



MITRE-owned servers like this are located at each of the participating airlines. This server handles four terabytes of data.

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Fusing Aviation Data: A New Approach to Keeping Skies Safer

The ability to capture and analyze previously untapped aviation safety data is key to improving the already high levels of U.S. air travel safety. Recognizing this, the Federal Aviation Administration asked MITRE to create a new repository of airline safety data that can be mined to spot potential safety issues before incidents occur.

Although air travel in the United States is the safest in the world, the FAA is working toward an even safer Next Generation Air Transportation System. Achieving this goal depends in part on finding and analyzing patterns in the information routinely collected by an aircraft’s flight data recorder, or “black box.” The data being studied by MITRE comes from 13 airlines and has not been collected into a comprehensive data repository until now. By helping the FAA tap into this critical safety data, MITRE is playing a central role in the FAA’s effort, called the Aviation Safety Information Analysis and Sharing (ASIAS—pronounced “a-sigh-us”) initiative.



Thirteen airlines are sharing air safety data with MITRE.

A Foundation of Trust and Experience

“We selected MITRE to lead this new initiative not only because of its world-class technical excellence, but also because MITRE is recognized within the airline community as a trusted entity,” said Nick Sabatini, FAA’s former associate administrator for aviation safety, at an FAA-sponsored safety conference last year. The power of this initiative is the ability to fuse enormous amounts of data to gain new insights about potential safety issues before incidents and accidents occur.

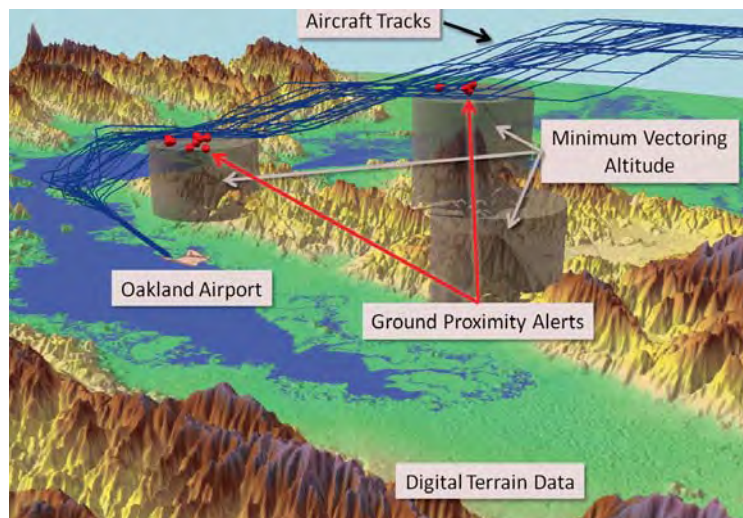
MITRE has been asked to focus on four areas: 1) analyze and safeguard the proprietary airline data; 2) integrate the airline data with MITRE’s extensive aviation safety data; 3) conduct studies; and 4) build analysis capabilities. “We will be leveraging MITRE’s vast expertise,” says Hassan Shahidi, associate director in MITRE’s FAA federally funded research and development center. “This includes expertise in data mining, data sharing and protection, systems engineering, and architecture.”

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First-of-its-Kind Data Sharing

Through ASIAS, the airlines have agreed to share their proprietary air safety data with MITRE in a first-of-its-kind undertaking. The airlines signed memorandums of understanding that stipulate how data is provided to MITRE and how MITRE will safeguard that data. The data architecture is geographically distributed, with MITRE-owned servers located at the airlines. MITRE’s information security experts worked with the airlines to set up the servers so they are secure. Shahidi expects a dozen more airlines, mainly regional airlines, to join the program over the next year.



Flight safety around airports can be examined by combining, or fusing, data from many different sources. This picture is a fusion of digital terrain data around Oakland Airport and aircraft flight tracks (blue) approaching and leaving the airport. The gray cylinders show the lowest altitude at which an airport radar controller can direct the aircraft using instrument flight rules. The ground proximity alerts (red dots) tell pilots when they are too low over certain terrain such as hills or mountain peaks.

“The data comes in two flavors,” explains Shahidi. “First there are the pilot safety reports written in text form by the pilots and crew of each airline. They describe safety issues that occurred during their flights. To date, we have compiled more than 50,000 written pilot reports from a three-year period. Second there are the flight data recorded by the flight data recorders. We have over four million digital records from thousands of flights, each flight with hundreds of parameters.”

Data Fusion Uncovers Safety Issues

Another valuable source of aviation data is MITRE itself. Over the last three decades MITRE has collected a vast repository of aviation data about weather conditions, winds, radar tracks, airspace, and air traffic procedures. This data is analyzed on a routine basis for many different projects for the FAA. “MITRE now has a unique capability to fuse our extensive in-house aviation data with the newly acquired airline safety data to paint a comprehensive picture for emerging safety issues,” says Shahidi.

Last year, MITRE delivered the first of several ASIAS studies to the FAA and aviation stakeholders. These studies detail issues that were difficult to discover without the fused data. “In a study on the airplanes’ Terrain Airborne Warning System, for example, we discovered vulnerabilities in procedures and airspace design in the Oakland, Calif. airspace,” says Shahidi. “The Terrain Airborne Warning System was triggering false alarms about potential collisions with nearby hills. With the fused data, we had a much more accurate picture about the exact location of these alerts.” Through MITRE’s analysis of this issue, new airspace procedures are being developed in the Oakland airspace to keep the airplanes at a safe altitude and eliminate these nuisance alarms.

By combining airline and MITRE data, the FAA has a richer context for analyzing safety issues, drawing conclusions, and making recommendations. “We are using our capabilities in modeling and simulation, trend analysis, and data synthesis,” notes Shahidi. “We’re conducting analyses that move from the reactive ‘What went wrong?’ to the prognostic ‘What *could* go wrong?’ We want to squeeze as much risk out of the system as possible.”

—by David A. Van Cleave

Contact:

For more information on this program, contact Randy McGuire, rmcguire@mitre.org, (703) 983-7925. For information on other MITRE programs, see www.mitre.org/news/digest

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