame of the motorcoach came into contact with the pavement, and the vehicle became stuck on the crossing. The driver moved the motorcoach back and forth in an attempt to dislodge it from the crossing, but was unsuccessful.

While the motorcoach was stuck on the crossing, an eastbound freight train operated by CSX Transportation was approaching the crossing at a recorded speed of 27 mph while continuously sounding its warning horn. The grade-crossing warning system activated when the train was about 29 seconds away; the warning lights began to flash, and 3 seconds later, the gate arm began to descend. As soon as he became aware of the approaching train, the motorcoach driver opened the vehicle’s loading door and told the passengers to evacuate. Due to their age and limited mobility, the passengers’ evacuation was slow and the aisleway became congested; only six passengers had safely evacuated before the train struck the grounded motorcoach.

The train engineer told investigators that he had noticed the motorcoach on the tracks ahead, but he expected it to clear the crossing before the train reached it. Once the engineer realized that the motorcoach might not clear the tracks, he put the train into emergency about 502 feet west of the crossing. About 14 seconds later, by which time the train had decelerated to about 19 mph, it struck the left side of the motorcoach, pushing it 259 feet down the tracks before coming to a stop, with the motorcoach still in contact with the lead locomotive. Four motorcoach passengers died, the driver and 37 passengers sustained injuries, and 8 passengers were uninjured. The train crewmembers were uninjured.

We determined that the probable cause of this crash was the failure of CSX Transportation and the City of Biloxi to coordinate and take action to improve the safety of the Main Street grade crossing, a high vertical profile crossing on which motor vehicles were known to ground frequently. Contributing to the circumstances of the crash was the inadequate guidance from the Federal Highway Administration (FHWA) on how to mitigate the risks posed by grade crossings with high vertical profiles.

As of result of this crash, we issued three new safety recommendations to the FHWA; one new safety recommendation each to the Federal Railroad Administration (FRA),
Mississippi Department of Transportation, City of Biloxi, Mississippi, American Association of State Highway and Transportation Officials, American Railway Engineering and Maintenance-of-Way Association, and to the American Short Line and Regional Railroad Association; and two new safety recommendations to all Class I railroads. We also reiterated one safety recommendation previously issued to Federal Motor Carrier Safety Administration (FMCSA).

### Pickup Truck Centerline Crossover Collision With Medium-Size Bus

Concan, Texas (13 fatalities; 2 injured)

On March 29, 2017, a 2007 Dodge Ram 3500 pickup truck, occupied by a 20-year-old driver, was traveling north on US Highway 83, near Concan, Texas, when it crossed into the southbound lane and collided with a medium-size bus. The crash occurred near milepost 553.4, near the end of a right-hand curve. The 2004 Ford E350 Turtle Top Van Terra medium-size bus was occupied by a 66-year-old driver and 13 passengers and operated by the First Baptist Church of New Braunfels, Texas. As a result of the crash, the bus driver and 12 passengers were fatally injured. The driver of the truck and one bus passenger were seriously injured.

The crash investigation focused on safety issues associated with drug impaired driving and medium-size bus seat belt systems. We determined the probable cause of this crash was the failure of the pickup truck driver to control his vehicle due to impairment stemming from his use of marijuana in combination with misuse of a prescribed medication, clonazepam. Contributing to the severity of the injuries was the insufficient occupant protection provided by the lap belts worn by passengers seated in the rear of the medium-size bus.

As a result of this crash, we issued four new safety recommendations to NHTSA; one new safety recommendation each to the state of Texas, the Texas Department of Transportation (TxDOT), and to the following medium-size bus manufacturers: ARBOC Specialty Vehicles, LLC; Coach & Equipment Manufacturing Corporation; REV Group, Inc.; Diamond Coach Corporation; Forest River, Inc.; Girardin Blue Bird; SVO Group, Inc.; and Thomas Built Buses; and to seat manufacturers Freedman Seating Company and HSM Transportation Solutions. We also reiterated one safety recommendation previously issued to NHTSA.

### Motorcoach Run-Off-the-Road and Overturn

Laredo, Texas (9 fatalities, 38 injuries, 5 unknown)

On Saturday, May 14, 2016, a 1998 Van Hool 49-passenger motorcoach, operated by OGA Charters LLC of San Juan, Texas, was traveling northbound on US Highway 83 near Laredo, Texas. The motorcoach entered a horizontal curve to the right, and, as it moved through the curve, it drifted from its lane to the left. After the motorcoach drifted left, the driver steered to the right and applied the brakes, which resulted in the vehicle's loss of control, so that it slid and yawed clockwise. The motorcoach departed the right, or east, side of the highway and, after entering the earthen right-of-way, overturned onto its left side. Nine passengers died, 36 passengers sustained minor to serious injuries, and the motorcoach driver and trip coordinator were treated for minor injuries. The injury severity for five passengers could not be determined.

The crash investigation focused on the following safety issues:

- Inadequate federal oversight and guidance for commercial drivers with diabetes treated without insulin.
- Inaccurate and incomplete highway maintenance recordkeeping by TxDOT, leading to deficiencies in conducting safety-critical highway maintenance.
- Need for improved training for TxDOT maintenance workers to ensure that roadway maintenance operations result in acceptable levels of surface friction.
- Need for increased motorcoach crashworthiness through improvements to window glazing and retention.
- Driver fatigue resulting from poor safety management by OGA Charters and inadequate federal safety ratings for passenger motor carriers with repetitive safety violations in the area of driver performance.

We determined that the probable cause of this crash was the driver’s failure to maintain the motorcoach fully within the northbound travel lane, due to a combination of fatigue from an acute sleep deficit and blurred distance vision due to hyperglycemia resulting from poorly controlled diabetes, and his decision to abruptly steer to the right and brake, which caused the vehicle to leave the highway and roll over. Contributing to the driver’s inability to regain control of the motorcoach was the low friction value of the
Wet pavement and the inoperable antilock braking system. Contributing to the severity of the passenger injuries was the failure of the left side passenger windows to keep passengers within the motorcoach.

As a result of this crash, we issued five new safety recommendations to the FMCSA and TxDOT. We also reiterated two recommendations to the FMCSA and one recommendation to NHTSA.

**Special Investigative Report: Selective Issues in School Bus Transportation Safety: Crashes in Baltimore, Maryland, and Chattanooga, Tennessee**

Baltimore, Maryland (6 fatalities; 11 injured)

Chattanooga, Tennessee (6 fatalities; 26 injured)

School bus travel is one of the safest forms of transportation in the United States. Every day, nearly 600,000 buses carry more than 25 million students to and from school and school-related activities. Children are safer traveling in school buses than in any other vehicle. Although school buses are extremely safe, we continue to investigate school bus crashes in which fatalities and injuries occur. Improved oversight of school bus drivers and enhancements to school bus design—such as installation of passenger lap/shoulder belts, electronic stability control, and automatic emergency braking—could prevent or mitigate such crash outcomes.

In November 2016, we began investigating two multifatality school bus crashes. Each crash was initiated when the driver lost control of the school bus. The driver in the November 1 crash in Baltimore, Maryland, was epileptic and suffered a seizure; the driver in the November 21 crash in Chattanooga, Tennessee, was speeding while using a cell phone and ran off the road. In both cases, the school bus operators were private, for-hire motor carriers performing contracted student transportation services. Although the specific safety issues differed, the crashes shared one common factor: poor driver oversight by both the school districts and the contracted motor carriers, which resulted in the unsafe school bus operation.

This special investigation report focused on:

- School districts’ lack of oversight of student transportation service providers (Baltimore, Chattanooga).
- Poor management of unsafe school bus drivers by motor carriers and school districts (Baltimore, Chattanooga).
- Medically unfit school bus drivers (Baltimore).
- Commercial driver license fraud in Maryland (Baltimore).
- Large school bus occupant protection (Chattanooga).
- Electronic stability control, automatic emergency braking, and event data recorders (Baltimore, Chattanooga).

We determined that the probable cause of the Baltimore, Maryland, school bus crash was the loss of vehicle control due to the bus driver’s incapacitation because of a seizure stemming from a long-standing seizure disorder, the bus driver’s continued operation of a school bus with a disqualifying medical condition and a fraudulently obtained commercial driver’s license; and the failure of AAAordable Transportation and Baltimore City Public Schools to provide adequate bus driver oversight, allowing the medically unfit driver to drive a commercial vehicle with a medical condition that they knew, or should have known, could lead to the unsafe operation of the school bus. Contributing to the severity of the crash was the lack of a collision avoidance system with automatic emergency braking on the school bus.

We determined that the probable cause of the Chattanooga, Tennessee, crash was the school bus driver’s excessive speed and cell phone use, which led to the loss of vehicle control; Durham School Services’ failure to provide adequate bus driver oversight, allowing an inexperienced driver to operate a commercial vehicle with escalating risky driving behaviors that it knew, or should have known, could lead to the unsafe operation of the school bus; and the Hamilton County Department of Education's lack of follow-up to ensure that Durham had addressed a known driver safety issue. Contributing to the severity of the crash was the lack of passenger lap/shoulder belts on the school bus.

As a result of these crashes, we issued one new safety recommendation each to FMCSA; NHTSA; the states of Florida, Louisiana, Maryland, New Jersey, and New York; 42 states, the District of Columbia, and the territory of Puerto Rico; the Maryland Department of Education; the National Association of State Directors of Pupil Transportation Services, National Association for Pupil Transportation, National School Transportation Association, American School Bus Council, and Maryland School Bus Contractors Association; Blue Bird Corporation, Collins Industries, Inc., IC Bus, Starcraft Bus, Thomas Built Buses, Inc., Trans Tech, and Van–Con, Inc, IC Bus, Epic, Cerner Corporation, eClinicalWorks, MEDITECH, NextGen Healthcare, and Concentra, Inc. We also issued two new safety recommendations to National Express LLC, and three new safety recommendations to the Maryland Motor Vehicle Administration, and we reiterated four safety recommendations to NHTSA and reclassified one safety recommendation to the Baltimore City Public Schools. We issued three other associated recommendations in our March 2017 safety recommendation report.
Summary Report: Commercial Vehicle Overturn Resulting in Cargo Tank Rupture, Propane Release, and Fire
Stroud, Alabama (0 fatalities, 1 injured)

On Friday, March 11, 2016, a 2011 Peterbilt truck-tractor in combination with a 1962 North Texas Tank Company 10,500-gallon cargo tank semitrailer loaded with noncorrosive liquefied petroleum gas, operated by River City Propane, was traveling northbound on US Highway 431, a two-lane undivided highway, near Stroud, Alabama. As it entered a right curve near the intersection of County Route 256, it began to encroach on the southbound lane, which was occupied by a 2004 Pontiac sport utility vehicle (SUV). The driver of the Pontiac reported that he observed the driver of the Peterbilt make a hard right turn. The cargo tank semitrailer then separated from its truck-tractor, traveled westward into a ditch, and struck a rock. The impact with the rock breached the front head of the cargo tank; as the cargo tank's entire head became separated, releasing the tank's contents, which caught fire, and a deflagration occurred. The cargo tank semitrailer continued to travel westward through about 300 yards of forested area before coming to rest. The truck-tractor came to rest on the eastern ditch/embankment area and was destroyed. The Peterbilt driver was severely injured as a result of the crash and fire.

We determined that the probable cause of this crash was the combination vehicle driver's overcorrection while traveling on a curve, after he had encroached into the opposing lane of traffic. Contributing to the crash was the driver's excessive speed. Contributing to the severity of the crash outcome was the rupture of the tank and subsequent release and ignition of propane.

As a result of this crash, we issued two new safety recommendations to the FMCSA, three new safety recommendations to the Pipeline and Hazardous Materials Safety Administration (PHMSA), and one new safety recommendation to Enterprise Propane Terminals and Storage LLC.

Completed Accident Briefs

Rear-End Crash Involving Truck-Tractor Semitrailer and Sport Utility Vehicle
Goodland, Kansas (6 fatalities, 5 injured)

On Wednesday, June 29, 2016, a 2004 Toyota Sequoia 7-passenger sport utility vehicle (SUV), occupied by a 22-year-old male driver and 10 passengers, was traveling eastbound in the right lane of US Interstate 70 (I-70) approaching milepost 30.1. The SUV was taking the passengers from Houston, Texas, to Los Angeles, California (one passenger was to be dropped off in Denver, Colorado). According to interviews postcrash, the SUV experienced a mechanical problem that kept it from traveling at highway speeds.

About the same time as the SUV reached milepost 30, a 2016 Volvo truck-tractor in combination with a 2007 Great Dane semitrailer was traveling eastbound on I-70 behind the SUV; it was also in the right lane. The SUV was traveling at a slower speed than the truck, which overtook the SUV and rear-ended it. According to data from the truck's engine control module, the truck was traveling at 75 mph when it struck and overrode the rear of the SUV. As a result of the crash, six SUV passengers died and four received serious injuries. The SUV driver was seriously injured and the truck driver was uninjured.

We determined that the probable cause of this crash was the truck driver's failure to perceive and take effective action to avoid rear-ending the SUV due to his fatigue and lack of expectancy to encounter the slow-moving SUV on the highway ahead of him. Contributing to the crash was the SUV driver's decision to continue traveling on the highway at a reduced speed without using his vehicle's flashing hazard lights to make the slow-traveling SUV more conspicuous to other drivers. Contributing to the severity of the SUV passengers’ injuries were the SUV's overloaded condition, which resulted in an insufficient number of rear passenger seat belts, and the lack of a collision avoidance system on the truck.

No safety recommendations were issued as a result of this crash. The accident brief highlighted collision avoidance technologies that we have recommended and advocated for extensively in the past. The report will also be used to further issues on the NTSB's Most Wanted List.
Fire Damage to Bridge and Subsequent Collapse
Atlanta, Georgia (0 fatalities, 0 injuries)

On Thursday, March 30, 2017, construction materials stored under an Interstate 85 (I-85) overpass in Atlanta, Georgia, were set on fire. The fire propagated throughout the storage area. Just over 1 hour later, span 30 NB—a 92-foot-long elevated span of I-85—collapsed. No fatalities or injuries were reported from the fire and subsequent bridge collapse. One person was arrested and later charged with criminal damage to property. The Georgia Department of Transportation had been using the area as storage for 76 reels of high-density polyethylene conduit and nine racks of fiberglass conduit. The materials were left over from an earlier project on State Route 400 (SR-400) and were secured inside a chain-link fence.

We determined that the probable cause of the fire and subsequent collapse of the span 30 NB bridge structure on I-85 north, in Atlanta, Georgia, was excessive heat from the ignition of 76 reels of high-density polyethylene conduit and nine racks of fiberglass conduit stored beneath the overpass. Contributing to the bridge collapse was the decision of the Georgia Department of Transportation to store construction materials beneath the bridge and its failure to assess the increased fire risk due to the presence of these combustible materials.

No safety recommendations were issued as a result of this investigation, but the FHWA distributed an event report to the states informing them of the circumstances of the I-85 bridge collapse and its concern about storing materials under bridges. The FHWA indicated that once the NTSB investigation was complete, it would update the report and disseminate any additional information. Further, the FHWA encouraged bridge owners to direct inspectors, during their routine inspections, to be mindful of materials stored under bridges and to communicate any concerns to the bridge inspection program manager. We also issued a safety alert as a result of this investigation.

Fatal Pedestrian Collision with Car, Capitol Heights
Capitol Heights, Maryland (1 fatality, 0 injured)

On Wednesday, July 20, 2016, a 2015 Volkswagen Jetta occupied by a 19-year-old female driver and a 17-year-old male passenger was eastbound on Central Avenue near the Addison Road Metrorail station in Capitol Heights, Prince George’s County, Maryland. Meanwhile, an 18-year-old male pedestrian crossed the eastbound lanes of Central Avenue and was standing in a crosswalk on the median that separates the opposing lanes of travel. As the driver approached the median, she lost control of her vehicle, which traveled onto the median and struck a traffic sign, a concrete raised curb, the pedestrian, a pedestrian warning sign, and a barrier fence along the north side of the median. The vehicle then left the median, continued about 200 feet east, crossing all westbound lanes of Central Avenue, and came to final rest on the sidewalk.

We determined that the probable cause of this crash was the unlicensed driver’s excessive speed and failure to maintain control of the car so as to avoid colliding with the pedestrian.

No safety recommendations were issued as a result of this crash. This highway accident brief was combined with 14 other briefs in the Pedestrian Safety Special Investigation Report (discussed above) and associated interactive website.
Ongoing Investigations (as of December 31, 2018)

- Electric vehicle battery fire safety report, multiple cases.
- Two adults and three children hit by passenger vehicle while waiting to board a school bus in Tampa, Florida, November 1, 2018 (0 fatalities, 5 injured).
- A child crossing the highway to board a school bus was struck by a passenger vehicle in Baldwyn, Mississippi, October 31, 2018 (1 fatality, 0 injured).
- Two children crossing the roadway to board a school bus and were struck by a passenger car passing the bus in Hartsfield, Georgia, October 25, 2018 (1 fatality, 1 injured).
- Four children crossing the roadway in a school bus loading zone by a passing car in Rochester, Indiana, October 25, 2018 (3 fatalities, 1 injured).
- Limousine drove through a T-intersection and collided with a parked car in Schoharie, New York, October 6, 2018 (20 fatalities, 1 injured).
- School bus departed roadway, collided with utility pole and caught fire in Mesquite, Texas, October 3, 2018 (1 fatality, 0 injured).
- Truck tractor experienced tire failure and struck oncoming motorcoaches in Thoreau, New Mexico, August 30, 2018 (8 fatalities, 40 injured).
- Truck tractor collided with multiple vehicles at the end of a work zone traffic queue in Boise, Idaho, June 16, 2018 (4 fatalities, 1 injured).
- Electric vehicle burst into flames during normal operation (no collision) in West Hollywood, California, June 16, 2018 (0 fatalities, 0 injured).
- Passenger vehicle traveling at high speed crashed into a wall and postcrash fire and reignition occurred in Fort Lauderdale, Florida, May 8, 2018 (2 fatalities, 1 injured).
- A passenger vehicle struck a motorcycle in Dumfries, Virginia, April 12, 2018 (1 fatality, 0 injured).
- Passenger vehicle operating on AutoPilot crashed into barrier and postcrash fire resulted with reignition in Mountain View, California, March 23, 2018 (1 fatality, 1 injured).
- Uber SUV operating in automated mode struck pedestrian pushing bicycle in Tempe, Arizona, March 18, 2018 (1 fatality, 0 injured).
- Pedestrian bridge collapsed onto active roadway in Miami, Florida, March 15, 2018 (6 fatalities, 8 injured).
- Motorcoach transporting high school students departed bridge and fell into a ravine in Loxley, Alabama, March 13, 2018 (1 fatality, 46 injured).
- Multivehicle crash at end of a queue in Elmhurst, Illinois, March 1, 2018 (1 fatality, 6 injured).
- Electrical conduit broke away from tunnel impacting commercial vehicle in East Penn Township, Pennsylvania, February 21, 2018 (1 fatality, 0 injured).
- Chartered Amtrak grade crossing crash in Crozet, Virginia, January 31, 2018 (1 fatality, 9 injured).
- Passenger vehicle collision with a fire truck in Culver City, California, January 22, 2018 (0 fatalities, 1 injured).
- School bus crash and fire in Oakland, Iowa, December 12, 2017 (2 fatalities, 0 injured).
- School bus crash in Helena, Montana, November 27, 2017 (0 fatalities, 6 injured).
- Autonomous shuttle bus crash in Las Vegas, Nevada, November 8, 2017 (0 fatalities, 0 injured).
- Motorcoach and transit bus collision in Flushing, New York, September 18, 2017 (3 fatalities, 20 injured).
- Motorcycle and pickup truck collision in Augusta, Maine, September 10, 2017 (2 fatalities, 4 injured).
- Passenger vehicle crash in Lake Forest, California, August 25, 2017 (0 fatalities, 5 injured).

Three of these injuries were to emergency responders.
Safety Webinar

Reducing CMV Crashes Through the Use of Video Recorders

On September 13, 2018, we held a 1-hour safety webinar with investigators and recorder analysts from our Offices of Highway Safety and Research and Engineering, along with commercial fleet owners representing the truck and bus industries. Our discussions included why and how organizations use video recorders to improve safety, lessons learned from accident investigations, and case studies highlighting how companies use the data from cameras to review driver and vehicle performance and make modifications to safety plans. ‘Expand Recorder Use to Enhance Safety’ is on our MWL.

Safety Alert

Protecting Bridges From Fire Damage and Collapse (SA-073)

This safety alert provides information for bridge owners on how to protect and secure bridges from catastrophic events, such as fire damage.

Journal Publications


Advocacy and Outreach Presentations

- Transportation Research Board (TRB) conference presentations (3 presentations), January 2018
- M. Fox. NTSB Update on Crashes and Findings. ABA Hispanic Motorcoach Council meeting, January 30, 2018
- D. Pereira. Fuel Tank Crashworthiness. Society of Automotive Engineers (SAE) Government and Industry Presentations (2-Presentations), January 31, 2018
- S. Currie. Stroud, Alabama case findings—overall investigative process of the NTSB. CVSA’s COHED Hazardous Materials Conference, January 31, 2018
- D. Pereira. NTSB Lessons Learned on Maintenance of anti-lock braking system. ABA Bus Industry Safety Council meeting, January 31, 2018
- M. Fox. An Investigator’s Perspective of an NTSB Crash Investigation. ABA Bus Industry Safety Council meeting, January 31, 2018
- D. Karol. Importance of Safety-Focused Investigations. 2018 Arizona ASSE Health and Safety Summit, April 19, 2018
- M. Fox. Update on NTSB crash investigations and associated case studies on fatigue, impairment and technology. Ameriquest (Corcentric) Southern Private Fleet Conference, May 23, 2018
- M. Fox. Motorcycle Safety Outreach Event—“Educational Safety Day” with DC Metro PD, Maryland DOT, Pennsylvania DOT, Washington DC DOT, and SMSA, June 04, 2018
- HS Team presented HS-101 Course at the NTSB Training Center to industry and government, June 7, 2018
- K. Poland. Transportation on NTSB Investigations of Seat Belts on School Buses, Washington Association for School, June 23, 2018
- Article in National Association of State Motorcycle Safety Administrators Spotlight Magazine—NTSB Motorcycle Safety, July 7, 2018
- K. Poland. Automated Vehicle Symposium on Williston investigation, TRB, July 11, 2018
- M. Fox. Introduction of the National Transportation Safety Board and Overview of Crash Investigations. National Quarterly Safety Meeting, Coach USA/Mega Bus and
affiliated bus companies, Webcast, August 16, 2018
• M. Fox. American Traffic Safety Service Association Annual Conference in Williamsburg, Virginia, August 22, 2018
• T. Barth. Global Tech Regulation meeting and EV SIR RPM. Oslo, Sweden, September 13, 2018
• M. Fox. Latest crash investigations, Board Meetings and Recommendations Update. CVSA Fall Conference, Driver Enforcement Committee, September 26, 2018
• Held meeting with Aurora Tech to discuss process for NTSB Highway Crash Investigations, October 4, 2018
• Held meeting with Lyft to discuss process for NTSB Highway Crash Investigations, October 10, 2018
• D. Bruce. Collision Avoidance Systems and Driver Performance to University of Massachusetts human factors lab and HF student class, October 10, 2018.
• Held meeting with Waymo to discuss process for NTSB Highway Crash Investigations, October 11, 2018
• M. Beckjord. NTSB School Bus Fire Investigations. NAPT/NASDPTS conference, October 29, 2018
• D. Pereira. NTSB and Automated Vehicle Crash Investigations. Pennsylvania State Police Reconstruction Seminar, October 31, 2018
• D. Bruce. Automated Vehicle Testing. University of Massachusetts Safer-Sim Symposium, November 15, 2018
• K. Bragg & M. LaPonte. Fatigue. United Motorcoach Association Symposium, December 5, 2018
The Office of Marine Safety (MS) investigates major marine casualties on or under the territorial waters of the United States, including accidents involving US-flagged merchant vessels worldwide and those involving both US public and nonpublic vessels in the same casualty. In addition, the office investigates selected catastrophic marine accidents or those of a recurring nature.

The US Coast Guard (USCG) conducts preliminary investigations of all marine accidents and notifies the NTSB if an accident qualifies as a major marine casualty, which is defined as resulting in at least 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 as $500,000 or more.
- Serious threat (as determined by the USCG Commandant and concurred in by the chairman) to life, property, or the environment due to hazardous materials.

### Table 8: Office of Marine Safety Statistics

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
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<tr>
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<tr>
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<td>3</td>
</tr>
<tr>
<td>Recommendations Closed Unacceptably</td>
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<td>International Marine Investigations/SIS (Completed)</td>
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<td>International Marine Launches (SIS and non SISs)</td>
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<td>Journal Publications</td>
<td>2</td>
</tr>
<tr>
<td>Advocacy and Outreach Presentations</td>
<td>27</td>
</tr>
</tbody>
</table>

MS investigates and determines the probable cause of all major marine casualties. For select major marine casualties, the office launches a full investigative team and presents the investigative product to the Board. In all other major marine casualties,
MS launches marine investigators to the scene to gather sufficient factual information to develop a marine accident brief report. Most of these brief investigation reports are adopted by the MS director through delegated authority; the remainder are adopted by the Board, including public-nonpublic marine casualties.

**Completed Major Investigations**

- **Fire aboard the Panama Flag Roll-on/Roll-off Passenger Vessel Caribbean Fantasy**
  San Juan, Puerto Rico (0 fatalities, 6 injured)

  On August 17, 2016, a fire broke out in the main engine room of the roll-on/roll-off passenger vessel Caribbean Fantasy (Panama registry) when fuel spraying from a leaking flange came in contact with a hot surface on the port main propulsion engine. The fire could not be contained, so the master ordered the ship to be abandoned. USCG and other first responder vessels and aircraft, along with good Samaritan vessels, helped transport all 511 passengers and crew to the port of San Juan, Puerto Rico. Several injuries, none life-threatening, occurred during firefighting and abandonment efforts. The burning vessel drifted in the wind and grounded on the sandy bottom outside the port. Three days later, the vessel was towed into the harbor, where shore-based firefighters extinguished the last of the fire. The accident resulted in an estimated $20 million in damage to the Caribbean Fantasy, which was eventually scrapped in lieu of repairs.

Safety issues identified in this accident include the following:

- Machinery maintenance practices
- Fuel and lube oil quick-closing valves
- Fire protection
- Crew training on and familiarity with emergency systems and procedures
- Implementation of the company's safety management system
- Oversight by the flag state and the flag state's recognized organization

We determined that the probable cause of this investigation was the poor safety culture at Baja Ferries and its ineffective implementation of a safety management system on board the vessel, where poor maintenance practices ultimately resulted in a fire. Contributing to the rapid spread of the fire were fuel and lube oil quick-closing valves that were intentionally blocked open, ineffective fixed firefighting systems, and a structural fire boundary that failed. Contributing to the fire and the prolonged abandonment effort was the failure of the Panama Maritime Authority and the recognized organization, RINA Services, to ensure that Baja Ferries's safety management system was functional.

As a result of this investigation, we issued two new safety recommendations to the USCG; three new safety recommendations to Baja Ferries A.A. de C.V.; two new safety recommendations each to RINA Services and the Panama Maritime Authority; and, one new safety recommendation to the International Association of Classification Societies.

- **Fire On Board US Small Passenger Vessel Island Lady**
  Near Port Richey, Florida (1 fatality, 15 injured)

  On January 14, 2018, a fire broke out in an unstaffed space on the small passenger vessel Island Lady near Port Richey, Florida, during its scheduled transit to a casino boat located about 9 miles offshore in the Gulf of Mexico. After receiving a high-temperature alarm on the port engine, the captain turned the Island Lady around to return to the dock. During the return trip, smoke began filling the lazarette, main deck, and engine room. The captain deliberately beached the vessel in shallow water near shore to evacuate the passengers. All 53 crewmembers, employees, and passengers evacuated the vessel by entering the water and waded/crawled ashore. Fifteen people were injured and transported to hospitals.

6 Title 49 Code of Federal Regulations 830.2 defines a fatal injury as any injury that results in death within 30 days of an accident. It defines serious injury as that which requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received, results in a fracture of any bone (except simple fractures of fingers, toes, or nose); causes severe hemorrhages, nerve, muscle, or tendon damage; involves any internal organ; or involves second- or third-degree burns, or any burn affecting more than 5 percent of the body surface.
local hospitals; one passenger died in the hospital several hours after the fire. The *Island Lady*, valued at $450,000, was declared a constructive total loss.

We identified the following safety issues:

- Lack of company guidance regarding engine high-temperature alarms
- Lack of fire-detection in unstaffed spaces with exhaust tubing
- Insufficient preventive maintenance
- Insufficient crew training and documentation
- Inappropriate material and design of the fuel tank level-indicator system

We determined that the probable cause of this investigation was Tropical Breeze Casino Cruz’s ineffective preventive maintenance program and insufficient guidance regarding the response to engine high-temperature conditions, which resulted in the captain continuing to operate an engine that was overheating due to a cooling water pump failure, leading to the ignition of the exhaust tubing and surrounding structure. Contributing to the spread of the fire was the lack of fire detection in the vessel’s lazarette, which was not required by regulations and which allowed the fire to take hold unbeknownst to the crew.

As a result of this investigation, we issued two new safety recommendations each to the USCG and to Tropical Breeze Casino Cruz, LLC. We also reiterated two recommendations previously issued to the USCG.

### Completed Board Adopted Accident Briefs

####Capsizing and Sinking of US Fishing Vessel *Destination*

**Bering Sea near St. George Island, Alaska (6 fatalities, 0 injured)**

On February 11, 2017, while transiting from Dutch Harbor to St. Paul Island, Alaska, to deliver bait and to fish for crab, the fishing vessel *Destination* capsized 2.6 miles northwest of St. George Island, Alaska, and sank several minutes later. No mayday call was received; however, a signal from the vessel’s emergency position-indicating radio beacon alerted the USCG to the sinking. Searchers spotted debris and an oil sheen, but none of the six crewmembers aboard was found. The value of the vessel was estimated at $2.5 million.

We determined that the probable cause of the *Destination’s* capsizing and sinking was the captain’s decision to proceed during heavy freezing spray conditions without ensuring the vessel had a margin of stability to withstand an accumulation of ice or without taking sufficient mitigating action to avoid or limit the effects of icing.

No safety recommendations were issued for this investigation, but we issued a safety alert on ice accumulation addressing the risks of ice from freezing spray on vessel stability.

![Figure 36: Island Lady before the accident. Undated photo, courtesy of previous owner](image)

####Towing by Coast Guard Response Boat CG 29113 of Sailboat Vanguard, Resulting in Loss of Propulsion and Allision with Louisiana Highway 11 Bridge

**Lake Pontchartrain, Louisiana (0 fatalities, 1 injured)**

On May 3, 2017, the USCG response boat CG 29113 allided with the Highway 11 Bridge while responding to a non-distress search-and-rescue case involving the adrift sailboat *Vanguard* in Lake Pontchartrain, Louisiana. The accident caused a minor injury to one of the four USCG crewmembers and damage estimated at $337,000 to the CG 29113. The sailboat, valued at $20,000, eventually sank.

We determined that the probable cause of the towing accident was the challenging circumstances during a stern-to-stern tow in deteriorating weather conditions, which fouled the CG 29113’s propellers and caused a loss of propulsion. Contributing to the accident was the dilapidated state of the sailboat, which complicated the attempt to tow the vessel.

No safety recommendations were issued as a result of this investigation.

### Completed Delegated Authority Adopted Accident Briefs

####Grounding of Bulk Carrier *Nenita*

**Sakamokawa, Washington (0 fatalities, 0 injured)**

On November 19, 2016, the fully-laden bulk carrier *Nenita*, registered in the Marshall Islands, was...
outbound on the Columbia River when the vessel experienced an engine failure that impacted its ability to maneuver. *Nenita* subsequently ran aground at Three Tree Point, damaging its bulbous bow and hull. After the grounding, the *Nenita* was towed to Longview, Washington, for temporary repairs. Two weeks later, the vessel resumed the voyage to its original destination. There were no injuries or reported pollution as a result of the accident.

We determined that the probable cause of the grounding was the failure of a main engine cylinder cooling jacket that initiated an automatic reduction in engine speed, resulting in the eventual loss of steerageway. Contributing to the accident was the lack of information relayed from shipboard personnel to the pilot about the status of the main engine, which prevented him from taking effective corrective action following the engine casualty.

No safety recommendations were issued as a result of this investigation.

**Allision of Marguerite L. Terral Tow with Krotz Springs Railroad Bridge**
Krotz Springs, LA (0 fatalities, 0 injured)

On June 9, 2017, the towing vessel *Marguerite L. Terral* was pushing a flotilla of six cargo barges down bound on the Atchafalaya River in Krotz Springs, Louisiana, 35 miles west of Baton Rouge. At 2:48 p.m. local time, the starboard lead barge in the tow, RM 3367, and the barge immediately aft, RM 3304B, contacted a pier of the Union Pacific Railroad Bridge at mile marker 41.5. The allision damaged both barges and the bridge, requiring more than $4 million in repairs. There were no reports of pollution or injuries associated with this accident.

We determined the probable cause of the allision was the bridge tender’s delayed opening of the draw span due to distraction by his other duties. Contributing to the accident was the pilot’s failure to properly compensate for the current during the approach to the bridge.

No safety recommendations were issued as a result of this investigation.

**Fire aboard Vehicle Carrier Alliance St. Louis**
New Orleans, Louisiana (0 fatalities, 0 injured)

On January 16, 2017, the American flag vehicle carrier *Alliance St. Louis* was under way from Port Arthur, Texas, to Jacksonville, Florida, when a pipe plug on the fuel pump for the main engine’s no. 6 cylinder came loose, resulting in fuel spray onto the engine’s hot exhaust gas pipe manifold. The atomized fuel quickly ignited. The fire was contained to the main engine room and extinguished by the CO₂ fixed fire-suppression system. No injuries were reported; property damage exceeded $3,750,000.

We determined that the probable cause of the engine room fire was the improper tightening of a pipe plug on the top cover of the no. 6 cylinder fuel pump housing, which resulted in a high-pressure release of marine gas oil. Contributing to the fire was the improper attachment of a fuel spray shield to the top cover, which allowed fuel to spray directly onto the cylinder’s hot exhaust pipe and ignite.

No safety recommendations were issued as a result of this investigation.
Fire aboard Sailing Vessel Best Revenge 5
Falmouth, Massachusetts (0 fatalities, 1 injured)

On July 11, 2017, the uninspected sailing vessel Best Revenge 5 caught fire while docked at a marina pier in Falmouth Inner Harbor in Falmouth, Massachusetts. The vessel's two crewmembers escaped the burning vessel and attempted to fight the fire but could not contain it, and local firefighters later extinguished it. One crewmember sustained second- and third-degree burns to the arms, hands, and feet. An oil sheen was observed in the immediate vicinity of the vessel after the fire, but was contained by a floating boom. Damage to the Best Revenge 5 (which was declared a constructive total loss), to a vessel docked next to it, and to the pier totaled an estimated $1,508,000.

We determined that the probable cause of the fire was an electrical fault in an accommodation space on the vessel. No safety recommendations were issued as a result of this investigation.

Capsizing and Sinking of Fishing Vessel Langley Douglas
Cape Charles, Virginia (0 fatalities, 0 injured)

On the morning of September 11, 2017, the commercial fishing vessel Langley Douglas developed a port list, capsized, and subsequently sank 60 miles east of Cape Charles, Virginia. A USCG helicopter rescued the five people on board. No injuries or pollution were reported. The Langley Douglas was valued at $1.95 million.

We determined that the probable cause of the capsizing and sinking was the captain's decision to unload a large catch that overflowed the pen and spilled out on deck, which—coupled with trapped water on deck due to blocked freeing ports and shifting of liquids in partially filled tanks—caused the vessel to roll to port and down flood.

No safety recommendations were issued as a result of this investigation.

Breakaway of Containership Helsinki Bridge and Subsequent Allision with Black Falcon Cruise Terminal
Boston, Massachusetts (0 fatalities, 0 injured)

On December 6, 2017, the Panama-flagged containership Helsinki Bridge was moored in the reserved channel port side to the Paul W. Conley Container Terminal in Boston, Massachusetts. While the vessel was engaged in cargo operations at night during a period of moderate to high winds, a mooring bollard to which five of the vessel's head lines were secured failed. As a result of the bollard failure, the wind caused the vessel to drift away from the terminal and the remaining nine mooring lines to part. The vessel's bow then swung across the channel and struck the Raymond L. Flynn Black Falcon Cruise Terminal pier. There were no reports of pollution and no injuries among the 24 crewmembers and 10 longshoremen on board. The damage was estimated at $570,000 for the vessel and $40,500 for both terminals.

We determined that the probable cause of the breakaway and subsequent allision was the failure of the Massachusetts Port Authority to provide suitable berthing arrangements during ongoing construction at the Conley Container Terminal, which resulted in the overloading and failure of a single mooring bollard. Contributing to the accident was the lack of preparation by the vessel's master, who was aware of the less than suitable mooring arrangements and the deteriorating weather forecast but took no mitigating action to address the situation.

No safety recommendations were issued as a result of this investigation.
Completed Delegated Authority Accident Briefs

- **Atlantic Raider** (US), flooding, October 28, 1916, Jacksonville, Florida; Issued January 18, 2018
- **FV St Dominick** (US), grounding, March 6, 2017, Unalaska Island, Alaska; Issued January 18, 2018
- **FV Ambition** (US), sinking, Jul 23, 2016, False Pass, Alaska; Issued January 30, 2018
- **Tow Steve Plummer** (US), March 11, 2017, allision with CSX railroad bridge, Cumberland River MM190.4, Nashville, Tennessee; Issued May 1, 2018
- **Crane Barge Troy McKinney** (US), June 7, 2017, allision with high-tension power lines, Harvey Canal, Harvey, Louisiana; Issued May 2, 2018
- **UTV Todd Brown** (US), sinking, April 17, 2017, Columbus, Kentucky; Issued May 10, 2018
- **CFV Southern Bell** (US), sinking, October 13, 2017, Sabine Pass, Texas; Issued May 4, 2018
- **UTV Eric Haney** (US), foundering, July 9, 2017, Cairo, Illinois; Issued June 21, 2018
- **Tow James H Hunter** (US), June 6, 2017, allision with dock and fireboat, Nashville, Tennessee; Issued July 12, 2018
- **FV Lady Damaris** (US), sinking, June 22, 2017, Gulf of Mexico, en route to Galveston, Texas; Issued July 27, 2018
- **TV Gracie Claire** (US), capsizing and sinking, August 23, 2017, Venice, Louisiana; Issued August 13, 2018
- **TV Savage Ingenuity** (US), sinking, September 5, 2017, Gulf Intercoastal Waterway, near Sulphur, Louisiana; Issued August 31, 2018
- **Mia S (AG) allision**, August 18, 2017, New Orleans, Louisiana; Issued October 16, 2018
- **Cooperative Venture** (US), October 26, 2017, allision with Union Pacific Rail Bridge, St. Paul, Minnesota; Issued October 18, 2018
- **FV Ben & Casey** (US) sinking, October 30, 2017, South Padre Island, Texas; Issued November 1, 2018
- **TV George King** (US), engine room fire, January 24, 2017, St. Joseph, Louisiana; Issued November 7, 2018
- **TV Rickey Robinson** (US), foundering, December 8, 2017, Mckeller, Tennessee; Issued December 19, 2018
- **TV JW Heron** (US), fire, December 13, 2017, Twelve Mile Point, Alabama; Issued December 20, 2018

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International Program

The international program involves reviewing US position papers related to marine accident investigations and participating in select International Maritime Organization (IMO) meetings. In the last year, we attended IMO meetings related to reviewing and classifying maritime accidents and accident reporting, certifying and training mariners, and developing technical standards and requirements for VDRs.

Under the MS international program, we also coordinate with other US and foreign agencies to ensure consistency with IMO conventions, most notably in joint US-flag state marine accident investigations. We also cooperate with other accident investigation organizations worldwide, such as the Marine Accident Investigators’ International Forum (MAIIF), and track developments in marine accident investigations and prevention.

International Investigations

Given the international nature of the marine transportation system and the number of foreign-registered cruise and cargo ships operating from US ports, our investigation of accidents involving both domestic and foreign-registered vessels promotes marine safety worldwide. MS is responsible for the overall management of the NTSB international marine safety program and investigates major marine casualties involving foreign-flagged vessels operating in US waters and US-flagged vessels involved in major marine casualties anywhere in the world. MS has investigated accidents involving US-flagged ships as far away as the North Sea, American Samoa, Japan, and Singapore. Accidents involving foreign-flagged vessels accounted for 29 percent of NTSB marine accident investigations in the past 5 years.

MS also cooperates with the USCG and foreign marine casualty investigation authorities under standards established by the IMO *Code for the Investigation of Marine Casualties and Incidents* (CASUALTY INVESTIGATION CODE) as a substantially interested state (SIS)—for example, when a casualty involves a foreign-flagged cruise ship carrying US citizens outside US waters (each year, more than 11 million Americans are carried on board foreign-flagged cruise ships).
Completed International Accident Briefs

Fire on board Vehicle Carrier Honor
English Channel, Isle of Wight, United Kingdom (0 fatalities, 0 injured)

On February 24, 2017, the US-flagged roll-on/roll-off vehicle carrier Honor was in route from Southampton, England, to Baltimore, Maryland, when a fire broke out in the upper vehicle deck. The fire was extinguished by the crew using the vessel’s CO2 fixed firefighting system. One injury was attributed to the firefighting efforts. The accident resulted in extensive damage, amounting to more than $700,000, to the Honor’s hold as well its cargo of about 5,000 vehicles. No pollution resulted from the accident.

We determined that the probable cause of the fire was a fault in the starter motor solenoid in one of the personally owned vehicles being transported in the vessel’s cargo space.

No safety recommendations were issued as a result of this investigation.

Completed International Maritime Organization Serious Marine Casualty Investigations

Explosion and Fire onboard the 37-foot Bahamas Tour Boat
Off Exuma Island Bahamas

On June 30, 2018, a Bahamas-flagged small passenger vessel departed the dock at Barratarre, Great Exuma, with two crew members and ten passengers for an excursion. All the passengers were US citizens. Approximately 10 minutes after departing, an explosion occurred in the starboard pontoon, causing significant damage to the vessel and ejecting two passengers. One of the two ejected passengers later died at the hospital. Two other passengers sustained very serious injuries, and seven passengers sustained minor injuries.

The Bahamas Maritime Authority (BMA) represented the flag/investigating state in this investigation, and the United States participated as a SIS represented by the USCG. Two NTSB investigators, one from MS and the other from the RE, assisted the USCG.

Following the salvage of the vessel, personnel from the Bureau of Alcohol, Tobacco, and Firearms; USCG; NTSB; Bahamian Police; and the BMA conducted an investigation on scene. Initial findings have determined that an explosion occurred within the enclosed starboard pontoon forward of the vessel’s port fuel tank.

The BMA has produced a draft report of investigation; the USCG is not expected to produce a separate report. Following the practices in the IMO Casualty Investigation Code, the NTSB and the USCG Office of Investigation and Analysis have made joint comments to the draft BMA casualty report. We will post the final BMA report to the NTSB public docket.

Figure 46: Honor under way prior to the accident.
PHOTO COURTESY OF ERWIN WILLEMSE
Other Significant Products

- **Sinking of the US Cargo Vessel *El Faro*: Illustrated Digest**

  This 16-page illustrated digest summarizes the critical events and decisions that led to the October 1, 2015, sinking of *El Faro* and the loss of all 33 crewmembers. This publication took the first place award in the 2018 Adobe Government Creativity Awards in the Visual Communications–Print Communication, Graphic Design and Illustration Category.

- **Investigation of the Sinking of US Cargo Vessel *El Faro* (video)**

- **Safer Seas Digest 2017: Lessons Learned from Marine Accident Investigations**

  Our Safer Seas Digest contains concise summaries from the previous year’s completed accident investigations and represents our continuing commitment to sharing the lessons that we learn through our investigations.

Ongoing Domestic Major Marine Casualty Investigations and Public/Nonpublic Casualties

- **MV Nippon Maru (JP)**, allision, Naval Base, Guam, December 30, 2018 (0 fatalities, 0 injured)
- **TV Mary Lucy Lane (US)**, collision with USACE work boat Gibson, Warsaw, Kentucky, December 18, 2018, public/nonpublic (0 fatalities, 0 injured)
- **FV Jeanette (US)**, fire Pago Pago, American Samoa; December 5, 2018 (0 fatalities, 0 injured)
- **ITV Big Jake (US)**, barge breakaway and sinking, Cape Cod Bay, December 2, 2018 (0 fatalities, 0 injured)
- **CFV Imperial (US)**, grounding off Point Reyes, California, November 19, 2018 (0 fatalities, 0 injured)
- **Lift boat *Ram XVIII* (US)**, capsized off Grand Isle, Louisiana, November 18, 2018 (0 fatalities, 2 injured)
- **CFV *Arron & Melissa II* (US)**, sinking, 70 nm east of Portland, Maine, November 14, 2018 (0 fatalities, 0 injured)
- **Barge PTC 598 (US)**, sinking off Capt St. George, Florida, November 4, 2018 (0 fatalities, 0 injured)
- **TV Andrew Cargill MacMillan (US)**, struck grain elevator, Lower Mississippi River (MM442), near Vicksburg, Mississippi, October 24, 2018 (0 fatalities, 0 injured)
- **TV *Kristin Alexis*/*barge Mr. Ervin* (US)**, crane strike with Sunshine Bridge, St. James, Louisiana, October 12, 2018 (0 fatalities, 0 injured)
- **TV *Miss Roslyn* (US)**, sinking Lower Mississippi River MM 142, Reserve, Louisiana, October 9, 2018 (0 fatalities, 0 injured)
- **SPV *Grand Sun* (US)**, fire, Chandeleur Islands, Louisiana, October 8, 2018 (0 fatalities, 0 injured)
- **CFV *Captain M&M* (US)**, sinking 2 nm south of Sabine Pass, Texas, September 18, 2018 (0 fatalities, 0 injured)
- **ITV *Seeley & SV Sea Jay* (US)**, collision, Stamford Harbor, Connecticut, September 17, 2018 (0 fatalities, 0 injured)
- **TV *Jacob Kyle Rustoven* (US)**, engine room fire, West Helena, Arkansas, September 12, 2018 (0 fatalities, 0 injured)
- **CFV *Master D* (US)**, fire, 45 nm south of South Padre Island, Texas, August 31, 2018 (0 fatalities, 0 injured)
- **PV *Carnival Horizon* (PA)**, allision with Manhattan Cruise Terminal Pier 90, New York, New York, August 28, 2018 (0 fatalities, 0 injured)
- **FV *Hit List* (US)**, engine room fire with subsequent sinking, Newburyport Harbor, Massachusetts, August 24, 2018 (0 fatalities, 0 injured)
- **FV *Rose Marie* (US)**, fire, 57 nm east of Cape Cod, Massachusetts, August 23, 2018 (0 fatalities, 0 injured)
• Crane barge Atlantic Giant II (US), cane boom collapse into Brownsville Ship Channel, Brownsville, Texas, August 9, 2018 (0 fatalities, 1 injured)
• CFV Logger (US), engine room fire, Port Moller, Alaska, July 28, 2019 (0 fatalities, 0 injured)
• CFV Lady Toni (US) & recreational vessel Got’M ON, (US), collision, 45 nm east of Port O’Connor, Texas, July 28, 2018 (0 fatalities, 8 injured)
• CFV Pacific Knight (US), capsized in Nushagak Bay, 11 nm south of Dillingham, Alaska, July 25, 2018 (1 fatalities, 0 injured)
• Amphibious Passenger Vessel (APV) Stretch Duck 7 (US), capsized and sank in Table Lake, Near Branson, Missouri, July 19, 2018 (13 fatalities, 18 injured—major launch with Board member)
• Bulk carrier MV Yochow (HK) & tank barge OSG 243 (US), collision, Houston, Texas, June 13, 2018 (0 fatalities, 0 injured)
• Freight vessel MV Chipolbrok Moon (HK), cargo hold fire, Houston, Texas, May 23, 2018 (0 fatalities, 0 injured)
• CFV Cape Cod (US), engine room fire, Pago Pago, American Samoa, May 21, 2018 (0 fatalities, 0 injured)
• Tanker MV Tofteviken (BA) & FV Polaris (US), collision of south shore of Long Island in approach lanes to New York Harbor, New York (0 fatalities, 0 injured)
• TV Steve Richoux (US) with six cement barges allision with Mardi Gras World pier, New Orleans, Louisiana, May 7, 2018 (0 fatalities, 0 injured)
• Dredge Johnson King Boyd (US), struck submerged gas pipeline and caught fire, Port O’Conner, Texas, April 18, 2018 (0 fatalities, 0 injured)
• Bulk carrier MV Shandong Fu En (HK) collision with Erdon dock, New Orleans, Louisiana, April 6, 2018 (0 fatalities, 0 injured)
• Tow Clyde S Van Enkevot (US), dragged its starboard anchor and damaged underwater transmission lines, Mackinaw City, Michigan, April 1, 2018 (0 fatalities, 0 injured)
• FV Ole Betts Sea (US), fire and sinking, near Dry Tortugas, Florida, March 18, 2018 (0 fatalities, 0 injured)
• Tow Natalie Jean (US), struck another vessel’s anchor chain and capsized and sank near New Orleans, Louisiana, March 12, 2018 (2 fatalities, 0 injured)
• Tow Ms Nancy C (US), sinking, LMR MM 832, near Blytheville, Arkansas, March 6, 2018 (0 fatalities, 0 injured)
• Tow Leland Speaks (US), engine room fire, LWR MM 519, Arkansas, February 21, 2018 (0 fatalities, 0 injured)
• FV Progress (US), wave damage to wheelhouse, Bering Sea, near Cold Bay, Alaska, January 26, 2018 (0 fatalities, 0 injured)
• USACE Emsworth Damn/Locks, USACE workboats & commercial barges breakaway (US) (public/nonpublic), collision with public vessels, Ohio River below Pittsburg, Pennsylvania, January 13, 2018 (0 fatalities, 0 injured)
• TV JW Herron (US), fire, near Twelve Mile Island, Mobile River, Alabama, December 13, 2017 (0 fatalities, 0 injured)
• Offshore supply vessel HOS Red Dawn (US), catastrophic casualty to generator, 375 nm SSW of Amchitka Island, Alaska, December 12, 2017 (0 fatalities, 0 injured)
• CFV Misty Blue (US), foundering, near Nantucket Island, Massachusetts, December 4, 2017 (2 fatalities, 2 injured)
• Tank Barge Bouchard B-255 (US), explosion, Corpus Christi-Aransas Pass Anchorage, Texas; October 20, 2017 (2 fatalities, 0 injured)
• USS John S McCain (USN) & MV Alnic MC (PH) (public/nonpublic), collision, east of Straits of Singapore (territorial waters), Singapore; August 21, 2017 (10 fatalities, 5 injured)
• USS Fitzgerald (USN) & Ace Crystal (PH) (public/nonpublic), collision, 56 nm southwest of Yokosuka, Japan; June 17, 2017 (7 fatalities, 3 injured)

Safety Forum

Marine Accident Investigator International Forum (Americas—MAIIF)

MS hosted the Americas—MAIIF Annual Conference/Workshop at the NTSB Training Center June 12–13, 2018, furnishing speakers for all workshop modules and group breakout sessions.

Figure 49: Group photo of Americas MAIIF members, NTSB Chairman Robert Sumwalt, Managing Director Dennis Jones, Marine Safety Director Brian Curtis, and Marine Safety staff.
Safety Alert

Ice Accumulation: Addressing the Risks of Ice from Freezing Spray on Vessel Stability (SA-074)

This safety alert provides information on the importance of addressing the risks of ice from freezing spray on vessel stability.

Journal Publications

- B. Young (MS) and M. Richards (AS). 2018. Committee on Marine Transportation System paper on Extreme Weather Forecasting (Arctic).
- C. Spangler (SRC) and E. Stolzenberg (MS). 2018. El Faro: Developing a Digital Illustration of Hull Wreckage 15,400 Feet Below the Surface of the Atlantic Ocean. Poster publication that was accepted into the Association of Computing Machinery Special Interest Group on Computer Graphics and Interactive Techniques (ACM SIGGRAPH)® 2018 international conference and exhibition held in Vancouver, British Columbia, Canada. Christy Spangler and Eric Stolzenberg were the primary contributors to a multi-month effort to co-author this publication about the development of the 3D digital illustration of the hull wreckage as it rests on the bottom of the Atlantic Ocean. In addition to the academic submittal and poster describing the effort to produce the image, a 30-second movie describing the process was produced as well. The report, poster, and video were presented by NTSB over 5 days in the main hall of the convention center during the 45th ACM SIGGRAPH conference in Vancouver, BC, Canada, in August 2018 and is published in the ACM Digital Library. The conference had over 16,500 attendees from around the world.

Advocacy and Outreach Presentations

- B. Curtis. Presentation, Carnival Cruise Line VP Nautical and Safety Operations at HQ, January 31, 2018
- B. Curtis. PVA’s Duck Summit, February 28, 2018
- B. Curtis. Finnish Safety Investigation Authority—Executive Director, NTSBHQ, February 10, 2018
- L. Larue. IMO NCSR subcommittee working group, London, UK, February 19–23, 2018
- E. Stolzenberg. IMO SSE subcommittee working group, London, UK, March 12–16, 2018
- B. Curtis. El Faro investigation, American Waterway Operators Spring Convention, April 17, 2018
- B. Curtis. El Faro investigation presentation, GNOBFA, April 24–27, 2018
- B. Curtis. El Faro investigation presentation, Marine Log, May 2, 2018
- B. Curtis. El Faro investigation presentation, Maine Maritime Alumni, May 22, 2018
- M. Turrell. El Faro investigation presentation, EMAIF, Iceland, May 29–31, 2018
- C. Bell. IMO HTW, London, UK, July 16–20, 2018
- B. Curtis. JIAAC Argentina Investigation Agency Program, July 7, 2018
- B. Curtis. Presentation, Japan Safety Board (Marine,) July 24, 2018
- A. Tucker. CSMART Simulation with Member Weener, August 26–29, 2018
- B. Curtis. El Faro investigation presentation. Great Lakes Maritime, September 19–12, 2018
- B. Curtis. Clia Annual DC Conference, October 18, 2018
- L. Larue, C. Bell, M. Karr, A. Tucker, B. Young. MS-101 Course, NTSB Training Center, October 29–31, 2018
- B. Curtis. El Faro investigation, Marine Board/TRB/NAS, November 7, 2018
- B. Curtis. El Faro investigation, Work Boat Show, November 28–30, 2018
- M. Turrell. MARAD on agency MOU, December 12, 2018
- R. Jones. El Faro investigation presentation, Maine Safety Forum, December 13, 2018
- B. Curtis. Island Lady and Stretch Duck 7 issues, Passenger Vessel Association, December 18, 2018

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8 The Association of Computing Machinery Special Interest Group on Computer Graphics and Interactive Techniques (ACM SIGGRAPH) is the annual conference on computer graphics convened by the ACM SIGGRAPH organization. Dozens of research papers are presented each year, and SIGGRAPH is widely considered the most prestigious forum for the publication of computer graphics research. The recent paper acceptance rate for SIGGRAPH has been less than 26%. The submitted papers are peer-reviewed in a single-blind process.
The Office of Railroad, Pipeline, and Hazardous Materials Investigations (RPH) investigates accidents in two major modes of transportation: railroad and pipeline. The office also investigates accidents involving the release of hazardous materials in all modes of transportation, including those that result in fatalities or that cause major disruptions to a community.

The majority of railroad investigations involve freight train accidents, such as collisions and derailments, but RPH also places special emphasis on train accidents that involve the traveling public, such as passenger train and rail transit accidents. The criteria used for investigating a railroad accident includes whether or not fatalities or substantial damages were involved.

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

<table>
<thead>
<tr>
<th>Category</th>
<th>Railroad</th>
<th>Pipeline</th>
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<tr>
<td>Urgent Recommendations Issued</td>
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<td>Advocacy and Outreach Presentations</td>
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</table>
RPH also investigates pipeline accidents involving a release of natural gas, hydrocarbon liquid, ammonia, or carbon dioxide in which there are fatalities or substantial property damage. Pipeline accident investigations focus on the cause of the release, the emergency response, and, in the case of hydrocarbon pipelines, the actions taken to mitigate the spill.

Our hazardous materials investigations focus on the effects of materials released in transportation accidents, the emergency response by local authorities, and the adequacy of federal standards for hazardous materials transportation. When an accident involves the bulk transportation of hazardous materials, the investigation focuses on container performance, preparation for and handling of the material during transport, the health and safety hazards associated with the material, the labelings and hazard communications for the shipments, and the effectiveness of the emergency response.

The NTSB issues safety recommendations to federal and state regulatory agencies, industry and safety standards organizations, railroads, rail transit agencies, pipeline operators, equipment and container manufacturers, producers and shippers of hazardous materials, and emergency response organizations based on the findings of RPH investigations.

### Completed Investigations

#### RAILROAD

- **Special Investigative Report: End-of-Track Collisions**
  - Hoboken, New Jersey (1 fatality, 110 injured)
  - Brooklyn, New York (0 fatalities, 108 injured)

We launched investigative teams to two very similar accidents within 13 weeks of one another. In each accident, the engineers failed to stop the train before reaching the end of a terminating track at a station. The September 29, 2016, accident on the New Jersey Transit commuter railroad in Hoboken, New Jersey, killed one person, injured 110, and resulted in major damage to the passenger station. The January 4, 2017, accident on the Long Island Rail Road (LIRR, a subsidiary of the Metropolitan Transportation Authority) at the Atlantic Terminal in Brooklyn, New York, injured 108 people. As our investigations progressed, it became apparent that these accidents had almost identical probable causes and safety issues. We also realized that the safety issues we found were not unique to these two properties but exist throughout the United States at many intercity passenger and commuter passenger train terminals.

Figure 51 (at left): End-of-track collision at Atlantic Terminal in Brooklyn, New York.

Figure 52 (above): Damaged controlling cab car, Hoboken, New Jersey.
This special investigation report included descriptions of both accidents, discussion of the common safety issues, and analysis of the steps taken by New Jersey Transit and the LIRR in response to these events. It identified actions needed to prevent similar accidents, including the following:

• Improving measures to ensure that engineers are fit for duty.
• Installing PTC at terminal tracks.
• Developing and implementing safety management systems.

As a result of these investigations, we issued two new safety recommendations each to the FRA, New Jersey Transit, and the Metropolitan Transportation Authority.

■ BNSF Railway Roadway Worker Fatalities
Edgemont, South Dakota (2 fatalities, 0 injured)

On January 17, 2017, a BNSF Railway westbound train, traveling at 35 miles per hour, struck and killed two roadway workers, including the watchman/lookout, in Edgemont, South Dakota. The three-member roadway work group had been cleaning snow and ice from the track switch on the main track to prepare to move a train that needed brake testing on the main track. The crew of the striking train sounded the train horn and bell, and both members of the train crew applied emergency braking; however, there was no response from the roadway work group, and the train could not stop before reaching the work location.

This report addressed the following safety issues:

• Train approach warning
• Watchman/Lookout equipment
• Roadway worker-in-charge to roadway work group job briefings

We determined that the probable cause of this accident was the improper use of train approach warning by the BNSF Railway roadway work group to provide on-track safety. Contributing to the accident was incorrect information provided in the job briefing, including a miscalculated sight-distance assessment. Also contributing to the accident was the failure of BNSF to provide the watchman/lookout with the necessary equipment to alert the work group of oncoming trains and equipment. Further contributing to the accident was the FRAs inconsistent enforcement of federal regulations requiring that railroads equip watchman/lookouts.

As a result of this investigation, we issued four new safety recommendations to the FRA and three new safety recommendations to BNSF.

■ Derailment and Hazardous Materials Release of Union Pacific Railroad Unit Ethanol Train
Graettinger, Iowa (0 fatalities, 0 injured)

On March 10, 2017, an eastbound Union Pacific Railroad (UP) unit ethanol train with 3 locomotives, 98 loaded tank cars, and 2 buffer cars filled with sand derailed near Graettinger, Iowa. Of those, 20 loaded tank cars derailed, 14 of which released about 322,000 gallons of undenatured ethanol (ethyl alcohol without a denaturant added to it), fueling a postaccident fire. The accident occurred near a tributary of the Des Moines River. There were no injuries, though three nearby homes were evacuated. About 400 feet of railroad track and a 152-foot railroad bridge were destroyed in the accident. UP estimated damages, excluding environmental remediation for the cost of clearing the accident, at $4 million.

This report addressed the following safety issues:

• Adequacy of UP’s track maintenance and inspection program
• Adequacy of the FRA’s oversight
• Transportation of fuel ethanol without the use of volatile organic chemical denaturants

We determined that the probable cause of this accident was a broken rail that occurred as the train was traveling over the west approach of the Jack Creek Bridge, resulting from UP’s inadequate track maintenance and inspection program and the FRAs inadequate oversight of the application of federal track safety standards. Contributing to this accident was the continued use of US DOT specification-111 tank cars.

As result of this investigation, we issued one new safety recommendation each to the FRA, PHMSA, and UP. We also reiterated one safety recommendation previously issued to PHMSA.
Completed Accident Briefs

**RAILROAD**

**Southwestern Railroad Collision**
Roswell, New Mexico (1 fatality, 1 injured)

On April 28, 2015, a westbound Southwestern Railroad (Southwestern) freight train with nine locomotives and 79 cars collided with Southwestern's Roswell Local standing freight train. The striking train traveled through a switch that was in the reverse position at the east end of Chisum siding just south of Roswell, New Mexico. The two crewmembers on the lead locomotive of the striking train jumped before impact. The engineer died, and the conductor was seriously injured. Nine locomotives derailed from the striking train. Two locomotives and three empty hopper cars derailed from the standing train. Southwestern, which owned both trains, estimated the damage at $2.01 million.

We determined that the probable cause of the accident was that the conductor of the Roswell Local train failed to return the switch for main track movement because he was fatigued. Contributing to the accident was that the striking train crew did not perceive the misaligned switch in non-signaled territory in time to avoid the collision.

As a result of this investigation, we issued one new safety recommendation and reiterated three safety recommendations to FRA.

**Railroad Switching Services Employee Fatality**
Pine Bluff, Arkansas (1 fatality, 0 injured)

On April 3, 2015, a Railroad Switching Services crew—a locomotive operator and a ground person—was moving 34 railroad cars onto yard track 4 at the Evergreen Packaging plant in Pine Bluff, Arkansas. After moving the train about three car-lengths without receiving radio commands from the ground person, the operator stopped the train and disembarked. He found the ground person under the ninth car. The ground person died at the scene.

We determined that the probable cause of the accident was the switching crew's failure to establish the required safety protections before the ground person stepped between the railcars. Contributing to the accident was the minimal plant railroad safety oversight exercised by the FRA.

As a result of this investigation, we issued one new safety recommendation each to the Occupational Safety and Health Administration and to FRA.

**Southeastern Pennsylvania Transportation Authority Trolley Collision**
Upper Darby, Pennsylvania (0 fatalities, 42 injured)

On January 4, 2017, a Southeastern Pennsylvania Transportation Authority (SEPTA) trolley 9101 (struck trolley), traveling northwest on trolley route 10 with an estimated 47 passengers on board, stopped near the intersection of Lancaster Avenue and 38th Street, in Philadelphia, Pennsylvania, to offload passengers. SEPTA trolley 9085 (striking trolley), with 6 passengers on board, was also traveling northwest on trolley route 10, and struck stopped SEPTA trolley 9101 in the rear at an estimated impact speed of 10 mph. First responders transported 40 passengers and both operators to local hospitals for treatment of minor injuries. The total estimated equipment damage to both trolleys was $60,000.

We determined that the probable cause of this accident was the failure of the operator of trolley 9085 to slow and stop his trolley before colliding with the stopped trolley 9101, because of his impairment from fatigue and the sedating effects of the repeated doses of over-the-counter antihistamine diphenhydramine. Contributing to the operator’s fatigue was his illness, which negatively affected his medical fitness for duty.

As a result of this investigation, we issued a safety alert to rail transit agencies, the Federal Transit Administration (FTA), and the state safety oversight agencies. We also issued an early safety recommendation to the FTA.

No safety recommendations were issued as a result of this investigation.

Figure 55: Overhead view of the accident scene, Philadelphia, Pennsylvania
Southeastern Pennsylvania Transportation Authority Light Rail Collisions
Upper Darby, Pennsylvania (0 fatalities, 4 injured)

On February 21, 2017, SEPTA light-rail passenger train 57, traveling westbound on the Market-Frankford Line, entered the number 2 loop track at the 69th Street Transportation Center located in Upper Darby, Pennsylvania, and struck stopped SEPTA light-rail passenger train 67 on the number 2 loop track. The collision and associated derailment also caused train 67 to strike SEPTA light-rail train 51, which was operating in the opposite direction on the adjacent number 1 loop track. Train 57 was traveling about 14 mph at the time of the collision. Four people were injured (two passengers and two car operators) and transported by emergency responders to local medical facilities for treatment. The total estimated equipment damage to all involved light-rail equipment was $1.6 million.

We determined that the probable cause of this accident was the temporary loss of awareness and lack of proper speed control by the train 57 operator as the train entered the 69th Street station loop track.

As a result of this investigation, we issued one new safety recommendation to the FTA and two new safety recommendations to SEPTA.

Passenger Fatality on the Long Island Rail Road
Lynbrook, New York (1 fatality, 0 injured)

On April 5, 2018, a passenger was killed after walking into the side of LIRR train 884 as it was leaving the station.

We determined that the probable cause of this accident was the failure of the passenger to recognize that the departing train was moving as he walked on the station platform. Contributing to the cause of the accident was the high level of alcohol in the passenger’s bloodstream at the time of the accident.

No safety recommendations were issued as a result of this investigation.

TransCanada Corporation Pipeline (Keystone Pipeline) Rupture
Amherst, South Dakota (0 fatalities, 0 injured)

On November 16, 2017, a TransCanada Corporation, Keystone Pipeline ruptured near Amherst, South Dakota, between the Ludden, North Dakota, and Ferney, South Dakota, pump stations. Keystone’s Operational Control Center in Calgary, Alberta, was monitoring Keystone’s supervisory control and data acquisition system, which detected the leak and shut down the pipeline. Keystone’s field staff traveled to the indicated leak location, confirmed that the pipeline had ruptured, and initiated their spill response plan. The approximate spill area covered about 5,000 barrels of crude oil.

We determined that the probable cause of this accident was a fatigue crack, likely originating from mechanical damage to the pipe exterior by a metal-tracked vehicle during pipeline installation, that grew and extended to a critical size, eventually rupturing.

No safety recommendations were issued as a result of this investigation.

Third-party Damage by Sure Shot Communications to Ameren Natural Gas Distribution System
Canton, Illinois (1 fatality, 11 injured)

On November 16, 2016, a natural gas-fueled explosion occurred at a two-level commercial building in Canton, Illinois. One Ameren employee was killed and 11 people were injured, including two Ameren employees.

We determined the probable cause of this accident was third-party damage from Sure Shot’s directional drilling to install underground fiber optic conduit. Contributing to the pipeline damage was Sure Shot’s decision not to excavate at the utility crossing to visually inspect the work, while in progress, until clear of the underground utilities, as required by Illinois law. Contributing to the severity of the accident was the failure of Sure Shot and Ameren to evacuate the area.

No safety recommendations were issued as a result of this investigation.

Figure 56: Image of accident site and debris from the two-level opera house annex.
Completed Safety Recommendation Reports

RAILROAD

■ Train Approach Warning and Predetermined Place of Safety
Queens Village, New York (1 fatality, 0 injured)

We are investigating the June 10, 2017, accident in which an LIRR train struck and killed a roadway worker inside an interlocking in Queens Village, New York. During this investigation, our investigators became aware that LIRR roadway workers were improperly working in or near the tracks, which is a violation of LIRR operating rules and procedures and of the FRA’s roadway worker protection regulations.

As a result of this ongoing investigation, we issued two new urgent safety recommendations to the Metropolitan Transportation Authority, of which the LIRR is a subsidiary.

■ Train Operation During Signal Suspension
Cayce, South Carolina (2 fatalities, 93 injured)

We are investigating the February 4, 2018, collision that occurred in Cayce, South Carolina, in which Southbound Amtrak train 91, operating on a track warrant, diverted from the main track through a reversed hand-thrown switch into a siding and collided head-on with stationary CSX local freight train F777.

The engineer and conductor of the Amtrak train died as a result of the collision, and at least 92 passengers and crewmembers on the Amtrak train were transported to medical facilities. The engineer of the stopped CSX train exited the lead locomotive before the Amtrak train entered the siding and ran to safety. The lead locomotive conductor of the CSX train saw the Amtrak train approaching in the siding and ran to the back of the locomotive, where he was thrown off the locomotive and sustained minor injuries.

As a result of this ongoing investigation, we issued one new urgent safety recommendation to the FRA.

■ Inward- and Outward-Facing Audio and Image Recorders as Investigative and Safety Tools
Upper Darby, Pennsylvania (0 fatalities, 4 injured)

We have investigated numerous railroad and rail transit accidents, including an accident in Upper Darby, Pennsylvania, where inward- and outward-facing audio and image recorders provided or could have provided an unequivocal record of a train operator’s actions. These types of recorders are critical to improving operational safety, accident investigations, and management oversight, particularly in accidents where the train operator is killed or suffers memory loss.

As a result of this ongoing investigation, the NTSB issued one new safety recommendation to the FTA and two new safety recommendations to SEPTA.

PIPELINE

■ Installation of PermaLock Mechanical Tapping Tee Assemblies
Millersville, Pennsylvania (1 fatality, 3 injured)

During our ongoing investigation in Millersville, Pennsylvania, we provided safety recommendations and additional information to urge PHMSA and Honeywell to take action to prevent the incorrect installation of PermaLock mechanical tapping tee assemblies in gas distribution systems.

As a result of this investigation, we issued two new safety recommendations each to PHMSA and to Honeywell.

■ Natural Gas Distribution System Project Development and Review (Urgent)
Lawrence, Massachusetts (1 fatality, 21 injured)

On September 13, 2018, a series of explosions and fires occurred after high-pressure natural gas was released into a low-pressure gas distribution system in the northeast region of the Merrimack Valley, Massachusetts. The distribution system was owned and operated by Columbia Gas of Massachusetts, a subsidiary of NiSource, Inc. The system overpressure damaged 131 structures, including at least 5 homes that were destroyed in the city of Lawrence and the towns of Andover and North Andover. Most of the damage was a result of structure fires ignited by gas-fueled appliances. Several structures were destroyed. One person was killed and at least 21 individuals, including...
2 firefighters were transported to the hospital. Seven other firefighters received minor injuries.

As a result of this investigation, we issued one new safety recommendation to the Commonwealth of Massachusetts and four new urgent safety recommendations to NiSource, Inc.

### Ongoing Investigations

#### RAILROAD

- Two BNSF freight trains collided, derailment and subsequent fire, Panhandle, Texas, June 28, 2016 (3 fatalities, 1 injured)
- New York City Transit train struck two track workers, Brooklyn, New York, November 3, 2016 (1 fatality, 1 injured)
- Metro-North commuter train derailed, Rye, New York, May 18, 2017 (0 fatalities, 16 injured)
- LIRR train struck track worker, Queens Village, New York, June 10, 2017 (1 fatality, 0 injured)
- Amtrak train traveling south on main track 3 struck and killed two CSX employees, Washington, District of Columbia, June 27, 2017 (2 fatalities, 0 injured)
- CSX tank cars derailed and a propane car cracked, breached, and caught fire, Hyndman, Pennsylvania, August 2, 2017 (0 fatalities, 0 injured)
- SEPTA light-rail train collided with another SEPTA train, Upper Darby, Pennsylvania, August 22, 2017 (0 fatalities, 39 injured)
- UP remote-control locomotive in UP railroad yard killed UP employee, Arlington, Texas, September 22, 2017 (1 fatality, 0 injured)
- Amtrak passenger train derailed from a bridge, Dupont, Washington, December 18, 2017 (3 fatalities, 70 injured)
- Amtrak passenger train derailed after hitting CSX train, Cayce, South Carolina, February 4, 2018 (2 fatalities, 92 injured)
- CSX truck struck and killed maintenance-of-way worker, Wartrace, Tennessee, March 12, 2018 (1 fatality, 0 injured)
- Amtrak passenger train struck and killed an Amtrak maintenance-of-way worker, Bowie, Maryland, April 4, 2018 (1 fatality, 0 injured)
- CSX freight train derailed on bridge, Alexandria, Virginia, May 19, 2018 (0 fatalities, 0 injured)
- MARTA train struck and killed an employee, Atlanta, Georgia, June 2, 2018 (1 fatality, 0 injured)
- BNSF train struck a work train, Kingman, Arizona, June 5, 2018 (1 fatality, 1 injured)
- Dallas, Garland and Northeastern railroad conductor killed switching cars, Dallas, Texas, August 13, 2018 (1 fatality, 0 injured)
- 7-year-old boy fell and was killed while walking between moving SEPTA cars, Philadelphia, Pennsylvania, September 23, 2018 (1 fatality, 0 injuries)
- UP train collided with a stationary UP freight train, which then derailed, killing two crew members, Granite Canyon, Wyoming, October 4, 2018 (2 fatalities, 0 injuries)
- CSX train struck and killed CSX track welder, Estill, South Carolina, November 30, 2018 (1 fatality, 0 injured)
- NYC Transit train passenger fell while standing between cars, Bronx, New York, December 5, 2018 (1 fatality, 0 injured)

#### PIPELINE

- Washington Gas pipeline ruptured, exploded, and destroyed an apartment building, Silver Spring, Maryland, August 10, 2016 (7 fatalities, 42 injured)
- Magellan pipe ruptured and released 7,000 barrels of anhydrous ammonia, Tekamah, Nebraska, October 17, 2016 (1 fatality, 2 injured)
- Track hoe struck Colonial Pipeline gas pipeline that caused subsequent fire and injuries, Helena, Alabama, October 31, 2016 (1 fatality, 4 injured)
- Single-family home exploded during installation of a hot water heater, Firestone, Colorado, April 17, 2017 (2 fatalities, 2 injured)
- UGI Utility worker died while investigating a gas leak in a single-family home that subsequently exploded, Millersville, Pennsylvania, July 2, 2017 (1 fatality, 3 injured)
- Minnehaha Academy building exploded when a work crew attempted to relocate the gas meter, Minneapolis, Minnesota, August 2, 2017 (2 fatalities, 9 injured)
- Single-family residence exploded, ATMOS gas leak and two previous explosions 48 hours before causing 300 residence evacuations, Dallas, Texas, February 23, 2018 (1 fatality, 4 injured)
- Over pressure of a low-pressure gas system resulted in fires and explosions at over 60 locations. Columbia Gas of Massachusetts urged 146,000 residents to evacuate, Merrimack Valley, Massachusetts, September 13, 2018 (1 fatality, 21 injured)

#### HAZARDOUS MATERIALS

- Axiall Corporation tank car leaked chlorine resulting in evacuations and injuries, New Martinsville, West Virginia, August 27, 2016 (0 fatalities, 8 injuries)
- CSX tank car leaked ethanol, Fredericksburg, Virginia, November 3, 2016 (0 fatalities, 0 injuries)
- Air Products and Chemicals Company tube trailer loaded with hydrogen caught fire while in transit, Diamond Bar, California, February 11, 2018 (0 fatalities, 0 injuries)
- 9 BNSF tank cars breached, releasing an estimated 230,000 gallons of crude oil, Doon, Iowa, June 22, 2018 (0 fatalities, 0 injured)
Investigative Hearing

RAILROAD

Managing Safety on Passenger Railroads

On July 10 and 11, 2018, we held a 2-day investigative hearing on an Amtrak derailment in DuPont, Washington, and an Amtrak collision with a CSX Transportation freight train near Cayce, South Carolina.

Parties to the hearing included the FRA; the International Association of Sheet Metal, Air, Rail and Transportation Workers; the Brotherhood of Locomotive Engineers and Trainmen; the Brotherhood of Railroad Signalmen; CSX; Sound Transit; Amtrak; the Washington State Department of Transportation; and the Washington State Utilities and Transportation Commission.

This hearing allowed us to further our investigations of the associated accidents. We interviewed representatives from multiple agencies and companies to better understand the complex processes needed to operate the inaugural service in the DuPont accident. Using the Cayce accident as an example, we were able to obtain a better understanding of the relationships between Amtrak and its many host railroads throughout the United States.

Advocacy and Outreach Presentations

• G. Gregory. Transportation Research Board Annual Meeting & Taskforce for transit safety and security, The National Academies of Sciences, Engineering, and Medicine, January 7–8, 2018
• R. Frigo. Transportation Research Board Annual Meeting & Taskforce for transit safety and security, The National Academies of Sciences, Engineering, and Medicine, January 7, 2018
• G. Gregory. NTSB Investigative Process, DOT, Transportation Safety Institute, January 10–12, 2018
• R. Hall. International Cooperative Meeting, Finnish Safety Board delegation, NTSB Headquarters, February 20, 2018
• M. El-Zoghbi. PHMSA Working Group and Advisory Committee Meeting, February 28, 2018
• S. Rowlett. PHMSA Working Group and Advisory Committee Meeting, February 28, 2018
• R. Hall. PHMSA Working Group and Advisory Committee Meeting, February 28, 2018
• P. Stancil. Association of American Railroads Tank Car Committee, Association of American Railroads Conference, April 17–19, 2018
• G. Gregory, NTSB Investigative Process, DOT, Transportation Safety Institute, April 23–27, 2018
• R. Hall, S. Rowlett, and R. Payan. Meeting with the Argentinian Safety Board, NTSB Headquarters, May 2, 2018
• R. Payan and, D. Sanzo. FTA State Safety Oversight Conference, May 17, 2018
• R. Hall. New England Conference of Public Utilities Commissioners Symposium, May 19, 2018
• R. Hall. NTSB Rail Training Course, NTSB Training Center, May 30, 2018
• R. Hall, S. Rowlett and M. El-Zoghbi. American Gas Association Operations Managing Committee, June 25, 2018
• R. Evans. Pipeline Accident Investigations – Update, Western Regional Gas Association Conference, August 28, 2018
• R. Hall. Meeting with Canada TSB Director on Doon, Iowa tank car investigation, NTSB Headquarters, September 18–19, 2018
• P. Stancil. NTSB Investigation Update. Association of American Railroads Tank Car Committee, Association of American Railroads Conference, October 16–19, 2018
• D. Bucher. SmartTransit SEPTA 2018 Meeting, October 23, 2018
• A. Garcia and D. Bucher. Transportation Safety Board Canada Annual Meeting, November 27–30, 2018
The Office of Research and Engineering (RE) provides technical expertise to NTSB accident investigators in all modes of transportation. The office also conducts safety studies, generates periodic statistical reviews of aviation accidents, and provides medical expertise and toxicology support for investigations. RE consists of three laboratory divisions—vehicle recorders, materials laboratory, and vehicle performance—one safety research division, and a medical investigation and consultation program.

Table 10: Office of Research and Engineering Statistics

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Studies Published</td>
<td>1</td>
</tr>
<tr>
<td>Safety Data Analyses Completed</td>
<td>315</td>
</tr>
<tr>
<td>Vehicle Recorders and Other Electronic Devices Received</td>
<td>380</td>
</tr>
<tr>
<td>Readouts of Vehicle Recorders and Other Electronic Devices Completed</td>
<td>442</td>
</tr>
<tr>
<td>Material Laboratory Exam Reports Completed</td>
<td>165</td>
</tr>
<tr>
<td>Vehicle Performance Reports and Animations Completed</td>
<td>67</td>
</tr>
<tr>
<td>Medical Investigation Reports Completed</td>
<td>159</td>
</tr>
<tr>
<td>Journal Publications</td>
<td>2</td>
</tr>
<tr>
<td>Advocacy and Outreach Presentations</td>
<td>42</td>
</tr>
</tbody>
</table>

In 2018, the office continued to work to expand the NTSB's technological capabilities by developing close relationships with outside transportation agencies, both in the United States and abroad. For example, the office participated in the Accident Investigator's Materials International conference in Ottawa, Canada, and technical staff gave presentations on subjects such as the fractography of saddle fusion joints in high-density polyethylene pipe and the details of a General Electric stage 2 turbine disk failure. The office also participated in the Accident Investigator's Recorders International conference in Taiwan. This conference enabled technical staff from international accident investigation boards' recorder laboratories to discuss new methods and techniques and to benchmark capabilities and technical approaches to laboratory work. NTSB staff presented case studies on lessons learned from the underwater recovery of a CVR in Lake Erie. The office also laid the groundwork for the 2018 Accident Investigator's Performance conference.

RE continues to develop and build competencies in emerging transportation modes such as autonomous vehicles. In 2018, the office supported five accident cases involving autonomous vehicles, allowing staff to work with manufacturers on the

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9 These publications are co-authored with another office. Each office will be counted separately, but the over agency statistic will only count the publications once.
type and format of data collected on the vehicles’ computers. To develop technical background, staff also participated in several autonomous vehicle conferences. The office also has an initiative underway to enhance the health record management of operators and passengers involved in our accident investigations. These improvements, which require the office to create the appropriate policies and software, will enable medical and survival factors staff to gain further insight into accidents’ causes and their associated injuries.

In 2018, the Vehicle Recorder Division received 380 devices (44 of which were from foreign accidents); completed 442 readouts, transcripts, and studies in support of aviation, railroad, marine, and highway investigations; and launched to 16 accident sites. Division engineers supported numerous NTSB reports and recommendations, issuing new recorder safety recommendations or reiterating prior safety recommendations for the investigation of the crash of a Hageland Cessna 208B in Togiak, Alaska; school bus crashes in Baltimore, Maryland, and Chattanooga, Tennessee; and several aviation investigations. Among these recommendations were calls for 25-hour CVRs.

The Materials Laboratory Division acquired a new 3D Faro arm laser scanning system to enable 3D documentation of evidence to support metrological analysis and stress modeling. The division also continued to develop methods and skills in 3D visualization, documentation, and stress analysis of failed components. Materials Laboratory Division staff completed 165 reports for 122 accident cases, launched to 8 accident sites, and supported numerous NTSB reports and recommendations. For example, the division supported the investigation of a turbine engine fan blade failure that resulted in one fatality on a Boeing 737-700 airplane in Philadelphia, Pennsylvania. Staff conducted the root cause failure analysis of the fan blade and supported the regulator in developing corrective inspections. The division is continuing to support the development of a Board report and Board meeting regarding this investigation. The division also supported the ongoing investigation of a concrete pedestrian bridge collapse in Miami, Florida, overseeing bridge material testing and coordinating stress models and other testing. Finally, fire and explosion investigators determined the fire origin and cause of numerous marine fires, including an engine room fire on the ferry vessel Caribbean Fantasy in Punta Salinas, Puerto Rico.

Vehicle Performance Division staff completed 67 products (aircraft and surface vehicle performance studies, and video/photograph studies) in support of accident investigations. Among the products completed by the division were video analyses and vehicle simulations used to support the probable cause and recommendations for two school bus accidents in Chattanooga, Tennessee, and Baltimore, Maryland. The division has also been exploring the animation capability in Google Earth to correlate position and event data in an accident sequence; this technology served as the basis for an animation indicating the approximate path to final rest of 20 ethanol unit train tank cars that derailed in Graettinger, Iowa.

The Safety Research Division staff completed 1 safety study on motorcycle crash risk factors, which resulted in 10 safety recommendations; initiated 2 new safety studies focused on improving bicyclist road safety and preventing turbulence-related injury in commercial aviation; published 2 annual aviation accident data reports and 1 transportation accident fatalities summary online; generated 8 rapid reports and 39 data reports and geospatial products to support major accident investigations in aviation, highway, marine, and rail; and completed an additional 265 aviation data report and statistical analysis requests. Division staff also participated in numerous presentations and training sessions for internal and external organizations.

Figure 58: Fire and explosion specialist, Nancy Mcatee, documents evidence from a pedestrian bridge collapse in Miami, Florida.

Figure 59: Edward Komarnicki, engineering technician (at left) and Eric Mueller, materials engineer, cutting metallurgical samples from a portion of bulkhead from the barge of the articulated tub and barge Buster Bouchard.
The Medical Investigation and Consultation program’s two physicians participated in more than 150 NTSB accident investigations and completed 250 reports in all transportation modes in 2018. These included evaluating and addressing medical issues through formal factual and analytical reports, advising on safety recommendation development, coordinating with other agencies, and giving formal presentations to NTSB staff and external audiences. Medical staff played an important role in the investigation, report writing, and development of safety recommendations for the following reports:

- **Selective Issues in School Bus Transportation Safety**, which addressed two school bus crashes in Baltimore, Maryland, and Chattanooga, Tennessee, that together killed 12 people and injured 37.
- Two **end-of-track collisions at terminal stations** in Hoboken, New Jersey and Brooklyn, New York, which resulted in the death of one person and injuries to 218.
- The collision of a **motorcoach with a combination vehicle after a traffic break on Interstate 10** in Palm Springs, California, which resulted in the deaths of 12 people and injuries to 31.
- The collision of a **pickup truck with a medium-size bus on US Highway 83** in Concan, Texas, which resulted in the deaths of 13 bus occupants and injured one bus passenger and the truck driver.

### Completed Safety Studies

#### Select Risk Factors Associated with Causes of Motorcycle Crashes

According to NHTSA, 5,286 motorcyclists died in traffic crashes in the United States in 2016. Per mile traveled, motorcyclist fatalities occurred nearly 28 times more frequently than passenger vehicle occupant fatalities in traffic crashes. Like accidents in other transportation modes, motorcycle crashes are complex events that can be influenced by multiple human, vehicle, and environmental factors; however, because motorcycles afford riders less protection, the likelihood of injuries and fatalities in a crash is much greater.

We undertook this study because motorcycle riders and their passengers have the highest risk of fatal injury among all motor vehicle users. Our study identified and made recommendations on the following motorcycle safety issues:

- Inadequate integration of motorcycles in crash warning and prevention systems and with vehicle-to-vehicle and vehicle-to-infrastructure systems.
- The need for enhanced braking and stability control systems on motorcycles.
- The limitations of the most recent data collected on motorcyclist alcohol and other drug use and motorcycle crashes in the United States.
- The need to evaluate the effectiveness of motorcycle rider licensing procedures.

As a result of this study, we issued eight new safety recommendations to NHTSA and one new safety recommendation each to the FHWA, the Motorcycle Industry Council, the American Motorcyclist Association, and the Motorcycle Safety Foundation.
Ongoing Safety Studies

### Improving Road Safety for Bicyclists

According to NHTSA, in 2016, 835 bicyclists were fatally injured in motor vehicle crashes on US public roads. Further, between 2010 and 2016, the bicyclist fatality rate increased from 0.20 to 0.26 per 100,000 population. The increase may reflect the growth in popularity of bicycling—for example, more US workers are bicycling to work, and bikeshare programs and ridership have increased. This study will examine collisions between bicycles and motor vehicles on public roads to describe the fatal and nonfatal injury burden of motor vehicle crashes involving bicyclists, including trends and geographic patterns; examine the scope and nature of bicyclist risk factors and assess data limitations; identify proven countermeasures that may be underused; assess obstacles that may interfere with the full use of the identified countermeasures; and explore emerging and promising technologies for both vehicles and bicycles that are relevant to bicycling safety.

### Preventing Turbulence-Related Injuries in Part 121 Air Carrier Operations

Turbulence-related accidents are the most common type of accident involving air carrier aircraft operating under Title 14 CFR Part 121. From 2008 through 2016, we found turbulence to be a causal or contributory factor, or designated it as the defining event, in 36% of Part 121 accidents. This study will examine the details of the turbulence problem and develop safety recommendations to reduce the risk of turbulence on Part 121 operations. Specifically, the study will attempt to summarize the types and causes of turbulence, detail the safety impacts of turbulence on Part 121 operations, and examine methods to reduce the likelihood of Part 121 turbulence encounters and methods to reduce the consequences of them.

**Figure 62: NTSB investigator Joe Gregor downloads data from an airbag control module in the Ford Explorer involved in the March 1, multi-vehicle collision in Elmhurst, Illinois.**

#### Journal Publications


#### Advocacy and Outreach Conference Presentations

- L. Groff. Risk-Based Aviation Analysis and Decision Making for Aviation Safety and Accident Investigation. 2018 Annual Meeting, TRB, January 7, 2018
- J. Foster. Heavy Vehicle Event Data Recorders: Lessons Learned from NTSB Investigations. 2018 Annual Meeting, TRB, January 10, 2018
- K. Poland. Analysis of a Helicopter Crash Involving a Severe Postcrash Fire in Frisco, Colorado. 2018 Annual Meeting, TRB, January 10, 2018
- K. Poland & C. Schultheisz. Session Organized—Accident Investigations by the National Transportation Safety Board. 2018 Annual Meeting, TRB, January 10, 2018
- N. Doble & I. Cheung. Reducing Speeding-Related Crashes Involving Passenger Vehicles. 2018 Annual Meeting, TRB, January 10, 2018
- E. Mueller. Lessons Learned on the GEnx Engine on Boeing 787s. ASM International, ASM Philadelphia Chapter Meeting, February 15, 2018
- T. Burtch. Case Study of a Crash of a Lancair IV, N86NW, Near Duluth, Minnesota. Advanced General Aviation Accident Investigation, FAA Transportation Safety Institute, March 1, 2018
- J. O’Callaghan. Data Sources and Processing. Accident Investigators Performance Meeting, NTSB, March 13, 2018
• D. Horak. Video Analysis. Accident Investigators Performance Meeting, NTSB, March 14, 2018
• J. O’Callagahan & K. Renze. Runway Performance. Accident Investigators Performance Meeting, NTSB, March 14, 2018
• S. Lack. Syntyeses for Video Analysis. Accident Investigators Performance Meeting, NTSB, March 15, 2018
• K. Renze. Google Earth Animation for Accident Investigation. Accident Investigators Performance Meeting, NTSB, March 15, 2018
• S. Payne. Duluth Lancair IV Case Study and Other Presentations. FAA Advanced General Aviation Accident Investigation Training Course, FAA Transportation Safety Institute, March 18, 2018
• N. Doble & I. Cheung. NTSB Recommendations to Reduce Speeding-Related Crashes. 2018 Michigan Traffic Safety Summit, March 20, 2018
• L. Groff. Mining the NTSB Aviation Database. Info Share, March 21, 2018
• D. Crider. The Success of Simulator Training in Reducing Aviation Accidents. World Aviation Training Conference & Trade Show, April 17 and 18, 2018 (2 presentations)
• K. Renze. Accident/Incident Reconstruction and Visualization. Joint Rail Conference, ASME, April 20, 2018 (2 presentations)
• N. Doble & I. Cheung. NTSB Recommendations to Reduce Speeding-Related Crashes. 2018 Lifesavers National Conference on Highway Safety Priorities, April 22, 2018
• D. Crider. The Success of Simulator Training in Reducing Aviation Accidents. A4A Simulation Group Meeting, April 25, 2018
• L. Groff. Part 121 Accidents, National Air Carrier Association Meeting, May 16, 2018
• M. Mckay. Prescription and Over-the-Counter Drugs in All Modes of Transportation. TRB—AAA Workshop, May 21, 2018
• D. Crider. Accident Data for Scenario Development. RAeS Simulation Conference. Royal Aeronautical Society. June 11, 2018
• I. Cheung & N. Doble. Reducing Speeding-Related Crashes Involving Passenger Vehicles. Women’s Transportation Seminar—San Antonio Region Chapter Monthly Lunch Meeting. June 20, 2018
• C. Schultheisz. Cybersecurity—What Happens When AVs are Hacked. Automated Vehicles Symposium 2018, Association for Unmanned Vehicle Systems International and the Transportation Research Board, July 9, 2018
• N. Webster. Physiological Issues Contributing to Loss of Control. EAA AirVenture Oshkosh 2018, July 24, 2018
• L. Groff. GA Accident Risks and Trends. EAA AirVenture Oshkosh 2018, July 24, 2018
• L. Groff. Part 121 Cargo Accidents. ALPA Safety Forum 2018, July 30, 2018
• N. Doble. Turbulence Accidents and NTSB Research Update. Turbulence Impact Mitigation Workshop 3, NCAR/MITRE, September 6, 2018
• J. Price. Fighting Fatigue in Transit Operations. Tri-State Transit Conference, September 12, 2018
• S. Payne. El Faro Presentation. RTCM/NMEA Annual Meeting, September 15, 2018
• C. Babcock. Cleveland Citation Underwater Recovery. Accident Investigator Recorder, IRIG, September 19, 2018
• I. Cheung & L. Walton. Improving traffic safety for vulnerable road users: recent and ongoing NTSB activities and products. Walk/Bike/Places 2018, Project for Public Places, September 19, 2018
• N. Doble & I. Cheung. Recommendations to Reduce Speeding-Related Accidents in the United States. Australian Road Safety Conference, October 4, 2018
• M. Mckay, T. Barth & K. Poland. Medical Investigation after a Motorcoach Strikes the Rear of a Tractor Semitrailer Parked on the Highway, 13 Fatal. Association for the Advancement of Automotive Medicine Annual Meeting, October 8, 2018
• M. Mckay, K. Poland, D. Bruce & E. Becic. Fatal Crash between a Car Operating with Automated Control Systems and a Tractor-Semitrailer Truck. Advancement of Automotive Medicine Annual Meeting, October 8, 2018
• L. Groff. Applying Natural Language Processing to Aviation Occurrence Reports. ICAO iStars User Meeting, December 19, 2018
Since 1967, the NTSB has served as the court of appeals for holders of pilot, mechanic, air carrier, and mariner certificates when the FAA or the USCG suspends or revokes a certificate, and when a certificate application is denied.

The judges within the agency’s Office of Administrative Law Judges (ALJ) hear and consider the cases and issue initial decisions on administrative appeals of FAA aviation enforcement actions. The judges also adjudicate, under the Equal Access to Justice Act, claims from certificate holders for legal fees and expenses incurred in defending against FAA certificate actions; further, the judges 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 the judges’ decisions to the five-member Board. The Board’s review of appeal of an administrative law judge’s decision 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 USCG administrative law judges and may be appealed to the Vice Commandant of the USCG. The ruling of the Vice Commandant may then be appealed to the NTSB. The same appellate process is followed for marine certificate actions as is conducted for aviation actions.

Table 11: Office of Administrative Law Judges Statistics

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cases Received</td>
<td>220</td>
</tr>
<tr>
<td>Total Cases Closed</td>
<td>227</td>
</tr>
<tr>
<td>Emergency Cases Received</td>
<td>123</td>
</tr>
<tr>
<td>Emergency Cases Closed</td>
<td>123</td>
</tr>
<tr>
<td>Challenges to Emergency Determinations</td>
<td>25</td>
</tr>
<tr>
<td>Hearings Held</td>
<td>31</td>
</tr>
<tr>
<td>Board Opinions and Orders</td>
<td>3</td>
</tr>
<tr>
<td>Advocacy and Outreach Presentations</td>
<td>3</td>
</tr>
</tbody>
</table>
We currently have four judges: three assigned to headquarters in Washington, DC, and one in Denver, Colorado. One of the judges assigned to the headquarters office is stationed in Dallas-Fort Worth, Texas. The judges hold hearings primarily based on their circuit assignments.

- In 2018, ALJ disposed of 96% percent of its caseload.
- 253 appeals were filed with the NTSB’s administrative law judges.
- The judges held 31 hearings and closed 227 cases.
- The office received 123 emergency cases, which, by statute, require expedited handling and hearing, and these numbers are reflected in the figure below. Emergency cases are those in which the certificate, because of a serious concern for aviation safety, is taken immediately from the certificate holder by the FAA during the pendency of the case.
- Three of the judges’ decisions were appealed to the Board, which decided 1 appeals on the merits, affirming the judge in 1, and remanding 2 cases to the judges for further proceedings.

Advocacy and Outreach Conference Presentations

- Judge W. Mullins, Office Administrative Law Judges, *What it is and What it does*, Experimental Aircraft Association, July 28, 2018
- Chief Judge A. Montano, Office of Administrative Law Judges and NTSB Appeals Process Overview, Aircraft Owners and Pilots Association, October 18, 2018
- Judge J. Schumacher, Office of Administrative Law Judges and NTSB Appeals Process Overview, October 18, 2018
The NTSB Training Center, located in Ashburn, Virginia, provides training opportunities for NTSB employees and others from the transportation community through a variety of course offerings to improve attendees’ accident investigation techniques and ability to respond to transportation disasters. The core of the training program continues to be key investigative courses that focus on competencies important to safety investigations to enhance safety in all modes of transportation.

The mission of the NTSB Training Center is to promote safe transport by:

- Ensuring and improving the quality of accident investigation through critical thought, instruction, and research.
- Communicating lessons learned, fostering the exchange of new ideas and new experiences, and advocating operational excellence.
- Providing a modern platform for accident reconstruction and evaluation.
- Using its high-quality training resources to facilitate family assistance and first responder programs, sister agency instruction, and other compatible federal activity.

Table 12: NTSB Training Center Statistics

<table>
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<th>Category</th>
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<tbody>
<tr>
<td>Courses, Programs, Seminars Offered</td>
<td>27</td>
</tr>
<tr>
<td>Workforce Development Courses</td>
<td>54</td>
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<tr>
<td>Student (Individual) Attendance</td>
<td>1,819</td>
</tr>
<tr>
<td>External Participants</td>
<td>1,324</td>
</tr>
<tr>
<td>Foreign Participants (representing 33 countries)</td>
<td>115</td>
</tr>
<tr>
<td>NTSB Participants</td>
<td>624</td>
</tr>
<tr>
<td>Federal Partnerships</td>
<td>5</td>
</tr>
</tbody>
</table>

The Training Center’s laboratory area contains the reconstruction of TWA Flight 800, as well as other wreckage and materials that are used in investigative courses so participants can gain hands-on experience with real-world items. The Workforce Development curriculum, open specifically to NTSB staff, offers employees access to additional courses focused on career development and improvement of management, leadership, and other mission-critical skills. Vacant seats are open to employees of other federal agencies to maximize training opportunities and knowledge management for the federal workforce, and to provide the best stewardship of taxpayers’ training dollars. Investigators from the NTSB and other organizations in the domestic and international transportation community use the training center as a means of improving their accident investigation competencies.
Training Offerings

In 2018, the NTSB Training Center continued to upgrade and refine a comprehensive array of training courses for NTSB staff focused on mission-related skills, as well as for domestic and international participants. Because the NTSB's mission is the key focus of NTSB Training Center programs and courses, training center staff focus heavily on improving investigative programs and courses for agency employees and for the public. In addition to core accident investigation classes, in 2018, the training center offered a variety of courses ranging in length from 1 day to 2 weeks, with wide applicability to the investigative field, such as Cognitive Interviewing for Accident Investigators, Investigating Human Fatigue Factors, and Transportation Disaster Response—Family Assistance.

The majority of those attending training center courses are from the transportation and emergency response communities. Recognizing the importance of using the training material in the real-world environment, training center courses emphasize and rely heavily on examples, demonstrations and, when appropriate, hands-on training. For example, the training center received a fully intact UH-1 Iroquois (“Huey”) helicopter from the US Army for use in hands-on exercises in the NTSB Helicopter Accident Investigation class.

New and continuing courses in 2018 created many unique training opportunities. The Training Center expanded its opportunities for NTSB managers with the addition of executive coaching. By continually assessing the needs of external and internal customers, the training center not only addressed the current set of necessary skills and abilities in its course offerings, but also anticipated skills necessary for the future. Ensuring and improving the quality of accident investigations through critical thought, instruction, and research is the center's goal. Some examples of courses that focus on future needs include:

- Accident Site Photography
- Advanced Interviewing
- Cell Phone Forensics
- Civil Treatment
- Comprehensive Project Management
- Covey 7 Habits for Managers
- Critical Incident Stress Management Training
- Transportation Disaster Response—Family Assistance
- Media Relations
- Scrum Master Training
- Unmanned Aerial Systems

Transportation Community and Partnerships

Furthering its commitment to meeting the training needs of those in other areas of government, the transportation safety community, and the security and emergency response communities, the NTSB Training Center continues to build upon its alliances with private organizations and federal agencies. One example of these alliances is the partnership between the training center and the USCG. The training center has held multiple courses each year to train USCG aviation safety, and marine safety investigators. Additionally, the training center continues to attract attendees from the worldwide transportation community, as well as many foreign governmental agencies and transportation entities. For example, the training center worked with the Army National Guard (ARNG) Safety Center at Fort Rucker to develop and present a 2-week aircraft accident investigation course, exclusively tailored for the ARNG. The course was so well received that the ARNG requested a 1-week helicopter accident investigation course in addition to its 2-week aircraft accident investigation course. The training center is also working with the US Air Force Reserve to develop and present accident investigation courses specific to its needs. Whenever possible, the training center works with its investigative partners to offer classes to larger groups at other locations. One example is the public affairs course on Managing Communications During a Transportation Disaster. This course was presented to Cathay Pacific Airlines and Alaska Airlines and received outstanding reviews.

The training center also presents several general aviation safety seminars each year. We partner with the FAA and other interested groups to develop these seminars that focus on the safety, regulatory, and training aspects of general aviation safety. These safety seminars are designed for pilots, flight instructors, and other members of the general aviation community. Pilots participating in the FAA’s WINGS Program receive credit for attendance. In 2018, the training center delivered its second annual Inspection Authorization Renewal Safety Seminar for airplane mechanics to receive 8 hours of training to fulfill their annual certification requirements. The training center also delivered an additional seminar on night flying safety.

Figure 65: Root Cause Analysis course at the Training Center.