

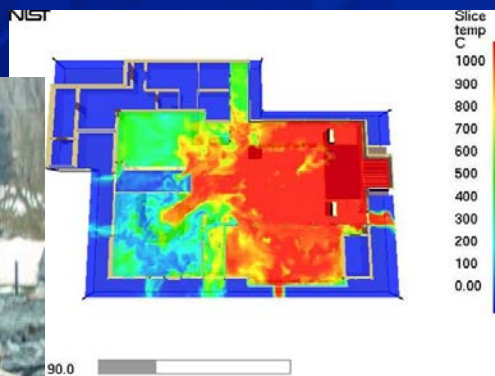


Presentation on EL's Fire Investigations

March 27, 2015

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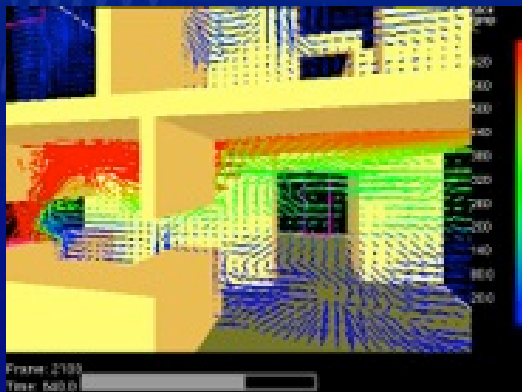
**2003 Station Nightclub Fire
E Warwick, RI**



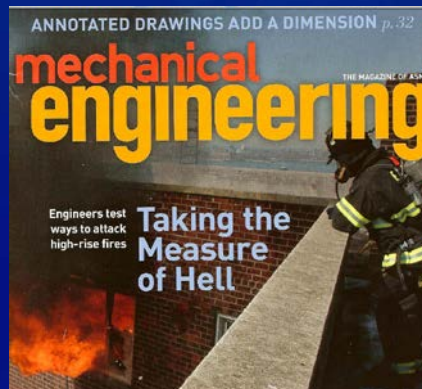
**2012 Waldo Canyon Fire
Colorado Springs, CO**

Fire Research at NIST

- Research prioritized to reduce fire losses and costs by addressing the measurement science needs of the U.S. building & fire safety communities
- Measurement science supporting the technical basis for standards, codes, guidelines, models, software decision-tools, standard reference materials, and databases
- Rich technical partnerships with industry, standards organizations, and government (local, state, and federal)



models



measurements



investigations



standards



EL's Disaster and Failure Studies Program

Hazards

- Earthquakes
- Hurricanes
- Construction/Building
- Tornadoes
- Fires (structural and WUI)

Purpose:

- Probable technical cause
- Lessons learned
- Improve standards, codes, practices
- Future research priorities

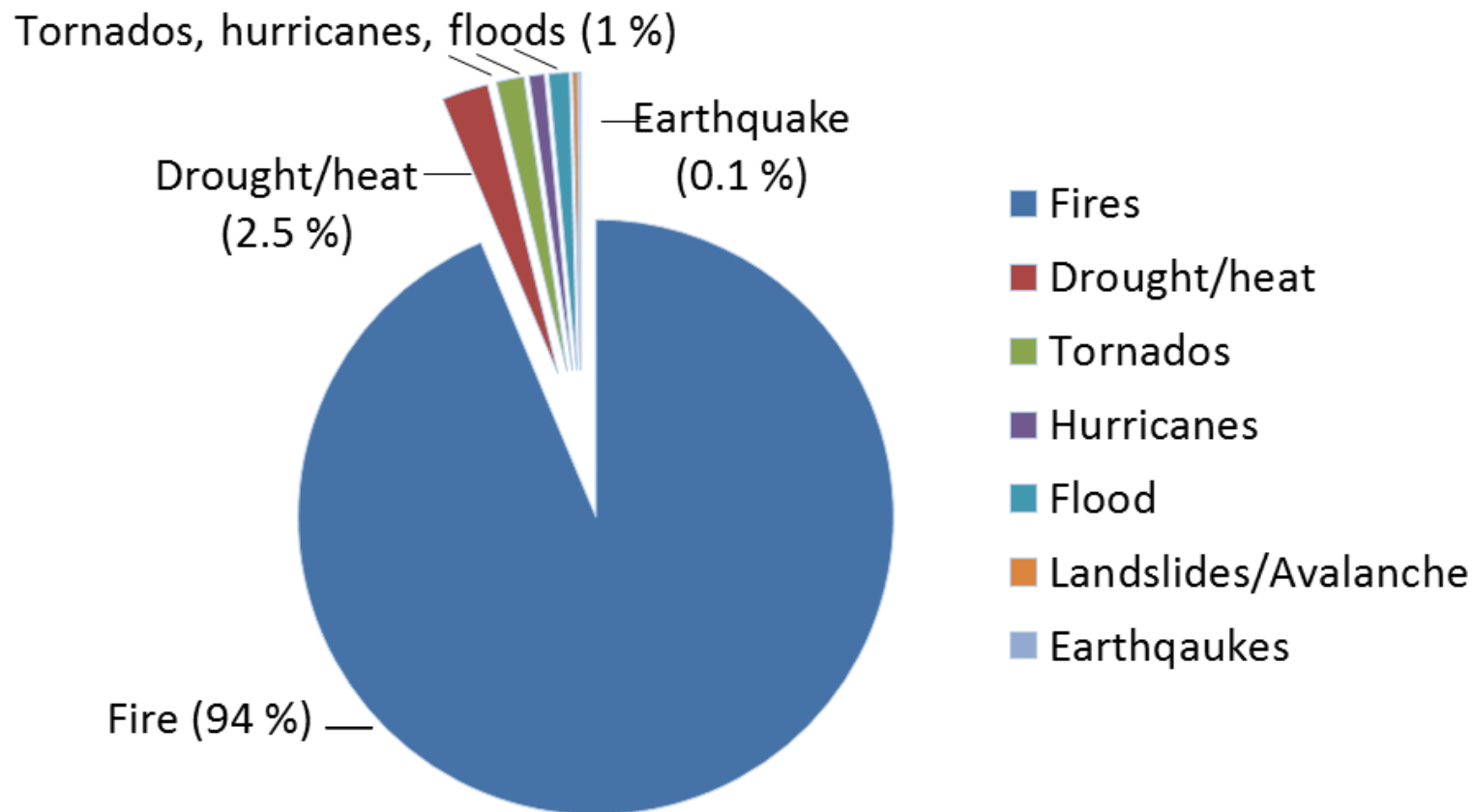
Authorities:

- ***Fire Prevention and Control Act (1974):*** fire investigations
- ***NCST Act (2002):*** building failures, evacuation and emergency response
- ***NIST Act (1986):*** structural investigations
- ***NEHRP Reauthorization Act (1990):*** earthquakes
- ***National Windstorm Impact Reduction Act (2004):*** wind, storms and floods
- ***Federal Response Framework:*** structural and fire safety; disaster operations and situation assessment; urban and industrial hazard analysis; recovery



Disasters and Life Safety

6200 Average Annual U.S. Fatalities
(1960 – 2012)



Data sources: NOAA, USGS, Census, NFPA, Met. Life Statistical Bulletin



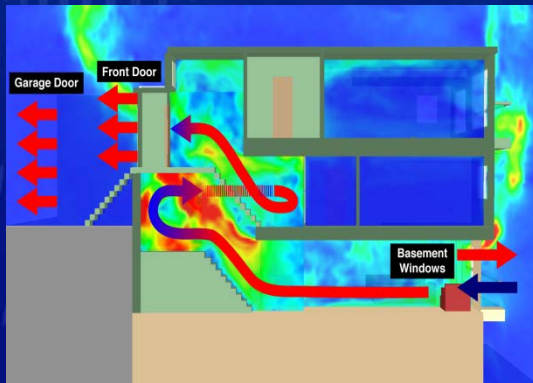
Fire Investigations Closely Tied to Fire Research

Internal and external investigations inform EL fire research

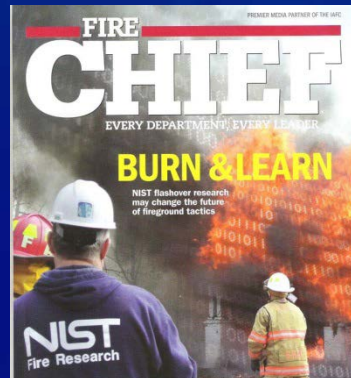
- External
- National Fire Incident Reporting System (NFIRS) data
 - NIOSH and fire service LODD investigations
 - CPSC investigations
 - EL fire investigations (structural fire performance; performance of building elements in the WUI;...)

Fire research provides the technical foundation for investigations

- Fire science: fire dynamics, materials flammability, flame spread,...
- Fire modeling as a forensic tool



models



measurements



investigations



standards



Investigation Challenges

- Perishable nature of evidence and artifacts
- Complexity and scale of incidents
- Quantification of transient exposure, ignition, and burning conditions
- Limitations of fire models
- Limited resources

Last 30 years of NIST Fire Investigations

Post-Earthquake Fires

Loma Prieta Earthquake, CA (1989)
Hokkaido, Japan (1993)
Northridge Earthquake, CA (1994)
Kobe, Japan (1995)

Residential Fires

Hillhaven Nursing Home (1989)
Watts St, New York City (1994)
Vandalia St, New York City (1998)
Cherry Road, Washington, DC (1999)
Keokuk, IA (1999)
Houston, TX (2000)
Houston, TX (2009)
San Francisco, CA (2011)
Chicago, IL (2012)
Riverdale Heights, MD (2012)

WUI Fires

Oakland Hills, CA (1991)
Witch Creek Fire, San Diego, CA (2007)
Tanglewood Fire, Amarillo, TX (2011)
Waldo Canyon, Colorado Springs, CO (2012)

Non-Residential Fires

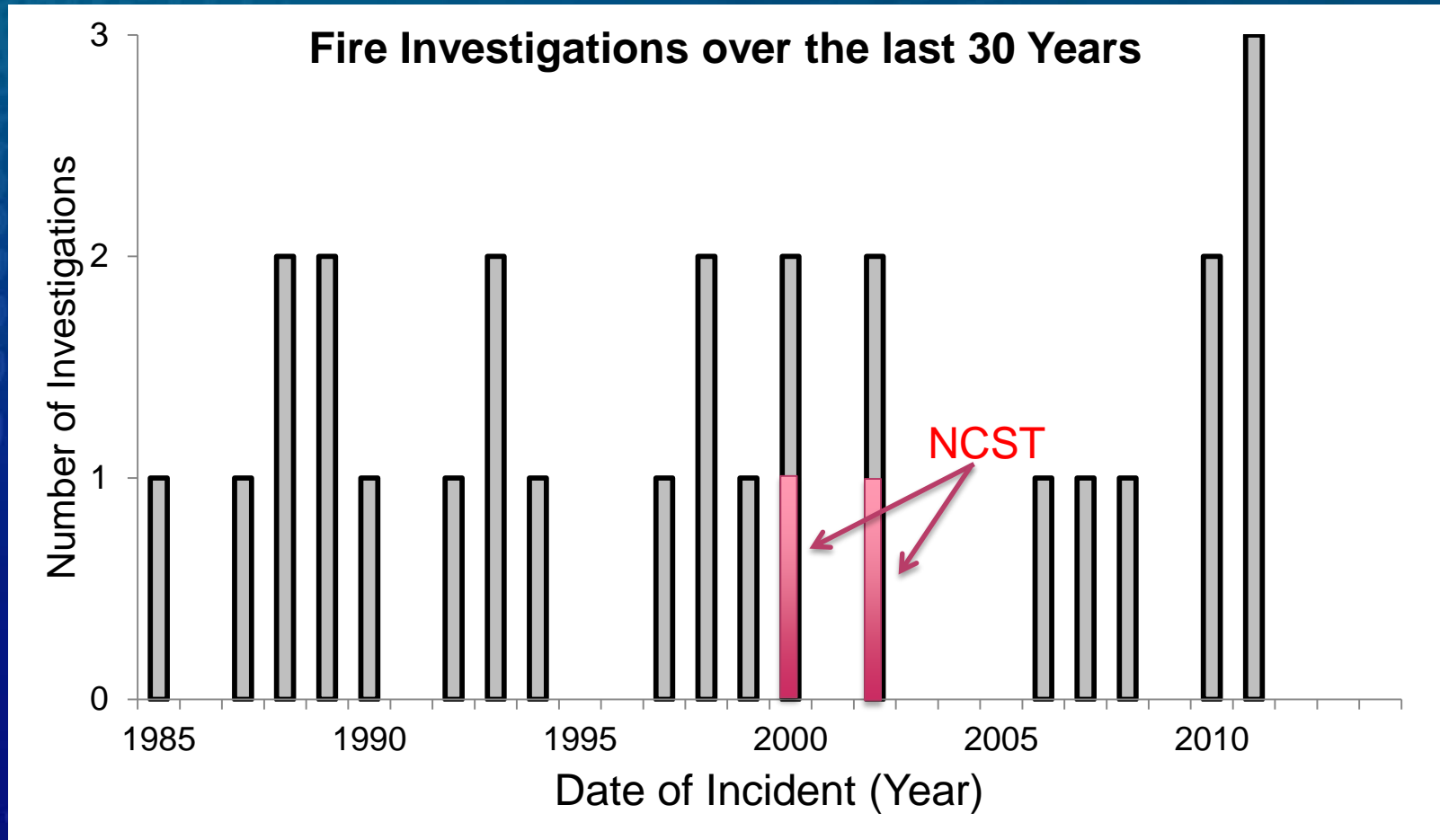
DuPont Plaza Hotel, San Juan, PR (1986)
First Interstate Bank, Los Angeles, CA (1988)
Pulaski Building, Washington, D.C. (1990)
Happyland Social Club, Bronx, NY (1990)
Hardware Store, New York City (2001)

NCST { **World Trade Center (2001)**
The Station Nightclub, RI (2003)

Cook County Administration Bldg, IL (2003)
Charleston Sofa Super Store Fire, SC (2007)



Frequency of NIST Fire Investigations



Character of Recent Fire Investigations

<u>Characteristics</u>	<u>NCST</u>	<u>non-NCST</u>
Incidents since 2001	2	10
Criteria:	formalized criteria	multiple considerations <ul style="list-style-type: none">- request by participating agency- aligns with project- resource availability- technical considerations
Typical duration of study	3 to 7 years	0.5 to 4 years
Scale of Work (Report pages)	700 to 10,000	50 to 1000



Impact of Recent Fire Investigations

- **World Trade Center (2001):** U.S. model building codes changes adopted for fire proofing; fire resistance rating; structural integrity; occupant evacuation & fire service access elevators; active fire protection systems; emergency responder communications.
- **Station Nightclub Fire (2003):** NFPA 101 (Life Safety) adopted requirements on automatic sprinklers, restricted festival seating in new and existing buildings, crowd managers for existing and new assembly occupancies, and egress inspection recordkeeping adopted.
- **Charleston Super Store Fire (2007):** ICC code changes requiring installation of automatic water sprinklers and improved systematic recordkeeping for retail, manufacturing and storage occupancies with upholstered furniture or mattresses.
- **WUI Fires (2007 – 2012)** Knowledge on WUI fire data collection methods used by Texas Forest Service and others. Identification of the critical role of embers in fire spread, fire service effectiveness protecting structures, and identification of knowledge gaps that preclude quantitative understanding of fire exposure.
- **Line of Duty Death Fire Investigations (2009 – 2012):** Lessons learned on fire dynamics and thermal hazard incorporated into NFPA 1403 Standard on Live Fire Training.



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NCST {



Summary of Presentations on Fire investigations

- NIST has conducted many fire investigations over the last 30 years
- Investigations represent an important means to gain insight into real-world problems and improve the understanding of:
 - fire hazards
 - real-world performance of buildings at the component and system levels
 - effectiveness of emergency response and evacuation procedures
- Investigations are a key part of NIST fire research activities:
 - provide critical technical insight
 - inform fire research direction
 - require extensive collaboration with other government agencies (local, state, federal)
- Fire research provides the technical foundation for fire investigations

