



Clear Skies for NextGen

Looking up at a sleek new aircraft crossing a blue sky may lead you to daydreaming about flying to Las Vegas to try your luck or hoping that the birthday present you overnighted to your Aunt June arrives in time. But when MITRE's Gregg Leone looks skyward, he anticipates a future where advances in aviation technology and air traffic management enable an unprecedented increase in air transportation options for the public, cargo shippers such as FedEx and UPS, and the military.

According to Leone, a technical director for MITRE's Center for Advanced Aviation System Development (CAASD), the next two decades will provide sky watchers with a lot more to contemplate. Even with the recent economic doldrums, air travel is expected to double according to some estimates. Passenger traffic isn't the only factor. There's also overnight delivery, which is no longer a luxury but a necessity, forcing shippers' air fleets to grow. And an increasing number of unmanned aircraft will take flight on missions of science, law enforcement, and homeland defense.

But how can the Federal Aviation Administration prepare the air traffic management system to accommodate this increased traffic while still maintaining our national airspace's admirable safety record?

Says Leone, "MITRE is working with the FAA and other federal agencies to transform the National Airspace System to meet the future needs of air travel. The FAA looks to us to generate new concepts, develop new standards, and find new solutions to evolve and improve our national airspace system."

The Next Generation of Aviation Technology

These new concepts, standards, and solutions are known collectively as the Next Generation Air Transportation System, or NextGen. One of the critical principles of NextGen is to make airspace more efficient by enabling planes to fly routes that are more direct and more tightly spaced. Margaret Gomes, program manager for MITRE's NextGen Evolution and Integration team, says, "By 2025, NextGen will change how airplanes, airspace, and airports operate and are managed in the United States."

Imagine this future: Aircraft trajectories for the entire airspace are computed by both ground-based and airborne flight management systems and can be quickly modified based on changing weather or traffic flow patterns. Communications between the ground and the cockpit are enhanced by digital data exchange. Each pilot can see digitized data about neighboring aircraft and surrounding terrain on a head-up display system, allowing the pilot better-than-visual situational awareness.

To achieve this future, NextGen must overcome the problem of older technology dictating the placement of air routes. For decades, air routes have been determined by the location of ground-based navigation beacons. Aircraft may not fly out of the range of these navigation aids, so the routes are often inflexible and inefficient.

Two of the concepts critical to the NextGen system—Area Navigation (RNAV) and Required Navigation Performance (RNP)—have been refined in MITRE's air traffic management laboratories in McLean, Va., and have already been tested in real world operations. RNAV and RNP use advanced satellite-based navigation and procedures that allow equipped aircraft to fly more direct routes into and out of airports, enhancing efficiency of arrivals and departures while saving time and fuel.

With more precise and accurate paths, more lanes can be built into the same limited airspace, creating more capacity where we need it. What's more, the increased flexibility in air routes and the increased accuracy in satellite-guided approaches will open up runways across the country previously inaccessible to certain aircraft. RNAV and RNP will make more room for aircraft in the air and on the ground.

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-Gregg Leone

More traffic in the air will require that individual aircraft present a more accurate accounting of their position to air traffic managers and each other. MITRE, in cooperation with several other organizations, has provided the means for such an accounting with Automatic Dependent Surveillance-Broadcast (ADS-B). ADS-B's development recently earned the most prestigious honor in aviation: the Robert J. Collier Trophy.

A plane's ADS-B system broadcasts precise data in real time about the plane's location, speed, and altitude. This increased situational awareness will allow air traffic controllers to place air routes in tighter proximity to each other while still remaining within required safety standards. It will also allow pilots to keep a closer eye on neighboring aircraft in case of emergencies. “In addition, through its broadcast capabilities, ADS-B will give pilots access to critical weather services, terrain maps, and flight information services,” Leone says.

Safety First

The massive amounts of data zipping from satellite to plane to air traffic control in the NextGen future will require the FAA to modernize its communications infrastructure as well. MITRE is working with the FAA to construct a high-capacity air-ground digital data communications system to increase its capacity for data transmission. “Reducing the pilot and controller voice communications workload will increase safety by minimizing the risk of possible miscommunication,” says Leone.

In developing NextGen, safety is the top priority. MITRE applies proven safety assessment methods every step of the way. For many of its analyses, MITRE can now draw on the Aviation Safety Information Analysis and Sharing (ASIAS) database, an extensive repository of aviation information, including pilots' reports and black box readings. MITRE uses ASIAS as part of its collaboration with the aviation community to develop new and improved solutions in air safety.

Coordinating the development of these technologies and their integration into the National Airspace System has required close cooperation between the FAA and MITRE. To facilitate this cooperation, the FAA has created an integration and implementation team populated by experts in such domains as communications, navigation, surveillance, weather, security, and net-centric operations. MITRE, in turn, has formed a complementary integration team, called “The I-Team,” staffed with its own highly regarded domain experts to work hand-in-hand with the FAA.

The I-Team has been creating operational scenarios involving NextGen concepts to ensure that MITRE and the FAA have a common understanding of the technological and procedural improvements needed for the updated National Airspace System and of the interdependencies of those advanced concepts.

While MITRE has a fruitful history of working in tandem with the FAA, Gomes points out that the FAA is not the only agency with a stake in NextGen's success. “In 2003, Congress enacted the ‘Vision 100—Century of Aviation Reauthorization Act.’ That act chartered the Joint Planning and Development Office to plan and implement NextGen as a joint initiative of the Departments of Transportation, Defense, Commerce, and Homeland Security, as well as of NASA and the White House Office of Science and Technology Policy.”

MITRE has assisted the Joint Planning and Development Office since its inception in assessing research, developing implementation plans, and setting development priorities for NextGen. MITRE also provides the office with expertise in air traffic management, aviation security, meteorology research, net-centric operations, and business and portfolio analysis, to cite a few areas of technical engagement.

MITRE's work with NextGen is the latest chapter in our historic role in the evolution of our nation's airspace. Through engagement with the FAA and other agencies in the Joint Planning and Development Office on evolving technologies, procedural changes, and updated policies, MITRE will continue to assist that transformation in order to keep our nation's citizens, goods, and aspirations soaring high and safe.

—by Christopher Lockhardt

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