# IMPROVING AVIATION SAFETY

## Collaborative Government and Industry Initiatives


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**Today U.S. commercial aviation is in its safest period in history. U.S. air carriers have transported more than 7.8 billion people[1] in U.S. passenger operations since 2010—the equivalent of moving the population of the United States 23 times. During this time, two lives were lost. Over the same timeframe, five fatalities occurred in cargo service. This is a remarkable achievement for the industry, especially considering the complexity and scope of the aviation system: Each year, U.S. air carriers conduct more than 9 million flights, covering some 7 billion miles.**

**But the path to the present high level of safety was filled with significant hurdles. Loss of life has occurred throughout the history of commercial aviation. Although the lessons learned from those tragedies resulted in continuous improvements, it became clear that a reactionary approach to safety was insufficient. In the mid-1990s, the government and industry embarked on a joint effort to develop a new strategy to advance safety. This strategy was not the result of an overnight transition. Rather, it was the product of years of hard work and collaboration to develop a common, focused safety agenda. Let's explore the road to the present and where that road will lead in the future.**

> Even as we recognize how safe it is to travel in commercial air transportation, we must look beyond to face the challenge of how to make the system safer. How can we continue to improve aviation safety as demand and complexity increase?
>
> —Marion C. Blakey
> FAA Administrator, 2002-2007

**May 25, 1979:**
**American Airlines Flight 191 crashed immediately after takeoff from Chicago O'Hare International Airport. All 258 passengers and 13 crewmembers were lost, as were two individuals on the ground. As a result, there were discussions about grounding the Douglas DC-10. Leveraging data to make these decisions was paramount. However, the data was scattered throughout different organizations and not easily accessible.**

## Structured Approach: Regulator vs. Industry vs. Regulator

Earlier stages of air carrier safety were typified by isolation—air carriers formally collaborated little on safety among themselves, and their relationship with the FAA was one of avoidance. The mentality of aviation employees, from the smallest rural operators to the largest air carriers, was "don't talk to the FAA." This was due in part to a stringently structured regulatory posture at the FAA; at the time, even if a person voluntarily admitted to an honest mistake, more than likely a "ticket" would be written. The role of aviation safety inspectors from the FAA Flight Standards Service was challenging; they needed to spend time in the field conducting surveillance to detect safety issues. The inspectors typically focused their work on places where they believed a risk may exist, but they were not acting from a data-driven, systems perspective.

The entire FAA inspector workforce conducted approximately 400,000 surveillance activities in the mid-1990s. However, the FAA would need to consider whether these oversight activities were adequate following one of the highest-profile accidents in U.S. passenger service. On May 11, 1996, ValuJet Flight 592 crashed into the Florida Everglades following an in-flight fire in the cargo compartment that was initiated by the actuation of one or more oxygen generators being improperly carried as cargo. The ValuJet accident brought attention to air carrier safety, as the American public demanded action. The FAA found itself under the microscope, responding not only to intense congressional pressure but also to recommendations and hearings of the National Transportation Safety Board (NTSB) and other agencies. Expectations for the agency were not practical, as they exceeded its recourses and capabilities. After the ValuJet crash, Congress questioned the oversight processes, implying the agency should have been watching every aircraft cargo loading and unloading.

Thus, the FAA considered whether increasing the number of annual inspections to 800,000 would improve safety significantly or whether a different approach to oversight was needed. To examine this issue, the agency enlisted the support of Sandia National Laboratories, which had a long-established record of developing solutions to the nation's most challenging issues. Sandia helped the FAA pioneer a new approach to safety oversight, and from this research emerged the Air Transportation Oversight System (ATOS), which at its core was a data-driven, systems approach to managing safety. For the first time, the FAA inspector workforce would leverage a system-level approach to guiding oversight—but because it represented a significant cultural change for that workforce, the implementation of ATOS would take years. At the time, 125 air carriers needed to transition into ATOS. The FAA focused on the 10 largest operators first because it needed to develop a standardized approach for the certification of air carriers. During this transition, the FAA also acknowledged that the amount of information the agency was learning from its surveillance activities was minuscule compared to what it could receive from the air carriers' internal voluntary reporting systems—but the air carriers were reluctant to share their data.

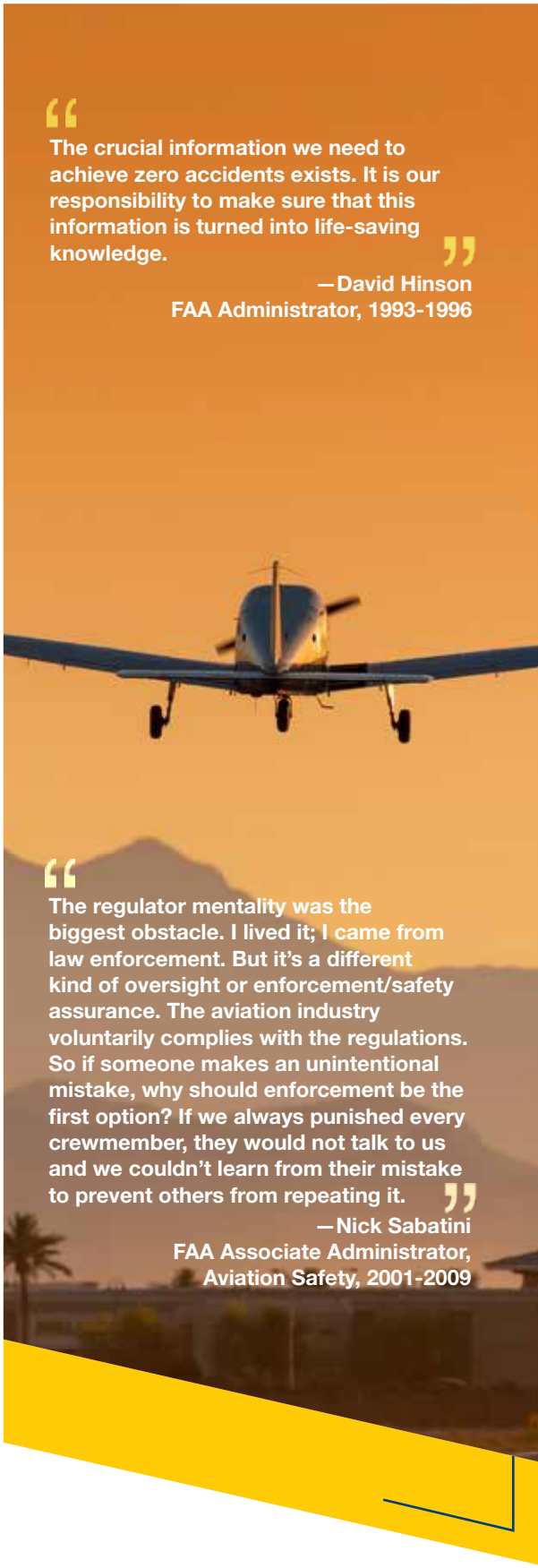
Meanwhile, air carrier accidents were not uncommon, and the fatal accident rate had been unchanged for years. Several high-profile accidents had occurred that the nation would never forget. The tragedies of air carriers crashing with large numbers of fatalities kept passengers on edge, and statistics backing the adage that "flying is safer than driving" were of little comfort to the public. In addition, studies by key aviation stakeholders didn't tell a positive story for the future fatality rate; based on a projected increase in the number of flights, the industry would experience even more fatal accidents in the future.

The general posture toward aviation safety at this time involved a reactionary approach demanding answers and resulted in a confrontational relationship between the FAA and industry. Air carriers had no desire to share information with the FAA because they believed the agency would overreact with costly regulations, aircraft modifications, or even fleet groundings if it obtained access to internal industry data.

A few people at the FAA began to discuss the need to work with the industry and sought ways to share information to advance safety without invoking fear of government retribution. These calls to action were often met with resistance. Although pilots would informally share information about close calls with each other, and to some extent within the company, the air carriers would not formally share safety data or information, even with industry colleagues—let alone with the government. Others believed it was not appropriate for the government to talk with industry, citing laws on ex parte communications. The saying "don't shoot the messenger" reflected the fear employees had of companies taking disciplinary or punitive actions against them or their colleagues. From the industry viewpoint, air carriers didn't want to provide data because the FAA could take enforcement actions against them.

To make progress, the community needed to overcome the reluctance to share safety information. The industry started to collect, use, and protect data, but it was not yet shared, so the initial success was only realized by individual air carriers rather than the industry as a whole. The missing piece was getting that information out as part of a bigger, national-level archive to determine if there were systemic safety issues that needed to be addressed.

Although the FAA was interested in working with air carriers, some in government and industry still pushed back, emphasizing the agency's role as the regulator and arguing collaboration was incompatible with regulatory oversight. The FAA always needed to retain the capability to take enforcement actions, should it need to, but improving safety would be the primary objective. Therefore, the agency needed more tools at its disposal than just the enforcement option. But there was very little trust in the industry about working with the FAA even with the establishment of protections for safety data.



**"The crucial information we need to achieve zero accidents exists. It is our responsibility to make sure that this information is turned into life-saving knowledge."**

**—David Hinson**
**FAA Administrator, 1993-1996**

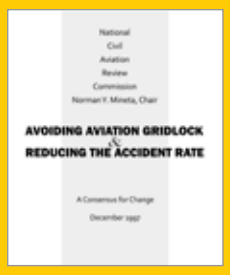
**"The regulator mentality was the biggest obstacle. I lived it; I came from law enforcement. But it's a different kind of oversight or enforcement/safety assurance. The aviation industry voluntarily complies with the regulations. So if someone makes an unintentional mistake, why should enforcement be the first option? If we always punished every crewmember, they would not talk to us and we couldn't learn from their mistake to prevent others from repeating it."**

**—Nick Sabatini**
**FAA Associate Administrator, Aviation Safety, 2001-2009**


**February 1997: The White House Commission on Aviation Safety and Security directed the FAA to reduce the rate of accidents by a factor of five within a decade.**

### Protection from Disclosure

**In 1996, Congress enacted legislation providing for the protection from disclosure of safety information voluntarily provided to the FAA, in the form of Title 49, U.S. Code § 40123. In 2001, the FAA took this one step further by promulgating Title 14, Code of Federal Regulations Part 193, which created a process for granting such protections. Since that time, the FAA has issued several notices designating various classes of voluntarily provided safety information as protected from disclosure under the Freedom of Information Act (Title 5, U.S. Code § 552).**




**December 1997: The National Civil Aviation Review Commission called for an 80 percent reduction in the accident rate, an emphasis on performance-oriented safety programs, and government-industry collaboration.**

## Cooperative Approach: Before Consensus Acceptance

*Early Efforts*

As the turn of the century approached, the slow, sporadic path to government-industry collaboration continued. There were disparate groups on the right path but with no cohesive approach. Among the many different efforts, most were driven by individual agendas instead of from a data viewpoint. However, these efforts would lay the foundation for industry to move forward. Boeing and other manufacturers were trying to get the industry to come together to tackle the threat of increased fatal accidents. Boeing had developed compelling fatal accident prediction charts, which were getting people's attention because they showed an unacceptable number of fatal accidents would occur if the industry didn't act. The FAA also had teams looking at data. The FAA Aircraft Certification Service had identified the top accident causal types and which causal factors were most important to address to make meaningful reductions in the fatality risk. The FAA Flight Standards Service worked with the air carriers to pioneer new approaches to collecting and using data from voluntary safety programs. Momentum was building in the aviation community to develop a new strategy to tackle the fatality risk.

It was clear that simply looking at accident data was not the way forward because too many investigations revealed that the safety issues resulting in an accident were already known. It was necessary to enable individuals to report safety issues they observed in the system, and a non-punitive culture was needed so they could do so without fear of retribution. This would be the only way to shift from a reactionary approach for managing safety to a more proactive posture. These noble efforts were trying to build momentum for change.

As a first step in this process, the FAA started working with a single air carrier on a prototype voluntary program to address altitude deviations. The FAA and industry knew it was important to understand the underlying contributing factors leading to deviations to proactively develop effective mitigations. Disciplinary or enforcement actions did very little to keep others from making the same errors. Information flow under such actions was restrictive and the risks would remain in the system, with others repeating the same mistakes with the potential of more adverse outcomes. This voluntary initiative helped develop trust among labor, air carrier management, and the FAA. The program helped foster a voluntary safety reporting culture by ensuring data was used only to advance safety. It provided invaluable insight into the underlying contributing factors, which simply was not possible when punitive actions were involved. Over time, the success of this pilot program helped it to evolve beyond just a focus on altitude deviations.

However, more formalized protocols and protections would be necessary to translate this pilot program to an industrywide initiative.

Before the FAA could take possession of voluntarily provided safety information, it needed the ability to protect those submissions from public disclosure. To that end, the FAA started to work with Congress in the early 1990s to build a framework to protect voluntarily provided safety data. Congress agreed that such protections were in the public's interest because the air carriers were in a better position to know about safety risks than the FAA, and the FAA needed those insights.

As fatal accidents continued to occur during this period, public and congressional scrutiny intensified. The FAA and industry needed to take the next step and fold these efforts into a national-level initiative focused on a shared safety agenda. The focus needed to go beyond reacting to accidents. Voluntary safety programs were critical to learning about events involving inadvertent/unintentional errors or perceived safety risks. These events represented precursors to accidents, and the FAA and industry knew it was vital to understand and mitigate these risks before they could lead to losses of life.

Congress recognized that these programs needed to be protected if they were to be successful at the national level. In 1996, it granted the FAA Administrator the authority to designate voluntary safety information as protected from public disclosure. These protections became the foundation upon which voluntary safety programs began to build and evolve across the aviation industry and different domains. At that time, the FAA also issued FAA orders to provide guidance to its inspector workforce on the use of information and established procedures to prevent protected data from being used in enforcement activities. The only exception to these protections were instances of intentional disregard of regulations or careless/reckless operations.

Meanwhile, a White House commission and the National Civil Aviation Review Commission (NCARC) were holding meetings focused on reducing the fatality risk. These groups were highly focused. The White House commission set the goal of "reducing the rate of accidents [in commercial aviation] by a factor of five within a decade,"[2] while the NCARC recommendations challenged the FAA and industry to work together in a comprehensive and concerted effort "that will require new ways of doing business with each other and a greater emphasis on cooperation and collaboration."[3] The NCARC recommendation would ultimately lead to formation of the Commercial Aviation Safety Team (CAST), a government-industry team focused on reducing the fatality risk through data-driven risk prioritization methodology. The timing finally seemed right for the disparate efforts of years past to find a collaborative home.

### *Commercial Aviation Safety Team (CAST)*

The FAA's first approach to this collaborative strategy was called the FAA Safer Skies Initiative. The initiative's primary philosophy was that risk reduction had to be data-driven, but it mainly focused on an analysis of past accidents and incidents to identify precursors to those events and then develop interventions. It incorporated components from commercial aviation and general aviation (GA), which encompasses noncommercial flights conducted by private operators other than air carriers.

**1997:**
**CAST was established, cooperatively developing and implementing a prioritized safety agenda using data-driven risk management and consensus decision-making.**

### CAST Membership

**CAST membership has grown since its inception and now includes the following government, industry, and labor organizations:**

**Government:**

- FAA
- NASA
- Transport Canada Civil Aviation
- U.S. Department of Transportation

**Industry:**

- Aerospace Industries Association
- Airbus
- Airports Council International – North America
- Airlines for America
- The Boeing Company
- Flight Safety Foundation
- General Electric (representing all engine manufacturers)
- National Air Carrier Association
- Regional Airline Association

**Labor:**

- Air Line Pilots Association, International
- Coalition of Airline Pilots Associations
- National Air Traffic Controllers Association

> **Our success in addressing risk and improving safety in aviation over the past two decades is the result of strong safety partnerships between government and industry to pursue safety improvement collaboratively and in a proactive manner.**
>
> **—Peggy Gilligan**
> **FAA Associate Administrator, Aviation Safety**
> **CAST and ASIAS Government Co-chair, 2009-2017**

Safer Skies was resource-intensive, requiring the attention of senior managers and staff members from across the FAA. Government and industry executives knew they needed to pull together subject matter experts from across the community if the effort were to succeed. The teams needed leadership from experts with in-depth knowledge of the National Airspace System (NAS), as well as skills in building a shared vision on improving safety through data-driven decisions. Government and industry both conducted an in-depth review to identify individuals with the unique skill sets. Jay Pardee, an FAA Senior Executive in the Aircraft Certification Service, and Paul Russell, a Boeing Chief Engineer for Aviation System Safety, were selected as the chairs to coordinate the team-level work.

Pardee began as an airframe and powerplant mechanic before earning an engineering degree. He worked as a flight test engineer before joining the FAA, eventually becoming the Director of the Office of Accident Investigation and Prevention, and later Chief Scientific and Technical Advisor for Vulnerability Discovery and Safety Measurement Programs. Notable among his awards was the 2008 Collier Trophy, as part of the Commercial Aviation Safety Team, "for achieving an unprecedented safety level in U.S. commercial airline operations." Peggy Gilligan noted about him: "We realized early on that Jay Pardee was looking at aviation safety through an entirely new lens. He pushed us in the direction of voluntary data sharing and analysis. And he was absolutely right. The accident rate proves that."

Russell served for 24 years in the U.S. Coast Guard, retiring with the rank of Captain. He served as the chief training pilot, commanded two aviation units, and coordinated search-and-rescue and disaster relief operations in the Gulf of Mexico, the Great Lakes, and the North Pacific Ocean. He joined Boeing in 1984, serving as a Boeing 737 flight crew instructor and editor of B737 operations manuals, chief engineer for airplane safety engineering, and eventually chief engineer, aviation system safety. He was recognized by the FAA for his support of the Safer Skies Initiative and is a recipient of the Flight Safety Foundation President's Citation for Safety Leadership.

The initial work under Safer Skies provided the foundation for Pardee and Russell to build a dedicated team of key experts from government and industry to form an analytical unit that would support CAST. The Safer Skies work provided detailed historical knowledge of risks in commercial aviation. CAST, the new analytical group, pioneered new methodologies that were more prognostic and identified accident precursors.

Limited resources were an issue for both the FAA and the industry. The Air Line Pilots Association, International (ALPA), provided volunteers from the air carriers and was instrumental in fostering the trust desperately needed within the pilot community. But compared with previous initiatives, what was unique to CAST was the broad, long-term commitment to the effort from across the industry. One of the key shortfalls from previous efforts was lack of commitment to ensuring that mitigations were put in place. The new group's guiding principles called for the initiative to be data-driven, involve multidisciplinary teams, and focus on implementing mitigations. The FAA and industry held one another accountable for the interventions identified

by the teams, a key component in ensuring the success of the voluntary program. These safety enhancements represented best practices that organizations could leverage to help address the risks identified by CAST. This was a new approach for industry; traditionally, air carriers waited for a regulatory requirement from the FAA. This principle would prove to be the key to CAST's success because the FAA, working alone through regulations, couldn't have achieved the same level of safety improvement.

The FAA's involvement in CAST was challenging because the concept was not well understood. As is often the case when something new is attempted, the team encountered resistance, requiring supporters to persevere. One of the biggest challenges was trying to keep the group accountable for sticking to this data-driven approach because some team members were not accustomed to working that way. Another early challenge involved team members wanting to analyze issues based on personal experience or intuition. CAST had to follow the results of the data analysis and focus on what it determined were the highest risk-reduction priorities.

Finding a way to prioritize the events and risks meant CAST needed people to bring their expertise to the table with open minds and not represent their organizations' agendas. And when funding was low and budgets were tight, prioritization of risks became even more important.

In the early years, CAST focused on looking back at past accidents to identify systemic issues and their underlying contributing factors. It identified intervention strategies, prioritizing the most effective risk-reduction strategies and adopting them as recommended safety enhancements. Between 1997 and 2008, this approach yielded an 83 percent reduction in U.S. commercial aviation fatalities—an unprecedented achievement.

CAST's success was enabled by the participation and commitment of key stakeholders from across government and industry. Although it started small, CAST involved government agencies, such as the National Aeronautics and Space Administration (NASA) and the U.S. Department of Defense. Major industry representation in CAST included the air carriers and their associations, manufacturers, the Aerospace Industries Association, and ALPA, along with the counterparts to these organizations in Europe. The international parties kept CAST informed of new and ongoing safety activities on a global scale, and leveraged CAST work within their own organizations. CAST membership now represents a solid cross-section of the commercial aviation industry.

CAST's early years involved the participants learning to work together, testing out new methodologies, and evaluating new priorities for implementation. CAST always took a strategic approach to managing safety and always looked forward. Even as CAST implemented its safety portfolio, it began to look beyond its initial risk-reduction targets into the future. CAST's growing success yielded additional opportunities for data sharing. These first efforts in establishing voluntary safety programs in the industry proved vital in advancing safety into the future.

**1998:**

**An early example of government-industry cooperation took place in 1998. The Boeing Company broke the ice by inviting the FAA Transport Airplane Directorate (TAD) to attend internal Boeing Safety Review Board meetings. The Boeing engineers were initially reluctant to speak while the FAA was present, fearing potential reactions from the agency and their own management. The meeting typified the turbulent atmosphere at the time, but this was a first step by a dedicated group of people in both government and industry roles who were still working to break through the silos.**

**TAD reciprocated and invited Boeing engineers to attend FAA Safety Review Meetings. This helped open the door for data sharing, which would improve safety decisions.**

**"We must as Secretary Slater says, 'raise the bar' in fulfilling the FAA's critical safety mission. To meet this challenge, it is essential that we significantly enhance our capability to efficiently collect, properly assess, and widely disseminate aviation safety information."**

**—Jane Garvey**
**FAA Administrator, 1997-2002**

## CAST/ICAO Common Taxonomy Team (CICTT)

**CICTT is co-chaired by one representative each from CAST and ICAO. The team includes experts from air carriers, aircraft and engine manufacturers, pilot associations, regulatory authorities, transportation safety boards, and ICAO, as well as representatives from Canada, the European Union, France, Italy, the Netherlands, the United Kingdom, and the United States.**

**CICTT taxonomies have been adopted worldwide, including by:**

- AvGen
- Aviation Safety Network
- CAST
- European Coordination Centre for Accident and Incident Reporting Systems
- FAA
- German Air Force
- International Civil Aviation Organization
- International Register of Civil Aircraft
- Namibia Civil Aviation Authority
- NASA
- National Aerospace Laboratory – Netherlands
- National Transportation Safety Board
- The Boeing Company
- Transport Canada
- United Kingdom Civil Aviation Authority
- United States Air Force

### *Aviation Safety Information Analysis and Sharing (ASIAS)*

While CAST was analyzing past accidents and looking to develop new methodologies, parallel efforts were underway to establish voluntary safety programs. Building on earlier demonstration projects in the 1990s at the FAA, air carriers and labor groups had developed voluntary safety reporting programs. One of these programs, known as the Aviation Safety Action Program (ASAP), allowed crewmembers to report events experienced in the operating environment–including mistakes they might have made. The intent was to analyze the circumstances of reported events, identify corrective actions, and enhance safety. Such voluntary safety programs relied on three key parties working together: the FAA, air carrier management, and labor. One of the biggest challenges was getting air carrier management and the FAA to understand that after a report was accepted, no punitive action would be taken against the reporter; instead, the parties would work to understand the underlying issues and take steps to prevent a recurrence. This was one of the most important aspects of voluntary safety programs because accident investigations would only bring a limited amount of data, whereas reported incidents that didn't reach the point of an accident could point to precursors that might prevent future accidents.

Congress believed the FAA should make the data more easily accessible to the public because lack of easy access had created the perception that the agency was keeping safety secrets. The National Aviation Safety Data Analysis Center (NASDAC) was launched as a repository for data on accidents, incidents, air traffic facility information, aviation safety studies, and voluntary reports from the Aviation Safety Reporting System (ASRS). NASDAC worked to consolidate data from across the FAA, commercial sources, and foreign civil aviation authorities, then restructured and prepared the data to make it more easily consumable by the aviation safety community. More than just a data repository, NASDAC was also staffed with analysts who could assist users with accessing and analyzing its data, as well as using the data to perform studies. The time when data queries would take days and result in stacks of paper for analysts was gone; the analysts could now query millions of records in a matter of seconds. In response, the FAA established the NASDAC repository, allowing this information to be queried directly over the web.

The FAA sponsored the Global Aviation Information Network (GAIN), which it envisioned as an information-sharing network of domestic and international aviation safety information. GAIN enjoyed broad support from the International Civil Aviation Organization (ICAO) and industry. Initial activities focused on demonstration projects to help prove the concept and explore analytical tools. One aspect even involved a data-sharing prototype. While liability concerns over access and use of data grounded these efforts, the NASDAC initiative led to what is now known as the ASIAS program. ASIAS is composed of two nodes—public and confidential. The public node (formerly NASDAC) continues to

leverage government and commercial data sources, while the confidential node includes proprietary data from industry and government voluntary safety reporting programs.

NASDAC also helped unlock the value of existing safety data sources by addressing the lack of taxonomies and standardization in the data systems. These initial efforts helped pave the way for the establishment of international safety data taxonomies. Building on the work accomplished by NASDAC, CAST, and ICAO established the CAST/ICAO Common Taxonomy Team (CICTT). Efforts to improve aviation safety on an international scale require the ability to draw meaningful comparisons of information from myriad sources. As part of this goal, CAST collaborated with ICAO in 1999 to form CICTT. CICTT's mission is to develop a common language of descriptors and standards to facilitate the worldwide sharing of safety data and information.

Working with representatives of civil aviation authorities and industry participants from around the world, CICTT meets regularly to establish comprehensive taxonomies of common descriptors for aviation equipment, procedures, and events. CICTT also established an extensive database of aircraft make, model, and series designations and powerplant make, model, and submodel designations. These common taxonomies improve the quality and facilitate sharing of collected information, greatly enhancing the aviation community's capacity to focus on common safety issues.

CICTT continues to develop new taxonomies as opportunities arise. Recent efforts include standardizing the parameters and metrics used in flight-data monitoring software. The goal of this initiative is to help GA operators collect, share, and analyze their data to look for accident precursors and validate their mitigation strategies.

The ASIAS confidential node was established in 2007 to bring together data from voluntary safety programs across the industry. It was a key step in the transition from a forensic, reactive approach to an active one. The success of CAST helped pave the way for the development of a national archive of voluntary safety data from across the air carrier community. In 2006, a wrong runway departure accident in Lexington, Kentucky, had underscored the need to bring this data together. Before the Lexington accident, there had been 116 similar aviation safety events over 20 years, although none of those led to an accident. However, these events were captured in voluntary safety reports where no single air carrier experienced more than one or two events, with some experiencing none. To enable the detection of this type of systemic risk, building a national archive was imperative.

**"We created GAIN to develop tools and processes to enable and facilitate the collection, analysis, and sharing of aviation safety information to improve safety. Getting the concept started in the mid-1990s was pushing a big rock up a big hill, but today GAIN-type tools and processes are in widespread use around the world, under various names, and their positive impact on aviation safety has been astounding."**

**—Chris Hart**
**NTSB Chairman, 2014-2017**

**2007:**
**The ASIAS confidential node was established. ASIAS is a collaborative government-industry initiative on data sharing and analysis to proactively discover safety concerns before accidents or incidents occur, leading to timely mitigation and prevention.**

### ASIAS Confidential Membership

**Since its inception in 2007, ASIAS has grown rapidly. With nearly 150 member organizations at the time of this publication, the program covers 99 percent of the commercial aviation industry in the United States, including labor organizations; air carriers and operators; manufacturers; maintenance, repair, and overhaul companies; flight training organizations; and government agencies.**

**"We are able to do so much more as a community than any individual carrier alone. Risks that emerge from our combined data might be overlooked by a single carrier."**

**—Al Madar**
**Managing Director, Corporate Safety, American Airlines, 1984-Present**

**ASIAS Executive Board Industry Co-chair, 2016-Present**

## EVOLUTION OF SAFETY PROGRAMS AND INITIATIVES


## Collaborative Approach: Industry and Government Improving Aviation Safety Together

The ASIAS program faced many challenges in the early years because air carriers were apprehensive about allowing sensitive data to leave company premises. Initially, a few air carriers agreed to participate, and more slowly joined. This process was gradual because each air carrier needed to clear its own internal legal and technical hurdles, as well as modify its labor agreements. Trust continued to build among the FAA, manufacturers, air carriers, and unions, and the partnerships these groups were able to foster began to produce results. Just as it took a lot of effort for the FAA and industry to properly establish CAST and get the partners on board, ASIAS also needed time. However, CAST's success is why ASIAS was able to work. Today, ASIAS participation represents 99 percent of the operations in the NAS. A key component of this success was establishing a protected environment for this data to come together. The group settled on the FAA's federally funded research and development center operated by The MITRE Corporation (MITRE). Protection of the data was a key factor in persuading labor unions to support the program.

ASIAS data enabled CAST to adopt 22 of its safety enhancements, marking a key transition in using non-accident data to drive safety improvements. The ASIAS program is recognized by the aviation community as one of the foremost enablers of advancing aviation safety.

The program continues to grow, and its efforts have drawn worldwide attention. Similar pilot efforts are now underway in Europe and Asia.

With the founding of ASIAS, the path to collaboration was set.

As CAST and ASIAS gained credibility, the FAA began to solidify its focus on influencing positive change rather than taking enforcement action.

As trust began to grow between the FAA and industry, collaboration increased and participation in voluntary safety programs grew significantly. Participants from all areas of the aviation industry began to attend collaborative meetings to share safety information and lessons learned from operational events at their companies. The industry's mantra was shifting from "don't talk to the FAA" to "safety is not a competition." This marked a defining moment in which safety was treated as a community responsibility, not a competitive advantage. Stakeholders were on board from both government and industry, working together as a unified team. Fatal accidents were becoming very rare.

Congress took note of the value of the collaborative programs, especially the potential improvements ASIAS could unlock with more voluntarily provided safety data. A provision of Public Law 112-95, enacted by Congress on February 14, 2012, provides additional protections for data in ASIAS. This enables the program to grow and expand its data repositories, allowing analysts to study operational factors from routine flights rather than from accident reports. More important, with the greater access to data from numerous air carriers and private operators, ASIAS analysts could explore large amounts of data looking for "precursors" that might help identify safety issues and assess the effectiveness of mitigation strategies. Working groups and other study teams were able to explore these precursors and bring recommendations to CAST on safety mitigations to prevent future accidents. Once adopted by CAST, the FAA and industry began to voluntarily implement these safety enhancements.

As CAST and its working groups continued to work on finding precursors and identifying, vetting, and prioritizing potential vulnerabilities through data analysis, another group was also working on addressing risk in the GA industry. In a story that parallels the beginning of CAST, the GA sector was also experiencing a high fatality risk.

### *General Aviation Joint Steering Committee (GAJSC)*

The GAJSC was launched in 1997 as part of the FAA Safer Skies Initiative to improve GA safety. However, the group gained little traction and ultimately went www dormant. As a vital component of the aviation industry, it was crucial to engage the GA community to improve safety in the NAS. Risks were not isolated to a particular sector of the aviation community, and mitigations required an integrated approach.

**"The ASIAS and CAST combination has been instrumental and extremely effective in improving system safety through analytics and strong collaboration. There is an inherent trust between all stakeholders, knowing above all else that safety is never subordinated and it equally belongs to everyone.**

**—Michael Quiello**
**Vice President, Corporate Safety,**
**United Airlines, 2010-Present**

**ASIAS Executive Board**
**Industry Co-chair, 2014-2016**
**CAST Industry Co-chair, 2016-2019**

## GAJSC Membership

**GAJSC membership includes the following government and industry organizations:**

**Government:**

- FAA
- NASA
- U.S. Department of Transportation
- National Weather Service

**Industry:**

- Aircraft Electronics Association
- Aircraft Owners and Pilots Association
- Experimental Aircraft Association
- General Aviation Manufacturers Association
- Light Aircraft Manufacturers Association
- National Air Transportation Association
- National Business Aviation Association
- National Association of Flight Instructors
- Society of Aviation and Flight Educators

Given the successes of CAST and ASIAS, Secretary of Transportation Ray LaHood's Future of Aviation Advisory Committee called for a new focus on GA. With this renewed push, the GAJSC revitalized in 2011 with updated methodologies and tools to improve safety through data-driven risk-reduction efforts focused on education, training, and enabling use of new equipment in aircraft.

The diversity of GA aircraft and operations meant that it was even more important to collaboratively acquire, share, and analyze aviation safety data than in the commercial environment. The GAJSC initially focused on the leading categories of accidents, identifying accident precursors. To that end, the GAJSC developed an incident-based risk-reduction methodology using accident and incident precursors to identify anomalies and trends.

Armed with new technologies not envisioned at the time of the GAJSC's inception, the group set out to decrease the GA fatality risk by 10 percent between 2009 and 2018. The GAJSC not only achieved its initial goal but surpassed it before 2018, and is now working to establish its next goal of a further 1 percent reduction per year through 2028.

One example of the GAJSC's success with this renewed effort to reduce the risk of fatalities is the focus on angle-of-attack (AoA) indicators in GA. Following the CAST methodology, the GAJSC chartered a Loss of Control Working Group in September 2011. This working group developed safety enhancements to reduce risk by reviewing approach and landing phase loss of control-inflight (LOC-I) accidents. This working group formulated mitigations focused on increasing use of AoA indicators in light GA aircraft to improve pilots' awareness of the state of the aircraft during flight. At that time, AoA indicators were not widely used in GA. Since the push to install AoA indicators, the University of North Dakota (UND) and the Partnership to Enhance General Aviation Safety, Accessibility, and Sustainability (PEGASAS) Center of Excellence performed studies to measure how well AoA indicators have mitigated GA LOC-I risks. UND and PEGASAS both determined that AoA systems improved pilot awareness of aircraft pitch during flight but highlighted the importance of training for pilots to realize the full benefits.

While efforts like this demonstrated the efficacy of the CAST model, the GAJSC also realized the importance of the ASIAS model (proactively using flight data to reduce fatality risk). Before ASIAS could incorporate GA flight data, the GAJSC had to develop a framework to collect and process it. They accomplished this through the development of the National General Aviation Flight Information Database (NGAFID). Designed to facilitate flight data monitoring in GA aircraft, NGAFID permits pilots to replay data from their flights to identify safety risks. By storing and analyzing data from across GA operations, NGAFID provides many of the same benefits to the GA community that other ASIAS capabilities provide to commercial aviation. Participation in NGAFID originally required an onboard flight recorder. To encourage more widespread adoption, the GAJSC and MITRE developed a free app for iOS[4] called the General Aviation Airborne Recording Device (GAARD). GAARD uses the built-in Global Positioning

System (GPS) on a smartphone or tablet to record flight data and can connect to select attitude and heading reference systems to record more robust flight data.

Enabled by the collaboration lessons learned through CAST, the GAJSC and its component working groups have successfully worked with flight training institutions to implement data-driven safety improvements. Examples include establishing information sharing among training institutions and ASIAS, as well as testing new safety technologies to collect data.

### *Aviation Safety InfoShare (InfoShare)*

By this time, government and industry had demonstrated that information sharing is vital to advancing aviation safety, and they were looking for more ways to improve that sharing and reap the benefits.

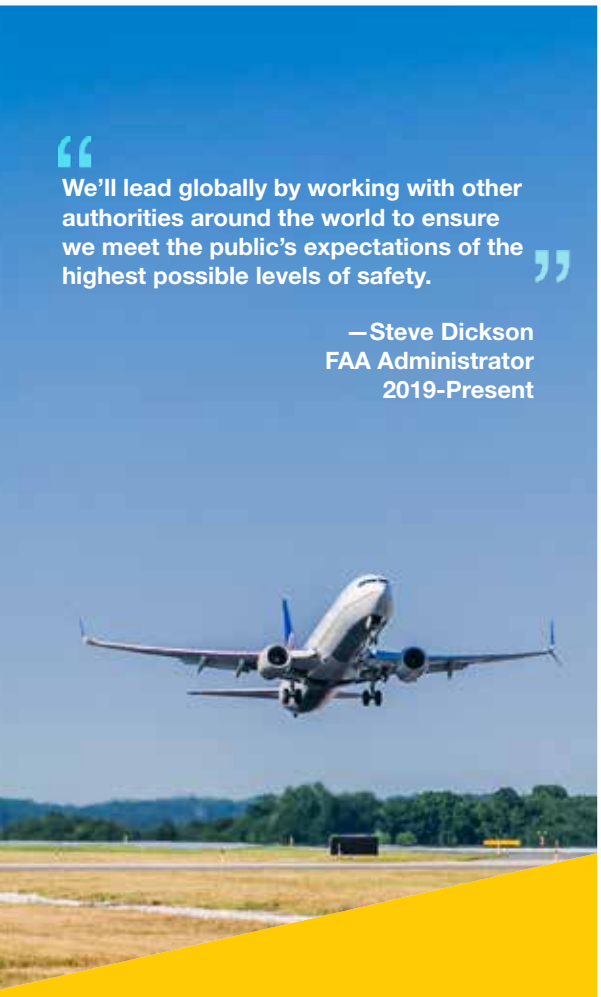
InfoShare was born when representatives from air carriers, labor groups, and industry associations met with the FAA to share safety issues and best practices discovered through voluntary safety reporting programs. Initially these meetings were at an individual operator level, but they eventually led to industry-level sharing. Since that time, InfoShare, an industry meeting where key organizations are invited to participate, has grown in size and scope and meets twice each year for three days. InfoShare attendance now includes more than 1,000 representatives of U.S. and foreign air carriers and other commercial operators; labor associations; maintenance, repair, and overhaul organizations; the FAA; NTSB; NASA; the U.S. armed forces; foreign civil aviation authorities; aviation universities; and commercial and business aircraft operators.

InfoShare's success is founded on the attendees' mutual respect for the confidentiality of all information presented. To ensure the greatest degree of openness, strict protocols are observed. "Rules of the Road" recited at the start of each session emphasize the proprietary and confidential nature of the information presented and underscore the need to protect this information to advance aviation safety.

Insights gained through InfoShare have enabled participants to proactively mitigate systemic risks in the NAS before they lead to significant events or accidents. InfoShare is being modeled by aviation authorities around the world and by other industries to advance safety.


**"By sharing data and best practices with each other, we've proven that safety has no borders."**

**—Michael Huerta**
**FAA Administrator, 2011-2018**



> **We'll lead globally by working with other authorities around the world to ensure we meet the public's expectations of the highest possible levels of safety.**
>
> **—Steve Dickson**
> **FAA Administrator**
> **2019-Present**

## Sharing Lessons Learned around the World to Improve Safety

Since its inception, CAST analyzed commercial aviation accidents and incidents globally to identify safety issues that may not have appeared in the United States. CAST used the data to drive its message of raising awareness of safety issues at engagements around the world and leveraged its safety portfolio to identify potential safety mitigations.

The FAA and industry officials used these forums to meet with regional civil aviation authorities and air carriers to build more direct engagement opportunities. In the early years, few regions had the resources to conduct the in-depth analytical studies undertaken by CAST. By sharing its safety portfolio, CAST was able to assist regions in adapting the portfolio to address local safety risks. These efforts not only helped improve safety abroad but also provided safety benefits for overseas air carriers operating in U.S. airspace.

This collaboration with the international community also provided an opportunity for CAST to promote government and industry collaboration. CAST recognized that the regional teams would play a vital role in advancing safety globally. Therefore, it was critical to help build collaborative initiatives within the regions. Building trust and encouraging the development of voluntary safety programs to provide the regions with sources of data would take time and would need support from international organizations such as ICAO. The result was more formalized international safety teams.

This engagement with international communities evolved into the ICAO Regional Aviation Safety Group (RASG) in each region of the world. ICAO began this program in 2008, with the development of a RASG in the North America, Latin America, and Caribbean regions. These safety teams continue to mature their capabilities over time. Some have developed safety enhancement initiatives, much like CAST's safety enhancements. They have also established formalized information-sharing agreements to help in the analysis of safety issues in their regions of the world.

### *CAST International Outreach*

CAST works with foreign states and regional safety teams to introduce the CAST methodology to regional aviation communities and build momentum for safety initiatives by providing detailed CAST safety plan information based on regional risk data. CAST members then work with regional safety groups to adapt CAST safety enhancements to the particulars of each region. CAST's goal is to reduce fatality risks in worldwide commercial aviation, based not on the number of U.S. passengers traveling to the region but on the fatality risk itself.

CAST members attend and participate in regional safety group meetings and initiatives by providing updates on CAST's work. This includes international data-sharing initiatives similar to ASIAS.

These programs collect voluntarily submitted data from various stakeholders and partners, then de-identify that data and provide it to all participants for use in safety studies.

One such program is Flight Data eXchange (FDX), which was established in 2009. FDX is a component of the International Air Transport Association (IATA) Global Aviation Data Management program, which collects and provides to contributors aggregated, de-identified reports and analyses about industry accidents and incidents, as well as ground damage reports and controlled flight data on more than 2.5 million flights and 100 airports. CAST entered into an agreement with IATA in 2014 to share analytical methodologies and capabilities to help facilitate the sharing of safety issues and mitigation strategies.

Another recent data-sharing initiative is the Regional Data Collection, Analysis and Information Sharing for Aviation Safety (AP-SHARE) program. Launched by the Asia Pacific Regional Aviation Safety Team (APRAST), AP-SHARE began in 2013 when APRAST collaborated with MITRE and FSF to conduct a feasibility study and hold workshops to develop guiding principles for the program. In 2017, they launched a three-year pilot program to demonstrate the benefits of data sharing in the region. AP-SHARE has already generated results in the form of identified issues for future mitigation. The European Aviation Safety Agency launched Data4Safety (D4S) in 2017 based on the results of a 2015 feasibility study to determine requirements and the European aviation industry's interest in this program. ASIAS entered into a collaboration agreement with D4S in 2018 to share analytical methodologies and capabilities.

## Collaborative Model to Improve Safety in Aviation and Other Industries

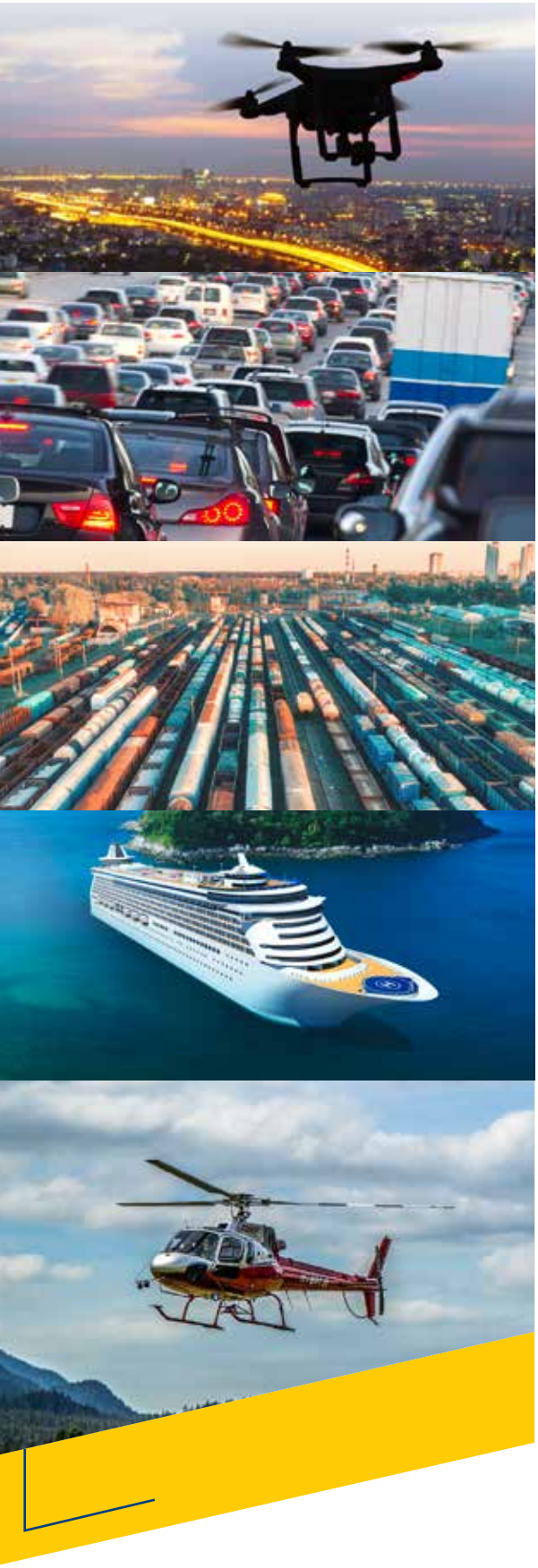
Today, CAST, GAJSC, and ASIAS are established success stories. Because of that success, others are looking to these initiatives as models to help their respective industries. And by their very nature, CAST, GAJSC, and ASIAS are always looking to the future to advance their ability to proactively identify and mitigate risks before they lead to significant events or loss of life.

U.S. commercial aviation is at its safest period in its history. As of December 2019, more than 7.8 billion passengers have been transported in the past decade, with two lives lost. Over the same period, GA pilots flew for an estimated 21,702,719 hours, with less than one fatality per 100,000 hours of flight time. However, the aviation system is not static; it will continue to evolve, presenting new challenges for CAST, GAJSC, and ASIAS. Sustaining this level of safety and addressing emerging risk requires a continued commitment to working together, holding each other accountable, and avoiding complacency.

**"Other industries have started to look to the aviation industry as a model. Last year, NHTSA came to the FAA to learn from us and CAST members on how we achieved such a strong safety record through CAST."**

**—Ali Bahrami**
**FAA Associate Administrator for Aviation Safety, 2017-Present**

**Government Chair of AEB and CAST 2017-Present**



## *Applying Lessons Learned to Other Transportation Modes*

With the considerable safety improvements in the aviation industry over the past 20 years, U.S. commercial aviation has become a model to other industries in the United States. Other sectors of transportation are also looking to duplicate the success of CAST and ASIAS.

In 2016, the National Highway Traffic Safety Administration (NHTSA) held a safety forum titled "Enhancing Safety Culture in Transportation: Lessons Learned from Aviation." The NHTSA invited FAA Administrator Michael P. Huerta and several ASIAS and CAST industry and government members to discuss data collection, analysis, and sharing, as well as safety culture.

The railroad industry is moving toward a similar approach. Amtrak hired an aviation professional who is an expert on safety management systems, and the company hopes to leverage that experience in its own program.

The cruise industry sent representatives to one of the twice annual InfoShare meetings to observe and determine how to translate the InfoShare concepts and best practices to its operations.

ASIAS' focus within the aviation industry is not only on airplane safety. For helicopter safety, there is the U.S. Helicopter Safety Team (USHST), the U.S.-centric subteam of the International Helicopter Safety Team. In the short period since the USHST was founded in 2013, the U.S. civil helicopter industry has experienced a 30 percent reduction in the accident rate. ASIAS is expanding to include data from the helicopter community. The USHST uses the same approach as CAST and the GAJSC, studying safety data and developing safety enhancements for voluntary adoption by the helicopter community.

The drone industry is still too new to have had serious accidents or incidents, but the Unmanned Aircraft Safety Team (UAST) is already working to build on the ASIAS example by developing an incident reporting system to promote the sharing of safety data in a non-punitive environment to facilitate safety studies and help the team develop safety enhancements.

## *Other Industries*

The lessons learned in aviation are applicable to industries outside of transportation as well. In 1999, the National Academies of Sciences, Engineering, and Medicine's Committee on Quality of Health Care in America published a report titled "To Err is Human." The committee determined that at the time of the study at least 44,000 people and as many as 98,000 people died every year in hospitals because of preventable medical errors.[6] In its search for a model for analyzing and preventing these, hospitals adopted techniques advocated by CAST and ASIAS. This includes crew resource management, as well as the voluntary reporting systems that form the basis of the CAST and ASIAS approach. Representatives from the healthcare industry also have attended InfoShare as observers to determine if the voluntary disclosure and mutual respect for confidentiality of presentations at the heart of InfoShare could be adapted to the medical field.

*Looking to the Future*

The next step for ASIAS as it moves into the future of aviation safety is data fusion. The vision of data fusion is to combine all available data to enable a system-level view of safety issues. Analysts working with fused data will not be limited to the narrow view of an event offered by a single safety report or flight data file in isolation. Instead, they will be able to develop a comprehensive picture of circumstances and factors in play by examining data from multiple sources or looking at broader categories of events to identify new trends and risk factors. Analysts could ask questions of the data that were simply not possible before. As fusion comes online, ASIAS will be able to push the science of safety analysis even further by developing advanced modeling capabilities to enable the industry to transition to a more prognostic/predictive capability to manage safety in the NAS.

## Recognition

The results we see today started with the unwavering commitment to aviation safety from a small group of leaders in industry and government. They planted the seeds for these initiatives, and now the entire community is nurturing those efforts through collaborative safety programs. Several industry groups have publicly recognized these accomplishments with awards. In 2006, Aviation Week & Space Technology nominated CAST for its prestigious Laureate Award in the category of Commercial Aviation. In 2008, CAST received the prestigious National Aeronautic Association Robert J. Collier Trophy, which is awarded each year to an individual or organization for "the greatest achievement in aeronautics or astronautics in America, with respect to improving the performance, efficiency, and safety of air or space vehicles, the value of which has been thoroughly demonstrated by actual use during the preceding year." The GAJSC was nominated for the Robert J. Collier Trophy in 2014. In 2015, the U.S. Department of Transportation (DOT) awarded ASIAS the DOT Secretary's Safety Team Award. And in 2018, Aviation Week & Space Technology selected CAST and ASIAS for the Laureate Award in the Commercial Safety category.


**Aviation Week & Space Technology Laureate Award**

**U.S. Department of Transportation Secretary's Safety Team Award**

**Robert J. Collier Trophy**

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1 *At the time of publication, data was available from the Bureau of Transportation Statistics for January 1, 2010, through August 31, 2019. Available at* ***https://transtats.bts.gov/TRAFFIC/****. Last accessed December 10, 2019.*

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*Available at* ***https://library.unt.edu/gpo/NCARC/reports/pepele.htm****. Last accessed December 10, 2019.*

4 *Available from the Apple App Store:*
***https://itunes.apple.com/us/app/general%E2%80%90aviation%E2%80%90airborne/id929718718?mt=8****.*
*Last accessed December 10, 2019.*

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*Available at* ***https://www.nap.edu/catalog/9728/to-err-is-human-building-a-safer-health-system****.*
*Last accessed December 10, 2019.*

Commercial Aviation Safety Team
https://www.cast-safety.org

asias

GAJSC
General Aviation
Joint Steering Committee

General Aviation Joint Steering Committee
https://www.gajsc.org


Aviation Safety Information
Analysis and Sharing
https://www.asias.faa.gov

COMMON TAXONOMY TEAM

CAST/ICAO Common Taxonomy Team
http://www.intlaviationstandards.org

Aviation Safety
INFOSHARE