Authors' Commentary: Aviation Security Baggage Screening Strategies: To Screen or Not to Screen, That Is the Question!

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Introduction and Background

The events of September 11, 2001 make it the worst day in the history of commercial aviation. These events have lead to massive changes in the manner in which aviation security is organized and implemented at the 429 commercial airports throughout the United States. These changes include, for example,

- the creation of the Transportation Security Administration (TSA),
- the federalization of aviation security personnel,
- a more extensive use of air marshals on domestic flights,
- extensive positive passenger baggage matching protocols, and
- enhanced passenger and baggage security screening at airport terminal checkpoints and gates.

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The problems posed in this year's modeling competition, based on research supported by the National Science Foundation through the Division of Design, Manufacturing and Industrial Innovation, Program in Service Enterprise Engineering, are motivated by several of the challenges faced by the TSA in addressing the December 31, 2002 Congressionally-mandated deadline for 100% screening of all checked baggage on all domestic commercial flights in the United States. This mandate has resulted in the rapid manufacturing and deployment of several thousand explosive detection systems (EDSs) and explosive trace devices (ETDs). Key questions faced by the TSA have included

- where to deploy such baggage screening devices,
- what combination of EDSs and ETDs should be used at individual airports, and
- how such devices should be used once deployed.

The problems in this year's competition embody several of these questions.

Aviation and Transportation Security Act

On November 19, 2001, the United States Congress passed the Aviation and Transportation Security Act (ATSA), resulting in widespread and sweeping changes in how security is addressed for all forms of transportation (with a particular emphasis on air travel). An aggressive schedule was included for the federalization of airport security personnel (with a deadline of November 19, 2002) and the screening of all checked baggage on commercial flights using federally approved security screening devices and systems (with a deadline of December 31, 2002). Skeptics in both industry and government questioned whether these deadlines could be met, given the magnitude and scope of this undertaking. Moreover, the costs associated with such an endeavor were estimated to be in the billions of dollars (US). As the deadlines approached, the director of the TSA, Admiral James M. Loy, remained committed to meeting all specified deadlines. By December 31, 2002, over 90% of all airports had met this deadline, with the remaining airports aggressively moving towards compliance.

Formulation of the Contest Question

The authors of this year's contest question have been working in the area of operations research modeling of aviation security system since the mid 1990s. Their research has been disseminated in a wide variety of journals. The problems that they have addressed include

- a probabilistic analysis of access control security systems [Kobza and Jacobson 1996; 1997],

- a sampling procedure to estimate risk probabilities in access control security systems [Jacobson, Kobza, and Nakayama 2000],
- the analysis of baggage value performance measures for checked baggage security systems [Jacobson, Bowman, and Kobza 2001],
- a knapsack-problem model formulation for addressing aviation security system design problems [Jacobson, Kobza, and Easterling 2001],
- models for analyzing the impact of connecting passengers on selectee rates [Virta et al. 2002],
- a case study for checked baggage screening security system design [Jacobson et al. 2003a], and
- a cost/risk analysis of various checked baggage screening strategies [Jacobson, Virta, and Kobza 2003b].

All these research contributions focus on identifying strategies or procedures for enhancing the operation and design of aviation security systems.

This year's contest question relates to purchasing and deploying EDSs and ETDs for checked baggage screening at the 429 commercial airports around the United States. Many of the specific issues raised in the tasks described in the problem description grew out of ongoing discussions with TSA personnel, as well as from information extracted from Congressional testimonies by, for example, Kenneth Mead, the Inspector General of the United States Department of Transportation [Mead 2002a; 2002b], and a variety of newspaper and newswire sources. Factors that affect security equipment purchase and deployment decisions include

- the size of airports,
- the number of concourses within airports, and
- the schedule of flights departing from each airport (as well as their distribution throughout the day).

On a broader scale, the potential for growth at an airport must also be considered. All these factors play an important role in the decision-making process.

The initial goal of the TSA was to meet the requirement as defined in the ATSA. Therefore, feasibility was of paramount concern. However, once feasibility was attained, cost-effectiveness and operational efficiency became important. This year's modeling problem weaves together the feasibility issues that arose during the frenetic ramp-up period following the passage of the ATSA and the current cost-effectiveness issues to provide timely problems for the competition participants and an interesting and challenging evaluation process for the judges.

Conclusions

The transition process for aviation security operations since September 11, 2001 has not been smooth, but much progress has been made. However, aviation security is still a "work in process." New technologies being developed will significantly affect many of the operations in place today and require substantial changes. With the changing nature of system threats, aviation security will continue to evolve. This year's modeling competition clearly points out that there are many young people around the world who have the talent and the outstanding ideas needed to guide this evolution and affect the security of our world.

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