

# Aviation security decisions: Opportunities and challenges



Symposium outlines opportunities, challenges while fostering collaboration between government, academia and industry.

By Ali Abbas and Ken Fletcher

**Aviation security professionals are challenged with the security of the commercial aviation system** while facilitating the movement of legitimate travelers and goods. Commercial aviation is critical to the economic vitality and national security of the United States. According to the Federal Aviation Administration, commercial aviation accounted for \$1.5 trillion in economic activity and contributed nearly 5.5 percent of the U.S. gross domestic product (GDP) in 2012. In addition, commercial aviation supported 11.8 million jobs and nearly \$460 billion in annual earnings [1].

The Transportation Security Administration (TSA) interacts with a high volume of passengers on a daily basis, and these numbers are increasing rapidly. In 2014, more than 650 million domestic travelers flew aboard commercial flights, with passenger volume approaching 1 billion worldwide. Annual growth in passenger travel by commercial air is projected to be between 2.5 percent and 3.2 percent over the next decade, and the largest domestic airports are expected to increase enplanements between 50 percent and 90 percent above their current activity. This projected increase in



Ali Abbas (center front, blue coat) and Ken Fletcher (center front, light gray coat) chaired the CREATE-TSA Aviation Security Symposium held at the University of Southern California.

operational demand is occurring with a persistent threat of terrorism focused on commercial aviation while financial pressures are shrinking security budgets and reducing resources.

To manage the current and future challenges confronting aviation security, new research developments are needed in both theory and practice. New opportunities therefore lay ahead for the field of operations research, which has a crucial role to play in providing new analytical methods and validating these methods to ensure limited resources are efficiently allocated to optimize security and minimize the impact on our nation's transportation networks. To better achieve this outcome, there is a demand for a network of operations researchers to work closely with government and industry to provide meaningful solutions to these large-scale problems.

The TSA, in conjunction with the Center for Risk and Economic Analysis of Terrorism Events (CREATE), recently held a symposium at the University of Southern California with representatives from industry, academia and the Department of Homeland Security to begin building a network of academic researchers capable and interested in addressing the opportunities and challenges that lay ahead in aviation security. The symposium had several objectives: (i) to foster collaboration between government, academia and industry; (ii) to develop a deeper understanding of aviation security challenges across the research community; (iii) to shape the context for aviation security-related research; (iv) to focus research directions toward providing solutions that address

the TSA and aviation industry needs; and (v) to provide independent support for, and validation of, aviation security approaches.

This article summarizes some of the main takeaways from the symposium and some directions for academic researchers interested in getting involved.

#### Key Principles to Guide Academic Models

TSA Chief Risk Officer Ken Fletcher opened the symposium with a speech that set the context for aviation security challenges, overviewed TSA's risk-based security approach to passenger screening via the TSA PreV® initiative, and highlighted near-term changes and future challenges. During his comments, Fletcher provided five basic principles that guide a risk-based approach to aviation security:

1. The vast majority of people and commerce are low risk.
2. The more information available on travelers and commerce the easier it is to assess risk.
3. Methods to detect deviations from the expected, as well as advanced analytical techniques, should be strengthened.
4. Accelerating efforts to optimize screening and pre-screening processes, and the use of technology, will result in enhanced effectiveness and greater system-wide efficiencies.
5. Security increases by focusing limited resources on unknowns and identified higher risks, while identifying and expediting the legitimate movement of people and commerce.

Ali Abbas, professor of Industrial and Systems Engineering and Public Policy at USC, followed

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with some essential considerations with regard to decision-making:

1. There is a difference between the quality of decision and the quality of the outcome.
2. Because we are not guaranteed a good outcome when uncertainty is present, we can only rely on rigorous decision-making methods to address these new problems.
3. Awareness about the implications of various model assumptions is essential, and simplicity is not an excuse for using a wrong model.
4. There is a need to continually expand the frame to identify threat scenarios beyond security points.
5. We must think about our trade-offs, and we must preserve our values; it is easy to make a high-security flight that nobody would want to use because of the inconveniences of heightened security and having no carry-ons.
6. The media needs to play a responsible role in conveying meaningful results within context instead of rushing to provide pure opinions.

### **TSA PreV**

The symposium presenters addressed numerous programs such as the TSA PreV. Sheldon Jacobson, professor of Computer Science at the University of Illinois at Urbana-Champaign, said that “the best way to secure our air system is to grow and enhance programs like TSA PreV,” adding that, “Screening passengers under a worst-case scenario makes it easier for people with nefarious intent to breach security. In such cases, being overly cautious actually makes the system less secure.” Jacobson and Laura McClay, associate professor at the University of Wisconsin, also noted that identifying high-risk passengers is a significant challenge, and that “TSA PreV works to identify passengers with no risk, and focuses security resources on the remaining passengers.”

Amy Ward, from the Marshall School of Business at USC, presented a stochastic model to determine the benefits of the TSA PreV. “The reason we expect TSA PreV to reduce passenger waiting is that the screening times for TSA PreV passengers are shorter than those for non-TSA PreV passengers,” she said. “Therefore, the more people who sign up for TSA PreV, the less passenger waiting there should be.”

### **Economic Analysis**

Mark Stewart, professor of Infrastructure Performance and Reliability at the University of Newcastle, estimated that programs like TSA PreV contribute to about \$1 billion in economic benefit. Adam Rose, professor of Public Policy at USC, presented his economic consequences analysis tool (E-CAT) that is intended for use by policymakers and

analysts who need quick estimates of the economic impact of terrorist attacks, natural disasters and technological accidents on U.S. GDP and employment. E-CAT can evaluate the magnitude of various threats in order to make decisions on how to allocate budgets across interdiction, mitigation, resilience and disaster assistance options. Erwann Michel-Kerjan of the Wharton School of Business, University of Pennsylvania, illustrated the importance of insurance models in aviation security. “Without insurance, there is no aviation,” he said.

### **Behavioral Considerations in Modeling**

Fred Roberts, professor at the University of Rutgers, highlighted analogies between aviation security screening and screening at stadiums. He illustrated a particular problem he has been working on this past year of how to evacuate the stadiums in the face of an event. What he found is that the evacuation methods in real-world situations do not work as they do in the lab. Environmental conditions are crucial and determinative and must be taken into account in the modeling.

Paul Slovic, emeritus professor at the University of Oregon, also highlighted the role of behavioral considerations when dealing with the public. Heather Rosoff, research assistant professor of Public Policy, demonstrated a scenario of passenger reaction if a bomb was found on a plane. Milind Tambe, professor of Computer Science and of Industrial and Systems Engineering at USC, said it was very inspiring to see the use of computational game theory gaining acceptance as a quantitative approach to optimizing the use of limited resources in homeland security, noting that this opens up important new avenues for research in computational and behavioral game theory and massive-scale optimization.

The Institute for Creative Technology (ICT) at USC presented demonstrations on virtual humans, a technology adapted from video games, and illustrated how this technology can be used in training and automatic detection of anomalous behavior.

### **Input from Various Participants**

Patrick Gannon, chief of Airport Police at Los Angeles World Airports, presented findings from the LAX shooting incident in 2013. Jim McDonnell, sheriff of Los Angeles County, also attended the symposium, as did Rear Adm. Fred Midgette, commander of the ninth district of the United States Coast Guard, who presented analogous situations to aviation security that the Coast Guard faces. Geraldine Knatz, professor of Public Policy and Engineering at USC and former director of the ports of Los Angeles and Long Beach, also discussed the similar nature of problems they encounter at ports with re-

gards to screening at speed. Industry participants included representatives from Boeing, IATA, Regional Airline Association and Northrup Grumman among others, who offered their views on aviation security.

### The Future: Opportunities and Challenges

It was clear during the symposium that the field of operations research has an important role to play in aviation security, particularly in defining new transformative models that can change the security paradigm. TSA's Fletcher noted that research opportunities exist in three broad areas: (i) to address gaps and weaknesses in current core capabilities; (ii) to develop new capabilities needed to improve the existing processes and approach; and, (iii) to create transformation capabilities that will fundamentally change the aviation security paradigm.

USC's Abbas reminded the group that World War II led to a plethora of unique problems that required new ways of thinking and methods of problem-solving, which in turn led to significant developments in information theory, control theory and the field of operations research. This is very much the situation we face today. New models that may allocate security in different ways include the Dynamic Aviation Risk Management System (DARMS), which may allocate security based on the risk level of individual flights as well as the risk level of individual passengers.

Jerry Booker, director for TSA's Risk Management Division, identified several challenges and opportunities moving forward, starting with the need to facilitate the conversations and networking between academics and the government. He also emphasized the need to operationalize the models and research ideas presented during the symposium, and posed the question of how to identify the required data sources needed for these new problems and methods for handling their large-scale quantities. In addition, Booker identified the need to better facilitate the sharing of information amongst all involved entities, and questioned whether new technologies were needed to support these ideas.

Paul Fujimura, assistant administrator for the TSA Office of Global Strategies, commented that as this symposium leads to follow-on research, researchers must remember that we are dealing with people and need to take into account the emotional impact that security can have on travelers as models are developed. He also outlined opportunities for moving forward, especially with international travel anticipated to grow exponentially. According to Fujimura, one such research area involves incorporating intelligent design



**Sheldon Jacobson:** "The best way to secure our air system is to grow and enhance programs like TSA Pre✓."

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into international airports to better enable security effectiveness and mitigate security issues. Another area of research need is predictive analytics involving how to combine data collected from foreign airports with current threat information to create risk management models capable of better responding to current threats and better able to predict and enable responses to changes in the future risk environment.

Planning has started for a follow-on symposium in a year, where the group will discuss various advances and operations research tools to help with this topic. We welcome the inclusion of more academic research to help provide state-of-art models for optimizing aviation security resources while facilitating travel and trade. **ORMS**

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**Ken Fletcher** ([Kenneth.Fletcher@tsa.dhs.gov](mailto:Kenneth.Fletcher@tsa.dhs.gov)) is the chief risk officer for the Transportation Security Administration, where he is responsible for developing and driving the long-range strategic vision and objectives for TSA with respect to risk-based security and risk management activities, and implementing enterprise risk management across the agency. He has helped lead the development and implementation of TSA's transition to a risk-based security approach to aviation passenger screening for the past several years.

Abbas and Fletcher chaired the CREATE-TSA Aviation Security Symposium described in this article.

### REFERENCE

1. "The Economic Impact of Civil Aviation on the U.S. Economy," Federal Aviation Administration (June 2014); [https://www.faa.gov/air\\_traffic/publications/media/2014-economic-impact-report.pdf](https://www.faa.gov/air_traffic/publications/media/2014-economic-impact-report.pdf).