

Challenges and research for an evolving aviation system

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A comprehensive aviation safety system as envisioned by NASA would require integration of a wide range of systems and practices, including building an in-time aviation safety management system (IASMS) that could detect and mitigate high-priority safety issues as they emerge and before they become hazards, says a [new report](#) by the National Academies of Sciences, Engineering, and Medicine. An IASMS could continuously monitor the national airspace system, assess the data that it has collected, and then either recommend or initiate safety assurance actions as necessary.

"Commercial aviation in the United States and most other regions of the world is the safest mode of transportation," said Kenneth Hylander, past chairman of the Board of Governors at the Flight Safety Foundation, executive vice president of safety at Amtrak, and chair of the committee that conducted the study and wrote the report. "This high level of safety is the result of many factors, including decades of investments by industry and government and the dedication of researchers, engineers, pilots, air traffic controllers, and a great many other members of the aviation community. As the national airspace system is constantly changing, it is time to develop a new, real-time safety assurance system."

The report envisions an IASMS that can collect data on the status of aircraft, air traffic management systems, airports, and weather, and then assess the data second by second, minute by minute, and hour by hour to detect or predict elevated risks quickly. Additionally, the IASMS would focus on risks that require safety assurance action in-flight or prior to

flight, such as making a decision to postpone or cancel a flight until flight conditions change or equipment is repaired, for example. Safety assurance actions generated by an IASMS may take the form of recommendations that operators take action upon or, when urgent action is required, IASMS may be designated to initiate safety assurance actions autonomously.

Successful development of an IASMS will require overcoming key technical and economic challenges, and the task of maintaining a high level of [safety](#) for commercial airlines is complicated by the dynamic nature of the national airspace system—the common network of U.S. airspace, airports or landing areas, aeronautical information, rules, regulations, and procedures, technical information, and manpower and material. As the national airspace system evolves to accommodate the increase in number of flights and numerous new entrants, such as increasingly autonomous systems, [aviation safety](#) programs must also evolve to ensure that changes to the national airspace system do not inadvertently introduce new risks.

The report recommends 10 high-priority research projects for consideration by agencies and organizations in government, industry, and academia with an interest in developing an IASMS for the national airspace system. Of these 10 projects, developing a detailed concept of operation for an IASMS is judged by the committee to be of the highest priority and will involve considering multiple possible system architectures, evaluating key trade-offs, and identifying system requirements. For most of the research projects, meeting the needs of an IASMS will likely require a mix of new technologies, improvements to existing technologies, and/or the application of existing technologies developed for other applications.

Each recommended project would rely on academia, industry, and government agencies to develop new technologies and products

associated with the development of an IASMS. The committee specifically called on academia to participate in research at lower levels of technology readiness and on industry to focus on more advanced research and product development.

Furthermore, government agencies should support research and development consistent with their own organization's mission objectives and the desired nature of the given organization's research portfolio in terms of risk, technical maturity, and economic potential, the report recommends. For example, the Federal Aviation Administration (FAA) is leading the NextGen program, some elements of which pertain directly to the development of an IASMS. NASA could contribute primarily by supporting basic and applied research for the advanced development of systems by industry and the FAA. The U.S. Department of Defense could monitor any changes to the [air traffic management](#) system that could impact the operation of military aircraft in civil airspace. In addition, each research project could be addressed by partnerships involving multiple organizations in the federal government, industry, academia, and other international [government agencies](#).

The report acknowledges that executing all of the high-priority research projects identified in the report would require significant resources although many of the research projects could achieve substantial advances using currently available resources, especially if program planning and executing takes maximum advantage of the synergies that exist among some of the research projects.

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