# Judges' Commentary: The Fusaro Award Wheelchair Paper

Peter Anspach
National Security Agency
Ft. Meade, MD
anspach@aol.com

Marie Vanisko
Dept. of Mathematics
California State University Stanislaus
Turlock, CA
mvanisko@csustan.edu

The Ben Fusaro Award for the 2006 B problem went to the team from Maggie L. Walker Governor's School in Richmond, VA. Their paper fell just short of the Outstanding designation due to a slightly less sophisticated level of mathematics than could have been used. However, the paper exemplified some outstanding characteristics:

- It presented a high-quality application of the complete modeling process;
- it demonstrated noteworthy originality and creativity in their modeling effort; and
- was well-written, in a clear expository style making it a pleasure to read.

Addressing real-world problems involves formulating a mathematical description of the problem, solving the mathematical model, interpreting the mathematical solution, and critically evaluating the model. Before a team could formulate a mathematical description of the problem, it was necessary to do research to estimate reasonable values for parameters to be used.

The Maggie L. Walker team began by getting current statistics on the number of wheelchair passengers and how airlines and airports serve their needs. In addition, they looked at the Department of Transportation Congressional Report on disability-related airline complaints. From their assumptions, it was clear that the team considered many issues. Certain assumptions—for example, wheelchairs are always functional, an important issue—treated issues that

*The UMAP Journal* 27 (3) (2006) 413–414. 

might seem superfluous but are otherwise not tractable in a model. The team justified their assumption that the pattern of calls for wheelchairs follows a Poisson process.

The team considered how many escorts and wheelchairs to place at each airport, and the most efficient way for escorts and wheelchairs to move around. The team considered small and large airports and linear, pier, satellite, and curvilinear-shaped concourses.

Their model consisted of three parts:

- an algorithm for finding the number of escorts that an airport should hire, based on the need to balance costs and recognizing that the primary costs are the salaries of escorts;
- establishing that the best wheelchair-to-escort ratio is one-to-one;
- showing that wheelchair service is most efficient when escorts have a central hub, whose location depends on the concourse type.

To test the efficiency of their model, the team used a spreadsheet to simulate wheelchair service in small, medium, and large airports. They recognized that some of their assumptions—for example, that all escorts are perfectly efficient and all passengers are completely cooperative—weaken their model by ignoring the human element. However, they demonstrated the flexibility in their model, allowing for changes as the airline industry grows and the traveling population ages.

This paper is a fine example of the fact that mathematical modeling can be done at many levels. The team is to be congratulated on their thoroughness, their clarity, and their utilization of the mathematics that they knew to create their own model and solve the problem at hand. The judges felt that the model itself was both reasonable and well thought out.

# About the Authors

Marie Vanisko is in her fifth year of teaching at Cal State Stanislaus. Prior to that, she taught for 31 years at Carroll College in Montana and was a visiting professor at the U.S. Military Academy at West Point. She chairs a College Board committee for the SAT Subject Tests in Mathematics and serves on a national joint committee for the NCTM and MAA. For each of the past two years, Marie has co-directed an MAA Tensor Foundation grant project for high school girls, entitled Preparing Women for Mathematical Modeling, with the hope of encouraging more young women to select careers that involve mathematics. She serves as a judge for the COMAP MCM and HiMCM has also been active in the MAA PMET (Preparing Mathematicians to Educate Teachers) project.