

The Towson University  
Applied Mathematics  
Laboratory

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# Introduction



- ❖ The Applied Mathematics Laboratory has been at Towson University for over 20 years.
- ❖ We look for mathematical research problems sponsored by local companies and government agencies.
- ❖ These problems are studied by teams of 2-6 students, led by two faculty members, usually for a full academic year.

# What I want to tell you...



- ❖ What do we mean by a project?
- ❖ How is the Applied Mathematics Laboratory organized?
- ❖ How do we get students?
- ❖ How do we find projects?
- ❖ How are we supported?
- ❖ What resources do we have?
- ❖ How do we get faculty?
- ❖ How have we changed over time?

# Towson University



❖ Towson University is a state school and a member of the University System of Maryland.

❖ Enrollment:

➤ 14,000 undergraduate students and

➤ 3,000 graduate students, mostly at the Master's level.

❖ Towson University is located in Baltimore County, just outside Baltimore City.

❖ Incoming Freshmen

➤ SAT Scores 1020-1170

➤ H.S. GPA 3.54

# The Mathematics Department



- ❖ The Mathematics Department has 32 full-time faculty members.
- ❖ We offer undergraduate concentrations in
  - Mathematics Education
  - Applied Mathematics
  - Actuarial Science and Risk Management
  - Pure Mathematics
- ❖ We have 140 undergraduate majors, with roughly 30 graduates per year.
- ❖ We offer Master's degrees in
  - Applied and Industrial Mathematics
  - Mathematics Education.

❖ We have 18 graduate students, in Applied and Industrial Mathematics, and most are part-time.

# What is a Project?



- ❖ All of our research projects are sponsored by local companies or government agencies.
- ❖ Our projects are real and have importance to the sponsoring organization; however none are critical to the sponsor.
- ❖ Most projects are interdisciplinary

# Past Projects



- ❖ Science Applications International Corporation (SAIC)
  - Validation and Enhancement of Applications of Models from Epidemiology to INFOSEC Assurance Metrics
- ❖ Becton Dickinson Microbiology Systems
  - Scheduling Production of Prepared Plated Media
- ❖ State of Maryland, Comptrollers Office, Retail Sales Tax Division
  - Estimation of Sales Tax Liability



# Baltimore City Fire Department



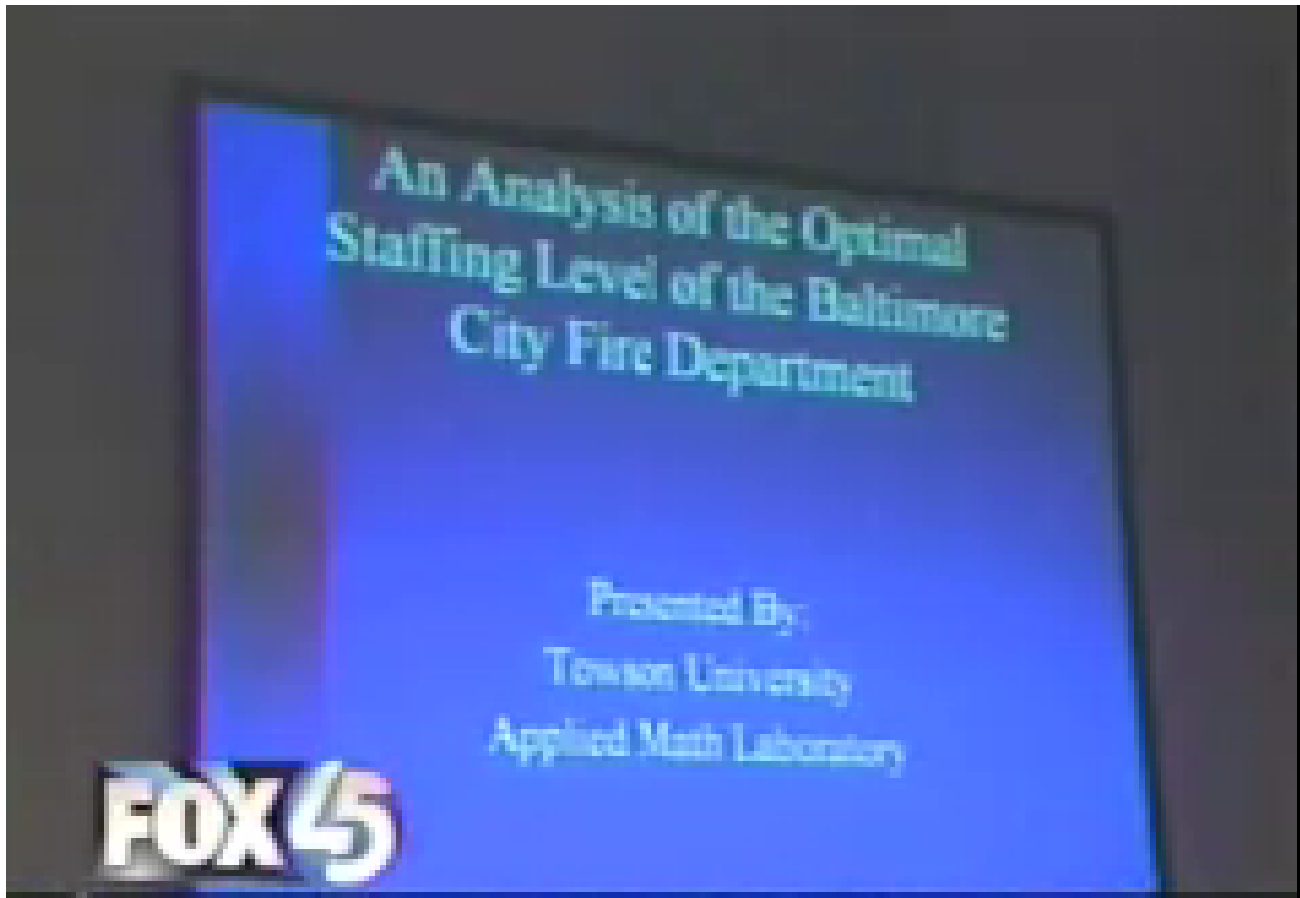
- ❖ In Summer 2002, the Baltimore City Fire Department asked the Applied Mathematics Laboratory to analyze their scheduling process.
- ❖ The Fire Department is two million dollars over its budget in overtime.
- ❖ A team of six undergraduates led by two faculty members studied the problem for two semesters.
- ❖ The student research team presented their results to Baltimore Mayor Martin O'Malley, his staff, and Fire Department officials at the CitiStat briefing at City Hall in May 2003.

❖ The students' analysis suggests that the city could save as much as \$250,000 per year by adjusting their staffing.

# Baltimore City Fire Department

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- ❖ The result received media attention, including a piece on a local television newscast and an article from Associated Press.





Student team member Michael Machovec briefs Mayor O'Malley and his staff.



Student team member Marco Radzinschi responds to a question from Mayor O'Malley.

# Baltimore City Fire Department



- ❖ The student research had three components-
  - The students analyzed the data on absences provided by the Fire Department to determine what patterns were present.
  - They constructed a nonlinear program to determine a candidate optimal staffing level.
  - They created a computer simulation of the Fire Department's daily staffing which was used to determine the expected costs of the staffing level found by the nonlinear program.

# Baltimore County Department of Environmental Protection and Resource Management



- ❖ In 2003-2004 a student team is working with the Baltimore County Department of Environmental Protection and Resource Management.
- ❖ The rural areas of the county rely on well water, and during the drought of 2001-2002, many wells ran dry.
- ❖ They have asked us to analyze the data they have on well construction throughout the county to see if there are patterns that will help them make decisions- especially zoning decisions- to mitigate the next drought.
- ❖ The students are using data mining techniques and geostatistics to do the analysis.

# Baltimore County Department of Environmental Protection and Resource Management



- ❖ This problem is inherently interdisciplinary.
- ❖ Students and faculty from the Geography department are part of the team.

# How Are We Organized?



## ❖ Director of the Applied Mathematics Laboratory

- Finds projects; day-to-day administration

## ❖ Applied Mathematics Laboratory Committee

- Oversight, advice, assistance

## ❖ Projects

- Each project has a faculty director and a co-director.
- As our M.S. program grows, some of our graduate students will act as co-directors.
- The project director is from the mathematics department, but the co-director is often from another department.



# How Are We Organized?



- ❖ Over our history, 19 different faculty members have served as project directors or co-directors.
- ❖ One-third of our current tenured and tenure-track faculty have served either as a project director or co-director.

# How Are We Organized?



- ❖ Each project has a contact from the sponsoring organization.
- ❖ Strict lines of communication are enforced on the students.

# Academic Structure



- ❖ Students who participate in an Applied Mathematics Laboratory Project enroll in a three-credit course, Applied Mathematics Laboratory I or II.
- ❖ At the end of the Fall semester, students write an interim report, and give a presentation to the sponsor, usually at Towson.
- ❖ At the end of the Spring semester, students write the final report, and give the final presentation to the sponsor, usually at the sponsor's offices.
- ❖ Students do not need to participate for the entire year, though that is typical.

# How Do We Find Students?



- ❖ Student participation is by invitation only.
- ❖ Students are chosen based on
  - faculty recommendations
  - transcripts, and
  - area of interest.
- ❖ When choosing students, the emphasis is on forming good teams.
- ❖ Workload!

# How Do We Find Projects?



Publicity!

# Public Lectures



- ❖ The Applied Mathematics Laboratory sponsors talks on applied mathematics.
- ❖ In 2002, we had a local applied mathematician from industry give a nice talk on applied mathematics for a general public audience.
- ❖ We then sent letters of invitation to leaders of local companies and government agencies inviting them to attend.
- ❖ The invitation described the Applied Mathematics Laboratory.
- ❖ Result- a number of new contacts, including the contact that gave us our project with the Baltimore City Fire Department.

# University Relations



❖ The University Relations department has been invaluable.

❖ They

➤ Created the initial list of contacts for our mailing,

➤ Did the manual work for the mailing,

➤ Organized the publicity for our briefing for the mayor, including writing a press release and providing a photographer.



# Contacts within the University



- ❖ Contacts within the university are even more important than those outside the university.
- ❖ Finding the right person in university relations was a challenge- Where do you go first?
  - University Advancement?
  - College of Graduate Education and Research?
  - University Marketing?
- ❖ Faculty in other disciplines have provided many useful contacts.
  - Our current project with the Baltimore County Department of Environmental Protection and Resource Management came about in this fashion.

# Other Contacts



- ❖ Don't forget your alumni!
- Our contact person for the Baltimore City Fire Department was one of our graduates.

# How Are We Supported?



- ❖ For much of its history, the Applied Mathematics Laboratory charged a fee to sponsoring organizations to cover our expenses.
- ❖ This made us self-supporting, and the only undergraduate research program that turned a profit.
- ❖ Projects are much more difficult to find.
  - You need to find a project that is important enough for a company to spend its money, but not so important that you need to guarantee results.
- ❖ We have had success working for companies that are submitting grant proposals.

❖ The fee money would be used to give faculty release time to work on the project, and purchase equipment.

# How Are We Supported?



- ❖ Our latest projects for government agencies have been done without charge.
- ❖ These types of projects are easier to find.
- ❖ They give students experience with service learning and civic responsibility.
- ❖ These projects place a greater burden on the faculty member and the department.

# What Resources Do We Have?



- ❖ We have a small conference room set aside for the Applied Mathematics Laboratory.
- ❖ We also have two computers of relatively recent vintage.

# How Do We Get Faculty?



- ❖ Faculty volunteer for an Applied Mathematics Laboratory projects.
- ❖ In the past, when our teaching load was 12 credit hours per semester, and the project was supported by money from the sponsor
  - The project director would receive 6 hours of teaching credit.
  - The project co-director would receive 3 hours of teaching credit.
  - Both the director and the co-director would receive some money in the summer prior to the start of the project to prepare.

# How Do We Get Faculty?



- ❖ Our teaching load has been dropped to 9 credit hours per semester, and our projects have been unsupported.
  - The project director would receive 3 hours of teaching credit.
  - The project co-director would receive my thanks.
  - The project director and co-director have swapped roles between semesters.
- ❖ Our graduate students are required to have a one-year long internship, and have begun to act as project co-directors.



# Questions?

