Industry Innovation and Government Oversight: An Effective Partnership for Safety in the Skies
• 6 million people board airplanes and arrive safely every day

• Fatal accidents occur less than once every 2 million flights

• In 1950s and 1960s, fatal accidents occurred once every 200,000 flights

This report focuses on:

✔ Government Oversight
✔ Manufacturers
☐ Carriers/Operators
☐ Pilots & Training
☐ Defense & Security
Taken by any measure, aviation continues to top the list of the world’s safest forms of transportation. In terms of hours flown, number of passengers transported, and number of aircraft in the air – across commercial, general aviation and cargo sectors – the single most dangerous part about flying continues to be, in the words of one analyst, “driving to the airport.”

Despite intense media coverage of increasingly rare aviation accidents and anomalies, public debate rarely centers on whether aviation is safe, but rather on what accounts for the unique circumstances that lead to accidents.

Well-documented contributors to aviation safety include technological advancements, better materials, improved aircraft design, and effective government oversight of aircraft manufacturing and operations. With a greater focus on safety management principles, a critical part of the government’s role has also been collaborating with industry stakeholders to develop processes designed to identify, share, and incorporate lessons learned from incidents and accidents. Risk-based decision-making, data sharing and safety promotion are becoming the operating norm rather than the exception.

In total, the decades-long upward trend in aviation safety reflects not only technological advances, and the continuous evolution of government regulations and policies, but also the partnership forged between industry and regulators who share the goal of making air travel as safe as possible.

This sustained, joint approach – more than any single advancement– accounts for the significant improvement in air safety since the inception of flight. For the purposes of this report, aviation security – dealing with physical security and protection of people from terrorism and other security threats – is not addressed, other than to note that ongoing industry-government partnership has yielded improvement as well.

Whether in service of aviation safety or security, however, the aerospace industry partnership with government regulators remains symbiotic and essential. Over decades, the Federal Aviation Administration (FAA) has devised systems and processes that leverage industry expertise, technology, and a vast amount of safety data covering areas such as rulemaking, continued operational safety, and product approvals. This successful approach is considered the preferred model by many countries around the world and is the outcome of evolutionary and continuous assessment. When it comes to product approval, the delegation and designee system is one such example. Through a delegation system, the FAA can leverage qualified industry experts and organizations to keep up with ever-increasing market demand for innovative products.

Today’s delegation system has its roots going back to the 1920s, and has evolved to be what is known as the Organization Designation Authorization or ODA. This system allows the FAA to oversee manufacturers’ practices and certification of aircraft and parts to achieve design conformance and compliance with applicable government standards. Central to the success of this model is the recognition of roles and responsibilities between the FAA and manufacturers, increasing confidence in approved processes, and a commitment to allow the systems approach to certification to be institutionalized. A passion for safety is a critical link between the regulators and industry experts that drives continuous improvement of oversight and information sharing. While the system has some detractors, aviation’s safety record speaks for itself.

In an industry with no tolerance for error, however, the quest for safety does not end at a fixed statistical benchmark. It is an ongoing process that must be safeguarded against opposing threats such as unnecessary regulatory changes and public perception that the FAA is allowing “self-certification” or relaxing standards. In today’s global aviation system, no single entity is the sole champion for safety; rather all government and industry stakeholders play critical roles in safety promotion and enhancement.

This report explains how the current approach has led to unprecedented aviation safety, and how the smart evolution of the FAA and an ongoing industry commitment is a combination that will continue to strengthen safety in the skies.
Since aviation safety statistics were first gathered in the 1920s, the number of aviation-related accidents and fatalities has steadily and dramatically decreased. While year-to-year comparisons reveal fluctuations, the safety trend in the industry has been improving for nearly a century. In 1929, for example, there were 24 fatal accidents reported, which amounted to about one accident per every million miles flown. If the same accident rate were applied to today’s air transportation system, which has a fatality rate of .07 per billion passenger miles, the U.S. accident rate would result in nearly 7,000 fatalities per year.\(^3\)

Today’s worldwide aviation safety record is also 10 times better than it was in the 1950s and 60s, as measured against airline departures, which have climbed into the tens of millions over the past 50 years.\(^4\)

In fact, 2014 went on record as one of the safest years for U.S. commercial aviation since 1946.\(^5\)

What accounts for this trend? Early on, aviation industry leaders recognized that safety was an important part of making flight commercially viable. Their urging led to the passage of the Air Commerce Act in 1926, landmark legislation that established air traffic rules, operating procedures and aircraft certifications, and led to the appointment of a senior-level public official in charge of aviation oversight.\(^6\)

As flight technology evolved, the industry expanded and by World War II, technology had matured to a level where aircraft were playing a significant role in military campaigns and strategy. Much of the technology developed in wartime aided the growth of the commercial airline industry and enabled a post-war boom in passenger airline flight. Between 1945 and 1956, U.S. air traffic more than doubled, and the federal government responded in 1958 with the creation of an independent Federal Aviation Agency – the modern precursor to today’s FAA – that provided for “the safe and efficient use of national airspace.”\(^7\)

U.S. Air Carrier Fatalities
(per 100 million persons aboard, Fiscal Year 1946 - March 2014)

![Graph showing U.S. Air Carrier Fatalities](image-url)

Government/Industry partnerships and new technology keep drawing down the accident rate.
Today, operational safety of the skies relies on an effective partnership between the FAA and the aviation industry, which has worked since the dawn of flight on technologies, processes and capabilities that have worked in parallel with the efforts of government oversight agencies.

“FAA authorized delegation has been around a long time – since 1927. The program has evolved tremendously over the past nine decades. It is now a highly effective and continuously improving industry-government partnership. As a member of Boeing’s ODA team, I’m proud of the role I play in ensuring that our airplanes are in compliance with FAA standards.”

– Kathy Landino
Manager, ODA Unit Member
Boeing Commercial Airplanes

### Aviation Safety: Global Trends

- Despite an increase in passenger traffic from 2.9 billion in 2012 to 3.1 billion in 2013, the global accident rate decreased by 13%.

- The number of aviation-related fatalities in 2013 represented a decrease of 53% from 2012, and is 65% below the average number of fatalities over the previous five-year period.

- The number of accidents involving general aviation aircraft in 2013 also decreased by 10% when compared with the average annual accident rate during the previous five-year period.
From improved instrumentation, communications and navigation capabilities, to materials, aircraft design and emergency procedures, the list of industry-enabled safety improvements continues to grow and evolve.

The government has also provided critical testing, certification and support that has allowed the commercialization and widespread deployment of new safety technologies. This tradition includes famous turning points that led to significant improvements in safety industry-wide.

Perhaps none is more cited than pilot Jimmy Doolittle’s Mitchell Field flight on September 24, 1929, when he conducted a test of new navigation technologies in thick fog for the world’s first “blind” flight. On board a Navy Consolidated NY-2 with a new altimeter runway homing indicator, he completed a 10-minute flight utilizing only instruments, radio beacons, and the help of ground radio operators. In 1933, Boeing incorporated these innovations into the 10-passenger Model 247 for United Airlines, propelling the industry to a new level of safety.

Decades later, other technologies followed that continued to address the most prevalent challenges encountered by pilots including poor visibility, adverse weather, terrain, sensory confusion and stalls. Several innovations formed the foundation for a system that eventually established commercial airline flight as the safest mode of transportation in the world.

Ground Proximity Warning Systems (GPWS) were introduced in the 1970s to prevent “controlled flight into terrain,” in which a pilot, while still in control of the aircraft, unknowingly flies into the ground, an obstacle or a mountainside. The FAA soon began requiring operators to install GPWS equipment on their large aircraft. A type of Terrain Awareness Warning System (TAWS), these systems today have evolved to include Enhanced GPWS that uses GPS and aircraft inputs such as position, attitude, airspeed, glideslope and internal terrain databases to alert pilots to an impending collision.

Traffic Collision Avoidance Systems (TCAS) are also credited with reducing the number of aviation accidents. Also known as Airborne Collision Avoidance Systems, these airborne technologies are designed to increase flight crews’ awareness of nearby aircraft and serve as a last defense against mid-air collisions.

Perhaps one of the most important safety technologies introduced to 20th century flight was the modern jet engine. In the early 1960s, engine failures resulting in in-flight shutdowns occurred at an approximate rate of 40 per 100,000 flight hours. Today, the engines installed on the current generation of aircraft have a failure rate of less than 1 per 100,000 flight hours.11

And they continue to improve. According to a 2010 study, current high-bypass turbine engine designs today are 2-3 times less likely to experience a blade or disk failure versus those produced when jet engines first entered service.12

In the unlikely event of an accident, improvements to aircraft structures and interiors have increased the likelihood of surviving an impact or fire. Today’s airplane seats are required to withstand more than twice the amount of dynamic force as those introduced in the 1930s, and must also meet updated FAA standards to protect against head injuries.13 The FAA also requires the use of “self-extinguishing” fire-resistant materials in aircraft passenger cabins and components. This regulation means the material must stop burning on its own after a flame source has been removed. This standard applies to nearly any exposed surface in the cabin, and also to electrical wire and cable insulation.14

These and other improvements are credited with high survival rates among passengers involved in airline accidents. A report by the National Transportation Safety Board found a 95.7 percent passenger survival rate across 639 serious accidents from 1983-2000. According to the NTSB, the “large number of people who survive even the most serious accidents emphasizes the importance of work aimed at ensuring that crash survivors can safely remove themselves from the accident aircraft.”15
CAST PROGRAM: Reducing Aviation Fatalities

Founded in 1998, the Commercial Aviation Safety Team (CAST) has developed an integrated, data driven strategy to reduce the commercial aviation fatality risk in the United States and promote new government and industry safety initiatives around the world. This group operates under the direction of government and industry co-chairs, and identifies precursors and contributing factors of the most prevalent categories of risk that pose the greatest threat to loss of life. By encouraging industry stakeholders to focus resources on the most prevalent risks, CAST has been able to reduce the risk in commercial aviation posed by icing, maintenance, contained engine failures and other factors.

When CAST was founded, its goal was to reduce the commercial aviation fatality rate in the United States by 80 percent by 2008. By 2008, CAST was able to report that by implementing the most promising safety enhancements, the fatality rate of commercial air travel in the United States had been reduced by 83 percent.

CAST is now moving beyond the historic approach of examining past accident data to a more proactive approach that focuses on detecting risk and implementing mitigation strategies before accidents or serious incidents occur. The goal over the next decade is to transition to prognostic safety analysis, and the group now aims to reduce the U.S. commercial fatality risk by 50 percent from 2010 to 2025.
Meanwhile, the FAA is in the midst of a major upgrade of the nation’s air traffic control system. The Next Generation Air Transportation System – called NextGen – updates a woefully out-of-date segment of the transportation infrastructure and holds tremendous promise for air travelers and the U.S. economy.

The nation’s current ATC system of beacons, radars and radios is based on aging and often ineffective technology. Despite the advent of advanced GPS and digital technology, the current system steers aircraft toward radio beacons installed in the same locations where bonfires guided cross-country airmail flights in the 1920s. Flights are guided in straight lines between a series of fixed points and controllers ask pilots via radios to increase or decrease altitude in steps – rather than by more efficient gradual and continuous descents and climbs.

NextGen will bring air traffic control fully into the 21st century, greatly advancing aviation safety. Thanks to NextGen’s GPS-based navigation systems, for the first time pilots and controllers will be able to look at the same real-time displays of air traffic. Controllers and pilots will also communicate using data and text, sent digitally, rather than relying on radio voice communication, which can be unreliable and lead to serious – sometimes fatal – errors.

But despite the benefits promised by new systems such as NextGen, industry experts warn that technological solutions to safety challenges will only become more elusive.

Experts also say that as catastrophic failures become increasingly rare, lessons learned from investigations – while invaluable – will also yield less information to an already vast body of knowledge about accidents and their causes.

“The sample [from accidents] is so small, you won’t have effective data sampling,” says Hank Krakowski, former co-chairman of the Commercial Aviation Safety Team, a joint effort of government and industry leaders that is focused on further improving aviation safety. Instead, experts say, the most viable approach today is the analysis of data from safe flights.16

Accident avoidance, however, is just one aspect of aviation safety. As critical for achieving long-term safety goals are, the processes and coordination commitments made by industry and government continue to drive the sector’s extraordinary safety record.
The U.S. aviation industry not only provides critical safety technologies to the nation’s air transportation infrastructure, but also acts as an extension of the FAA in determining compliance with design, manufacturing, and maintenance regulatory requirements. This privilege is only granted to qualified individuals or entities after they have met stringent FAA requirements and have demonstrated consistent performance as determined by the successful outcome of detailed FAA reviews.

Since the 1920s, the FAA has been authorized by Congress to delegate authority to private citizens to help accommodate the rapid introduction of new products and expansion in the aviation sector. Today, the FAA’s “Organization Designation Authorization” (ODA) is granted to companies that maintain an approved system of procedures, manuals and personnel that meet government standards for collaboration, technical knowledge, and procedural rigor – qualifying them to act on the FAA’s behalf to determine compliance and conformance with applicable standards. A manufacturer with ODA authority, for example, is approved to perform FAA-audited certification activities associated with the design and production of a new aircraft, right down to individual parts.

The individual designees and delegated organizations augment the activities of more than 1,300 FAA certification staff. Their role is significant at a time when the growing number of aircraft in service, the technical complexity of modern aviation systems and new technologies entering the market threaten to strain government resources for aviation safety and oversight. When the Boeing 737 entered service in 1968, it contained approximately 400,000 parts. Today, the 787 is manufactured using 2.3 million parts, a 777 has 3 million parts, and the new 747-8 contains at least 6 million parts – each of which requires FAA approval. In addition, aircraft manufacturers today source parts from worldwide supplier networks, requiring the FAA to monitor locations that might include Dubai, Vietnam or Morocco.

It is simply not possible – from a resourcing or logistical perspective – for the FAA to be directly involved in monitoring millions of aircraft parts originating from sources around the globe.

The solution has been to evolve the oversight system from individuals to organizations and leveraging robust processes and systems to produce compliant and conforming products consistently. This shift did not occur overnight; rather it has been underway since the 1950s. In 2009, the FAA consolidated all types of delegated authority into a single system, known as ODA. This move allowed further efficiency and consistency in the FAA oversight model and facilitated standardized audits and oversight of large and complex design, manufacturing, and maintenance facilities.

For nearly a century, the delegation of FAA authority has progressed in parallel with the steady and dramatic improvement of flight safety in the United States and around the world. Today, the FAA is on the cusp of moving

“\nThe ODA delegated to HEICO permits a tighter cooperation and optimized use of both FAA and HEICO resources. This partnership has allowed me to be part of a highly successful and robust certification program.”

Marco Cuberos
ODA Administrator,
HEICO Aerospace
forward with more advanced methods of product approval and oversight, based on Safety Management System (SMS) principles. These efforts are consistent with the congressional mandates to maintain U.S. global competitiveness and reduce the time for introducing new products into the market. More importantly, given the current budgetary environment, these advanced methods are necessary to allow FAA to do more with less and focus on important initiatives to enhance domestic and international air transportation systems.

The aviation industry welcomes these changes and will continue to be an active player in the development of the necessary regulatory standards and guidance materials. However, growth in aviation and trends in manufacturing and business models are outpacing the FAA’s transformation. Congress recognized this, and through Sections 312 and 313 of the FAA Modernization and Reform ACT (FMRA), that mandated FAA to work with industry and reduce certification delays and inconsistencies in regulatory interpretation.

An expanding global supply chain and increase in aircraft complexity are straining oversight resources.

SOURCE: BOEING

Evolution of FAA Delegation

1920s-40s
Individual delegations established (DER, DMIR, DPE, etc.). Allowed FAA to authorize qualified individuals to approve certification data on behalf of the FAA.

1950s

1960s
Designated Alteration Station (DAS) – “Organizational” delegation for operators, repair stations and modifiers. Permitted FAA to designate qualified modifiers and repair stations to perform a certain certification tasks.

1970s
SFAR 36 – “Organizational” delegation for operators and repair stations. Permitted FAA to designate qualified air carriers to approve repairs made to their fleet of aircraft.

1980s
“Individual” delegation established for Designated Airworthiness Representatives (DARs). Permitted FAA to designate qualified manufacturing/maintenance inspectors to conduct certain actions on behalf of the FAA.

1990s
ODAR – “Organizational” delegation for Production Approval Holders for quality systems. Permitted FAA to designate qualified production approval holders to perform certain inspection functions.

TODAY
ODA – “Organizational” delegation for all organization types. Consolidated all forms of organizational delegation (DOA, DAS, SFAR 36, ODAR) into a single designation system to standardize processes and enhance oversight.

FUTURE
CDO – Certified Design Organization. When implemented will entitle qualified entities to perform certification functions through a process other than delegation.
Certification Streamlining

In response to section 312 of the FAA Modernization and Reform Act of 2012, the FAA's Aviation Rulemaking Committee (ARC) made recommendations to streamline certification. In 2013, the FAA streamlined the project sequencing process to include a more collaborative approach between certification applicants and the FAA's aircraft certification offices.

This new process was recently implemented, employing best practices and existing tools to improve a process for establishing priorities for certification of products that lacked transparency and, in some cases, created significant certification delays.

Another recommendation was designed to bring about systemic changes in the way new approaches, tools, and practices are introduced within the FAA's Aircraft Certification Service. Still awaiting implementation, this recommendation would influence the change-management process and stimulate cultural change within the FAA workforce. Despite implementation of certain recommendations, the net benefits of certification streamlining have yet to be realized. This requires real transformation in the way FAA works. Unless FAA and industry seek out effectiveness measures that focus the FAA staff's involvement on projects based on risk the parties won't be able to work together to improve systems performance and the expected improvements will continue to be elusive and unachievable.

“Incorporating ODA has fostered an increased level of communication and cooperation between all levels of the FAA and Honeywell.”

Chris Eick
ODA Lead Administrator, Honeywell
Consistency of Regulatory Interpretation

Another FAA rulemaking committee has addressed the regulatory inconsistencies, as called for by Section 313 of the FAA Modernization Act. Also awaiting implementation, “Section 313” would address compliance challenges arising from midstream alterations in processes certified during planning but requiring changes during the actual project. These types of changes are often costly and “unacceptable” to the organizations requiring certification.19

Certified Design Organization

Certified design organizations provide an ideal way for the FAA to leverage the experience and track record of manufacturers to handle day-to-day certification activities while allowing the FAA to focus limited resources on safety critical trends and issues. This approach, now explicitly authorized and encouraged by Congress, is a positive and significant step toward further improving and streamlining the current certification process.

These and other changes will solidify FAA processes as the “gold standard” for global aviation safety, but challenges loom on the horizon. Competition from a growing number of international entrants threatens the U.S. position as the dominant provider of the world’s aircraft and aviation systems – a leading position that adds significantly to the country’s GDP, supports millions of jobs and contributes to a U.S. trade surplus in the aerospace sector. The certification process must evolve in order to preserve and strengthen U.S. competitiveness for the next century of flight.
In its vision for transforming the nation’s aviation system, the FAA has set forth ambitious safety goals. The agency aspires to “transform the way we assure safety by expanding our safety culture to enhance standards and oversight [and] take action to manage risk by proactively identifying hazards and risk based on continuous analysis of data.”

The U.S. aviation industry is in total alignment with this vision and will continue to support any activity that leads the aviation community closer to these goals. Industry efforts, in partnership with the FAA, have produced an unprecedented level of safety in the skies. Through its collaboration with regulators, the industry maintains a long-standing commitment to develop and strengthen processes, technologies and standards that ensure the ongoing improvement of aircraft and flight safety.

In light of budget realities that both FAA and industry are facing, it is paramount that we dedicate our precious resources on breakthrough efforts and activities that result in improvement that are measured in leaps rather than inches. The FAA’s model of delegated authority is effective and can be improved upon, but what’s long overdue is a transformation of the certification process. Having SMS and Certificated Design Organization (CDO) in place will enable the aviation community to reach the more advanced methods of product approvals and oversight. This transformation must begin now through cultural changes at the FAA to maximize the flexibility ODA provides, and recognize and reward those stakeholders who contribute to success of this transformation.

The exchange of information between industry and government is critical. Government leverages industry expertise, and benefits from industry safety data shared by operators, suppliers and manufacturers. In doing so, the FAA can more effectively use its authority to oversee a system that continues to expand at an impressive pace.

Continuing to streamline and expand FAA delegation will allow industry to focus on new capabilities that will strengthen aviation safety while freeing the FAA to prioritize the use of public resources on systemic examinations of long-term safety trends. Combined with adequate FAA resourcing and a commitment to NextGen deployment, these are among the steps that will help propel aviation safety to the next level and through this exciting next century of flight.
“We have the technology and processes in place to scale our aviation safety infrastructure to meet the demands of the 21st century. The question is whether policies, programs and regulations will evolve in time. I maintain that we are in a golden age of aviation safety, and I am optimistic that effective industry and government collaboration will continue to offer the best path forward toward safeguarding our skies.”

– Marion Blakey
President & CEO
Aerospace Industries Association.
1 Boeing: http://www.boeing.com/boeing/commercial/safety/
4 Boeing: http://www.boeing.com/boeing/commercial/safety/
6 http://www.faa.gov/about/history/brief_history/
7 http://www.faa.gov/about/history/brief_history/
9 Ibid.
20 FAA: “Destination 2025.”