Fire Research and Education at the University of Maryland

J. G. Quintiere
Department of Fire Protection Engineering
History of FPE at Maryland

- Founded in 1956
- First head: John L. Bryan
- 2nd: Steven Spivak, 1993
- 3rd: Marino diMarzo, 2001
Undergraduate Program
120 credit hours

- Mathematics, Chemistry, Physics, Arts, Electives
- **Introduction to Fire Protection Engineering**
  - Social, economic, environmental and legal dimensions of the fire problem, introduction to basic fire phenomena, urban fire protection.
- **Fire Assessment Methods and Laboratory**
  - Introduction to experimental evaluation of fire phenomena and test methods.
- **Structural Fire Protection**
  - Effects of temperature on structural materials, fire resistance of building assemblies.
- **Fire Alarm and Special Hazards Design**
  - Gaseous and particulate fire suppression systems, code criteria, fluid theory to the design process, design of detection systems.

- **Fire Protection Fluid Mechanics**
  - Basic principles of fluid flow associated with fire protection systems and fire scenarios.

- **Water Based Fire Protection Systems Design**
  - Aqueous suppression system agents, code criteria, hydraulic theory for design.

- **Heat and Mass Transfer**
  - Fundamentals of heat and mass transfer with application to fire problems.
Fire Risk Assessment
- System analysis, probability theory, engineering economy, and risk.

Fire Dynamics
- Flames; ignition, flame spread and rate of burning, fire plumes.

Problem Synthesis and Design
- Capstone course Student research projects in selected areas.

Life Safety and Risk Analysis
- Components of buildings, physical and psychological variables.

Fire Modeling
- Current fire modeling techniques.

Building Safety and the Law
- Safety regulation, product liability, engineering ethics.

Professional Development Seminar
- Career development course through invited seminars.
Undergraduate Trends

Graduated 810 since 1956
About 18/year
Graduate Program

- **MS**
  - 30 credits including thesis
  - Launched distance program in 2004 (no thesis)

- **PhD**
  - Currently administered through others
Graduate Courses

- **Fire Induced Flows**
  - Fire induced buoyancy driven flows. plumes, ceiling jets, vent flows, compartment flows.

- **Toxicity Evaluation and Analysis**
  - Toxic components in thermally produced smoke, human tenability characteristics.

- **Egress Characteristics and Design**
  - Refuge and evacuation design principles, egress analyses.

- **Fire Dynamics Laboratory**
  - Experiments in fire phenomena.
Courses, cont.

- **Analytical Procedures of Structural Fire Protection**
  - Wood, steel, concrete, composites; computer models.

- **Fire Protection Engineering Hazard Analysis**
  - Prevention, intervention, control, suppression

- **Causative Analysis**
  - Failure and fault tree analysis. Computer models.

- **Advanced Fire Modeling**
  - Applications of models in risk assessment, underwriting, loss prediction, hazard analysis.
Courses, cont.

- **Smoke Detection and Management Systems**
  - Design and analysis of smoke management systems.

- **Computational Fluid Dynamics**
  - Governing eqns, numerical methods. CFD models

- **Diffusion Flames and Burning Rate Theory**
  - Basic principles burning for gaseous, liquid, and solids

- **Fire and Combustion**
  - Fire initiation and spread, smoldering, boil-over.
Graduate Trends

125 since 1990
About 10 per year
Program began in 2004

MS Distance Learning

Growing!
<table>
<thead>
<tr>
<th>Faculty</th>
<th>Research Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Brannigan</td>
<td>Performance codes, regulations, law</td>
</tr>
<tr>
<td>M. diMarzo</td>
<td>Suppression, sprinkler skipping, foams</td>
</tr>
<tr>
<td>A. Marshall</td>
<td>Sprays, plumes, PIV, saltwater models</td>
</tr>
<tr>
<td>J. Milke</td>
<td>Structures, detection, egress</td>
</tr>
<tr>
<td>F. Mowrer</td>
<td>Flammability, design methods</td>
</tr>
<tr>
<td>P. Sunderland</td>
<td>Soot, microgravity, combustion</td>
</tr>
<tr>
<td>A. Trouve</td>
<td>CFD, LES, field and zone modeling</td>
</tr>
<tr>
<td>J. Quintiere</td>
<td>Fire growth, compartments, materials</td>
</tr>
</tbody>
</table>
Research Funding

- US funding limited
- NIST reduced
- NSF new opportunities
- Fire Fighter technology
Facilities

- Since 1990, added three new laboratories
- Currently 600 m²
- Expect 1000 m²
  - new location
  - consolidation
- MFRI
Laminar Flames and Fire

Lighter flames

Diffusion flames in microgravity
Ceiling Jet Research

Saltwater

CFD, LES
Ignition of Wood

(a) Localized glowing start at 60 s
(b) Glowing ignition at 84 s
(c) Flaming autoignition at 882 s

Localized glowing spots

Flames
Other Research
Issues for FPE Education

- Small department, vulnerable, but distinctive
- Limited traditional fire research funding
- US needs more FPE’s than produced
- Developing countries looking to FPE
- Regulations stifle engineering
- Litigation encourages engineering
That's all

www.fpe.umd.edu