Testimony of Kerry Buckley, Ph.D.
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House Transportation and Infrastructure Committee
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Chairman Graves, Ranking Member Larsen, and distinguished members of the Transportation and Infrastructure Committee, thank you for the opportunity to testify before you on the past, present, and future vision of aviation safety. My name is Kerry Buckley, and I am a Vice President at The MITRE Corporation, a 501(c)(3) not-for-profit corporation. We are chartered to operate in the public interest, which includes operating federally funded research and development centers, or FFRDCs, on behalf of federal agency sponsors. We currently operate six FFRDCs.

I am also the General Manager and Director of MITRE's Center for Advanced Aviation System Development (CAASD), which is the Federal Aviation Administration's (FAA's) FFRDC. MITRE has supported the FAA for more than 60 years as a trusted and objective mission partner, providing technical expertise in air traffic management systems engineering, aviation operations, airspace design, and systems automation and integration.

The United States has the largest, most efficient, and safest aerospace system in the world. We have achieved this safety record through a shared commitment to safety by members of the aviation community, from ground crews deicing aircraft, to FAA inspectors, and from aircraft designers to mechanics.

We have also achieved this safety record through continuous, world-leading innovation: from automated collision avoidance systems a half century ago to satellite-based position, navigation, and surveillance today. U.S. aviation continues to be a leader in, among other areas, the application of human factors and the development of simulator-based training.

The Role of Public-Private Partnerships in Innovation and Safety

It was the aviation community's shared commitment to safety that facilitated the trust and cooperation required for the development of the Aviation Safety Information Analysis and Sharing, or ASIAS program, a collaborative safety analysis and data sharing initiative focused on detecting risks before they result in accidents.

The FAA, aviation industry, and MITRE launched ASIAS in 2007. ASIAS enables risk-based assessments of emerging systemic hazards as the foundation of decision-making to advance safety. This public-private partnership (PPP) is an active, robust example of how 15 years of dedicated collaborative data sharing can have a positive impact in advancing safety.

Since its inception, ASIAS has completed over 150 studies, which have resulted in the voluntary adoption of systemic mitigations, including over 20 Commercial Aviation Safety Team, or CAST, safety enhancements, as well as numerous other localized mitigations to reduce aviation risk.

One example is an ASIAS study that identified the reasons behind the higher-than-expected incidence of flap misconfigurations on takeoff. It concluded that the potential for takeoff misconfiguration events occurs most frequently when flights are running behind schedule and pilots feel rushed to complete their takeoff duties. In particular, freezing temperatures and deicing conditions can interfere with the normal checklist flow for departures.

To reduce the risk of human error identified by ASIAS, the FAA issued Safety Alert for Operators (SAFO) 14005 to quickly raise awareness of the potential for flap misconfiguration during takeoff. It did so within weeks of the ASIAS findings to alert flight crews about the issue before it could become a more significant risk as the winter season approached and temperatures dropped. Three subsequent CAST safety enhancements were adopted to reduce the number of flap misconfiguration events on takeoff.

In 2015, ASIAS received the Department of Transportation Safety Award, and in 2018 ASIAS and CAST received the Aviation Week Laureate Award, which recognized this unparalleled collaboration between government and industry to improve aviation safety. Having exceeded its first 10-year goal in reducing U.S. commercial aviation fatality risk by 83%, CAST now aims for further reductions in risk, leveraging industry data and analytical tools from ASIAS.

MITRE is privileged to be the ASIAS Trusted Third Party, serving as the trusted bridge between government, industry, and other participants. MITRE serves as data steward, providing the secure data environment and related capabilities to protect and manage stakeholder data and results, while also executing technical work to answer partner-approved research questions.

ASIAS information is used solely for the identification, monitoring, and mitigation of systemic safety issues. ASIAS stakeholders voluntarily submit sensitive data (e.g., on-board Flight Operations Quality Assurance data and safety reports), enabled by assurances in 14 Code of Federal Regulations (CFR) Part 193 that the safety information they disclose will not be used punitively. While 14 CFR Part 193 provides protection from punitive action, participants in ASIAS are voluntarily providing sensitive data daily, and they must trust that it will be protected from other uses that could impact their business. Trust is the bedrock of the ASIAS program.

When ASIAS launched 15 years ago, four commercial airlines agreed to participate and share data for the greater good. Today, there are over 45 participating airlines, representing over 99% of all U.S. domestic commercial operations. Ten years ago, the program expanded to include general aviation, and today MITRE has executed over 150 data sharing and participation agreements with general aviation operators and data aggregators. Most recently ASIAS expanded to include participants from the rotorcraft community.

The ASIAS process starts with the intake and integration of various types of data to create a holistic “flight story.” Crucially, ASIAS processes require data de-identification (for example, the names or other identifying information for participating organizations and individuals), ensuring that the focus remains on addressing systemic safety issues in a non-punitive manner. This data is the foundation for studies and metrics that identify systemic hazards and their contributing

factors. Study results are shared with safety teams, such as CAST and the General Aviation Joint Safety Committee, or GAJSC, to develop mitigation solutions, such as adoption of procedures, training, or equipment to reduce the likelihood of accidents in the future.

Public-private partnerships like ASIAS ensure success by moving at the speed of trust. Trust has been a core value critical to the health and success of ASIAS since its inception. To endure, public-private partnerships like ASIAS require a foundation of trust in each partner's commitment, believing that each party will follow through in good faith according to their agreements. Trust underlies a public-private partnership's ability to adapt to changing circumstances and objectives.

The ASIAS model has been so successful that it has been leveraged in other industries. One example is the Partnership for Analytics Research in Traffic Safety, or PARTS. PARTS applies the same collaborative principles we learned from ASIAS to the automobile industry, which is itself experiencing rapid innovation. MITRE has worked with the National Highway Traffic Safety Administration (NHTSA) and nine original equipment manufacturers, or OEMs, that together represent almost 80% of the U.S. market, to increase safety for the American driving public. Moving at the speed of trust has enabled PARTS to rapidly move from initial exploratory meetings in 2017 to executing agreements and finishing an initial Phase 1 pilot study by 2019.

Partners proved willing and able to transfer sensitive data including OEM build records, warranty records, and crash records, and work collaboratively to conduct safety research. They agree that this model offers an improved ability to gain real-world insights into the performance of safety technologies, offering opportunities to learn from each other and improve safety for all. This is particularly striking in an industry that competes on safety, often highlighting safety achievements in television advertisement and other marketing materials.

PARTS recently released the results of the largest government-automaker study to date about the real-world performance of advanced driver assistance systems (ADAS) in passenger vehicles. This study shows that vehicles equipped with forward collision warning (FCW) and automatic emergency braking (AEB) avoid approximately half of front-to-rear crashes and that AEB performs in all conditions—even when roadway, weather, and lighting conditions are not ideal. The study also shows that vehicles equipped with active intervention technologies to help drivers stay in their lane are effective in single-vehicle crashes that lead to serious injury. A key strength of the study was the scope of cross-industry data on which it was based, made possible by the PARTS collaboration. Participating auto manufacturers provided vehicle equipment data for 47 million passenger vehicles from model years 2015–2020. Added to that was data from 12 million police-reported crashes from 13 states, provided by NHTSA. MITRE combined these data sources to analyze the effectiveness of six ADAS features in avoiding roadway crashes: FCW, AEB, and Pedestrian AEB (all designed to help prevent collisions) and lane departure warning, lane keeping assistance, and lane centering assistance—features designed to help ensure that drivers remain on the roadway. The report, prepared by MITRE, was published in November 2022.

Another example leveraging the ASIAS model is the Railroad Information Sharing Environment (RISE), which is a voluntary, non-regulatory, non-punitive, data-driven safety partnership consisting of railroad stakeholders, including Federal Railroad Administration, to advance railroad safety.

These examples illustrate how industry working together at the speed of trust can achieve great things for the American public. With the support of a trusted third party, like MITRE, this model could be applied to other safety-sensitive and critical areas like pipelines, supply chain, and more.

That said, the National Airspace System (NAS) continues to expand and change both in capability, via FAA's Next Generation Air Transportation System (NextGen) initiatives, and in operational tempo, with the advent of Uncrewed Aircraft Systems (UAS) and the continued growth of aerospace operations. New safety challenges demand rapid implementation of solutions to discover and prevent hazards before they become incidents or accidents.

ASIAS should increase the velocity at which data is collected, processed, and analyzed to share safety intelligence more quickly with its stakeholders and the broader aviation community. Additionally, new entrants, such as UAS, offer new challenges to aviation safety. ASIAS should look to adapt to these emerging risks and create new tools to analyze previously unknown concerns.

In the future, ASIAS must also advance its predictive capabilities. ASIAS already has tools to proactively identify and examine safety concerns that can lead to accidents; however, predictive capabilities could go further by anticipating the likelihood of future outcomes. For example, artificial intelligence (AI) would give safety teams and stakeholders the awareness and tools necessary to more rapidly inform decision makers of safety issues.

Additionally, ASIAS can have an even greater impact by increasing external collaboration on analyses conducted by the program. ASIAS should identify ways to evolve shared data environments where internal program analysts, external stakeholders, and aviation safety researchers can come together to spur innovation while adhering to the program governance requirements. It is through this collaboration that the ASIAS program can continue to be a leader in the global adoption of a non-punitive safety culture.

Modernizing and Integrating Safe National Aerospace Operations

The FAA's NextGen modernization program has, over the past 20 years, achieved critical advances in efficiency and safety, including Performance-Based Navigation standards, satellite-based operations, and data analytics for accident prediction and prevention. NextGen has created a strong foundation for where we are today—at the precipice of a new and more challenging evolutionary leap.

Looking forward, we have a new set of challenges and opportunities. Software-intensive systems, autonomous aircraft, and cybersecurity, to name a few, combined with developments in the UAS and commercial space industries. New approaches to addressing these challenges will continue to improve safety and facilitate the operations of all participants, from new entrants to the original entrant: America's general aviation.

But many of these innovations cannot come to fruition without an effective FAA. As both the aerospace regulator and the operator of the air traffic control system, the FAA is often a pacesetter in the development and implementation of new systems and technologies. On the regulatory side, it determines what is allowed and what is mandated, and the processes and standards to do so must keep pace with the aviation environment.

While safety is the overriding objective, the FAA has an essential role in increasing efficiency, capacity, and opportunities for growth in aviation. The FAA-published Charting Aviation's Future: Operations in an Info-Centric NAS outlines how the agency will build on NextGen and the foundations of Trajectory-Based Operations to create a more agile and flexible NAS for all airspace users. When NextGen implementation began in 2008, few could have predicted the multitude of new technologies, operations, and opportunities in aerospace and multi-modal transportation systems that the next 15 years would bring. This future requires more agile and scalable automation solutions that can extend to many more air traffic facilities, while also ensuring that these solutions are resilient to adversaries and system failures. The future NAS must safely accommodate these transformational changes, and the FAA's vision serves as an initial approach to do that.

In addition, the Department of Defense's (DoD) airspace needs for readiness training and research continue to evolve, placing additional demands on the NAS as a shared resource. A cross-agency perspective is vital to safely accommodate these competing demands for airspace in a flexible and efficient manner. In this regard, I want to commend this Committee for supporting Section 1093 of the Fiscal Year 2023 National Defense Authorization Act, which authorized the FAA and DoD to conduct a pilot program to explore new ways to manage special activity airspace to better meet the needs of both organizations.

Enactment of a forward-looking FAA Reauthorization bill will better position and enable the FAA to deliver on its daily operations, its modernization efforts, and its role in research and development. Delays in modernization programs increase both sustainment costs and the eventual cost of modernization, squeezing the FAA's budget from both sides. Ensuring that the modernization plans begun under NextGen are completed, especially those for Trajectory-Based Operations, should be a priority. There is a risk to system reliability and safety if we do not accelerate the shift from sustainment to modernization. This will require both substantially reducing sustainment costs and prioritizing those modernization activities most critical to NAS evolution. Planning and carrying out the necessary streamlining and improvement activities poses a considerable strategic challenge for the FAA, involving many competing demands and priorities that FAA has historically struggled to balance.

Moving Toward a Safe and Optimized Regulatory Framework

Today, the FAA assures safety for commercial and general aviation through a rigorous process of regulation, approvals, and compliance checking. These processes are appropriate for a mature industry with aviation operations that have been standardized over decades of development. However, they are not agile in the face of innovation and an increasingly diverse fleet because they presuppose an ability to match legacy regulations to new vehicles and operational concepts. As a result, the FAA must issue numerous waivers and exemptions, and dedicate significant staff effort to adapt the traditional "means of compliance" regulatory approach to these new entrants. Within this system, the FAA's primary means of scaling to demand is to delegate authority to review compliance, but with new entrants and technologies, that option creates challenges and concerns around the FAA's limited familiarity with the new product or service.

The scale and complexity of the NAS are compounded by the speed of change. We all are familiar with nearly daily updates to the software on our phones and computers. Under the current regulatory approach, changes to software on aviation systems on the ground and in the air require the same level of rigor and review as changing physical components such as engines. The current approval processes were not designed to support daily changes and an iterative product design process, and cybersecurity threats make the need for daily changes more necessary than ever. To keep pace with innovation while ensuring the safety of the NAS, a system is needed that scales by holding regulated parties accountable not just for compliance, but also for the safety performance of their products and services.

The FAA describes this performance-based system in the U.S. State Safety Program (US SSP) submitted to the International Civil Aviation Organization (ICAO). It presents how the FAA will evolve its safety management practices in a holistic manner by building on safety management principles to proactively address emerging risk. Such a data-driven, proactive management of safety performance is possible through the collaborative efforts of all parties to monitor their safety mitigations and anticipate points of weakness in the system.

Collaboration is different from more delegation, as a performance-based system leverages the safety management systems of operators, manufacturers, maintenance and repair stations, airports, the air traffic organization, and others to monitor the safety performance of the entire system from a 360-degree perspective. This focuses the approval and oversight functions on the highest risk areas based on performance data, and more importantly on predictions of growing areas of concern. Multiple perspectives provide independent verification of the data and events.

A performance-based regulatory system, by combining ubiquitous data from the digital revolution with advanced analytics to manage safety performance, could work in ways that are more predictive, adaptive, and agile.

- Predictive: Advanced analytics such as AI could drive proactive adjustments to mitigations, inform holistic review strategies for organizations in greater need of oversight, and provide more timely safety intelligence to guide actions that resolve areas of higher risk.
- Adaptative: The emphasis on monitoring performance will provide FAA and the community with a basis for creating performance-based standards and regulations that are adaptable to innovations of the emerging fleets. The FAA needs authority to flexibly respond to the diversity of ideas from industry.
- Agile: Safety management systems manage risk by continuous, incremental adjustments and self-correction. This should shorten the time that risks remain in the system by creating a community effort to spot and correct issues from multiple perspectives – operator, OEM, maintainer, etc.

By accelerating its transition to a data-driven performance-based agency, the FAA can significantly advance its goals of improving safety, increasing efficiency, and remaining world leading. To do so, the FAA needs the legislative authority to deploy this approach. Working with Congress, the FAA can create the appropriate regulatory framework focused on performance safety outcomes while retaining the authority to spot check compliance.

In addition, the FAA must continue to build a robust safety culture across its workforce, including use of Safety Management Systems, and a program of continuous safety training. This includes applying objective and repeatable methods to ensure adequate staffing to meet operational needs while balancing emerging workforce trends, in addition to evaluating potential improvements to how to accomplish medical certification for key roles like pilots and air traffic controllers to enable a modernized and more human centered, data-driven risk-based approach.

Achieving World-Class Cybersecurity

Safety also means ensuring our systems are resilient and protected from cyber adversaries. NAS dependency on GPS is increasing. Risks to the FAA from cyber-attack and cyber-compromise are substantial. As the FAA continues to evolve its computer and automation systems, those risks grow.

As cybersecurity adversaries become more sophisticated and threats increase, there is a continuing need to assess FAA systems for vulnerabilities to emerging threats. As digital transformation accelerates across private industry and government, new capabilities such as cloud, the proliferation of mobile devices, and a growing need for data sharing across the aerospace ecosystem, increase the need for a modernized cybersecurity approach that is built upon appropriate authentication and authorization. The infusion of proven cybersecurity technologies and methodologies into FAA operational capabilities must keep pace with modernization efforts.

Closing Remarks

Ensuring that the FAA retains its position as a global leader will require a collaborative partnership with industry to map the future. Industry, academia, international partners, and other associations, non-profits, and FFRDCs, must work with the FAA to innovate together. Likewise, interagency cooperation has never been more crucial than right now.

At The MITRE Corporation, we are a proud part of the aerospace community focused on innovation. As many of you know, MITRE has been and continues to be involved in every safety innovation and safety challenge that I have mentioned today, and more. We will continue to support the FAA and the aerospace community in the search for solutions to our most pressing challenges so we can all realize the benefits of a safe and modern aerospace system.

Thank you for the opportunity to provide a statement. I am happy to answer any questions the Committee may have.