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### Abbreviations

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<td>ALJ</td>
<td>Office of Administrative Law Judges</td>
</tr>
<tr>
<td>AS</td>
<td>Office of Aviation Safety</td>
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<tr>
<td>BAC</td>
<td>Blood Alcohol Concentration</td>
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<td>CFR</td>
<td>Code of Federal Regulations</td>
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<td>CY</td>
<td>Calendar Year</td>
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<tr>
<td>DOT</td>
<td>Department of Transportation</td>
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<td>FAA</td>
<td>Federal Aviation Administration</td>
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<td>FHWA</td>
<td>Federal Highway Administration</td>
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<td>FMCSA</td>
<td>Federal Motor Carrier Safety Administration</td>
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<td>FRA</td>
<td>Federal Railroad Administration</td>
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<td>GAO</td>
<td>General Accounting Office</td>
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<td>HAZMAT</td>
<td>Hazardous Materials</td>
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<tr>
<td>ICAO</td>
<td>International Civil Aviation Organization</td>
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<tr>
<td>IIC</td>
<td>Investigator-in-charge</td>
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<td>MD</td>
<td>Office of the Managing Director</td>
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<td>MS</td>
<td>Office of Marine Safety</td>
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<td>NHTSA</td>
<td>National Highway Traffic Safety Administration</td>
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<td>NTSB</td>
<td>National Transportation Safety Board</td>
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<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
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<td>RE</td>
<td>Office of Research and Engineering</td>
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<tr>
<td>SRC</td>
<td>Office of Safety Recommendations and Communication</td>
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<tr>
<td>sUAS</td>
<td>Small Unmanned Aircraft System</td>
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<td>TDA</td>
<td>Transportation Disaster Assistance</td>
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<td>USCG</td>
<td>United States Coast Guard</td>
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<tr>
<td>USC</td>
<td>United States Code</td>
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<tr>
<td>VDR</td>
<td>Voyage Data Recorder</td>
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Figure 1: NTSB Annual Reports to Congress from past years.
I am pleased to present the 2017 Annual Report to Congress for the National Transportation Safety Board (NTSB). Recognized internationally for our accident investigation expertise, the NTSB marked its 50th anniversary year in 2017. Since its inception in 1967, the agency has been at the forefront of transportation safety. We have investigated more than 146,000 aviation accidents and thousands of surface transportation accidents, and we have issued more than 14,650 safety recommendations.

In 2017, 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 details our completed and ongoing investigations, safety recommendations, transportation disaster assistance activities, and emerging safety-related issues.

The NTSB continued to respond to both longstanding and leading-edge challenges in 2017, as we continued to advance our transportation safety mission. We completed several major and significant accident investigations, such as the fatal crash of a passenger car operating under automated vehicle control, the sinking of the cargo vessel El Faro during Hurricane Joaquin, the hot air balloon crash that was the deadliest US aviation accident since 2009, and the derailment of a crude oil train, its collision with a second train, and the resulting fire.

In addition to deploying teams to accidents, we promoted the exchange of safety information by holding public forums, safety seminars, roundtables, and investigative hearings.

Safety Forum: Runway Incursion Safety Issues, Prevention, and Mitigation

Safety Seminars: Inspection Authorization Renewal, Preventing Loss of Control in General Aviation: Lessons Learned from NTSB Accident Investigations, and General Aviation—Transition Training

Roundtables: Act to End Deadly Distractions, Advanced Driver Assistance Systems—Strategies for Increasing Commercial Vehicle (Heavy-Duty Trucks) Adoption

Investigative Hearing: Crash of Ravn Connect Flight 3153

Beyond the agency’s domestic work, we continued 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 encouraged reciprocal support from our foreign partners when foreign equipment or a foreign carrier is involved in an accident in the United States.

We hope you find the 2017 Annual Report to Congress to be an informative presentation of the agency’s accomplishments.

Sincerely,

Robert L. Sumwalt, III
Chairman
During 2017, the National Transportation Safety Board (NTSB) marked the 50th year since its birth on April 1, 1967.

For 50 years, when accidents have happened, the NTSB has been there to ask why. Just as critically, we have been there to ask why not—to recommend improvements that would prevent or mitigate the harm from future accidents.

During that half-century, the NTSB has issued more than 14,650 safety recommendations, to all levels of government, to industry, to non-state organizations such as associations and unions, and to any entity that could improve safety.

We have conducted our investigations independently, for the sole purpose of improving safety. The recipients of our recommendations have acted favorably on more than 80% of the recommendations we’ve issued.

And as a result, transportation is much safer than the era in which the agency was born. If you know what to look for, you can see the safety advances all around you.

On airliners, you can see floor-level escape lighting and lavatory smoke detectors, and terminal doppler radar installations at our airports. If you’ve planned an excavation project, you have probably seen the national 811 “call before you dig” number that’s been so successful in preventing damage to pipelines.

You probably know that it’s not only the law, but also a safety no-brainer, to buckle your seatbelt. If you’ve had teenagers in recent decades, you’re aware of graduated driver licensing—a way of gradually granting full driving privileges. Many of us know that some states once allowed teenagers to drink; now the legal drinking age is 21 nationwide. And, recreational boaters of a certain age might know the history of boating-while-intoxicated laws.

These are just a few advances that people might remember when they think about the last 50 years of transportation improvements. Deeper changes, not always visible to the transportation user, are also at work:

Pipeline inspection techniques have improved markedly since 1967. Greater professionalism in the cockpit, terrain awareness warning systems, and crew resource management, have all played their roles in our present era of aviation safety. Positive Train Control is beginning to come online—the subject of NTSB recommendations since 1970.

Many have not heard that there are now higher standards for pressurized rail tank cars, that unpressurized DOT-111 tank cars are being phased out for carriage of energy products, or that standards have been developed for continuous welded rail. One of the least visible changes is the proliferation of safety management systems (SMS) in transportation. All these advances will also improve safety.

See our timeline beginning the following page to walk through some of the transportation safety milestones of the last 50 years. We have tried to capture what many remember about each era alongside the improvements to which NTSB’s safety recommendations contributed. See page 15 for a more extensive (though still partial) list of transportation safety improvements. You can also read more about the NTSB’s history here.

In 2017, our 50th anniversary year, we completed investigations into the fatal crash of a passenger car operating under automated vehicle control, a commercial space launch, and a Boeing 787 lithium battery fire, all topics that would have been science fiction in 1967.

Where appropriate, we issued recommendations before publishing our final report, to provide a safety benefit as it becomes recognized. And even as we issued recommendations, investigators were already at the scene of more recent accidents, teasing out new safety knowledge.

It’s now been longer since NTSB was founded, than it was from the end of World War I to NTSB’s birth. Change is continuous and accelerating. We’ll leave it to the futurists to tell us what’s coming next.

But as new technologies and fields of transportation come into existence, the NTSB will continue to fix its eye on a single constant goal: transportation safety improvement.
Making Transportation Safer

1967-2017 NTSB MILESTONES

Figure 5: Vintage NTSB investigative tools

Figure 4: NTSB at the TWA 514 crash in Berryville, Virginia in 1974. Inset, at right: Member Oscar Laurel talks to the press at the site of a 1969 DC-3 accident in New Orleans.

1967: NTSB operations officially begin

1968: First seatbelt and impairment recommendations

1967–2017 NTSB milestones

1967–1974

Figure 6: On October 15, President Johnson signed the Department of Transportation Act of 1966 that created the NTSB

Figure 7: First NTSB Seal 1967–1974

Figure 8 (right): From the NTSB investigation report

National Transportation Safety Board

2017 ANNUAL REPORT TO CONGRESS
The ’60s and ’70s

WHAT MANY REMEMBER: The future was bright. The Concorde first flew in 1969, and later that year Americans walked on the moon. Back on terra firma, shortly after the NTSB was born, seatbelts became required equipment in new cars; by the late 1970s, because of fleet turnover, seatbelts were common, but states did not require vehicle occupants to use them. In railroads, during 1977, Operation Lifesaver began its first nationwide highway-rail grade-crossing safety campaign in response to NTSB recommendations. In the mid-to-late 1970s, a series of explosions of pressurized tank cars, culminating in the Waverly, Tennessee explosion in 1978, led to NTSB recommendations for subsequent improvements. Many remember the popular song about the sinking of the Edmund Fitzgerald in 1975; the tragic sinking also led to 25 NTSB recommendations, improving the safety of Great Lakes vessels.

BEHIND THE SCENES: In 1970, the NTSB made its first recommendation urging development of Positive Train Control. After NTSB recommendations in 1971–1972 to study the feasibility of Terrain Awareness and Warning Systems (TAWS) to prevent controlled flight into terrain (CFIT) and shortly after a CFIT crash, in 1974, the FAA required TAWS in airliners. Also in 1974, the NTSB became fully independent, ensuring the ability to make recommendations to DOT modal administrations. In response to our investigation of an April 1977 airliner crash, the National Weather Service began to support air traffic control.

Figure 9: Operation Lifesavers sparked the national campaign, See Tracks? Think Train.
The ’80s

WHAT MANY REMEMBER: After a series of thunderstorm-related crashes, NTSB recommendations led to airport doppler radar, among other improvements. The 1982 collision of Air Florida flight 90 with Washington’s 14th street bridge during takeoff highlighted the dangers of junior crew not asserting safety concerns—a landmark in crew resource management (CRM). In the 1987 murder-suicide crash of Pacific Southwest Airlines Flight 1771, the NTSB assisted the Federal Bureau of Investigations (FBI) in its criminal investigation, reading out the airplane’s recorders. After NTSB recommendations that states raise the drinking age to 21, the age was set at 21 nationwide. State laws began requiring seatbelt use, but often with only secondary enforcement. NTSB recommendations contributed to the state-by-state move to a per se alcohol impairment standard of .08% blood alcohol content (BAC). Also state by state, seat belt use began to be mandatory.

Remember "Baby On Board" stickers? NTSB study and recommendations fueled more practical enhancements to child passenger safety, such as child safety seat standards and laws. In 1989, the NTSB investigated the Exxon Valdez grounding in Alaska, which led to Congress passing the Oil Pollution Act of 1990.

BEHIND THE SCENES: NTSB-recommended requirements for pilot windshear training, and a constant stream of weather data to the air traffic control system, complemented other weather warning and avoidance solutions. NTSB recommendations helped speed the phaseout of pre-1977 school bus designs and helped galvanize anti-impairment efforts. NTSB’s 1983 study and subsequent recommendations on recreational boating safety led to boating while intoxicated (BWI) laws in all 50 states. Prompted by NTSB recommendations, airlines began to train pilots in CRM.

Figure 17: NTSB diagram of flight path for Air Florida Flight 90 that crashed on January 13, 1982 in Washington, DC

Figure 18 (below): FAA issues new standards for passenger aircraft following NTSB recommendations

Figure 19 (above): 74 C Band radar (70s, 80s, early 90s) SOURCE: NATIONAL WEATHER SERVICE

Figure 20: a truck and school bus crash that claimed the lives of 27 people, and injured 34 others In May 1988 in Carrollton, Kentucky. NTSB investigated the Carrollton crash, and issued key impaired driving safety recommendations, which led to stronger impaired driving laws around the country, improving safety for all road users.
WHAT MANY REMEMBER: The 1993 collision of a tug with a railroad bridge near Mobile, Alabama, resulted in the worst Amtrak accident in history—and a spate of both railroad and marine safety recommendations. After TWA Flight 800 exploded off Long Island in 1996, the NTSB determined that the explosion originated with a spark in the center wing fuel tank. In the wake of the accident, the FBI and the NTSB strengthened their cooperative relationship. Congress responded with the Aviation Disaster Family Assistance Act of 1996, providing for the dignified treatment of families of victims and survivors, and naming the NTSB the federal agency responsible for facilitating recovery and identification of fatally injured passengers.

Parents of new drivers might remember that their children earned full driving privileges more gradually. Graduated driver licensing (GDL) began to be implemented in 1996. Today, every state has some GDL provision, urged on by NTSB investigations, a 2003 public forum, and safety recommendations.

BEHIND THE SCENES: After a 1992 Safety Study of Heavy Vehicle Airbrake Performance, the NTSB recommended requiring antilock braking systems (ABS) wherever airbrakes were used on heavy vehicles. Already an option on many passenger vehicles, ABS were finally required in all new vehicles (in conjunction with Electronic Stability Control) in 2013.

Beginning in 1993, transport category aircraft were required to have Traffic Collision Avoidance Systems, to head off mid-air collisions. Airlines, manufacturers, unions, the FAA, and others come together in the Commercial Aviation Safety Team, or CAST, which would reduce the fatal accident rate in aviation by more than 80% in ten years. In a 1994 workshop, the NTSB urged coordination among pipeline companies and government officials and promoted one-call “Call Before You Dig” numbers, resulting in the next decade’s national one-call number. The push began for aircraft fuel-tank inerting, supplementing efforts to eliminate sources of sparks by mitigating the risk that a spark will cause an explosion. In 2008 the FAA required systems that “reduce the flammability levels of fuel tank vapors on the ground and in the air.”
**WHAT MANY REMEMBER:** The September 11, 2001 attacks were a defining event of the new millennium. Many don’t realize that the NTSB provided aviation accident investigators with knowledge of aircraft structures and flight recorders to assist the FBI’s criminal investigation. The second-deadliest accidental airline crash on U.S. soil, the crash of American Airlines Flight 587, happened just two months later in New York City. Despite public fears of terrorist involvement, evidence showed that over-aggressive pilot rudder inputs caused the separation of the vertical stabilizer.

In 2003, the loss of the space shuttle Columbia gripped public attention; the NTSB sent specialists with expertise in vehicle structures and systems to assist in NASA’s investigation. The 2008 collision of a Union Pacific freight train with a Metrolink commuter train in Chatsworth, Calif., led to the Rail Safety Improvement Act of 2008, which mandated the implementation of Positive Train Control by the end of 2015 (although implementation is not yet complete). The Rail Passenger Disaster Family Assistance Act was signed into law.

Technophiles might remember that in 2004, the Ansari X Prize for launching a private reusable manned space vehicle twice in two weeks was awarded to the Tier One team for its entrant, SpaceShipOne. Also in 2004, in the Defense Advanced Research Projects Agency (DARPA) Grand Challenge, autonomous vehicles attempted a 150-mile off-road course. No entrant traveled more than 7.3 miles. In 2005 DARPA repeated the event, and five vehicles finished the course. Homeowners and contractors might remember the change from a local “call before you dig” number to the national 811 number in 2007. In 2009, the last multiple-fatality regularly scheduled US passenger aviation accident (at this writing) occurred in Buffalo, New York.

**BEHIND THE SCENES:** In 2001, international guidance on assistance to aircraft accident victims and families was circulated, reflecting the U.S. model. In 2003, the NTSB Training Center opened in Ashburn, Virginia. NTSB’s animation lab began its work to create accurate, detailed visualizations of accidents. In 2005, the FBI and the NTSB entered into a Memorandum of Understanding. The FAA first required fuel tank inerting systems in 2008.
The ’10s

IN THE PRESENT DECADE, work continues on unfinished business such as the implementation of positive train control, even as the NTSB continues to investigate new accidents and roadway crashes.

A pipeline explosion in San Bruno, California in 2010 killed eight and destroyed 35 homes. The NTSB made 32 recommendations to the utility involved, to California’s utility regulator, to industry associations, and to others. In 2011, the agency called on the states to ban the non-emergency driver use of portable electronic devices, handheld or hands-free, that do not support the driving task. NTSB recommendations, advocacy, and testimony played a critical role in the new law. And as smartphones have proliferated, the NTSB has continued to advocate recommendations to reduce distraction’s deadly impact on transportation.

The crash-landing of Asiana Flight 214 at San Francisco International Airport in 2013 demonstrated the value of improved evacuation lighting, fireproofing materials in the cabin, and 16-G cabin seats, all mandated in response to NTSB recommendations. Despite the violent accident sequence, 99% of passengers and crew survived. In 2015 the agency issued a report on the effectiveness of forward collision avoidance systems—a building block of automated vehicles. Shortly thereafter, 20 automakers agreed to make automatic emergency braking standard equipment by 2022. And, we continue to learn from crashes involving vehicles under automated control, and to make recommendations to improve their safety.

The NTSB investigated the fatal 2014 in-flight breakup of a manned commercial space flight (SpaceShipTwo). The agency continues to investigate accidents involving unmanned aerial vehicles (UAV)—even as we begin to use UAV in our accident investigations. The investigation of 2015 sinking of the Cargo Vessel El Faro in Hurricane Joaquin led to more than 60 recommendations for the improvement of marine safety. Utah has passed the first 0.5 BAC law, set to become effective December 30, 2018.

Time will tell what will stick in the popular memory of this era. But the NTSB will continue its evidence-based pursuit of safety improvement in every mode of transportation—so that more of our memories are good ones.
## 50 Years of Transportation Safety Improvements

### Multimodal
- **Reducing Distraction**
  - State legislation to restrict use of personal electronic devices when driving
  - Federal and industry requirements for personal electronic devices use while operating vehicles
- **Combatting Fatigue**
  - Implementing fatigue management programs
  - Improving hours of service requirements
- **Improving fitness for duty**
  - Recognizing sleep apnea as a widespread but treatable risk
  - Medical and physical requirements for operators
- **Eliminating Impairment**
  - Drug and alcohol testing for safety sensitive positions
- **Installing/improving data, audio and video recorders**
- **Implementing a Safety Culture**
  - Safety management systems/Risk management systems

### Highway
- Mandatory seat belt use laws enactment/enforcement
- Graduated driver licensing laws
- Age 21 and .05 BAC drinking and driving laws
- Pupil transportation and school bus safety, including lap/shoulder belts in school buses
- Smart air bags and depowered passenger vehicle airbags
- Child passenger safety including car seat inspection stations
- Vehicle stability control and collision avoidance technology
- Enforcement of commercial vehicle regulations
- Motorcoach safety: post-crash fires, passenger lap/shoulder belts
- Improved tunnel and bridge inspections
- CNV brake improvements
- Electronic logs for commercial vehicles
- 15 passenger van safety: seat belts, crashworthiness, stability
- Construction zone safety
- Oversize vehicle pilot car guidelines and education

### Aviation
- Floor-level escape lighting, fire-blocking seat coverings, lavatory smoke detectors, stronger cabin seats
- Terrain avoidance and warning systems
- Collision avoidance systems
- Crew resource management
- Thunderstorm/windshear avoidance technology/procedures
- Eliminating explosive fuel tanks on airliners
- Improved reporting of slippery runway conditions
- Shoulder harnesses in general aviation
- Air medical transport safety

### Marine
- Boating while intoxicated laws
- Survival gear for commercial fishing vessels
- Personal floatation devices for children
- Emergency position-indicating radio beacons (EPIRBs) on vessels
- Immersion suits on vessels
- Enclosed, firesafe, lifeboats on tankships
- Coast Guard Cutter safety
- Cruise ship fire safety
- Gas inerting on large tank vessels
- Bridge resource management
- Safety management systems for towing industry vessels

### Railroad/ Transit
- Positive train control
- 2-way end-of-train devices on freight trains
- Passenger rail car safety standards
- 1-800 emergency number posted at grade crossings
- Standards for continuous welded rail
- Revised track and switch inspection procedures
- Tank car enhancements

### Pipeline
- One-call systems before excavation (Call 811 Before You Dig)
- Internal inspection devices to detect flaws/damage
- Federal standards for pipeline safety on military bases
- Integrity management
- Facility response plan effectiveness and oversight
- Eliminate grandfather clause for hydro testing of gas transmission lines

### HazMat
- Lithium ion battery carriage, packing, and loading
- Hazard communications training for first responders, community planning, and preparedness
- Tanker truck rollover prevention and crash protection
- Enhance spill response planning/preparedness in marine operations
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 for proper oversight. The NTSB, which has no authority to regulate, fund, or perform oversight of 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 146,000 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 14,650 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 (MWL) 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, and we adjudicate appeals of civil penalty actions taken by the FAA.

Legislative Mandate

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

Mission

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

Core Values

Integrity
Transparency
Independence
Excellence
Strategic Goals & Objectives

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

**OBJECTIVES**

**EVOLVING TECHNOLOGY**
Increase agency focus on awareness of emerging technologies

**DATA ANALYTICS**
Broaden the use of data and analysis to improve decision making

**IMPROVED TRANSPORTATION SAFETY**
Promote transportation safety through response, products, recommendations, outreach, and proactive approaches and actions to remain resilient and effective.

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

**OBJECTIVE**

**STAKEHOLDER ENGAGEMENT**
Optimize outreach and build consensus with 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

Figure 33: NTSB Organizational Chart
### Regional Offices

#### ANC: Alaska Region
- Anchorage, Alaska

#### WPR: Western Pacific Region
- Anchorage, Alaska
- Federal Way, Washington
- Denver, Colorado
- Ashburn, Virginia

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

#### ERA: Eastern Region
- Alabama
- Connecticut
- Delaware
- Florida
- Georgia
- Kentucky
- Maine
- Maryland
- Massachusetts
- Mississippi
- Missouri
- New Hampshire
- New Jersey
- New York
- North Carolina
- Ohio
- Pennsylvania
- Rhode Island
- South Carolina
- Tennessee
- Vermont
- Virginia
- Washington, DC
- West Virginia
- Puerto Rico
- US Virgin Islands
### 2017 Safety Statistics At-A-Glance

#### Table 2: 2017 NTSB At-A-Glance Safety Statistics

<table>
<thead>
<tr>
<th>Safety Recommendations</th>
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<tbody>
<tr>
<td>Recommendations Issued</td>
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</tr>
<tr>
<td>Urgent Recommendations Issued</td>
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<tr>
<td>Urgent Recommendations Closed Acceptably&lt;sup&gt;1&lt;/sup&gt;</td>
<td>3</td>
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<tr>
<td>Recommendations Closed Acceptably</td>
<td>131</td>
</tr>
<tr>
<td>Recommendations Closed Unacceptably</td>
<td>37</td>
</tr>
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<table>
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<th>Reports and Products</th>
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<tbody>
<tr>
<td>Major Reports</td>
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<tr>
<td>Accident Briefs</td>
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<tr>
<td>Special Investigative Reports</td>
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<tr>
<td>Public Forums, Hearings, Roundtables, and Workshops</td>
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<tr>
<td>Safety Alerts and Videos</td>
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<tr>
<td>Other Products</td>
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<table>
<thead>
<tr>
<th>Accident Launches</th>
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<tbody>
<tr>
<td>Major Accident Launches</td>
<td>32</td>
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<tr>
<td>Regional/Field Accident Launches</td>
<td>218</td>
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<tr>
<td>International Accident Launches</td>
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<tr>
<td>International Serious Marine Casualty Investigations Completed</td>
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<table>
<thead>
<tr>
<th>Research and Engineering/Laboratory</th>
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<tr>
<td>Safety Studies Published</td>
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<td>Safety Data Analyses Completed</td>
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<tr>
<td>Readouts of VRs and Other Electronic Devices Completed</td>
<td>449</td>
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<tr>
<td>Material Laboratory Exam Reports Completed</td>
<td>160</td>
</tr>
<tr>
<td>Vehicle Performance Reports and Animations Completed</td>
<td>58</td>
</tr>
<tr>
<td>Medical Investigation Reports Completed</td>
<td>169</td>
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</table>

<table>
<thead>
<tr>
<th>Advocacy and Outreach</th>
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<tbody>
<tr>
<td>SRC Advocacy and Outreach Events Conducted</td>
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</tr>
<tr>
<td>Testimony to Congressional Committees</td>
<td>2</td>
</tr>
<tr>
<td>Testimony or Legislative Support to State Legislative Committees</td>
<td>9</td>
</tr>
<tr>
<td>Journal Publications</td>
<td>13</td>
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<tr>
<td>Advocacy and Outreach Conference Presentations</td>
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</table>

<table>
<thead>
<tr>
<th>Aviation Certificate Appeals</th>
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<tbody>
<tr>
<td>Total Cases Received</td>
<td>235</td>
</tr>
<tr>
<td>Total Cases Closed</td>
<td>222</td>
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<tr>
<td>Emergency Cases Received</td>
<td>122</td>
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<tr>
<td>Emergency Cases Closed</td>
<td>121</td>
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</table>

<table>
<thead>
<tr>
<th>Training Center</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Courses, Programs, and Seminars Offered</td>
<td>41</td>
</tr>
<tr>
<td>Federal Partnerships</td>
<td>4</td>
</tr>
<tr>
<td>External Participants</td>
<td>752</td>
</tr>
<tr>
<td>Foreign Participants</td>
<td>92</td>
</tr>
</tbody>
</table>

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<sup>1</sup> Acceptable statuses include “Closed—Acceptable Action,” “Closed—Acceptable Alternate Action,” and “Closed—Exceeds Recommended Action.”
The Office of Safety Recommendations and Communications (SRC) provides information to a range of stakeholders regarding the National Transportation Safety Board (NTSB) investigations, activities, and safety recommendations. These stakeholders include victims of transportation accidents and their families, the media, recipients of NTSB recommendations, the transportation industry, federal, state, and local government officials and agencies, and transportation safety advocacy organizations. The SRC mission spans the life-cycle of investigations, providing the transparency that supports our independence while building public trust and support. After an investigation concludes, SRC efforts focus on securing the support necessary to gain favorable action on safety recommendations issued following our investigations. Through proactive communication, SRC tells the NTSB story to gain support for and understanding of the NTSB, 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), and Digital Services (DS).

Table 3: Office of Safety Recommendations and Communications Statistics

<table>
<thead>
<tr>
<th>Recommendations Issued</th>
<th>168</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendations Closed Acceptably</td>
<td>131</td>
</tr>
<tr>
<td>Recommendations Closed Unacceptably</td>
<td>37</td>
</tr>
<tr>
<td>Urgent Recommendations Closed</td>
<td>3</td>
</tr>
<tr>
<td>Testimony to Congressional Committees</td>
<td>2</td>
</tr>
<tr>
<td>Testimony or Legislative Support to State Legislative Committees</td>
<td>9</td>
</tr>
<tr>
<td>Media Coverage Achieved (print, broadcast, online)</td>
<td>302,000</td>
</tr>
<tr>
<td>Family Members and Victims Assisted</td>
<td>1373</td>
</tr>
<tr>
<td>Advocacy and Outreach Events Conducted</td>
<td>181</td>
</tr>
</tbody>
</table>
Safety Recommendations Division

Safety recommendations are the primary product of NTSB investigations. Safety recommendations address specific issues uncovered during investigations and specify actions for the recipient to take to help prevent recurrence.

Table 4: 2017 Safety Recommendation Summary

<table>
<thead>
<tr>
<th>Recommendation Classification</th>
<th>Number of Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Recommendations Issued</td>
<td>168</td>
</tr>
<tr>
<td>Recommendations Closed Acceptably</td>
<td>131</td>
</tr>
<tr>
<td>Recommendations Closed Unacceptably</td>
<td>37</td>
</tr>
<tr>
<td>Urgent Recommendations Issued</td>
<td>5</td>
</tr>
<tr>
<td>Urgent Recommendations Closed Acceptably</td>
<td>3</td>
</tr>
</tbody>
</table>

The SR division helps the investigative offices develop NTSB’s recommendations and recommendation letters that result from their investigations. Recommendation letters are sent to the organizations best able to take corrective action. Typical recipients include the Department of Transportation (DOT) and its modal administrations, the United States Coast Guard (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.” Various other designations denote satisfactory, neutral, and unsatisfactory results. SR also maintains the NTSB safety recommendation database, compiles monthly statistics, and supports NTSB staff on recommendation data queries.

In 2017, the NTSB saw the acceptance of 131 safety recommendations by recipients. Over the last 5 years, the number of recommendations accepted by recipients has ranged from 184 in 2013 to 131 in 2017.

In response to NTSB safety recommendations, federal agencies issued, via Federal Register notices, several important Notices of Proposed Rulemaking, Notices of Proposed Federal Guidelines, and Airworthiness Directives in 2017. The table below provides a summary of these actions.

Table 5: Safety Recommendations Addressed in NPRMs, NPFGs, and ADs from Federal Agencies in 2017

<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>6</td>
<td>8</td>
</tr>
<tr>
<td>National Highway Traffic Safety Administration</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Federal Railroad Administration</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Advocacy efforts among the NTSB, the DOT, and the USCG led to the closure of 141 recommendations issued to those agencies.

Table 6: Recommendations Issued to the DOT, DOT Modal Agencies, and the USCG Closed During 2017

<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>4</td>
</tr>
<tr>
<td>Federal Aviation Administration</td>
<td>57</td>
</tr>
<tr>
<td>Federal Motor Carrier Safety Administration</td>
<td>16</td>
</tr>
<tr>
<td>Pipeline and Hazardous Materials Safety Administration</td>
<td>14</td>
</tr>
<tr>
<td>National Highway Traffic Safety Administration</td>
<td>23</td>
</tr>
<tr>
<td>Federal Transit Administration</td>
<td>0</td>
</tr>
<tr>
<td>Federal Highway Administration</td>
<td>5</td>
</tr>
<tr>
<td>United States Coast Guard</td>
<td>18</td>
</tr>
</tbody>
</table>

Figure 35: NTSB Recommendations Closed Acceptably by Year.

2 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 of transportation accidents. Staff respond to modal accident investigations that are not mandated by 49 USC sections 1136 and 1139, as well, either through travel to the accident location or by managing ongoing requests for information from family members via phone, mail, or e-mail.

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 2017, TDA staff participated in six accident launches, one of which (the DuPont, Washington, Amtrak derailment) met the requirements of the Rail Passenger Disaster Family Assistance Act (Title 49 USC sections 1139 and 24316). Staff also provided nonlaunch family assistance to an additional 319 accident investigations in all modes of transportation, interacting with over 1,373 accident victims and family members. TDA staff supported family members attending seven Board meetings and investigative hearings, supported 61 outreach events, and coordinated two training courses at the NTSB Training Center, resulting in direct contact with approximately 3,916 participants. Staff interfaced with 258 federal, state, and local agencies, transportation industry organizations, and other nongovernmental organizations that have a role in family assistance operations, with an average of 17 engagements per week requiring either travel or remote interaction.

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. The agency’s primary responsibility involves coordinating among federal agencies, domestic air carriers, state and local authorities, and the families of victims. 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 the same standards of victim assistance 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.

Figure 36: NTSB TDA Specialists at the NTSB Training Center engaging with participants at the biannual family assistance course.

Figure 37: NTSB TDA Specialists working in the Joint Family Support Operations Center during the Amtrak 501 accident response.

Figure 38: TDA hosted the Annual Air Carrier Family Assistance meeting, attended by representatives from industry, government, first responders and others involved in family assistance.

Media Relations Division

The Media Relations (MR) division 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, and safety recommendations. MR staff respond to media inquiries, arrange and support media interviews of NTSB personnel, and are the onscene public affairs officers supporting Board Members during major accident investigations. MR also supports deployed regional investigators and investigators-in-charge (IICs) 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.

The MR division helped the NTSB garner more than 302,001 print, broadcast, and online news articles in 2017. The ad equivalent value of that coverage is more than $1.2 billion. Special projects included media relations support for episodes of the Cineflex production Mayday, a Smithsonian Air and Space Magazine story on cockpit voice recorders and flight data recorders; the Preventing Loss of Control Workshop in Ronkonkoma, New York; the investigative hearing on the Crash of Ravn Connect Flight 3153 in Anchorage, Alaska; and initiation of a recurring series of interviews on SiriusXM’s Road Dog Trucking Show highlighting NTSB investigators’ work on highway safety issues. MR also rewrote the NTSB’s
media relations policy and developed a 1-hour, webinar-based media relations refresher training module for regional investigators and IIs.

MR focused on process improvements and innovation, starting with changing the format for the Most Wanted List (MWL) kickoff media event, creating a panel discussion for Board Members instead of the traditional stand-up press event. The panel format gained favorable comments from both NTSB leadership and the media. MR introduced integrated communication planning as a process, using a series of aviation safety alerts as the subject, and worked with the alert authors to define audiences, identify key messages, and state communication goals for releasing the alerts. The alerts to which the planning process was applied gained more click-throughs and slightly more earned media. This emphasis on planned media relations engagements helps broaden the reach of our products and coordinate, synchronize, and integrate SRC’s communication efforts.

MR emphasized the use of imagery in its news releases and tweets as a means of telling the NTSB story, increasing audience engagement, and garnering greater earned media coverage. More than 83 percent of news releases issued in 2017 contained imagery. During 2017, the first full calendar year for the new handle @NTSB_Newsroom, Twitter followers increased by nearly 83 percent and they clicked links to NTSB web content more than 19,000 times. The division’s news releases have an open rate of more than 28 percent, 7 points above the accepted 21 percent average for government communications. The click-to-open rate is just shy of the 18 percent average for government communications. The division’s news releases have only a 0.03 percent unsubscribe rate. Recipients of our news releases clicked through to NTSB web content more than 22,000 times in 2017, indicating that the news releases contained content that was relevant, engaging, and useful to the target audience. The resultant earned media coverage speaks to the power of the NTSB story.

MR launched staff on every major investigation and Go Team launch, and supported regional investigators remotely and, in some cases, on scene (for example, on the Icon A-5 crash, which gained national media attention due to the prominence of the pilot and the reputation of the aircraft within the aviation community). MR staff provided media relations training to more than 600 people in 2017 and assumed responsibility for providing media relations training to NTSB personnel to solidify relationships with the people we support.

**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 Safety Advocacy (SA) division to support programs and legislation consistent with safety recommendations and to monitor state legislative activity relevant to our recommendations.

In 2017, GA provided on-scene support to Board Members and investigators for seven 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 two hearings regarding highway safety, filed 12 statutorily required reports to Congress, and coordinated responses to ten engagements from the GAO. GA also supported the Senate confirmation process for the Chairman and the nomination process for a new Board Member.

At the state level, GA staff supported Board Member testimony before the Utah Senate Transportation Committee regarding our recommendations on impaired driving and before the Massachusetts Joint Public Safety and Homeland Security Committee regarding primary enforcement seat belt and cell phone use legislation. Similarly, GA supported staff testimony before the Delaware House Public Safety and Homeland Security Committee regarding motorcycle helmet requirements. Division staff also arranged staff-level briefings for congressional, state, and local officials on ongoing investigations and recommendations, including the our investigations into the July 7, 2017, overflight taxiway approach at San Francisco International Airport; the September 18, 2017, motorcoach and transit bus crash in Queens, New York; and the December 18, 2017, Amtrak derailment in DuPont, Washington, as well as on recommendations regarding autonomous vehicles and commercial balloon operations. Additionally, the division supported a general aviation safety seminar held in New York and a Board hearing in Alaska, and assisted in planning and executing a forum on runway incursions.

**Safety Advocacy**

SA leads the agency’s advocacy efforts and promotes the implementation of safety recommendations on the NTSB’s MWL. SA relays NTSB safety messages and lessons learned through print, digital media, and social media communications, including the Safety Compass blog on the NTSB website, Instagram, LinkedIn, Facebook, YouTube, and @NTSB Twitter. SA distributes agency products and information to stakeholders, including the Advocacy Spotlight newsletter, which details NTSB advocacy progress.

SA’s primary advocacy focus is the MWL. SA leads MWL development and works with Board Members and modal office directors to identify issues for the list and create strate-
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 the range of stakeholders interested in the MWL.

In November 2016, SA coordinated the press conference announcement of the 2017–2018 MWL. In November 2017, SA coordinated a midyear progress report meeting to evaluate industry and government progress in each of the MWL issue areas. This meeting resulted in strengthened and renewed stakeholder relationships and identified new collaborative approaches to addressing MWL issues and recommendations. For this meeting, SA placed all associated open recommendations related to the MWL on the NTSB website to underscore the correlation between the MWL and our accident investigations and recommendations.

One significant MWL-related event coordinated by SA in 2017 was the 2nd Distracted Driving Roundtable, Act to End Deadly Distractions, which focused on victim’s stories and how they can enhance advocacy efforts. This event, moderated by then Acting Chairman Sumwalt at NTSB headquarters, was held in collaboration with Stopdistractions.org, DRIVE SMART Virginia, and the National Safety Council. The discussion highlighted the impact distraction has on drivers on US roadways and identified specific solutions for eliminating distracted driving—from technological solutions to enforcement strategies.

In 2017, advocacy funds supported 65 agency staff member trips focused on promoting the recommendations in the MWL issue areas. In addition, SA participated in or supported 98 advocacy outreach activities in coordination with Board Members and agency staff, which reached more than 20,000 people.

SA helped the agency significantly increase use of its social media platforms, posting 632 tweets and increasing the number of @NTSB followers by 7,000 in one year to 128,644. SA posted 48 blogs, which received more than 31,000 views, and 116 items on Instagram, where its followers increased by 328 in one year to 1,294. SA posted 83 items on Facebook, reaching more than 325,000 people. Connections on the NTSB LinkedIn account increased by 654 in one year to 7,700.

SA created other original content, including “Behind the Scene @ NTSB,” a podcast featuring interviews with agency staff discussing their work, lessons learned from investigations, and pertinent safety messages. SA also developed four YouTube videos, receiving more than 3,000 total views, and released three Advocacy Spotlight newsletters to more than 8,000 advocacy groups and other interested stakeholders.

In April 2017, we launched our e-mail messaging and content distribution service via Constant Contact (CC). Transportation stakeholders and others interested in receiving NTSB information, such as advocacy updates, MWL materials, event-related information, safety alerts, investigative reports and briefs, video announcements, and news releases, could subscribe to this service. The number of NTSB product subscribers increased from fewer than 500 at initial launch in April to nearly 4,000 stakeholders by the end of 2017. Additionally, SA distributed 39 information releases to more than 61,000 stakeholders through the CC subscription e-mail service in 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 2017, DS completed more than 1,000 requests for information release via the web, social media, or visual media (graphics, publications, video). DS staff supported 17 major accident investigation launches, 12 Board meetings, and nine public forums, symposia, or other events. DS staff also provided graphics and video for the 2017–2018 MWL of transportation safety improvements.

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 launched to accident scenes around the country to gather imagery and video documenting the on-scene phase of the investigations. Staff also provided high levels of support for the release of the El Faro investigation report, including a complex computer modeling of the vessel’s final resting position on the bottom of the Atlantic Ocean.

Figure 44: Artist’s rendering of El Faro at final rest, based on data collected during search and recovery missions.

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 in the NTSB’s mission.

Table 7: SRC Accident Launch Support in 2017

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Accident Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail &amp; Pipeline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>January 4</td>
<td>Long Island, New York</td>
<td>Long Island RR #2817 derailed and struck a bumper</td>
</tr>
<tr>
<td>March 10</td>
<td>Graetting, Iowa</td>
<td>Derailment of freight train with ethanol units</td>
</tr>
<tr>
<td>June 27</td>
<td>Ivy City, District of Columbia</td>
<td>Amtrak #175 struck two CSX employees</td>
</tr>
<tr>
<td>August 2</td>
<td>Hyndman, Pennsylvania</td>
<td>Derailment with propane tank car crack</td>
</tr>
<tr>
<td>August 2</td>
<td>Minneapolis, Minnesota</td>
<td>Natural gas explosion at a school</td>
</tr>
<tr>
<td>August 22</td>
<td>Upper Darby, Pennsylvania</td>
<td>SEPTA light rail train collision</td>
</tr>
<tr>
<td>December 18</td>
<td>Dupont, Washington</td>
<td>Amtrak #501 derailed from bridge during Cascade inaugural run</td>
</tr>
<tr>
<td>Highway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March 7</td>
<td>Biloxi, Mississippi</td>
<td>Train collision with motor coach lodged on railroad tracks at grade crossing</td>
</tr>
<tr>
<td>March 29</td>
<td>Concan, Texas</td>
<td>Pickup truck collision with church bus</td>
</tr>
<tr>
<td>September 18</td>
<td>Flushing, New York</td>
<td>Transit bus struck by motor coach</td>
</tr>
<tr>
<td>Aviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>February 27</td>
<td>Riverside, California</td>
<td>Cessna T310Q impacted terrain</td>
</tr>
<tr>
<td>April 28</td>
<td>Amarillo, Texas</td>
<td>PC12 air ambulance crash</td>
</tr>
<tr>
<td>May 5</td>
<td>Charleston, West Virginia</td>
<td>SD3-30 crashed during landing on runway</td>
</tr>
<tr>
<td>May 15</td>
<td>Teterboro, New Jersey</td>
<td>Learjet 35A impacted terrain</td>
</tr>
<tr>
<td>November 7</td>
<td>Clearwater, Florida</td>
<td>Icon A5 crashed into shallow waters</td>
</tr>
<tr>
<td>December 7</td>
<td>St. Croix, Virgin Islands</td>
<td>BE58 impacted terrain on airport property</td>
</tr>
</tbody>
</table>
The mission of the Office of Aviation Safety (AS) is to (1) investigate all air carrier, commuter, and air taxi accidents; in-flight collisions; fatal and nonfatal general aviation accidents; and certain public aircraft accidents; (2) 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; and (3) 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 a regional investigation management structure consisting of four regional office sites. Investigators are located throughout the country. International aviation activities are coordinated from the Washington, DC, office.

### Table 8: Office of Aviation Safety Statistics

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
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<tr>
<td>Recommendations Issued</td>
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<td>Urgent Recommendations Issued</td>
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<td>Recommendations Closed Acceptably</td>
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</tr>
<tr>
<td>Recommendations Closed Unacceptably</td>
<td>14</td>
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<td>Major Reports</td>
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<tr>
<td>Accident Briefs</td>
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<tr>
<td>Special Investigation Reports</td>
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<td>Major Investigation Launches</td>
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<td>Regional Investigation Launches</td>
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<tr>
<td>International Accident Launches</td>
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<tr>
<td>Safety Alerts</td>
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<tr>
<td>Other Products</td>
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<tr>
<td>Journal Publications</td>
<td>2</td>
</tr>
<tr>
<td>Advocacy and Outreach Conference Presentations</td>
<td>9</td>
</tr>
</tbody>
</table>
Completed Investigations

Loss of Control at Takeoff, Air Methods Corporation, Airbus Helicopters
AS350 B3e, N390LG
Frisco, Colorado (1 fatality, 2 injured)

On July 3, 2015, an Airbus Helicopters AS350 B3e helicopter, N390LG, registered to and operated by Air Methods Corporation, lifted off from the Summit Medical Center Heliport, Frisco, Colorado, and then crashed into a parking lot; the impact point was located 360 feet southwest of the ground-based helipad. The pilot was fatally injured, and the two flight nurses were seriously injured. The helicopter was destroyed by impact forces and a postcrash fire. The flight was conducted under the provisions of Title 14 Code of Federal Regulations (CFR) Part 135 on a company flight plan. Visual meteorological conditions prevailed at the time of the accident.

Safety issues discussed in the report include the lack of a cockpit alert to pilots to indicate the loss of hydraulic boost to the pedal controls for AS350-series helicopters with a dual hydraulic system; the need for changes to the tail rotor flight controls of AS350-series helicopters with a dual hydraulic system to ensure pedal control hydraulic assistance and mitigate the possibility of pilot error during hydraulic system checks; the lack of readily available information for helicopter operators and customers regarding safety equipment and systems that would enhance a helicopter’s crashworthiness; the need for crash-resistant fuel systems for helicopters not covered by the November 1994 fuel system crashworthiness requirements; and the lack of requirements to install, on smaller aircraft, flight recorder systems that protect recorded data from crash impact damage and postcrash fire damage.

We determined that the probable cause of this accident was Airbus Helicopters’ dual-hydraulic AS350 B3e helicopter’s (1) preflight hydraulic check, which depleted hydraulic pressure in the tail rotor hydraulic circuit, and (2) lack of salient alerting to the pilot that hydraulic pressure was not restored before takeoff. Such alerting might have cued the pilot to his failure to reset the yaw servo hydraulic switch to its correct position during the preflight hydraulic check, which resulted in a lack of hydraulic boost to the pedal controls, high pedal forces, and a subsequent loss of control after takeoff. Contributing to the accident was the pilot’s failure to perform a hover check after liftoff, which would have alerted him to the pedal control anomaly at an altitude that could have allowed him to safely land the helicopter. Contributing to the severity of the injuries was the helicopter’s fuel system, which was not crash resistant and facilitated a fuel-fed postcrash fire.

As a result of this investigation, we issued two new safety recommendations each to the Federal Aviation Administration (FAA) and Airbus Helicopters; one new safety recommendation each to the European Aviation Safety Agency (EASA), the Association of Critical Care Transport, the Association of Air Medical Services, and the Air Medical Operators Association; and reiterated two recommendations to the FAA. Prior to this report’s completion, we issued three new safety recommendations to the FAA and one to the EASA.

Collision with Terrain, Promech Air, Inc., de Havilland DHC-3, N270PA
Ketchikan, Alaska (9 fatalities, 0 injured)

On June 25, 2015, a single-engine, turbine-powered, float-equipped de Havilland DHC-3 (Otter) airplane, N270PA, collided with mountainous, tree-covered terrain about 24 miles east-northeast of Ketchikan, Alaska. The commercial pilot and eight passengers sustained fatal injuries, and the airplane was destroyed. The airplane was owned by Pantechnicon Aviation, of Minden, Nevada, and operated by Promech Air, Inc., of Ketchikan. The flight was conducted under the provisions of 14 CFR Part 135 as an on-demand sightseeing flight; a company visual flight rules (VFR) flight plan (by which the company performed its own flight-following) was in effect. Marginal VFR conditions were reported in the area at the time of the accident. The flight departed about 1207 from Rudyard Bay about 44 miles east-northeast of Ketchikan and was on route to the operator’s base at the Ketchikan Harbor Seaplane Base, Ketchikan.

Safety issues discussed in this report relate to the need for training program improvements for Ketchikan air tour operators that address pilot human factors issues, such as assessment of safe weather conditions, pilot recognition of potentially hazardous local weather patterns, and operational influences on decision-making; the need for collaboration among Ketchikan air tour operators to...
identify and mitigate operational hazards through analysis of automatic dependent surveillance-broadcast data; the lack of conservative weather minimums for Ketchikan air tour operators; the lack of defined curriculum segments for controlled flight into terrain-avoidance training for all 14 CFR Part 135 operators; nuisance alerts from the Class B terrain awareness and warning system during tour operations; the limitations of older software and terrain database versions for the legacy Chelton Flight Systems FlightLogic electronic flight instrument system; the lack of minimum training requirements for operational control personnel and the lack of guidance for FAA inspectors for performing oversight of operational control training programs; the need for cruise industry awareness of schedule pressures associated with air tours sold as shore excursions; the lack of a requirement for a safety management system for Part 135 operators; and the lack of a crash-resistant flight recorder system.

We determined that the probable cause of this accident was (1) the pilot’s decision to continue visual flight into an area of instrument meteorological conditions, which resulted in his geographic disorientation and controlled flight into terrain; and (2) Promech’s company culture, which tacitly endorsed flying in hazardous weather and failed to manage the risks associated with the competitive pressures affecting Ketchikan area air tour operators; its lack of a formal safety program; and its inadequate operational control of flight releases.

As a result of this investigation, we issued nine new safety recommendations to the FAA and one new safety recommendation to the Cruise Lines International Association. We also reiterated three previously issued safety recommendations to the FAA.

Impact with Power Lines, Heart of Texas Hot Air Balloon Rides, Balóny Kubiček BB85Z, N2469L
Lockhart, Texas (16 fatalities, 0 injured)

On July 30, 2016, a Balóny Kubiček BB85Z hot air balloon, N2469L, operated by Heart of Texas Hot Air Balloon Rides, struck power lines and crashed in a field near Lockhart, Texas. The pilot and 15 passengers died, and the balloon was destroyed by impact forces and postcrash fire. The balloon was owned and operated by the pilot, and the flight was conducted under the provisions of 14 CFR Part 91 as a sightseeing passenger flight. The flight originated about 0658, just after sunrise, from Fentress Airpark, Fentress, Texas.

Safety issues discussed in the report include a lack of medical oversight for commercial balloon pilots and a lack of targeted FAA oversight of potentially risky commercial balloon operations.

We determined that the probable cause of this accident was the pilot’s pattern of poor decision-making that led to the initial launch, continued flight in fog and above clouds, and descent near or through clouds that decreased the pilot’s ability to see and avoid obstacles. Contributing to the accident were (1) the pilot’s impairing medical conditions and medications and (2) the FAA’s policy to not require a medical certificate for commercial balloon pilots.

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

Special Investigation Report: Improving Pilot Weather Report Submission and Dissemination to Benefit Safety in the National Airspace System (Multiple Locations, 26 fatalities, 218 injured)

We investigated several incidents and accidents that revealed deficiencies in the handling of pilot weather report (PIREP) information that resulted in delays, errors, and data losses. These types of issues, which we also discussed with members of various PIREP user groups, can play a role in the complex interaction of events and conditions that lead to aircraft accidents. Specifically, between March 2012 and December 2015, we investigated 16 accidents and incidents that exposed PIREP-related areas of concern. We also held a 2-day forum to facilitate dialogue among the various PIREP user groups and to gain information on opportunities for improving the PIREP system.

We identified several issues across user groups that reduced the effectiveness of PIREPs; these issues fell generally into two broad categories: submission issues (related to the quantity and quality of incoming PIREPs), and dissemination issues (related to the distribution of PIREPs received).

As a result of this special investigation report, we issued 13 new safety recommendations to the FAA; two to the National Weather Service; and one each to the National Air Traffic Controllers Association, the Aircraft Owners and Pilots Association (AOPA) Air Safety Institute, the Aviation Accreditation Board International, the National Association of Flight Instructors, the Society of Aviation and Flight Educators, and the Cargo Airline Association.

In the August 2017 issue of NASA’s Aviation Safety Reporting System’s (ASRS) publication, Callback, ASRS reports on its involvement with the PIREP forum and provides some examples of PIREPs’ contributions to safety.

Investigative Hearing

As part of our ongoing investigation of the October 2, 2016, accident involving Hageland Aviation flight 3153 near Togiak, Alaska, we held an investigative hearing on August 17, 2017, to take sworn testimony from individuals regarding their knowledge of the facts and circumstances of the accident and related issues. The hearing was held in Anchorage, Alaska.

Among the safety issues discussed at the investigative hearing were operational control at Hageland Aviation, including its FAA oversight, organizational structure, policies and procedures, and training and guidance for operational control agents; pilot training and guidance

Figure 48: Aerial view of the Lockhart, TX hot-air balloon accident.
related to deteriorating weather conditions to mitigate the risk of controlled flight into terrain, including incorporating lessons learned from previous accidents involving controlled flight into terrain; and safety management, training, and oversight resources available to the Alaska aviation community.

Completed Accident and Incident Briefs

Runway Overrun, Eastern Airlines Flight 3452
Queens, New York (0 fatalities, 0 injured)

On October 27, 2016, Eastern Air Lines flight 3452, a Boeing 737-700, N923CL, overran runway 22 during the landing roll at LaGuardia Airport in Queens, New York. The airplane traveled through the right forward corner of the engineered materials arresting system (EMAS) at the departure end of the runway and came to rest off the right side of the EMAS. The 2 certificated airline transport pilots, 7 cabin crewmembers, and 39 passengers were not injured and evacuated the airplane via airstairs. The airplane sustained minor damage. The charter flight was operating under the provisions of 14 CFR Part 121. Night instrument flight rules conditions prevailed at the airport at the time of the incident, and an instrument flight rules flight plan was filed for the flight, which originated at Fort Dodge Regional Airport, Fort Dodge, Iowa, about 1623 central daylight time.

We determined that the probable cause of this accident was the first officer’s failure to attain the proper touchdown point and the flight crew’s failure to call for a go-around, which resulted in the airplane landing more than halfway down the runway. Contributing to the incident was the first officer’s initiation of the landing flare at a relatively high altitude and his delay in reducing the throttles to idle, the captain’s delay in manually deploying the speed brakes after touchdown, the captain’s lack of command authority, and a lack of robust training provided by the operator to support the flight crew’s decision-making concerning when to call for a go-around.

Figure 49: Runway overrun area showing path of airplane as it crossed the EMAS.

Drone Collision with US Army Helicopter
Hoffman Island, NY (0 fatalities, 0 injured)

On September 21, 2017, a Sikorsky UH-60M Black Hawk helicopter, R20087, operated by the US Army as CAVM087 (“Caveman 87”), collided with a privately owned and operated Dà-Jiang Innovations (DJI) Phantom 4 small unmanned aircraft system (sUAS). The collision occurred about 300 ft above mean sea level and 1 mile east of Midland Beach, Staten Island, New York, in the vicinity of Hoffman Island. The helicopter received minor damage, and the sUAS was destroyed. There were no injuries or ground damage.

Figure 50: Photo showing Boeing 737 Airplane that overran runway in LaGuardia Airport in Queens, New York.

Figure 51: Map depicting the flight paths of the civilian drone and an Army helicopter collision over Staten Island, New Jersey.
We determined that the probable cause of this accident was the failure of the sUAS pilot to see and avoid the helicopter due to his intentional flight beyond visual line of sight. Contributing to the incident was the sUAS pilot’s incomplete knowledge of regulations and safe operating practices.

Figure 52. Photo of drone part and damage to helicopter from the civilian drone collision with the UA60 Army helicopter over Staten Island, New Jersey.

Completed Safety Recommendation Reports

**Rolls-Royce Power Turbine Governor Bearing Failures**
This recommendation is intended to prevent failures of spool bearings installed in the power turbine governors (PTGs) of certain Rolls-Royce (formerly Allison) 250-series engines. It is derived from our investigation of a fatal accident in which an investigation of a fatal accident in which a McDonnell Douglas Helicopters 369E helicopter, N629JK, impacted trees and terrain near Reedsdale, Wisconsin.

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

**Preventing Catastrophic Failure of Pratt & Whitney Canada JT15D-5 Engines Following Birdstrike or Foreign Object Ingestion**
This recommendation is intended to prevent catastrophic failure of Pratt & Whitney Canada JT15D-5 engines installed on Beechcraft Beechjet 400A airplanes following a birdstrike or foreign object ingestion. It is derived from three NTSB investigations of incidents in which liberated fan blades breached engine cases and cowlings after bird species well below the weight required for certification testing were ingested. Subsequent testing and analysis identified a failure mode in the event of a birdstrike or foreign object ingestion at a certain engine speed.

As a result of these investigations, we issued one new safety recommendation to Transport Canada.

**Uncommanded Nosewheel Steering Anomalies During Landing in Embraer EMB-145 Regional Jets**
These recommendations are derived from our investigations, as well as our participation in foreign-led investigations, of several runway excursion events involving uncommanded nosewheel steering anomalies during landing in Embraer EMB-145 regional jets.

As a result of these investigations, we issued two new safety recommendations to Embraer and three new safety recommendations to the FAA.

**Unsafe Wiring Conditions in Piper Model PA-31T-Series Airplane Floor-Mounted Circuit Breaker Panels**
This recommendation is intended to detect and correct unsafe wiring conditions that could lead to chafing, thermal stress, or arcing in the area directly below the floor-mounted circuit breaker panel in Piper Aircraft, Inc., model PA-31T-series airplanes. It is derived from an ongoing investigation of an accident in which a Piper PA-31T broke up in flight and crashed shortly after the pilot reported smoke in the cockpit.

As a result of the preliminary findings in this investigation, we issued one new urgent safety recommendation 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 (SARPS) provided in Annex 13 to the convention.

If an accident or serious incident occurs in a foreign state involving a civil aircraft of US registry, a US operator, or an aircraft of US design or manufacture, and the foreign state is a signatory to the ICAO Convention, that state is responsible for the investigation. In accordance with the ICAO Annex 13 SARPS, upon receipt of ICAO notification of the accident or serious incident, the NTSB designates a US-accredited representative and appoints advisors to carry out the obligations, receive the entitlements, provide consultation, and receive safety recommendations from the state of occurrence.

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 2017.

- On **December 31, 2017**, a chartered Cessna 208B airplane, operated by Nature Air, crashed shortly after takeoff from the Isilita Airport, near Corozalito, Costa Rica. The airplane was destroyed and the 2 crewmembers and 10 passengers were fatally injured. The accident is being investigated by the Costa Rica Consejo Técnico de Aviación Civil, Unidad de Investigación de Accidentes e Incidentes Aéreos, and because the passengers were United States citizens and the United States is the state of manufacture and design of the airplane, we appointed a US-accredited representative to assist in the investigation, in accordance with ICAO Annex 13.
• On September 30, 2017, the no. 4 engine inlet and fan rotor separated from the engine of an Airbus A380 flying from Paris to Los Angeles (Air France flight AF66). The airplane diverted to Goose Bay, Canada, for landing. The accident is being investigated by the French Bureau d’Enquêtes et d’Analyses pour la sécurité de l’aviation civile and, because the engine was manufactured in the United States, we appointed a US-accredited representative to assist in the investigation, in accordance with ICAO Annex 13.

• On September 15, 2017, American Airlines flight 2393 experienced a tailstrike while landing at Grantley Adams International Airport, Christchurch, Barbados. The airplane was substantially damaged and none of the passengers and crewmembers were injured. The accident is being investigated by the Barbados Civil Aviation Department, and because the US is the state of registry of the airplane, we appointed a US-accredited representative to assist in the investigation, in accordance with ICAO Annex 13.

• On September 5, 2017, Japan Airlines flight JL6, a Boeing 777-300, flying from Tokyo to New York City experienced an engine failure after takeoff. The accident is being investigated by the Japan Transportation Safety Board and, because the engine was manufactured in the United States, we appointed a US-accredited representative to assist in the investigation, in accordance with ICAO Annex 13.

• On March 28, 2017, Peruvian Airlines flight 112 departed the right side of the runway at Francisco Carle Airport, Jauja, Peru, after landing and impacted the perimeter fence. The airplane was destroyed by postimpact fire, but the 141 passengers and 9 crewmembers were uninjured. The accident is being investigated by the Peru Comisión de Investigación de Accidentes de Aviación, and, because the airplane was manufactured and designed in the United States, we appointed a US-accredited representative to assist in the investigation, in accordance with ICAO Annex 13.

• On March 14, 2017, a Sikorsky S-92 helicopter, Irish registration EI-ICR, crashed offshore near Blackrock Island, west of Blacksod Bay, Ireland. The four occupants were fatally injured, and the helicopter was destroyed. The helicopter, operated by the Irish Coast Guard, was repositioning for a search-and-rescue mission at the time of the accident. The Ireland Air Accident Investigation Unit is investigating the accident and, because the helicopter and its engine were manufactured and designed in the United States, we appointed a US-accredited representative to assist in the investigation, in accordance with ICAO Annex 13.

• On February 20, 2017, a Raytheon model B200 (King Air) airplane, Australian registration VH-ZCR, impacted a building and roadway shortly after takeoff from Essendon Airport, Victoria, Australia. A postimpact fire ensued. The pilot and four passengers were fatally injured, and the airplane was destroyed. The Australian Transport Safety Bureau is investigating the accident and, because the airplane was manufactured and designed in the United States, we appointed a US-accredited representative to assist in the investigation, in accordance with ICAO Annex 13.

• On January 16, 2017, Turkish Airlines cargo flight TK6491 impacted terrain about 900 meters from the runway at Manas International Airport, Bishkek, Kyrgyz Republic after initiating a go-around. The airplane was destroyed, and the four crewmembers were fatally injured. The accident is being investigated by the Russian Interstate Aviation Committee and, because the airplane was manufactured and designed in the United States, we appointed a US-accredited representative to assist in the investigation, in accordance with ICAO Annex 13.
Public Forums and Seminars

Safety Forum: Runway Incursion Safety Issues, Prevention, and Mitigation

On September 19 and 20, 2017, we held a safety forum on runway incursions that focused attention on and raised awareness of runway incursion safety issues and promoted and facilitated dialogue among government and industry officials to better define the issues and determine how to effectively address them to improve safety. The forum was structured as a series of panels in which invited experts from federal agencies, airlines, and industry associations made presentations on relevant topics. On the second day, we hosted a roundtable discussion involving all the panelists. The aviation industry provided information on current and planned technologies as well as research to aid in the prevention or mitigation of runway incursions.

Safety Seminar: Preventing Loss of Control in General Aviation: Lessons Learned from NTSB Accident Investigations

On September 9, 2017, we presented a seminar in Ronkonkoma, New York, to provide the audience with information about in-flight loss of control (LOC) causes and how to avoid LOC. Nearly half of the fatal general aviation accidents in the New York/tri-state region were caused by LOC. Prevent Loss of Control in Flight in General Aviation has been on the NTSB’s MWL for several years. NTSB investigators presented local accident case studies and experts from the FAA and AOPA provided their own unique perspectives on this critical safety issue.

Safety Seminar: Inspection Authorization Renewal

On March 11, 2017, we presented a seminar at the NTSB Training Center, providing an opportunity for aircraft mechanics to renew their inspection authorizations (IAs). We partnered with the FAA for this useful and educational seminar, which included 8 hours of material designed to increase the participants’ knowledge in all facets of the inspection process and share lessons learned from NTSB investigations. Not only were mechanics able to renew their IA certificates, but they were also given material encouraging them to become more informed mechanics and inspectors. Accident case studies involving maintenance issues were presented by NTSB investigators and staff as an opportunity to learn from these often tragic events.

Safety Alerts

Stay Centered: Preventing Loss of Control During Landing (SA-060)

Information on preventing LOC during landings.

Loss of Tail Rotor Effectiveness in Helicopters (SA-062)

Information on preventing loss of tail rotor effectiveness in helicopters.

PIREP Weather Reports—Pay it Forward (SA-064)

Information on using PIREPs to improve weather forecasts and advisories and helping pilots avoid weather hazards.
Flying on Empty: Prevent the Preventable with Careful Fuel Management (SA-067)
This safety alert provides information on preventing fuel-related accidents.

Flight Helmet Chords Can Impede Egress (SA-068)
This safety alert provides information on improving the safety of direct-to-airframe cord connections.

Pilots: Prevent Carbon Monoxide Poisoning (SA-069)
This safety alert provides information to pilots on preventing carbon monoxide poisoning.

Mechanics: Prevent Carbon Monoxide Poisoning (SA-070)
This safety alert provides information to mechanics on preventing carbon monoxide poisoning.

Do Your Takeoff Homework: Runway Length Matters (SA-071)
This safety alert provides information on understanding the potential hazards of intersection takeoffs.

Safety Videos3

Flight Helmet Cords Can Impede Egress
Pilots: Prevent Carbon Monoxide Poisoning
Mechanics: Prevent Carbon Monoxide Poisoning
Loss of Tail Rotor Effectiveness
Runway Length Matters

Figure 65: Screen capture of the Safety Alert video on helmet cords.

Figure 66: Screen capture of the Safety Alert video on carbon monoxide poisoning.

3 These safety videos accompany the above-mentioned safety alerts.

Journal Publications


Advocacy and Outreach Conference Presentations

• W. English. UAS for Accident Investigation, Virginia Public Safety UAS Conference, Charlottesville, VA. March 1, 2017.
• W. English. UAS for Accident Investigation, AUVSI Xponential, Dallas, TX. May 9, 2017.
• W. English. UAS for Accident Investigation, Interdrone, Las Vegas, NV. September 6, 2017.
• W. English. UAS for Accident Investigation, Airworks Conference, Denver, CO. November 7–9, 2017.
• D. Schulze. Safety Issues, Today and Tomorrow, AViCON, Stevensville, MD, September 13, 2017.
The Office of Highway Safety (HS) investigates accidents that have a significant impact on public confidence in highway transportation safety, highlight national safety issues, or 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 studies 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 9: Office of Highway Safety Statistics

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<td>Advocacy and Outreach Conference Presentations</td>
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Collision Between a Car Operating With Automated Vehicle Control Systems and a Tractor-Semitrailer Truck

Williston, Florida (1 fatality, 0 injured)

On May 7, 2016, a 2015 Tesla Model S 70D car, traveling eastbound on US Highway 27A (US-27A), west of Williston, Florida, struck a refrigerated semitrailer powered by a 2014 Freightliner Cascadia truck-tractor. At the time of the collision, the truck was making a left turn from westbound US-27A across the two eastbound travel lanes onto NE 140th Court, a local paved road. The car struck the right side of the semitrailer, crossed underneath it, and then went off the right roadside at a shallow angle. The impact with the underside of the semitrailer sheared off the roof of the car.

System performance data downloaded from the car indicated that the driver was operating it using the Traffic-Aware Cruise Control and Autosteer lane-keeping systems, which are automated vehicle control systems within Tesla’s Autopilot suite.

We became aware of the circumstances of the crash when the National Highway Traffic Safety Administration (NHTSA) began a defect investigation on June 28, 2016, which focused on the automatic emergency braking and Autopilot systems of the Tesla Models S and X, for model years 2014–2016. We initiated our investigation, which focused on the use of the Autopilot system, upon learning of the May 7, 2016, Williston crash that prompted the NHTSA investigation.

We determined that the probable cause of the crash was the truck driver’s failure to yield the right of way to the car, combined with the car driver’s inattention due to overreliance on vehicle automation, which resulted in his lack of reaction to the presence of the truck. Contributing to the car driver’s overreliance on the vehicle automation was its operational design, which permitted his prolonged disengagement from the driving task and his use of the automation in ways inconsistent with guidance and warnings from the manufacturer.

As a result of this investigation, we issued three new safety recommendations to NHTSA; two new safety recommendations to manufacturers of vehicles equipped with Level 2 vehicle automation systems (Volkswagen Group of America, BMW of North America, Nissan Group of North America, Mercedes-Benz USA, Tesla Inc., and Volvo Car USA); and one new safety recommendation each to the DOT, the Alliance of Automobile Manufacturers, and the Association of Global Automakers. In addition, we reiterated two recommendations to NHTSA.

Motorcoach Run-Off-the-Road and Collision with Vertical Highway Signpost

Livingston, California (4 fatalities, 19 injured)

On August 2, 2016, a 1998 Van Hool 49-passenger motorcoach, operated by Autobuses Coordinados USA Inc., was traveling north on State Route 99, from Los Angeles to Modesto, California, when it departed the travel lanes to the right, crossed the paved shoulder, struck a W-beam guardrail, and collided with a 14-inch-diameter vertical highway signpost. The motorcoach was occupied by the driver and 24 passengers. The signpost entered the passenger compartment at the stepwell entry area. As the vehicle continued forward, the signpost tore the right (passenger side) sidewall, cargo bays, and roof from the bus body for almost its entire length. Four passengers died, 19 received serious to minor injuries, and one was not injured. The bus driver was seriously injured.

We determined that the probable cause of the crash was driver fatigue resulting from acute sleep loss and circadian factors. Contributing to the cause of the crash were the inadequate safety practices of Autobuses Coordinados and the Federal Motor Carrier Safety Administration’s (FMCSA’s) lack of oversight of Autobuses Coordinados, which allowed the company to continue operations despite known safety issues. Contributing to the severity of the crash were the guardrail, which was not designed to redirect the motorcoach and did not prevent it from colliding with the vertical highway signpost, and the extensive intrusion of the signpost into the passenger compartment.

As a result of this investigation, we issued one new safety recommendation each to the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials. We also reiterated one safety recommendation to the FMCSA.
Motorcoach Collision with Combination Vehicle After Traffic Break on Interstate 10
Palm Springs, California (13 fatalities, 31 injured)

On October 23, 2016, in dark conditions, about 5:16 a.m. Pacific daylight time, a motorcoach ran into the rear of a stopped combination vehicle near mile marker 32.5 in the westbound lanes of Interstate 10 (I-10), outside Palm Springs, California.

Figure 69: Combination vehicle and bus at final rest. (Source: California Highway Patrol)

About 5:07 a.m. (9 minutes before the crash), the California Highway Patrol (CHP) initiated a traffic break (a method of temporary traffic control used to slow or stop traffic, most typically to allow for construction activities) for both eastbound and westbound traffic on I-10 in support of utility work that was being performed about 1.5 miles west of the crash location. At that time, a 2015 International Prostar truck-tractor in combination with a 2012 Utility semitrailer, operated by Tri-State Collision LLC, was traveling westbound on I-10. The combination vehicle stopped when it reached the traffic queue that had formed as a result of the break. About 5:14 a.m., after a traffic break that lasted about 7 minutes, the CHP released westbound traffic to start moving again. Despite the release, however, the combination vehicle remained stopped in the center-right lane of the four-lane westbound roadway and, according to witnesses, was stationary as westbound traffic resumed normal flow.

About 2 minutes after the traffic break ended, a 1996 Motor Coach Industries International Inc. (MCI) 47-passenger motorcoach, operated by USA Holiday, was traveling at highway speed on westbound I-10 in the lane in which the combination vehicle was stopped. The motorcoach, which was occupied by a 59-year-old driver and 42 passengers, struck the rear of the semitrailer, intruding about 13 feet into the semitrailer and pushing the combination vehicle 71 feet forward before coming to a stop. As a result of the crash, the bus driver and 12 passengers died, and the truck driver and 30 bus passengers were injured.

We determined that the probable cause of the crash was (1) the California Department of Transportation’s inadequate transportation management plan for the traffic break, which resulted in a hazardous traffic situation in which law enforcement did not detect the combination vehicle’s lack of movement after the traffic break ended and the bus driver did not receive any advance warning of potential traffic stoppage ahead; (2) the truck driver’s not moving his combination vehicle after the traffic break ended, most likely due to his falling asleep as a result of his undiagnosed moderate-to-severe obstructive sleep apnea; and (3) the bus driver’s lack of action to avoid the crash due to his not perceiving the combination vehicle as stopped, as a result of his fatigue and the fact that he did not expect to encounter stopped traffic.

As a result of this investigation, we issued three new safety recommendations to the FHWA, two new safety recommendations to the FMCSA, and one new safety recommendation each to Tri-State Collision LLD, the American Trucking Associations, the Owner-Operator Independent Drivers Association, the Commercial Vehicle Safety Alliance, the International Association of Chiefs of Police, and the National Sheriffs’ Association. We also reiterated safety recommendations to the FMCSA, the FHWA, Daimler Trucks North America LLC, Fuji Heavy Industries USA Inc., Hino Motors Manufacturing USA Inc., Coach Industries International Inc., Navistar Inc., PACCAR Inc., Van Hool NV, and Volvo Group North America LLC. In addition, we reiterated and reclassified one safety recommendation to the FMCSA.

Motorcoach Collision with Crash Attenuator in Gore Area US Highway 101
San Jose, California (2 fatalities, 14 injured)

On January 19, 2016, a 2014 MCI D4505 motorcoach, operated by Greyhound Lines, Inc., and occupied by a driver and 21 passengers, was traveling north on US Highway 101 (US-101), in San Jose, California. The weather conditions were dark, with moderate to heavy rain and reported winds from the east-southeast at 20 mph.

Figure 70: At-rest position of the bus atop concrete barrier, straddling left exit HOV lane for SR-85 at left and US-101 HOV lane at right. (Source: California Highway Patrol)
At the US-101 and State Route 85 (SR-85) interchange, the bus moved to the left and entered a 990-foot-long unmarked gore area. The gore separates the US-101 lanes from the left exit high-occupancy-vehicle (HOV) lane for SR-85. A crash attenuator with a missing retroreflective object marker was positioned at the end of the gore in advance of a concrete barrier. The bus driver maintained the vehicle’s path through the gore and collided with the crash attenuator and the concrete barrier.

Following the impact, the bus traveled another 65 feet, rolled 90 degrees, and came to rest on its right side atop the concrete barrier, straddling two lanes of traffic. As a result of the crash, two passengers were ejected and died, and the driver and 13 passengers were injured.

We determined that the probable cause of the crash was the failure of the California Department of Transportation to properly delineate the crash attenuator and the gore area, which would have provided improved traffic guidance. Contributing to the crash were the bus driver’s error in entering the gore and the out-of-compliance signage, which affected traffic guidance. Contributing to the severity of the injuries was the lack of passenger seat belt use.

As a result of this investigation, we issued two new safety recommendations to the FHWA, four new safety recommendations each to the California Department of Transportation and Greyhound Lines, Inc., and one new safety recommendation to the American Bus Association and the United Motorcoach Association. We also reiterated safety recommendations to the FMCSA, NHTSA, the state of California, and MCI.

**Agricultural Labor Bus and Truck-Tractor Collision**

St. Marks, Florida (4 fatalities, 30 injured)

On July 2, 2016, a 1979 Blue Bird bus, operated by Billy R. Evans Harvesting, Inc., of Belle Glade, Florida, was traveling south on State Road 363 (SR-363), near St. Marks, Florida. The bus was occupied by a 56-year-old driver and 33 passengers, most of whom were migrant agricultural (AG) workers. As the bus driver approached the US Highway 98 (US-98) intersection, he did not stop at the stop sign and overhead flashing red traffic control beacons, entered the intersection, and was struck by a westbound 2005 Freightliner truck-tractor in combination with an enclosed semitrailer. The truck-tractor—occupied by a 55-year-old driver and a passenger—was operated by Verity Van Lines, Inc., of Seafood, New York. Overhead flashing yellow traffic control beacons controlled westbound traffic on US-98 at the intersection.

The front of the truck-tractor struck the left side of the bus slightly behind its front axle, resulting in the rapid counterclockwise rotation of the truck-tractor and the breach of its right-side-mounted diesel fuel tank, which ignited a fire. The front of the semitrailer then struck the left side of the bus near its rear wheel as both vehicles proceeded toward the southwest corner of the intersection. Prior to coming to rest, the vehicles collided with fixed roadside objects, including a utility pole and its supporting cables. As a result of the crash, the truck driver and three bus passengers died. The bus driver, 28 bus passengers, and a passenger in the sleeper berth of the truck sustained injuries of varying degrees.

We determined that the probable cause of the crash was the bus driver’s failure to stop at the intersection due to inattention, likely caused by the effects of fatigue, and his unfamiliarity with the rural roadway, which was dark with limited lighting. Contributing to the crash were the failure of Billy R. Evans Harvesting, Inc., to exercise adequate safety oversight of the bus driver and the lack of effective oversight of the motor carrier by the FMCSA and the US Department of Labor. Contributing to the severity of the injuries was the rupture of the truck’s right-side-mounted diesel fuel tank, leading to a fast-spreading postcrash fire, and the failure of the truck driver to wear his lap/shoulder belt.

As a result of this investigation, we issued four new safety recommendations each to the US Department of Labor and the FMCSA, one new safety recommendation to NHTSA, two new safety recommendations to the Florida Department of Transportation, and one new safety recommendation each to SAE International, the American Association of State Highway and Transportation Officials, the National Association of Counties, the National Association of County Engineers, the National League of Cities, the National Association of Towns and Townships, the Institute of Transportation Engineers, the American Traffic Safety Services Association, the American Society of Highway Engineers, the American Society of Civil Engineers, the American Bus Association, and the United Motorcoach Association. We also reiterated safety recommendations to the FMCSA and the state of Florida, and reiterated and reclassified safety recommendations to the FMCSA.

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4 (a) A gore area is typically a triangular-shaped boundary created by white lines and delineated by diagonal cross-hatching or chevrons. Its purpose is to separate an entrance or exit lane from the main lanes of the highway. The gore at this location was a theoretical gore—that is, a marked area of pavement formed by convergence or divergence of the edges of a main lane and an exit/entrance lane. (b) A crash attenuator is a device intended to reduce the damage to structures, vehicles, and motorists resulting from a motor vehicle collision. It is designed to absorb the colliding vehicle’s kinetic energy.
Completed Accident Briefs

**Pickup Truck Collision with Multiple Bicycles**
Cooper Township, Michigan (5 fatalities, 4 injured)

On June 7, 2016, a 1996 Chevrolet pickup truck operated by a 50-year-old male was traveling northbound on North Westnedge Avenue in Cooper Township, Kalamazoo County, Michigan. The truck approached a northbound group of nine cyclists traveling in a single file line on the 4-foot-wide shoulder adjacent to the travel lane. The cyclists were part of a private bicycle group that was participating in a 28.5-mile recreational ride. The truck left the travel lane and went onto the shoulder, striking all nine cyclists in succession. The truck continued northbound for some distance before coming to final rest across a drainage ditch. The truck driver fled the scene but was later apprehended by responding officers. As a result of the collision, five cyclists died and four cyclists were seriously injured.

We determined that the probable cause of the crash was the impairing effects of the driver’s polysubstance abuse in the hours before the crash.

No safety recommendations were issued with this investigation.

Completed Safety Recommendation Reports

**Shortcomings of Driver Qualification Processes for Baltimore City Public Schools and of the Disqualified Driver Database for all Maryland School Districts**
Baltimore, Maryland (6 fatalities, 11 injured)

We are investigating a collision involving a school bus, a car, and a transit bus that occurred in Baltimore, Maryland, on November 1, 2016. As a result of the crash, the drivers of both buses and four transit bus passengers died. Seven transit bus passengers were seriously injured. Two transit bus passengers and the teacher aide on the school bus sustained minor injuries. The car driver also sustained minor injuries.

In the course of the investigation, we identified deficiencies with the oversight of school bus driver operations and qualifications by the city of Baltimore and by the Maryland State Department of Education (MSDE). These deficiencies include the failure of Baltimore City Public Schools (BCPS) to adequately review or take action in response to reports of previous crashes concerning its school bus drivers, and inconsistencies in the interpretation of state regulations on what conditions disqualify school bus drivers from employment and on when drivers should be entered into the state database of disqualified drivers.

As a result of this investigation, we issued two new safety recommendations to BCPS, one of which was designated urgent, and one new safety recommendation to the MSDE.

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5 Please see the Motorcoach Collision with Crash Attenuator in Gore Area US Highway 101 investigation above in the completed reports.
6 Three of these injuries were to emergency responders.

Addressing Motorcoach Driver Seat Design to Prevent Separation in a Crash
San Jose, California (2 fatalities, 14 injured)

We investigated a motorcoach collision that occurred in San Jose, California, on January 19, 2016. The motorcoach, operated by Greyhound Lines, Inc., was traveling northbound on US Highway 101 (US-101) in San Jose when it entered and traveled in a gore area, rather than the intended HOV lane, and collided with a crash attenuator. During the crash, the driver seat detached from the floor. In the course of the investigation, we identified a potential problem with the driver seat attachment.

As a result of this investigation, we issued one new safety recommendation to the motorcoach manufacturer, MCI.

Addressing 911 Communication Problems in the Area of Cooper Township, Michigan
Cooper Township, Michigan (5 fatalities, 4 injured)

We investigated a collision between a Chevrolet pickup truck and nine cyclists that occurred in Cooper Township, Michigan, on June 7, 2016. As a result of the collision, five cyclists died, and four cyclists were seriously injured. In the course of the investigation, we identified a serious problem with communication among the agencies that received 911 notifications concerning precrash actions by the driver involved in the crash.

As a result of this investigation, we issued two new urgent safety recommendations: one to the Kalamazoo County Board of Commissioners and one to the Kalamazoo Department of Public Safety, the Kalamazoo County Sheriff’s Office, and the Township of Kalamazoo Police Department.

Ongoing Investigations (as of December 31, 2017)

- School bus crash, Oakland, Iowa, December 12, 2017 (2 fatalities, 0 injured)
- School bus crossing crash, Helena, Montana, November 27, 2017 (0 fatalities, 6 injured)
- Autonomous shuttle bus crash, Las Vegas, Nevada (0 fatalities, 0 injured)
- Motorcoach and transit bus collision, Flushing, New York, September 18, 2017 (3 fatalities, 20 injured)
- Motorcycle and pickup truck collision, Augusta, Maine, September 10, 2017 (2 fatalities, 4 injured)
- Tesla Model X single vehicle crash, Lake Forest, California, August 25, 2017 (0 fatalities, 5 injured)
- Fire damage to bridge and subsequent collapse, Atlanta, Georgia, March 30, 2017 (0 fatalities, 0 injured)
Pickup truck and bus collision, Concan, Texas, March 29, 2017 (13 fatalities, 2 injured)

Motorcoach railroad grade crossing collision, Biloxi, Mississippi, March 7, 2017 (4 fatalities, 39 injured)

School bus crash, Chattanooga, Tennessee, November 21, 2016 (6 fatalities, 26 injured)

School bus collision with car and transit bus, Baltimore, Maryland, November 1, 2016 (6 fatalities, 11 injured)

Truck tractor collision with semitrailer and SUV, Goodland, Kansas, June 29, 2016 (6 fatalities, 5 injured)

Motorcoach rollover, Laredo, Texas, May 14, 2016 (9 fatalities, 43 injured)

Tanker truck collision fire, Stroud, Alabama, March 11, 2016 (0 fatalities, 1 injured)

Public Roundtables
Act to End Deadly Distractions

On April 26, 2017, we collaborated with Stopdistractions.org, DRIVE SMART Virginia, and the National Safety Council to host our second roundtable on distracted driving to facilitate the continued discussion about this life-threatening problem and specific solutions to eliminate it from our highways. The program focused on three key components needed to end distracted driving: education, legislation, and enforcement. Survivor advocates spoke about their experiences, challenges, and successes in the fight to end distracted driving. Methods for fostering more productive collaboration between survivors and advocacy groups were shared. The roundtable also examined legislative and enforcement actions that have been successful in reducing the number of distraction-related crashes. Then Acting Chairman Sumwalt moderated the participant-driven discussion.

Advanced Driver Assistance Systems—Strategies for Increasing Adoption Among Commercial Vehicles (Heavy-Duty Trucks)

On July 24, 2017, we collaborated with the National Safety Council to host a roundtable on advanced driver assistance systems (ADAS) in heavy-duty trucks in Schaumburg, Illinois. ADAS—also known as collision avoidance technologies—can play a significant role in preventing crashes and saving lives. Although we have seen significant growth in the passenger vehicle market, ADAS adoption in the commercial vehicle market (heavy trucks) and among employer and rental fleets has been slow. The goal of the roundtable was to encourage more widespread adoption of these systems.

Safety Alert

Drowsy Driving Among Young Drivers: Get the right amount of sleep to stay alert behind the wheel (SA-061)

Information to young drivers and their parents on ways to avoid drowsy-driving crashes.

Other Significant Activities

10th International Conference—Managing Fatigue

Along with the Virginia Tech Transportation Institute, we cohosted the 10th International Conference on Managing Fatigue from March 20 to 23, 2017. The theme of the conference was “Managing Fatigue to Improve Safety, Wellness, and Effectiveness,” and the main emphasis of the biennial conference was fatigue in transportation, with representation from other sectors, such as natural resources, mining, health care, and the military. During the conference, experts from around the world shared the latest findings on fatigue, its causes, and research on the efforts to manage and mitigate its effects. Former Chairman and Board Member Christopher Hart provided a cap note address for the conference, which focused on NTSB investigations and recommendations to reduce fatigue-related accidents.
Journal Publications


Advocacy and Outreach Conference Presentations

- K. Poland, Seat Belts on School Buses: NTSB Crash Investigations, Buckle Up New Mexico, Santa Fe, New Mexico, 03/15/17.
- J. Morrison, Chaired Wrong-way Crash Session: We Know the Problem but How Do We Fix It? Overcoming Wrong-way Crashes, Lifesavers Annual Conference, Charlotte, North Carolina, 3/27/2017.
- K. Bragg, Prince George's County, Maryland Youth Traffic Safety Symposium presentation, Upper Marlboro, Maryland 05/03/17.
- D. Karol, Roadside Barrier Issues: Lessons Learned from NTSB Investigations, 1st International Roadside Safety Conference, San Francisco, California, 06/14/17.
- K. Bragg, Glen Burnie High School Student Traffic Safety presentation, Glen Burnie, Maryland, 09/26/17.
- J. Price, Investigating Human Fatigue Factors, NIOSH Working Hours, Sleep and Fatigue Speaker series (webinar), 09/27/17.
- K. Poland, Seat Belts on School Buses: Loss of Consciousness, Self-Evacuation, and Concussions, National Association of School Pupil Transportation Directors, Columbus, Ohio, 11/04/17.
- D. Bruce, Impact of Vehicle Technologies & Automation on Users Presentation on Williston, FL Tesla Crash, AAA Foundation and University of Utah, Salt Lake City, Utah, 11/08/17.
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 USCG conducts preliminary investigations of all marine accidents and notifies us 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; or
- Serious threat (as determined by the USCG Commandant and concurred in by the NTSB Chairman) to life, property, or the environment due to hazardous materials.

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.

### Table 10: Office of Marine Safety Statistics

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\(^7\) Substantially Interested State
International Program

The international program involves reviewing US administration position papers related to marine accident investigations and participating in select International Maritime Organization (IMO) meetings. In the last year, we attended IMO meetings about reviewing and classifying maritime accidents and accident reporting, certifying and training mariners, and technical standards and requirements for voyage data recorders (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 investigation 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, the investigation of accidents involving both domestic and foreign-registered vessels promote 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.

Along with the USCG, MS also cooperates with 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 with US citizens on board. Every year, more than 11 million Americans are carried on board foreign-flagged cruise ships.

Completed Major Investigations

US flagged, roll-on/roll-off cargo ship El Faro
Crooked Islands, Bahamas
(33 fatalities, 0 injured)

On Thursday, October 1, 2015, the USCG received distress alerts from the 737-foot-long roll-on/roll-off cargo ship El Faro. The US-flagged ship, owned by Sea Star Line, LLC, and operated by TOTE Services (TOTE), was 40 nautical miles northeast of Acklins and Crooked Islands, Bahamas, and close to the eye of Hurricane Joaquin. The ship was en route from Jacksonville, Florida, to San Juan, Puerto Rico, with a cargo of containers and vehicles. Just minutes before the distress alerts, El Faro’s master called TOTE’s designated person ashore and reported that the ship was experiencing some flooding. He said the crew had controlled the ingress of water, but the ship was listing 15 degrees and had lost propulsion. The USCG and TOTE were unable to reestablish communication with the ship. Twenty-eight US crewmembers and five Polish workers were on board, all of whom perished. Damages from the sinking were estimated at $36 million.

The USCG deployed helicopters and search vessels to the ship’s last known position, but the search was hampered by hurricane-force conditions on scene. On Sunday, October 4, a damaged lifeboat, two damaged life rafts, and a deceased crewmember wearing an immersion suit were found. A debris field and oil slick were found on Monday, October 5, and the USCG determined that the El Faro was lost, declaring the event a major marine casualty. The USCG suspended the unsuccessful search for survivors at sundown on Wednesday, October 7.

On Tuesday, October 6, 2015, we launched a full team to Jacksonville to lead the federal investigation in cooperation with the USCG, the American Bureau of Shipping (the El Faro’s classification society), and TOTE as parties. The US Navy Salvage and Diving division of the Naval Seas Systems Command was contracted to locate the sunken ship, assist in the sea floor documentation of the wreckage, and recover the VDR.
We determined that the probable cause of the sinking of *El Faro* and the subsequent loss of life was the captain’s insufficient action to avoid Hurricane Joaquin, his failure to use the most current weather information, and his late decision to muster the crew. Contributing to the sinking was ineffective bridge resource management on board *El Faro*, which included the captain’s failure to adequately consider officers’ suggestions. Also contributing to the sinking was the inadequacy of both TOTE’s oversight and its safety management system. Further contributing factors to the loss of *El Faro* were flooding in a cargo hold from an undetected open watertight scuttle and damaged seawater piping; loss of propulsion due to low lube oil pressure to the main engine resulting from a sustained list; and subsequent downflooding through unsecured ventilation closures to the cargo holds. Also contributing to the loss of the vessel was the lack of an approved damage control plan that would have assisted the crew in recognizing the severity of the vessel’s condition and in responding to the emergency. Contributing to the loss of life was the lack of appropriate survival craft for the conditions.

As a result of this investigation, we issued 29 new safety recommendations to the USCG; 2 new safety recommendations to the Federal Communications Commission; 10 new safety recommendations to TOTE Services, Inc.; 9 new safety recommendations to the International Association of Classification Societies; and 1 new safety recommendation each to the National Oceanic and Atmospheric Administration (NOAA), the American Bureau of Shipping, and the Furuno Electric Company, Ltd.

### Completed Accident Briefs

**Collision of Tugboat Cerro Santiago with USCG Cutter Tampa**

*Mirafllos Lake, Panama Canal* (0 fatalities, 0 injured)

On April 18, 2017, while transiting northbound through the Panama Canal, the Panama-flagged tugboat *Cerro Santiago* collided with the USCG cutter *Tampa* in Mirafllos Lake, Panama. Although the tugboat was not damaged, the cutter sustained $170,018 in damage to the stern as well as to various systems in the steering gear room. No injuries or pollution were reported.

![Figure 67: Stern view of Panama flag ship assist tug Cerro Santiago, which collided with Coast Guard Cutter Tampa.](image)

**Collision of Matachin Tow with US Coast Guard Cutter Thetis**

*Panama Las Cascadas Reach, Panama Canal* (0 fatalities, 0 injured)

On June 2, 2016, the dump scow barge 123 being pushed by the Panama-flagged towing vessel *Matachin* collided with the US USCG cutter *Thetis* in Las Cascadas Reach, Panama Canal. Although the *Matachin* and its tow were not damaged, the *Thetis* sustained an estimated $1.2 million in damage to the hull and deck plate aft, as well as to various systems in the steering gear room. No injuries or pollution were reported.

We determined that the probable cause of the collision was the failure of the *Matachin’s* master to maintain a proper lookout and use radar to detect the vessel traffic ahead to avoid a collision. Contributing to the collision was the failure of the *Thetis’s* pilot and navigational crew on board to maintain a proper lookout.

No safety recommendations were issued with this investigation.

**Engine Room Fire Aboard Cruise Ship Carnival Liberty**

*Charlotte Amalie, USVI* (0 fatalities, 0 injured)

On September 7, 2015, a fire broke out in the engine room aboard the Panama-flagged cruise ship *Carnival Liberty*. At the time, the vessel was alongside the dock in the Port of Charlotte Amalie, St. Thomas, US Virgin Islands. The master ordered the passengers aboard the vessel to evacuate to the dock. The crew used the ship’s water mist and carbon dioxide (CO₂) firefighting systems to extinguish the fire. No injuries or pollution were reported. Fire damage to the ship was estimated at $1.725 million.

We determined that the probable cause of the engine room fire was loosened bolts, likely resulting from improper tightening during prior maintenance and vibration of the piping over time, on a fuel supply inlet flange on diesel generator 4, which triggered an uncontrolled fuel spray from the inlet flange onto a hot surface on the diesel generator.

As a result of this investigation, we issued two new safety recommendations to Carnival Corporation & PLC, and one new safety recommendation to Cruise Lines International Association.
Flooding and Sinking of Fishing Vessel Captain David
Oregon Inlet, North Carolina (0 fatalities, 0 injured)

On February 15, 2016, the US-uninspected fishing vessel Capt. David became disabled and began flooding about 40 miles off Oregon Inlet, North Carolina, while attempting to assist another disabled fishing vessel in developing gale conditions. The USCG responded by dispatching a shore-based motor lifeboat to assist both fishing vessels. The US Navy dock landing ship USS Carter Hall was operating nearby the stricken vessels and launched a small boat to assist. Upon the arrival of the Navy boat at the Capt. David’s location, there was physical contact between the vessels and flooding increased on the Capt. David. At the urging of the Navy crew, the fishing vessel’s crew abandoned their vessel into the Navy boat about 4:15 p.m. The fishing vessel later sank. The crew of the other disabled fishing vessel declined rescue by the Navy boat and the vessel was towed back to Oregon Inlet by the USCG motor lifeboat several hours later. No injuries or pollution were reported.

We determined that the probable cause of the flooding and sinking of the fishing vessel was an engine cooling water leak that disabled the vessel during a forecasted small craft advisory and developing gale conditions.

No safety recommendations were issued with this investigation.

Completed International Accident Briefs

Sinking of Commercial Fishing Vessel Orin C
Cape Ann, Massachusetts (1 fatality, 0 injured)

On December 3, 2015, the US commercial fishing vessel Orin C sank in the Atlantic Ocean about 13 miles east of Cape Ann, Massachusetts. All three crewmembers abandoned the vessel just prior to the sinking and were recovered by US USCG motor lifeboat 47259. However, the captain of the Orin C became unconscious in the water before being pulled to the motor lifeboat by a USCG crewman. When examined aboard the motor lifeboat, the captain had no pulse. In response, USCG crewmembers performed CPR, but he could not be revived. No injuries or pollution were reported. The Orin C sank in about 300 feet of water and was not salvaged.

We determined that the probable cause of the sinking was the structural failure of the disabled vessel’s wooden hull and subsequent flooding of the vessel while being towed in adverse conditions.

No safety recommendations were issued with this investigation.

Grounding of Articulated Tug and Barge Nathan E Stewart/DBL 55
Bella Bella, British Columbia, Canada, Edge Reef (0 fatalities, 0 injured)

On October 13, 2016, the articulated US-flagged tug and barge (ATB) Nathan E Stewart/DBL 55 ran aground on Edge Reef off Athlone Island in the Seaford Channel near Bella Bella, British Columbia, Canada. At the time of the accident, the Nathan E Stewart was en route to the Port of Vancouver with the empty DBL 55. None of the crewmembers was injured, but environmental damage occurred when approximately 29,000 gal-
Ions of fuel and lube oil were released. Damage to the vessel and barge was estimated at $12 million.

We determined that the probable cause of the grounding of the ATB Nathan E Stewart/DBL 55 was the second mate falling asleep while on watch. Contributing to the grounding was the ineffective implementation of the company’s safety management system procedures for watchstanding.

No safety recommendations were issued with this investigation.

**Grounding of Freighter Roger Blough**
Sault Sainte Marie, Gros Cap Reefs, Ontario, Canada (0 fatalities, 0 injured)

On May 27, 2016, the US-flagged freighter Roger Blough ran aground near the Gros Cap Reefs Light off Sault Sainte Marie, Ontario, Canada. The grounding occurred as the vessel entered the Birch Point Course section of the St. Marys River federal navigation channel from Whitefish Bay in eastern Lake Superior. No injuries or pollution were reported. The vessel sustained $4.5 million in damage to its hull and cargo system.

![Figure 85: Laker Roger Blough (US), aground in Canadian waters, Gros Cap Reefs, Ontario; starboard view–red hull with white forward and aft house](image)

We determined that the probable cause of the grounding of the lake freighter was the second mate’s failure to use all navigational resources to determine the ship’s position as it approached shallow water near Gros Cap Reefs. Contributing to the accident was inadequate monitoring of the vessel by Vessel Traffic Service (VTS) St. Marys River.

No safety recommendations were issued with this investigation.

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**Completed Delegated Authority Accident Briefs**

**Allision of Passenger Vessel Adventure Hornblower with San Diego Seawall**
San Diego Bay, California (0 fatalities, 8 injured)

On the afternoon of March 31, 2016, the US-flagged passenger vessel Adventure Hornblower was attempting to dock at the Navy Pier in downtown San Diego, California, following a whale-watching excursion. As the vessel approached the pier, its bow unexpectedly swung to starboard and collided with the pier’s passenger embarkation dock. The Adventure Hornblower then accelerated forward until it struck the seawall at the foot of the pier.

Eight passengers sustained minor injuries in the accident. The allision caused nearly $1.06 million in damage to the vessel, pier, and seawall.

We determined that the probable cause of the allision with the Navy Pier and the downtown San Diego seawall was a failure of the port engine’s transmission to disengage from the forward propulsion position due to the operating company’s lack of adherence to the transmission manufacturer’s recommended periodic maintenance schedule and the lack of routine maintenance and upkeep of the propulsion system’s equipment. Contributing to the accident was the lack of instrumentation to provide positive indication of thrust direction or an alarm to indicate the propulsion control system was not responding properly to the captain’s commands.

No safety recommendations were issued with this investigation.

**CFV Alaska Juris foundering**
Bering Sea, west of Dutch Harbor, Alaska (0 fatalities, 0 injured)

On July 26, 2016, a crewmember on the US-flagged fishing vessel Alaska Juris discovered flooding in the engine room while it was under way in the Bering Sea, approximately 160 miles west of Adak, Alaska. Shortly afterward, the rapid ingress of water caused the main engine and generators to shut down, resulting in a loss of propulsion and electrical power. There was no attempt to dewater the vessel, which sank later that
day. All 46 persons on board abandoned ship into life rafts and were rescued without injury. The Alaska Juris, which was carrying approximately 87,000 gallons of diesel fuel, had an estimated value of $4.3 million.

We determined that the probable cause of the sinking of the fishing vessel Alaska Juris was a lack of watertight integrity, which failed to contain flooding in the engine room. No safety recommendations were issued with this investigation.

Collision of Bulk Carrier Aris T with Tank Barge WTC 3019, Towing Vessel Pedernales and Shoreside Structure
Norco, Louisiana (0 fatalities, 2 injured)

On January 31, 2016, the Greek-flagged bulk carrier Aris T collided with tank barge WTC 3019, US-flagged towing vessel Pedernales, and two facility structures, all of which were located on the left descending bank of the Mississippi River between mile marker (mm) 125.2 and mm 126.0 at Norco, Louisiana. Also damaged during the collision were one additional shoreside structure, another towing vessel, and two other tank barges, bringing the total damage cost to more than $60 million. No pollution resulted from the accident, and two dock workers reported injuries.

We determined that the probable cause of the collision was the failure of the pilot on the Aris T to take early and effective action to mitigate the risk presented by the developing upriver traffic situation, and the distraction of the captain on the Loretta G. Cenac from safety-critical navigational functions as a result of his cell phone use.

No safety recommendations were issued with this investigation.

Completed Safety Recommendation Reports

Tropical Cyclone Information for Mariners

We issued this report to urge the National Oceanic and Atmospheric Administration (NOAA), the National Weather Service (NWS; a component of NOAA), and the USCG to take action on the safety recommendations in this report. The safety recommendations address, in the interest of mariner safety, the development of tropical cyclone information and its availability to mariners. The safety recommendations derive primarily from factual information gathered during our investigation into the sinking of cargo vessel El Faro on October 1, 2015.

In this report, we issued two new safety recommendations to NOAA; seven new safety recommendations to NWS; and one new safety recommendation to the USCG.

Shared Waterways: Safety of Recreational and Commercial Vessels in the Marine Transportation System

We issued this report after our investigation of a New York City accident to illustrate the dangers of recreational and commercial vessels operating on shared waterways. Several stakeholders previously discussed with us their concerns about the increase in encounters between these types of vessels. Given the number of encounters currently observed between commercial and recreational vessels, the predicted increase in the number of such encounters, and feedback from marine industry representatives, we sought to better understand the scope of the issue and determine the extent to which the safety of our nation's waterways is impacted. This report provides our findings as well as recommendations to improve shared waterway safety.

In this report, we issued three new safety recommendations to the USCG and one new safety recommendation each to the National Association of State Boating Law Administrators and the National Water Safety Congress.

Completed International IMO (SIS) Serious Marine Casualty Investigations (as of December 31, 2017)

P/V Star Pride
(Bahamas-flagged, grounding near Panama; US passengers aboard, 0 injured)

On December 22, 2015, the Bahamas-flagged cruise ship Star Pride was approaching its destination at Isla de Coiba, Panama, when it grounded on rocks in the Canal de Ranchería at a speed of about 14 knots. The vessel’s momentum carried it over the rocks and into deeper water. The contact resulted in hull damage and multiple hull breaches, which led to the flooding of double-bottom tanks as well as machinery and laundry spaces. None of the
156 passengers and 140 crewmembers on board was injured, nor was there any environmental damage reported.

The master, who was conning the ship at the time of the accident, ordered the release of the starboard anchor afterwards, at about 6:31 a.m. Once the vessel had anchored, passengers began disembarking via shore-based tender boats. Meanwhile, the vessel began listing between 1 and 1.5 degrees to port. The master then notified the vessel operator—Windstar Cruises, headquartered in Washington State—of the grounding. At about 10:40 a.m., he made an announcement for the remaining passengers on board to proceed ashore. About 25 minutes later, shore-based divers were in the water to inspect the ship’s hull and made temporary repairs to six cracks in the hull. At about 12:15 p.m., the vessel lost main power as a result of flooding in the engine spaces and remained on emergency power. The Star Pride’s passengers and some crewmembers embarked two other passenger vessels later and repatriated at their next port of call.

The Bahamas Maritime Authority (BMA) has produced a draft report of the 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 dock. The investigation close-out memo was signed on September 5, 2017.

CS Anthem of the Seas
(Bahamas-flagged, rough seas incident from NYC to Bahamas; US passengers aboard; Government of Bahamas requested NTSB assistance in weather expertise; 0 injured)

The Anthem of the Seas departed Bayonne, New Jersey, on February 6, 2016, and began encountering heavy weather about 1:00 p.m. on February 7. The weather lasted through midnight that night, after which the vessel turned around to return to Bayonne. The ship arrived back in Bayonne at 6:00 p.m. Wednesday evening, February 10.

According to crew interviews, actual winds encountered exceeded 80–90 knots, per onboard anemometers, with gusts well over 100 knots. Seas reached more than 30 feet. NTSB investigators noted external wind damage and overturned furniture inside the ship. MS launched two investigators to meet the ship on Wednesday, February 10. They participated in crew interviews.

A member of the NTSB Office of Aviation Safety Operational Factors Division provided weather expertise during the on-scene investigation via phone with the NTSB IIC. The USCG asked us to assist its efforts to support the Bahamas investigation by providing weather expertise, and, on May 3, 2017, the IIC sent the USCG a weather factual report and an analytical white paper.

Following the practices in the Casualty Investigation Code, the NTSB and the USCG Office of Investigation and Analysis plan to make joint comments to the draft BMA casualty report. As of the date of this memo, the BMA lead investigator has not scheduled the report review. Because the BMA will produce a report, and the USCG and the NTSB will comment on that report; we will not pursue a separate investigation. The investigation close-out memo was signed on September 1, 2017.

CS Norwegian Breakaway
(Bahamas-flagged, rescue boat wire fall failure resulting in 2 fatalities; Bermuda; Government of Bahamas requested NTSB assistance in wire rope failure analysis)

On July 20, 2016, the Bahamas-flagged cruise ship Norwegian Breakaway was conducting routine drills while the vessel was docked at Heritage Wharf in the Royal Navy Dockyard, Bermuda. The port-side rescue boat was launched, recovered, and launched again. As the boat was recovered to its stowed position at the embarkation deck the second time, the single wire rope supporting the boat completely parted, dropping the rescue boat with four crewmembers aboard to the water. Two crewmembers who landed on the boat as it struck the water were critically injured and subsequently died from the fall. Two others who landed in the water outside the boat had minor injuries. No passengers were involved. Due to incident, the starboard boat was taken out of service.

Following the accident, personnel from Bermuda Department of Maritime Administration and the BMA boarded the vessel to conduct an on-scene investigation. Initial findings indicated a failure of the single wire rope supporting the rescue boat. The Government of Bermuda requested US assistance with metallurgical testing of the section of the wire that parted, and the USCG consulted with the NTSB regarding an appropriate laboratory to conduct the testing. The MS investigator facilitated the transfer of the wire rope and additional launch davit components to NTSB Research and Engineering Materials Laboratory personnel. Additionally, the MS investigator and Materials Lab personnel obtained equipment manuals and specifications, shipboard operating procedures, witness testimony, and photographic and video evidence of the accident to aid the examination. Discussion with USCG and Bermuda investigators indicated that, in addition to the wire rope failure, the launch davit had not fully retracted prior to the incident.

The NTSB Materials Laboratory produced two reports to support the accident investigation, delivered to the USCG on May 31, 2017.

1. NTSB Research and Engineering Materials Laboratory Factual Report No. 17-038. This report includes an examination of 20 feet of the parted wire rope lifting cable (including the failed portion), an exemplar wire rope from the opposite side of the vessel, and the rod end bearing and link pin in the davit assembly.

2. NTSB Research and Engineering Materials Laboratory Video Study 17-038S. This study examines the port-side video captured of the rescue boat launch and its percent of movement relative to full retraction and extension.

The Bermuda Department of Maritime Administration and the BMA are producing a joint 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 will make joint comments to the draft Bermuda Department of Maritime Administration/BMA casualty report. We will post the final report to the NTSB public docket. The investigation close-out memo was signed on June 19, 2017.

**CS Splendour of the Seas**  
(Bahamas-flagged, engine room fire, en route to Argostoli, Greece; 0 injured)

On October 22, 2015, the Bahamas-flagged cruise ship Splendour of the Seas experienced a machinery space fire originating on diesel generator no. 1 (DG1) in its forward engine room. The vessel was under way in the Ionian Sea at 15 knots, en route to the Greek Port of Argostoli with 2,626 passengers and crewmembers (aggregate total only provided in flag report). Due to damage from the fire, the ship diverted directly to Venice, Italy, under its own power using only its aft engine room generators.

The incident began with the engineering crew observing a heavy fuel oil (IF 380) leak from the hotbox on DG1 at 7:50 a.m. The engine was secured remotely, but about 40 seconds later, at 7:52 a.m., a fire erupted near the engine. The fixed low-pressure “FlexiFOG” water mist system was activated and deployed about a minute later as well as the fixed high-pressure “Ultrafog” water mist system. However, it was later determined that the Ultrafog system did not operate due to a fire-damaged electrical cable. At the time of the accident, two generators were running at 80 percent load.

Within 15 seconds of the fire, dense smoke enveloped the forward engine room. By 7:53 a.m. the crew had mustered to fight the fire. At 7:55 a.m. the crew secured the fuel oil quick-closing valves to DG1 and, at 7:58 a.m., secured the fuel feeder pumps to the engine.

Fire teams equipped with fire suits and breathing apparatus fought the fire with boundary cooling and foam. At 8:24 a.m. the master announced over the public address system that the fire was under control. At 8:32 a.m. it was extinguished. However, the master did not activate the ship’s emergency signal or muster the passengers. At 8:41 a.m. smoke migrated to the accommodation spaces on deck nos. 1, 2, 3, 4, requiring the affected areas to be evacuated. The fire teams stood down at 12:00 p.m.

Initially, the intense heat and dense, acrid smoke trapped 12 crewmembers within three workshops adjoining the forward engine room. Some crewmembers did not escape until fire teams provided waterwall (cooling) protection. Those trapped suffered from minor smoke inhalation and were treated on board in the ship’s medical center.

NTSB investigators provided a detailed list of investigative questions and documents to review to the USCG and the BMA investigator for consideration.

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. The investigation close-out memo was dated April 27, 2017.

**Other Significant Reports**

**Safer Seas Digest 2016: Lessons Learned from Marine Accident Investigations**

The NTSB’s Safer Seas Digest is a review of concise summaries from the previous year’s accident investigations and represents our continuing commitment to sharing the lessons that we learn through our investigations.

**Ongoing Domestic Major Marine Casualty Investigations** (as of December 31, 2017)

- TV JW Herron (US), fire, Twelve Mile Island, Alabama; December 13, 2017 (0 fatalities, 0 injured)
- OSV HOS Red Dawn (US), other, Alcorn, Alaska; December 12, 2017 (0 fatalities, 0 injured)
- UTV Rickey Robinson (US), foundering, MM733 LMR, Mckeller Lake, Near Memphis, Tennessee, December 8, 2017 (0 fatalities, 0 injured)
- MV Helsinki Bridge (PA), allision, Boston, Massachusetts, December 7, 2017 (0 fatalities, 0 injured)
- CFV Misty Blue (US), foundering, 9 nm east of Nantucket Island, Massachusetts, December 4, 2017 (2 fatalities, 2 injured)
- CFV Ben & Casey (US), foundering, 5 nm offshore jetties South Padre Island, Texas, October 30, 2017 (0 fatalities, 0 injured)
- TV Cooperative Venture (US), allision, St. Paul, Minnesota, October 26, 2017 (0 fatalities, 0 injured)
- Tank Barge Bouchard B-255 (US), explosion, Corpus Christi-Aransas Pass Anchorag, Texas, October 20, 2017 (2 fatalities, 0 injured)
- CFV Southern Bell (US), grounding, Sabine Pass, Texas; October 13, 2017 (0 fatalities, 0 injured)
- CFV Langley Douglas (US), sinking, 60 nm east of Cape Charles, Virginia; September 11, 2017 (0 fatalities, 0 injured)
- TV Savage Ingenuity (US), sinking, Lake Charles Channel, Louisiana; September 5, 2017 (0 fatalities, 0 injured)
- TV Gracie Claire, (US), sinking, Venice, Louisiana; August 23, 2017 (0 fatalities, 0 injured)
- USS John S McCain (USN) & MV Alnic MC (Public nonpublic), collision, east of Straits of Singapore (territorial waters), Singapore; August 21, 2017 (10 fatalities, 5 injured)
- Bulker MIA-S, allision, Nashville Ave Wharf A, New Orleans, Louisiana; August 19, 2017 (0 fatalities, 0 injured)
• Highpoint Marina recreational vessels (US), fire, Pottsville, Texas; July 19, 2017 (0 fatalities, 0 injuries)
• SPV Best Revenge (US), fire, Falmouth, Massachusetts; July 10, 2017 (0 fatalities, 0 injured)
• Tow Eric Heney (US), foundering, UMR MM 13, near Cairo, Illinois; July 9, 2017 (0 fatalities, 0 injured)
• CFV Lady Damaris (US), foundering, 30 nm east of Galveston, Texas; June 22, 2017 (0 fatalities, 0 injured)
• USS Fitzgerald (USN) & Ace Crystal (PH) (Public nonpublic), collision, 56 nm southwest of Yokosuka, Japan; June 17, 2017 (7 fatalities, 3 injured)
• Tow Marguerite L Terral (US), allision with Krotz Springs Railroad Bridge, Krotz Springs, Louisiana, June 9, 2017 (0 fatalities, 0 injured)
• Crain Barge Troy McKinny (US), allision with Harvey Canal bridge, New Orleans, Louisiana; June 7, 2017 (0 fatalities, 0 injured)
• Tow James H Hunter (US), allision, MM91, Columbia River, Nashville, Tennessee; June 7, 2017 (0 fatalities, 0 injured)
• Stagstad Marina recreational vessels (US), Seattle, Washington; May 21, 2017 (0 fatalities, 0 injured)
• CFV Seaborn (US) source of fire, FV Julia Kae; FV Pacific Lady (US), consumed in fire, Craig, Alaska; May 11, 2017 (0 fatalities, 0 injured)
• CG boat 29113 & SV Vanguard (US) (Public nonpublic), allision, Lake Pontchartrain bridge near Slidell, Louisiana; May 5, 2017 (0 fatalities, 1 injured)
• Tow Todd Brown (US), foundering, Columbus, Kentucky; April 17, 2017 (0 fatalities, 0 injured)
• Port Orchard Marina fire, Port Orchard, Washington, March 20, 2016 (0 fatalities, 0 injured)
• Tow Steve Plummer (US), allision, Nashville, Tennessee; March 14, 2017 (0 fatalities, 0 injured)
• CFV St. Dominick (US), grounding, Pumicestone Bay, Alaska; March 6, 2017 (0 fatalities, 0 injured)
• Car Carrier Honor (US), fire, English Channel, International; February 24, 2017 (0 fatalities, 1 injured)
• CFV Destination (US), foundering, 2.7 nm north of St. George Island, Bering Sea, Alaska; Feb 11, 2017 (6 fatalities, 0 injured)
• Ro-Ro Alliance St. Louis (US), fire, 100 NM south of SW Pass, Louisiana; Jan 16, 2017 (0 fatalities, 0 injured)

• CFV Exito (US), foundering, Gulf of Alaska, Alaska; December 7, 2016 (2 fatalities, 0 injured)
• Bulk Carrier MV Neinita grounding, Shamokawa, Washington; November 19, 2016 (0 fatalities, 0 injured)
• TV Atlantic Raider (US), grounding, east of Jacksonville, Florida; October 28, 2016 (0 fatalities, 0 injured)
• MT Aframex River, allision and fire, Port of Houston, Texas; September 6, 2016 (0 fatalities, 0 injured)
• Ro-Ro PV MV Caribbean Fantasy (PN), fire, off San Juan harbor entrance; August 17, 2016 (0 fatalities, 5 injured)
• CFV Ambition (US), foundering, King Cove, Alaska; July 24, 2016 (0 fatalities, 0 injured)

Public Workshop

Investigation Operations at Sea
We held a workshop on June 8, 2017 with federal agencies and interested parties to identify the challenges of accident investigations and evidence recoveries involving submerged wreckage. These accidents would primarily be either aviation or marine casualties. The workshop documented lessons learned from the El Faro VDR recovery and identify requirements, including equipment, technologies and cooperative agreements to facilitate a rapid response in the future.

Safety Alert

Tropical Cyclone Information for Mariners (SA-065)
Information on how to stay up to date on tropical cyclones.

Advocacy and Outreach Conference Presentations

• B. Curtis, Keynote Presentation on NTSB Marine Safety, American Waterways Operators (AWO), Annual Convention, Houston, Texas, January 25, 2017
• B. Curtis, Speaker at AWO Reginal Meeting Cincinnati, Ohio, March 8, 2017
• M. Turrell, Presentation on NTSB-MS Safety Issues, Passenger Vessel association (PVA), Seattle, Washington, January 29, 2017
• B. Curtis, Presentation on NTSB-MS Safety Issues, Massachusetts Maritime Academy,
faculty, students, and Society of Naval Architecture and Marine Engineering (SNAME) New England Chapter, Buzzards Bay, Massachusetts, March 30, 2017


- B. Young, Presentation on NTSB-MS Safety Issues, SUNY Maritime College Towing Vessel Forum, Fort Schuyler, New York, March 15, 2017

- M. Turrell, Presentation on NTSB-MS Safety Issues, USCG Mishap Investigators, NTSB Training Center, Ashburn, Virginia, March 20, 2017

- M. Turrell, Presentation on NTSB-MS Safety Issues, US Power Squadron Chapter, Rockville, Maryland, April 12, 2017


- Vice Chairman Bella Dinh-Zarr & M. Kucharski, Presentation on NTSB-MS Safety Issues, American Institute of Marine Underwriters (AIMU), New York, New York, May 10, 2017

- M. Kucharski, Presentation on NTSB-MS Safety Issues, Southeastern Admiralty Lawyers Institute (SEALI), Annual Meeting/CLE Seminar, Charleston, South Carolina, June 15, 2017

- M. Turrell, Presentation on NTSB-MS Safety Issues, FBI Training on Marine Investigations, NTSB Training Center, Ashburn, Virginia, September 18, 2017

- M. Turrell, M. Kucharski, A. Ehlers, Presentation on NTSB-MS Safety Issues, visit and discuss collaboration in investigations (MOU), Norfolk Naval Base, Virginia, July 19, 2017

- MS Management, Presentation on NTSB-MS Safety Issues, Annual Summit at NTSB HQ with TSB Canada (Marine), MAIB UK and NTSB MS, Washington, DC, October 24, 2017

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 involving fatalities or those causing major disruptions to a community.

The majority of railroad investigations involve freight train accidents, such as collisions and derailments, but the office 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.

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.

The hazardous materials investigations focuses on the effects of materials released in transportation, the emergency response by local authorities, and the adequacy of federal standards for hazardous material transportation. When the accident involves bulk hazardous material transportation, the investigation focuses on container performance, material preparation and handling during transport, material health and safety hazards, shipment labeling and hazard communications, and the effectiveness of the emergency response.

On the basis of the accident investigations conducted by this office, we issue safety recommendations to federal and state regulatory agencies; industry and safety standards organizations; railroads; rail transit agencies; and pipeline operators, equipment and container manufacturers, producers and shippers of hazardous materials, and emergency response organizations.

| Table 11: Office of Railroad, Pipeline, and Hazardous Materials Investigations Statistics |
|----------------------------------|---------------|-----|
| Recommendations Issued          | Railroad      | 35  |
|                                 | Pipeline      | 4   |
| Recommendations Closed Acceptably | Railroad    | 14  |
|                                 | Pipeline      | 16  |
| Recommendations Closed Unacceptably | Railroad  | 2   |
| Major Reports                   | Railroad      | 2   |
| Accident Briefs                 | Railroad      | 12  |
|                                 | Pipeline      | 1   |
| Major Accident Launches         | Railroad      | 11  |
|                                 | Pipeline      | 5   |
|                                 | Hazardous Materials | 2 |
| Safety Alerts                   | Railroad      | 2   |
Completed Investigations

Railroad

Highway–Railroad Grade Crossing Collision
Valhalla, New York (6 fatalities, 10 injured)

On February 3, 2015, a 2011 Mercedes Benz ML350 sport-utility vehicle (SUV), driven by a 49-year-old woman, traveled northwest on Commerce Street in Valhalla, New York, toward a public highway–railroad grade crossing on the Harlem Subdivision of the Metro-North Railroad. Traffic on Commerce Street was heavy and congested when the driver turned northeast and entered the boundary of the highway–railroad grade crossing and stopped. The grade crossing consisted of two highway lanes (one for each direction) and two railroad tracks, and was equipped with reflectorized pavement markings, advance warning signs, flashing lights, and gates. The driver moved beyond the grade crossing boundary (stop line) and stopped adjacent to the railroad tracks. The grade crossing warning system activated, and the gate came down, striking the rear of her vehicle. She then exited her vehicle and examined the gate. The driver returned to her vehicle and moved forward onto the tracks. Meanwhile, Metro-North Railroad passenger train 659, consisting of eight passenger railcars, traveled north and approached the highway–railroad grade crossing at a speed of 59 miles per hour. The engineer from train 659 activated the train’s emergency brakes about 260 feet before the grade crossing and collided with the SUV at a recorded speed of 51 miles per hour.

The train and the SUV continued northbound, resulting in the damage of the electrified third rail on the west side of the track. The third rail detached, pierced the SUV, and entered the railcar. The train and the SUV came to rest about 665 feet from the point of collision. An estimated 343 feet of third rail penetrated the first passenger railcar.

Metro-North Railroad estimated 645 passengers were onboard train 659 at the time of the accident. Five passengers died, and nine passengers and the engineer were injured, all in the lead railcar. The driver of the SUV also died.

This report addressed the following safety issues:

- **Metro-North Railroad third rail design.** Metro-North Railroad’s third rail system was not constructed to fail in a controlled manner or break away. We found that Metro-North Railroad’s third rail system was not constructed to break away when subjected to undesirable overloaded conditions such as those involved in this accident.

- **Grade crossings.** There were three grade crossings within 2 miles of the Commerce Street grade crossing. The state of New York Department of Transportation had a policy that allowed for the consolidation of grade crossings wherever possible. We determined that the town of Mount Pleasant, New York, should take action to improve grade crossing safety.

  - **Grade crossing risk assessment.** The investigation found that the proximity of highway–railroad grade crossings with third rail systems belonging to commuter railroads or rail transit properties could increase the severity of highway–railroad grade crossing accidents. We found that conducting a risk assessment of such conditions could help mitigate this increased risk of grade crossing accident severity.

  We determined that the probable cause of the accident was that the driver of the SUV, for undetermined reasons, moved the vehicle onto the tracks while the Commerce Street highway–railroad grade crossing warning system was activated, into the path of Metro-North Railroad train 659. Contributing to the accident was the driver of the SUV (1) stopping beyond the stop line, within the boundary of the highway–railroad grade crossing, despite warning signs indicat-
Amtrak Train Collision with Maintenance-of-Way Equipment
Chester, Pennsylvania (2 fatalities, 39 injured)

On April 3, 2016, southbound Amtrak train 89 (train 89) struck a backhoe with a worker inside at milepost 15.7 near Chester, Pennsylvania. The train was authorized to operate on main track 3 (track 3) at the maximum authorized speed of 110 mph. Beginning on the morning of April 1, Amtrak had scheduled track-bed restoration—ballast vacuuming—at milepost 15.7 on track 2 on the Philadelphia-to-Washington Line. Track 2 had to be taken out of service between control points along the approach to the grade crossing; and (2) reducing the available time to clear the grade crossing by exiting the vehicle after the grade crossing warning system activated because her attention was diverted by the grade crossing warning system crossing gate arm striking her vehicle. Contributing to the severity of the accident was the third rail penetrating the passenger compartment of the lead passenger railcar and the postaccident fire.

As a result of this investigation, we issued two new safety recommendations to Federal Transit Administration, and one new safety recommendation each to Metro-North Railroad, Long Island Rail Road, National Railroad Passenger Corporation, Port Authority Trans-Hudson Corporation, Southeastern Pennsylvania Transportation Authority, State of New York Department of Transportation, and the town of Mount Pleasant, New York.

Figure 92: Post-accident photograph of the interior of the lead railcar of Metro-North Railroad train 659, front to rear. The railcar's interior is completely burned and long sections of the third rail are shown laying on top of the passengers’ seats.

Baldwin (milepost 11.7) and Hook (milepost 16.8) for the 55-hour duration of the project. As train 89 approached milepost 15.7, the locomotive engineer saw equipment and workers on and near track 3 and initiated an emergency brake application. The train speed was 106 mph before the emergency brake application, and 99 mph when it struck the backhoe. Two roadway workers were killed, and 39 other people were injured. Amtrak estimated property damages to be $2.5 million.

We determined that the probable cause of the accident was the unprotected fouled track that was used to route a passenger train at maximum authorized speed; the absence of supplemental shunting devices, which Amtrak required but the foreman could not apply because he had none; and the inadequate transfer of jobsite responsibilities between foremen during the shift change that resulted in failure to clear the track, to transfer foul time, and to conduct a job briefing. Allowing these unsafe actions to occur were the inconsistent views of safety and safety management throughout Amtrak’s corporate structure that led to the company’s deficient system safety program that resulted in part from Amtrak’s inadequate collaboration with its unions and from its failure to prioritize safety. Also contributing to the accident was the Federal Railroad Administration’s (FRA’s) failure to require redundant signal protection, such as shunting, for maintenance-of-way work crews who depend on the train dispatcher to provide signal protection prior to the accident.

As a result of this investigation, we issued two new safety recommendations to the FRA; nine new safety recommendations to Amtrak; and, three new safety recommendations to the Brotherhood of Maintenance of Way Employees Division, American Railway and Airway Supervisors Association, Brotherhood of Locomotive Engineers and Trainmen, and Brotherhood of Railroad Signalmen. We also reiterated one safety recommendation to the FRA.

Figure 93: PRailVac vacuum excavation machine on track 2 at the accident site.

Figure 94: Right (west) side of the lead passenger car and locomotive with damage to the lead passenger car.

Figure 95: The interior of the lead passenger car showing damaged windows, fallen ceiling tiles, rotated seats, and window frames pushed into the car.
Completed Accident Briefs

**Railroad**

**BNSF Railway Train Derailment and Subsequent Train Collision, Release of Hazardous Materials, and Fire**
Casselton, North Dakota (0 fatalities, 0 injured)

On December 30, 2013, a westbound BNSF Railway Company (BNSF) train with 112 cars loaded with grain derailed 13 cars while traveling on main track 1 at milepost 28.5 near Casselton, North Dakota. The first car that derailed (the 45th car) fouled the adjacent track, main track 2. At 2:11 p.m., an eastbound BNSF train with 104 tank cars loaded with petroleum crude oil (crude oil), traveling on main track 2, struck the derailed car that was fouling the track and derailed two head-end locomotives, a buffer car, and 20 cars loaded with crude oil. After the collision, about 476,000 gallons of crude oil were released and burned. On the day of the accident, the weather was cloudy with a temperature of -1°F and wind from the north at 7 mph. No injuries were reported by residents or either of the train crews. The BNSF reported damages of $13.5 million, not including lading and environmental remediation.

We determined that the probable cause of the collision of the oil train with the derailed grain train car was a broken axle on the 45th car of the grain train caused by an internal void that was created during axle manufacture. Contributing to the cause of the derailment were inadequate interchange rules used to locate internal material defects in secondhand-use axles. Contributing to the severity of the accident was the release and pooling of a highly flammable product that resulted in a fire and caused additional cars to fail.

As a result of this investigation, we issued two new safety recommendations to the Pipeline and Hazardous Materials Safety Administration (PHMSA) and one new safety recommendation to the FRA. We also reclassified four safety recommendations to the FRA.

**CSX Transportation Employee Struck by Remote Control Locomotive**
Richmond, Virginia (1 fatality, 0 injured)

On April 1, 2015, CSX Transportation (CSX) train Y391-31, operating with a remote-control locomotive, struck and killed a CSX employee (carman) who walked in front of it as it moved through the south end of yard switch N02, in remote control zone (RCZ) 91, of the ACCA Yard in Richmond, Virginia. The point of impact was estimated to be in the gage of the rails at the N02 switch points. About the time of the accident, the sky was clear with 10 miles visibility, temperature was 48°F, and the wind was from the north at 22 miles per hour gusting up to 29 mph.

We determined that the probable cause of the accident was the CSX lead carman’s failure to use safe practices for walking in the train yard when he moved into the path of train Y391-31 for unknown reasons. Contributing to the accident was the failure of the two carmen to conduct a thorough job briefing before starting a new assignment.

As a result of this investigation, we reiterated one safety recommendation to the FRA.

**BNSF Crude Oil Train Derailment, Subsequent Fire, and Evacuation**
Heimdal, North Dakota (0 fatalities, 0 injured)

On May 6, 2015, a BNSF crude oil unit train derailed six cars (81 through 86) near Heimdal, North Dakota. The train, consisting of 3 locomotives, 2 buffer cars, and 107 loaded tank cars carrying crude oil, was operating at 45 mph when the cars derailed. The train separated after a broken wheel on the 81st car struck the leading edge of the highway–rail grade crossing at milepost 149.01. A mark on the track structure at milepost 153.87 indicated that the broken wheel could not maintain its normal position on the rail at that point and the derailment sequence began. The momentum of the train pulled the 81st car and the following five cars off the track. Five of the derailed tank cars breached and released about 96,400 gallons of crude oil, which fueled a fire about 1 mile east of Heimdal. About 30 people were evacuated from Heimdal and the surrounding area due to the smoke plume that extended north. At the time of the accident, the sky was overcast, and the temperature was 57°F. BNSF estimated damage at $5 million.

We determined that the probable cause of this derailment was failure of a wheel on the 81st tank car due to a vertical split rim.

As a result of this investigation, we issued two new safety recommendations to the FRA and one new safety recommendation each to the FRA and the Association of American Railroads.
We determined that the probable cause of the broken rail, derailment, and subsequent fire was BNSF’s decision to defer track maintenance and continue to operate high-hazard flammable unit trains on the Aberdeen Subdivision. Contributing to the accident was the FRA’s track maintenance regulation that allowed high-hazard flammable unit trains to continue to operate after the track was reclassified to a lower standard. Contributing to the tank car breach and subsequent fire was the continued use of legacy US Department of Transportation-111 tank cars to carry flammable products.

As a result of this investigation, we issued one new safety recommendations to PHMSA and one new safety recommendation to both PHMSA and the FRA.

**South Florida Regional Transportation Authority Highway-Rail Grade Crossing Collision**

**West Palm Beach, Florida (0 fatalities, 1 injured)**

On July 6, 2016, northbound Amtrak Silver Meteor train P09806, operating on the South Florida Regional Transportation Authority (SFRTA) track, struck a 2004 white 4-door Mercury Sable at the 25th Street highway–rail grade crossing in West Palm Beach, Florida. At the time of the collision, a VTMI “signal employee was working in the crossing warning system bungalow. The event recorder in the bungalow recorded a 1-second warning before the collision. The automobile driver was seriously injured.

The train was en-route from Miami, Florida, to New York City. The train did not derail and the crewmembers and passengers were not injured. The damages to the train were estimated at $16,300; the automobile was a total loss. At the time of the accident, the sky was clear, the visibility was 10 miles, and the temperature was 88°F.

We determined that the probable cause of the accident was the failure of the VTMI signal inspector to provide for the safety of train movements and highway users prior to disabling the highway–rail grade crossing warning system at the 25th Street highway–rail grade crossing while performing tests. Contributing to the accident was the failure of the SFRTA and VTMI management to ensure proper procedures were followed during testing to provide for the safety of the train movements and the highway users.

As a result of this investigation, we issued one new safety recommendation each to SFRTA and to VTMI.
### Ongoing Investigations (as of December 31, 2017)

**Railroad**
- Union Pacific locomotive struck conductor switching cars, Pine Bluff, Arkansas, April 4, 2015 (1 fatality, 0 injured)
- Two Southwestern Railroad freight trains collided, Roswell, New Mexico, April 28, 2015 (1 fatality, 1 injury)
- Two BNSF freight trains collided; derailment and subsequent fire, Panhandle, Texas, June 28, 2016 (3 fatalities, 1 injured)
- New Jersey Transit train derailed after colliding with bumping post in terminal, Hoboken, New Jersey, September 29, 2016 (1 fatality, 110 injured)
- New York City Transit train struck two track workers, Brooklyn, New York, November 3, 2016 (1 fatality, 1 injured)
- Long Island Rail Road train collided with bumping post in Atlantic Terminal, Brooklyn, New York, January 4, 2017 (0 fatalities, 108 injured)
- Two SEPTA trolleys collided Philadelphia, Pennsylvania, January 4, 2017 (0 fatalities, 48 injured)
- BNSF Train struck two maintenance workers Edgemont, South Dakota, January 17, 2017 (2 fatalities, 0 injured)
- Two SEPTA trains collided Upper Darby, Pennsylvania, February 21, 2017 (0 fatalities, 4 injured)
- UP ethanol train derailed on trestle into the water Graettinger, Iowa, March 10, 2017 (0 fatalities, 0 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, DC, 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)

**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 how struck Colonial Pipeline gas pipeline that caused subsequent fire and injuries, Helena, Alabama, October 31, 2016 (1 fatality, 4 injured)
- Back how struck Ameren Illinois Gas pipeline that caused subsequent fire and injuries, Canton, Illinois, November 16, 2016 (1 fatality, 11 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)
- Keystone Pipeline leaked 210,000 gallons of oil, Amherst, South Dakota, November 16, 2017 (0 fatalities, 0 injured)

**Hazardous Materials**
- Axiall Corporation tank car leaked chlorine resulting in evacuations and injuries, New Martinsville, West Virginia, August 27, 2016 (0 fatalities, 8 injured)
- CSX tank car leaked ethanol, Fredericksburg, Virginia, November 3, 2016 (0 fatalities, 0 injured)

### Safety Alerts

**Watchman/Lookout – Your coworkers depend on you (SA-066)**
Information on providing warning in sufficient time for the work group to clear to a safe location.

**Rail Transit Vehicle Emergency Brake Push-button Electrical Switch Failure (SA-063)**
Information on rail transit vehicle emergency brake push-button electrical switch failure.

Figure 99: Safety Alert cover for Watchman/Lookout
The Office of Research and Engineering (RE) provides technical expertise to NTSB accident investigations 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 Recorder, Materials Laboratory, and Vehicle Performance), one Safety Research Division, and the Medical Investigation and Consultation section.

In 2017, RE 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, RE 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 (HDPE) pipe and details of a General Electric CF6-80C2 stage 2 turbine disk failure. RE also participated in the Accident Investigator’s Recorders International conference in Dublin, Ireland. 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 a flight test data investigation, electronic device recovery from a 16-fatel commercial balloon accident and transcribing a 26-hour audio recording. RE 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 2017, the office supported two accident cases involving autonomous vehicles, allowing staff the opportunity to work with manufacturers on the type and format of data collected on the vehicle computers. To develop technical background, staff also participated in several autonomous vehicle conferences.

RE also has an initiative underway to create the appropriate policies and software to enhance the management of health records and health information for operators and passengers involved in accident investigations. These improvements will enable medical and survival factors staff to gain further insight into the cause of accidents and associated injuries.

**Table 12: Office of Research & Engineering Statistics**

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
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<tbody>
<tr>
<td>Safety Studies Published</td>
<td>1</td>
</tr>
<tr>
<td>Safety Data Analyses Completed</td>
<td>302</td>
</tr>
<tr>
<td>Readouts of Vehicle Recorders and Other Electronic Devices Completed</td>
<td>449</td>
</tr>
<tr>
<td>Material Laboratory Exam Reports Completed</td>
<td>160</td>
</tr>
<tr>
<td>Vehicle Performance Reports and Animations Completed</td>
<td>58</td>
</tr>
<tr>
<td>Medical Investigation Reports Completed</td>
<td>169</td>
</tr>
<tr>
<td>Journal Publications</td>
<td>9</td>
</tr>
<tr>
<td>Advocacy and Outreach Conference Presentations</td>
<td>39</td>
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</tbody>
</table>
The **Vehicle Recorder Division** received 434 devices; completed 449 readouts, transcripts, and studies in support of aviation, railroad, marine, and highway investigations in 2017; and launched to 10 accident sites. (Forty-three of the recorders were from foreign accidents). Engineers supported numerous NTSB reports and recommendations including issuing new recorder recommendations or reiterating prior recommendations for the following investigations: Air Methods AS350 accident in Frisco, Colorado, Promech DHC-3 accident in Ketchikan, Alaska, Tesla crash in Williston, Florida, and the sinking of *El Faro* in the Atlantic Ocean.

Figure 100: Vehicle Recorder Division staff examine a recorder from the lead locomotive of Amtrak 501 that derailed in DuPont, Washington on December 18, 2017.

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 Materials Laboratory Division also continued to develop methods and skills in 3D visualization, documentation, and the associated stress analysis of failed components.

Materials Laboratory Division staff completed 160 reports for 128 accident cases, launched to 9 accident sites, and supported numerous NTSB reports and recommendations. In one example, the division supported a petroleum pipeline accident investigation that occurred in Centreville, Virginia, and, through experimental mechanics work, discovered that current regulatory rules for allowable dents in pipelines were not sufficiently conservative to minimize fatigue failures. As a result, we issued a recommendation to PHMSA to correct the problem. In a second example, the division conducted the metallurgical failure analysis and quantitative fractography on fractured turbine disk that resulted in an uncontained engine failure and airplane fire in Chicago, Illinois, resulting in new inspection recommendations. Lastly, based on several accidents, the division’s fire investigators developed a recommendation concerning truck-tractor side-mounted fuel tank crashworthiness to prevent catastrophic tank ruptures and limit postcollision fuel spillage.

Engineers and graphics specialists from the **Vehicle Performance Division** produced 5 accident reconstruction animations and video compilations for five NTSB events in 2017. Vehicle Performance Division staff completed 53 products (aircraft and surface vehicle performance studies, laser scanning reports, biomechanics studies, and video/photograph studies) in support of accident investigations and launched to three accident sites. Among the products completed by the division was a finite element model of the cargo lashings used on the cargo vessel *El Faro*; the results were used to support findings regarding the shifting of cargo during the voyage. An animation was also created depicting the sequence of events during *El Faro*’s that was shown at the Board Meeting on the investigation. In a second
example, division staff participated in an investigation into a fatal helicopter crash in Frisco, Colorado through an aircraft performance study, a crashworthiness study, and a video compilation shown at the Board Meeting on the investigation; one result was a novel recommendation to ensure that helicopter users were fully aware of the level of safety inherent in the equipment installed in any helicopter they bought or leased. Finally, Vehicle Performance Division staff participated in an investigation involving a collision between an automated vehicle and a truck, performing vehicle simulations, injury evaluations, and creating an animation; the simulation work allowed for a more confident conclusion that the driver of the automated vehicle had ample opportunity to avoid the collision and was therefore inattentive.

The Safety Research Division staff completed 1 safety study; initiated 1 new safety report; produced 2 annual aviation accident data reports and 1 transportation accident fatalities infographic; generated 4 rapid reports and 11 data reports in support of accident investigations; and completed more than 260 accident data analysis requests in aviation, highway, marine, and rail. Division staff also produced 26 geographic information system products and participated in numerous presentations and training sessions for internal and external organizations. Staff research analysts supported numerous NTSB reports during the year, including for the following investigations: Hageland Aviation Services, Inc. dba Raven Connect Flight 3153, Togiak, Alaska (ongoing); the Tesla crash in Williston, Florida, and the sinking of El Faro in the Atlantic Ocean.

The Medical Investigation and Consultation Section’s physicians participated in more than 106 NTSB accident investigations and completed 169 reports in all transportation modes in 2016. This included evaluating and addressing medical issues through formal factual and analytical reports, safety recommendations, coordination with other agencies, and formal presentations to the NTSB and external audiences. Medical staff played important roles in the investigation, report writing, and development of safety recommendations following the commercial hot air balloon accident in Lockhart, Texas that killed 16 people; the collision of a motorcoach and truck-semitrailer combination in Palm Springs, California, that caused the deaths of 13 motorcoach occupants; and the collision of an Amtrak passenger train and maintenance-of-way equipment in Chester, Pennsylvania, that resulted in the deaths of two maintenance-of-way workers.

**Completed Safety Studies**

**Reducing Speeding-Related Crashes Involving Passenger Vehicles**

In this safety study, we examined causes of and trends in speeding-related passenger vehicle crashes and countermeasures to prevent these crashes. The countermeasures presented represent several potential solutions to the issue, and, although they do not address every cause of speeding or type of speeding-related crash, they are intended to be widely applicable to a significant portion of these crashes.

We focused on the following five safety issues pertaining to the effective application of proven and emerging countermeasures for speeding: (1) speed limits, (2) data-driven approaches for speed enforcement, (3) automated speed enforcement, (4) intelligent speed adaptation, and (5) national leadership.

As a result of this safety study, we issued one new safety recommendation to DOT; eight new safety recommendations to NHTSA; four new safety recommendations to the FHWA; and one new safety recommendation to each of the 50 states, the Governors Highway Safety Association, the International Association of Chiefs of Police, and the National Sheriffs' Association.

**Ongoing Safety Studies (as of December 31, 2017)**

**Risk Factors Associated with Injury-Producing Motorcycle Crashes**

In this ongoing safety research, we will provide an updated look at factors that contribute to motorcycle crash risk using a new dataset collected by the FHWA’s Motorcycle Crash Causation Study and released to the public in 2017. The factors are then compared to the findings of the DOT’s last in-depth study of motorcycle crash risk, published nearly 40 years ago, in 1981. Finally, this safety report evaluates the need for recommendations aimed at improving motorcycle safety, given the many changes that have occurred in motorcyclist demographics and training, motorcycle size and power, patterns of motorcycle use, braking systems, and other safety technologies since 1981.
Journal Publications

- W.A. Tuccio, M. Nevile, *Using Conversation Analysis in Data-Driven Aviation Training with Large-Scale Qualitative Datasets*, Journal of Aviation/Aerospace Education & Research, 26(1).

Advocacy and Outreach Conference Presentations

- N. Webster, *Toxicology Aspects of Medical Accident Investigation*, Postmortem Forensic Toxicology Meeting CAMI, Oklahoma City, Oklahoma, April 5, 2017.


• M. Budinski, *Quantitative Fractography In Transportation Accident Investigation at the National Transportation Safety Board*, International Conference on Fracture, International Congress on Fracture, Rhodes, Greece, June 20, 2017.


• J. O’Callaghan, *Recreation of Out-the-Window Views and Electronic Traffic Displays for a Mid-Air Collision between an F-16 and a Cessna 150*, General Aviation Manufacturer’s Association Air Safety Investigation Annual Meeting (GAMA-ASI), General Aviation Manufacturer’s Association (GAMA), Dallas, Texas, September 27, 2017.


Since 1967, the NTSB has served as the “court of appeals” for holders of airman, mechanic, air carrier, and mariner certificates when the FAA or the Coast Guard 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 also 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 on 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 Coast Guard administrative law judges and may be appealed to the vice commandant of the Coast Guard. The vice commandant’s ruling may then be appealed to the NTSB. The same appellate process is followed for marine certificate actions as for aviation actions.

We currently have three judges, all assigned to headquarters in Washington, DC, and one judge in Denver. 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.

<table>
<thead>
<tr>
<th>Table 13: Office of Administrative Law Judges Statistics</th>
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<tbody>
<tr>
<td><strong>Total Cases Received</strong></td>
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<td><strong>Total Cases Closed</strong></td>
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<td><strong>Emergency Cases Received</strong></td>
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<tr>
<td><strong>Emergency Cases Closed</strong></td>
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<tr>
<td><strong>Challenges to Emergency Determinations</strong></td>
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<tr>
<td><strong>Hearings Held</strong></td>
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<td><strong>Board Opinions and Orders (O&amp;O)</strong></td>
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<td><strong>Board O&amp;O appealed to US Federal Courts</strong></td>
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<tr>
<td><strong>Advocacy and Outreach Conference Presentations</strong></td>
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10 Public Law 112-153 (the "Pilot’s Bill of Rights"), which became effective on August 3, 2012, vested authority to review the Board’s decisions in both the US Federal District Courts and US Courts of Appeals. Previously, only the Courts of Appeals had jurisdiction to review Board decisions.
In 2017, ALJ disposed of 71 percent of its caseload.

- 235 appeals were filed with the NTSB’s administrative law judges.
- The judges held 33 hearings and closed 190 cases.
- The office received 122 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.
- Twenty-four of the judges’ decisions were appealed to the Board, which decided 17 appeals on the merits, affirming the judge in 12, and remanding 3 cases to the judges for further proceedings.

Advocacy and Outreach Conference Presentations

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. The core of the training program continues to be key investigative courses that focus on competencies important to safety investigations to enhance the safety of 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 experience, and advocating operational excellence;
- Providing a modern platform for accident reconstruction and evaluation; and
- Using its high-quality training resources to facilitate family assistance and first responder programs, sister agency instruction, and other compatible federal activity.

The laboratory area contains the reconstruction of TWA Flight 800, as well as other wreckage and materials that are used in the Training Center’s investigative courses, so that 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 transportation community use the training center as a means of improving their accident investigation techniques.

<table>
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<th>Table 14: NTSB Training Center Statistics</th>
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<td>Courses, Programs, Seminars Offered</td>
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Training Offerings

In 2017, the NTSB Training Center continued to upgrade and refine a comprehensive array of training courses to NTSB staff focused on mission-related skills, as well as to 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, 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 TDA 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") from the US Army for use in hands-on exercises in the NTSB Helicopter Accident Investigation class.

New and continuing courses in 2017 created many unique training opportunities. 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 those 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
- TDA Incident Stress Management Training
- TDA 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, and 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 2017, 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 their agency’s needs. Whenever possible, the training center works with its investigative partners to offer classes to larger groups at other locations. Another example was the public affairs course on Managing Communications During a Transportation Disaster. This course was presented to JetBlue 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 GA 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 2017, the training center delivered its first 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 one additional seminar on transition training, and one additional seminar in Ronkonkoma, New York, on preventing LOC.
THE NEXT 50 YEARS: TOWARD A SAFER TRANSPORTATION FUTURE

Technologies that were fictional or completely unforeseen in 1967 now require steady attention as their safety evolves. For example, in both trade and general media, we see the tantalizing promise of automation—eliminating human operator error by eliminating human operators. NTSB investigations are helping to determine the safe path to the more automated future, and to maintain public confidence in our changing transportation system.

Technological advances are also enhancing risk mitigation through the use of data that we could not imagine having in 1967. Lithium batteries carried as hazmat or integrated into vehicles, the burgeoning field of automated cars and trucks, and commercial space ventures, are just three areas in which the NTSB brings penetrating, real-world investigations to the table, with only one interest in mind: safety.

We’re proud of the role that we have played in the last 50 years. The future of transportation looks bright—which should be a signal to remain vigilant. The moment that we take progress for granted, we risk complacency.

Safety leaders in industry must live with what Professor James Reason called a “chronic unease.” Leaders who embrace this unease and actively pursue safer operations will always brighten the future outlook; those who regard the future as inherently bright risk darker outcomes.

Today, hundreds still lose their lives annually in general aviation and Part 135 operations, and tens of thousands die on our roads. Many others are injured, sometimes with lifelong consequences. And throughout transportation, despite all our gains, the next accident or crash is one missed procedure, training deficiency, manufacturing defect, uninstalled safety system, or miscommunication away.

Action on existing NTSB recommendations can make us all safer. Sadly, the NTSB will no doubt investigate tragic events in the future. But with each investigation, we will learn the lessons that can improve safety tomorrow.

The most painful conversations we Board members have are with family members who have lost loved ones. Often, we meet them within hours of the event, when their emotions are still raw.

The only consolation I can ever offer grieving family members is our commitment to find out what happened, to prevent it from happening again.

So whatever the future holds, the NTSB will continue to investigate. We can’t peer into the future. But we are committed to looking deeply into any future tragedy, and finding answers that can continue to improve transportation safety.

Robert L. Sumwalt, III
Chairman

Making Transportation Safer

Yesterday Today & Tomorrow

National Transportation Safety Board 2017 ANNUAL REPORT TO CONGRESS