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
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.
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.
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.
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.
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!
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.
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 are even more important that 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?