

Why the Fire Service Needs Research



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A photograph of a firefighter in full gear, including a helmet and oxygen tank, standing in a dark, smoky environment. The firefighter is silhouetted against the light coming from the smoke. In the background, other firefighters and a large tree are visible through the haze. The scene is dimly lit, emphasizing the hazardous conditions of firefighting.

**UL's FSRI is dedicated to increasing
firefighter knowledge to reduce injuries
and deaths in the fire service and in the
communities they serve.**

Our Vision

Become the trusted global partner to the fire service by being the preeminent leader in firefighter safety research and disseminating the results through a global network of collaborators.

Overview of UL Firefighter Research

2006 - Structural Stability of Engineered Lumber under Fire Conditions

2007 - Firefighter Exposure to Smoke Particulates

2008 - Impact of Horizontal Ventilation

2009 - Firefighter Safety and Photovoltaic Systems

2009 - Basement Fires (NIST ARRA)

2010 - Impact of Vertical Ventilation

2010 - Governors Island Testing with FDNY and NIST

2011 - Exterior Fire Spread and Attics Fires

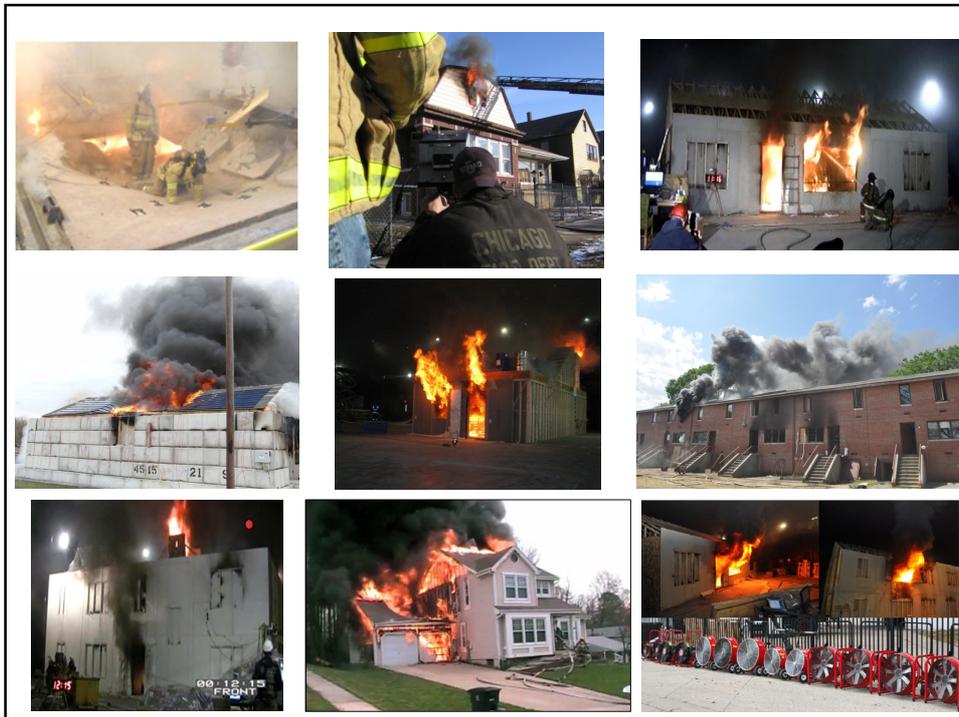
2012 - Study of Positive Pressure Ventilation in Homes

2013 - Impact of Fire Attack Utilizing Interior and Exterior Streams

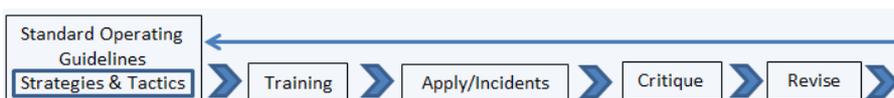
2013 - Cardiovascular and Carcinogenic Risks of Modern Firefighting (IFSI)

2014 - Study of the Fire Service Training Environment: Safety, Fidelity, and Exposure

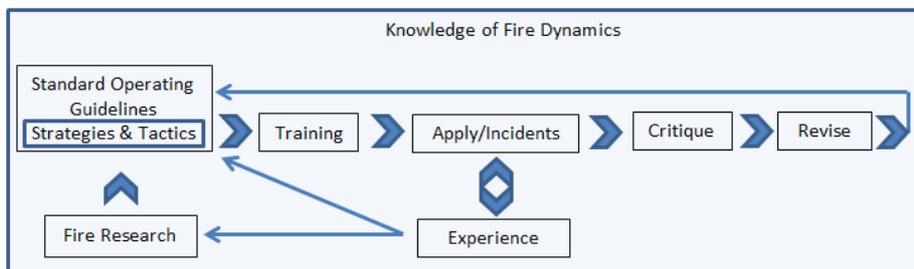




Where we are now.



Where we need to be.



Challenges

- The number of fires are down (More than half in the US since the 1970's, learning on the job?)
- No two fires are the same but...
- You can't go to enough fires to put all the pieces together by yourself.
- Just because you can go somewhere does not mean you should (Turnout gear and SCBA provide a factor of safety, they are not meant to be pushed to the limits).
- If you know why, you can be a thinking firefighter and not a robot.
- Experience and knowledge have to coexist, you don't gain experience if you don't know what is happening.
- You need the how to go with the why, don't overlook the basics.





What is Changing?

- Expectations of the Fire Service
- Technology
- The Fire Environment
- Fire Service Research
- The Pace of Change



Expectations – “All Hazard”

Fire Suppression

HAZMAT

EMS

Vehicle Extrication

Technical Rescue

- **High Angle Rescue**

- **Trench Rescue**

- **Water Rescue**

- **Confined Space Rescue**

Technology Mitigation

- **Electric Vehicles**

- **PV Systems**

- **Wind Turbines**

Fire Prevention

Personnel Management

Customer Service

People Skills

Sensitivity

Leadership

Risk Assessment

Risk Management

Fitness

Mental Health

Instructor

Incident Management

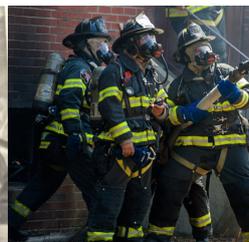
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Training needs to be accomplished in the same amount of time

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New Technology



Turnout Gear



Apparatus



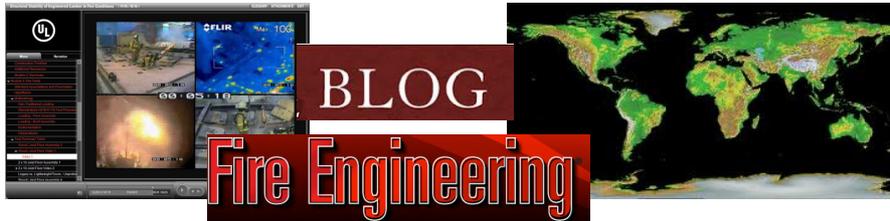
SCBA



Tools

New Technology

The Internet



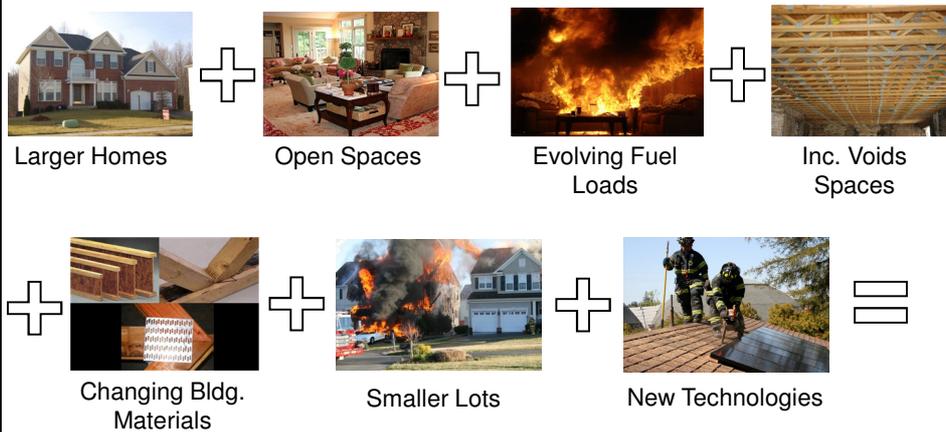
How do we introduce technology into the fire service?

How do we embrace experience happening everyday around the world?

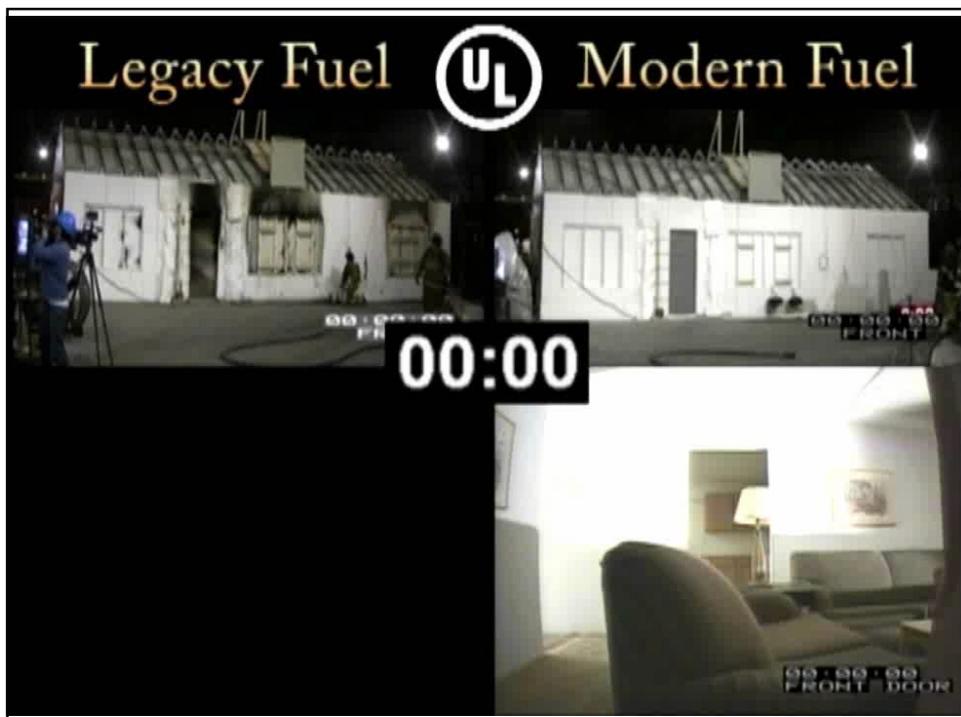
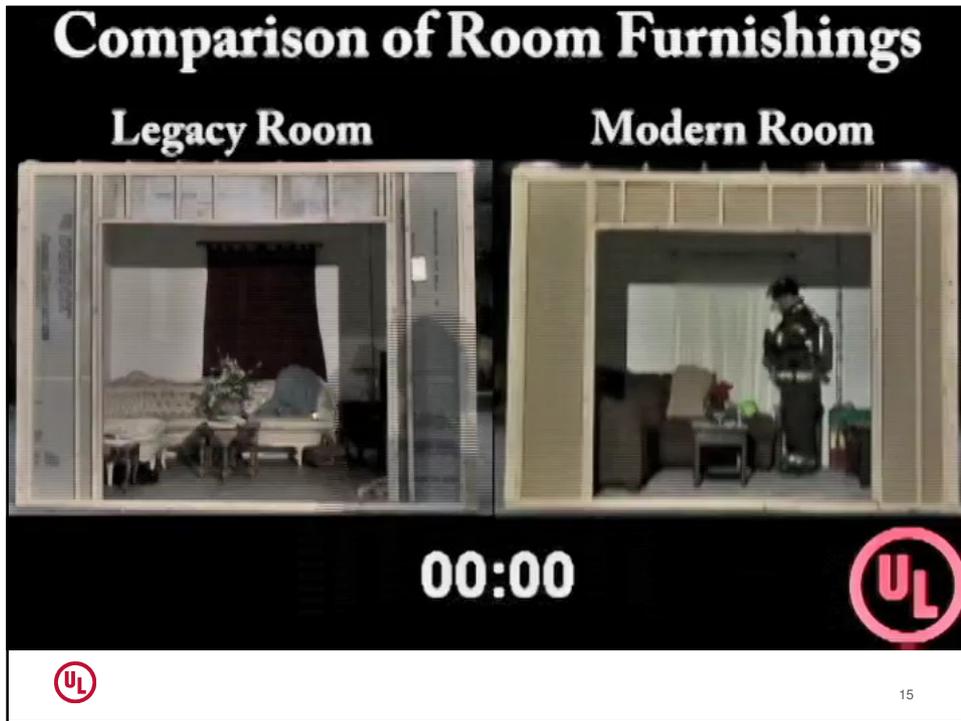


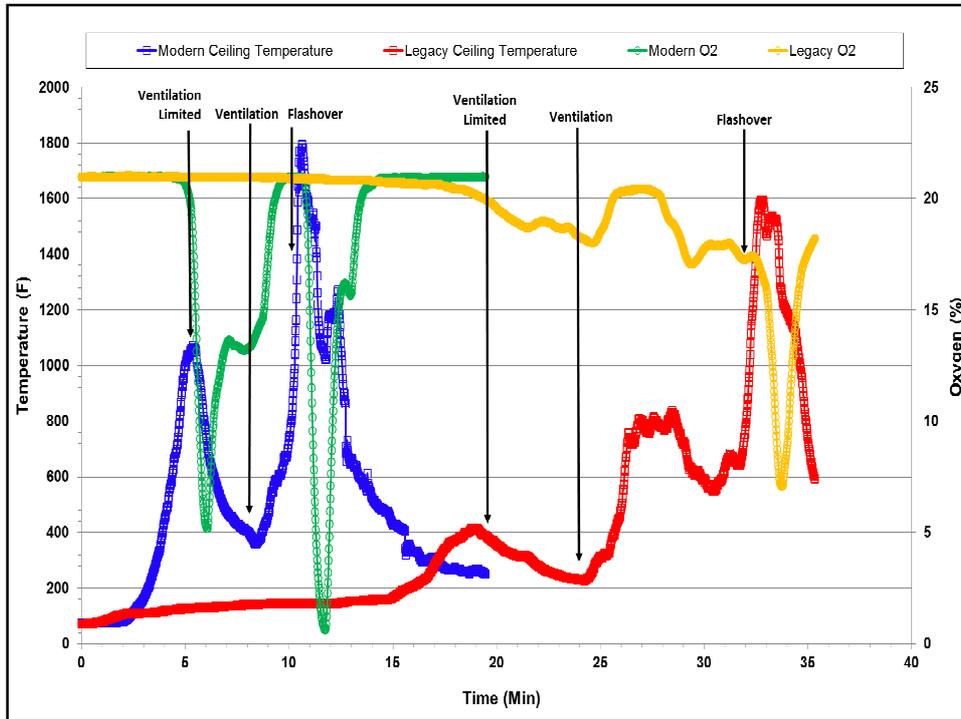
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Today's Fire Environment



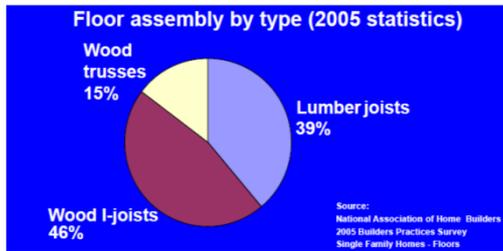
- **Faster fire propagation**
- **Shorter time to flashover**
- **Rapid changes in fire dynamics**
- **Shorter escape times**
- **Shorter time to collapse**
- **Inc. Exposure Problems**
- **New and Unknown Hazards**





Changing Building Materials – Structural Comps.

Old Growth Lumber → New Growth Lumber →
Engineered Lumber (I joists, Trusses, C joists)



Changing Building Materials - Structural Stability of Engineered Lumber



Assembly	Structural Element	Type	Ceiling	Fire Fighter Breach (min : sec)
1	2x10 Joist Floor	Legacy	None	18:35
2	Wood I Joist Floor	Lightweight	None	6:00
8	2x10 Joist Floor	Legacy	Lath and plaster	79*
3	2x10 Joist Floor	Legacy	Regular gypsum wallboard	44:40
4	Wood I Joist Floor	Lightweight	Regular gypsum wallboard	26:43
5	Metal Gusset Truss Floor	Lightweight	Regular gypsum wallboard	29*
6	Finger Joint Truss Floor	Lightweight	Regular gypsum wallboard	26:30
7	2x6 Joist & Rafter Roof	Legacy	Regular gypsum wallboard	38 ²
9	Metal Gusset Truss Roof	Lightweight	Regular gypsum wallboard	23:10




New Technologies

PV Systems, Battery Storage Systems, Wind Turbines




The Firefighters' New Work Place

Houses are getting larger

- 1973: 1,600 sq. ft. 2008: 2,500 sq. ft.

Housing lots are getting smaller

- 1976: 10,100 sq. ft. 2008: 8,800 sq. ft.

During the past 50 years fuel loads in homes have changed

- Resulting in fuel rich fire conditions within homes

Home designs more open (less compartmentation, engineered structural members) and more energy efficient (multi-pane windows, wrapped in plastic, alternate energy sources)

Evolutions in building materials create changes in the Fire Environment. How all of these changes compound is not well understood. Standards, Codes and Fire Service knowledge can't keep up.

Have staffing, training, tactics changed to adapt to these changes?



Firefighter Research has Changed

- DHS AFG FP&S Research and Development (2006)
- Instrumentation and Video
 - Hundreds of channels recorded per second
 - Lab and Field Capability



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Research can allow you to experience a large number of fires from your perspective and the victims

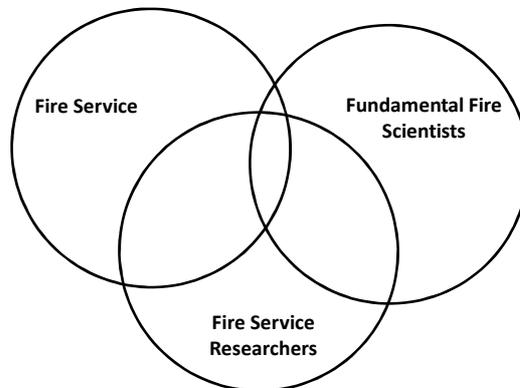


Summary

- To move forward, knowledge of fire dynamics has to be the foundation of the firefighting system, experience and fire research need to work together to improve strategies and tactics.
- Technology needs to support this system with the understanding that no amount of technology can replace knowledge (Turnout gear, SCBA, predictive tools, suppression tools, magic widgets...)
- Without dissemination of research results it is useless, this needs to be leveraged globally as there are few resources and more similarities than differences.



Summary



Now is a good time, fundamental fire scientists have laid the fire dynamics groundwork, fire service researchers have some funding available and the fire service is asking for more research and is participating in it.

Together we make the fire service safer and more effective!



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What's Coming?

Study of the Effectiveness of Fire Service Positive Pressure Ventilation During Fire Attack in Single Family Homes Incorporating Modern Construction Practices (2012 DHS AFG)



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PPV Project Video



DHS – 2012 Positive Pressure Attack

- Single Story Ranch (1200 ft²)
- Two Story Colonial (3200 ft²)
- 30 Cold Flow Experiments
- Single Story & Two Story
- 25 Fire Experiments
 - 15 Single Story
 - 10 Two Story
- Over 500 Visitors during the experiments



Dedicated to increasing firefighter knowledge to reduce injuries and deaths in the fire service and in the communities they serve.

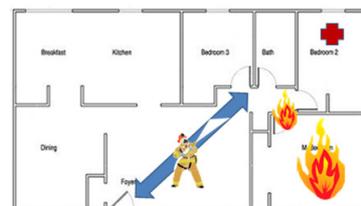
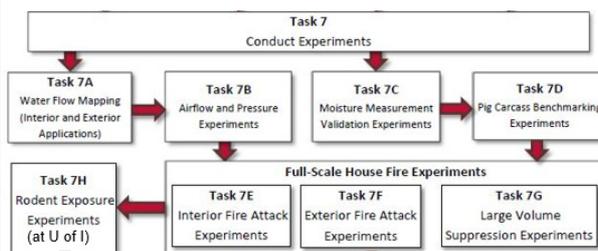
Yields:

- 72hrs of video (Post Processed)
- Over 2 Million Data Points
- 750 Graphs



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Study of the Impact of Fire Attack Utilizing Interior and Exterior Streams on Firefighter Safety and Occupant Survival (2013 DHS AFG)



Cardiovascular and Carcinogenic Risks of Modern Firefighting (IFSI)

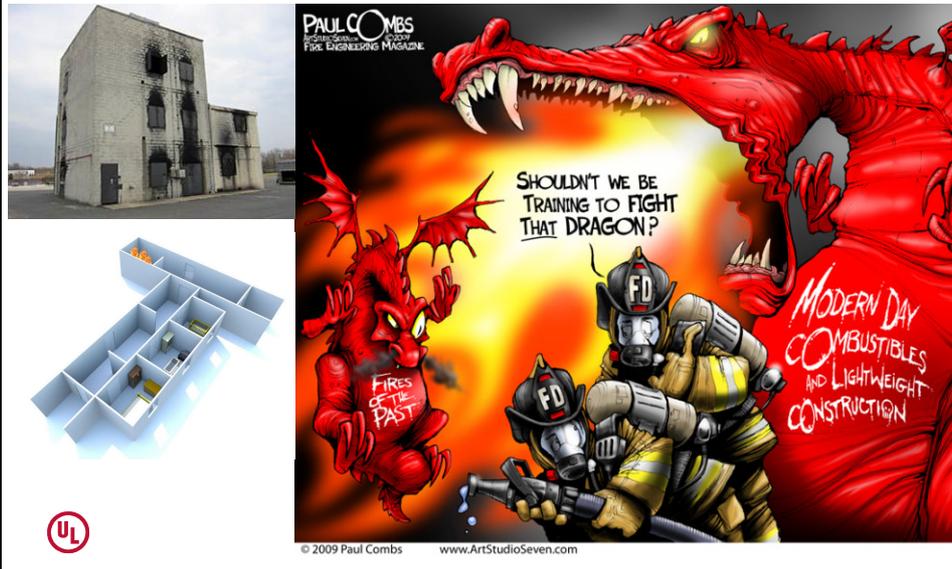


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Study of the Fire Service Training Environment: Safety, Fidelity, and Exposure



Free Online Fire Service Training www.ULfirefightersafety.com

Lightweight Collapse	Horizontal Ventilation	Basement Fires	PV Firefighter Safety
Vertical Ventilation & Suppression (40,000+)	Effective Tactics with FDNY and NIST (36,000+)		Attic & Exterior Fires (27,000+)

Get Involved



FIREFIGHTER SAFETY RESEARCH INSTITUTE

UL FRRI is dedicated to increasing firefighter knowledge to reduce injuries and deaths in the fire service and in the communities they serve.

Recent Project Updates

Follow UL FRRI's research projects for the fire service, firefighters, and the communities they serve.

[View all Projects >>>](#)

Case Fire Experiments Completed

August 21, 2015. No comments yet.

UL FRRI is currently conducting experiments and collecting the scientific data to support the fire service and the communities they serve.

Apply to be a part of the UL FRRI Firefighter Safety Research Institute

August 20, 2015. No comments yet.

UL FRRI is currently looking for fire service professionals to be a part of the project. Our team is looking for individuals who are interested in fire science that serves the fire service.

UL Firefighter Safety Research Institute

August 19, 2015. No comments yet.

UL FRRI is proud to announce the release of "Fire Science of the Service: Vertical Ventilation and Suppression Tactics in Single Family Homes" an online course that serves the fire service.



MODERN FIRE BEHAVIOR

An Informational Clearinghouse of Modern Fire Behavior Research Coupled with Modern Day Tactics

Where Science Meets the Streets

Hosted by UL Firefighter Safety Research Institute and the www.FireFighterCloseCalls.com Crew

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News

ModernFireBehavior.com is a joint effort between www.FireFighterCloseCalls.com and the Underwriters Laboratories Fire Safety Research Institute. This site is meant to serve as a clearinghouse of news and training information related to Modern Fire Behavior and Modern Building Construction Research, Tactics, and Practices along with actual street experiences. If you have any questions, please feel free to contact our Webmaster Brian Kazmierczak.

MARK FALKENHAN ATF LODD VIDEO

This video summarizes the ATF Fire Research Laboratory's Engineering Analysis of the fire that occurred at 38 Dowling Circle on January 19th, 2011 using actual scene audio, photographs and computer fire modeling video. ATF Fire Protection Engineers were asked to utilize engineering analysis methods, including computer fire modeling, to assist with determining the route of... [read more](#)

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QUESTIONS and DISCUSSION



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