

# Challenges to Accurate Fire Cause Determinations

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*Scientific Fire Analysis, Big Pine Key, FL*

*Forensics: Science Policies to Increase Confidence*

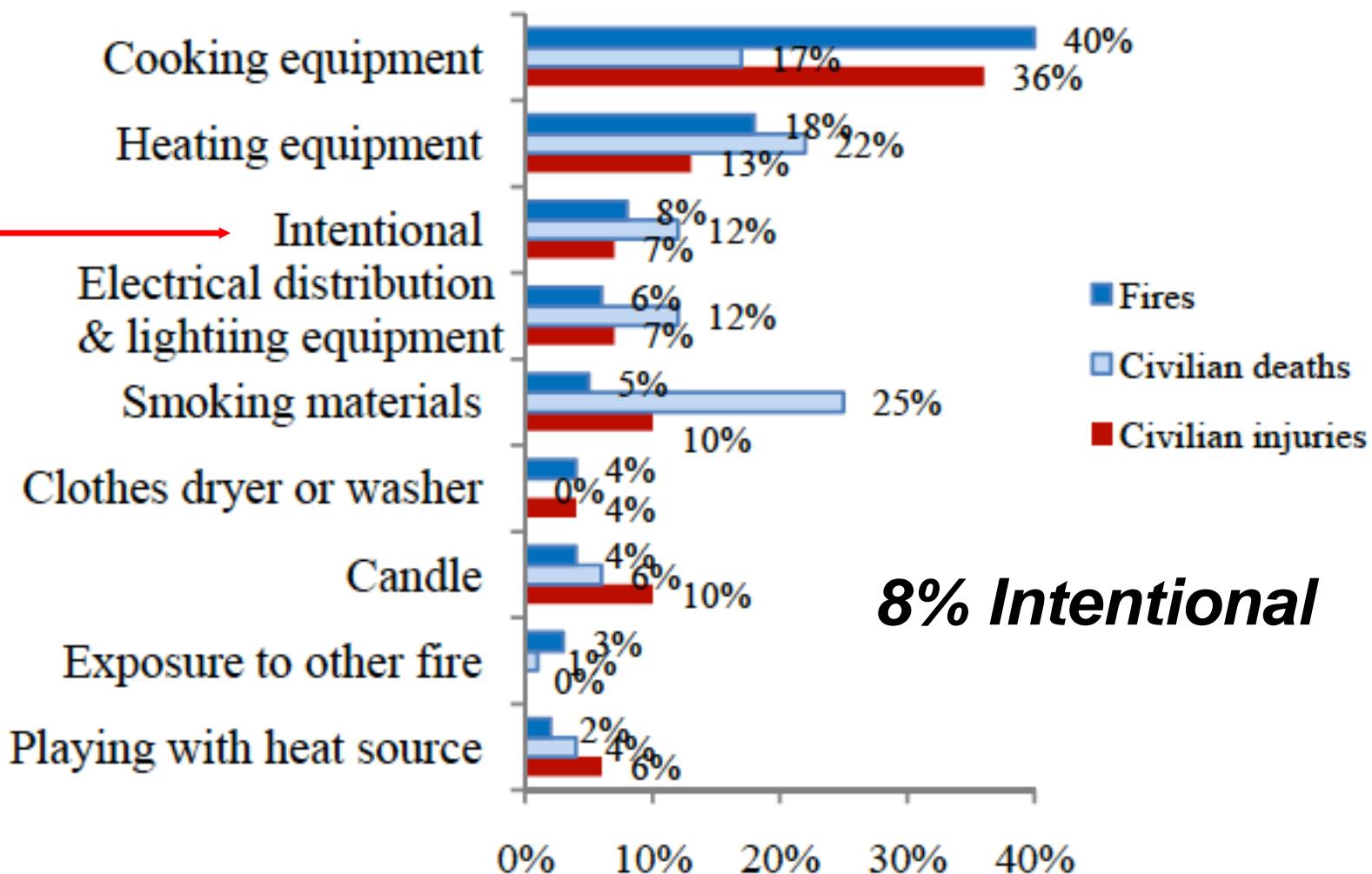
*September 26, 2012*

# *Recent Trends*

While the statistics can be a little slippery, the overall trend for arson is downward. This is either a result of effective law enforcement, more cautious fire investigators, or both.

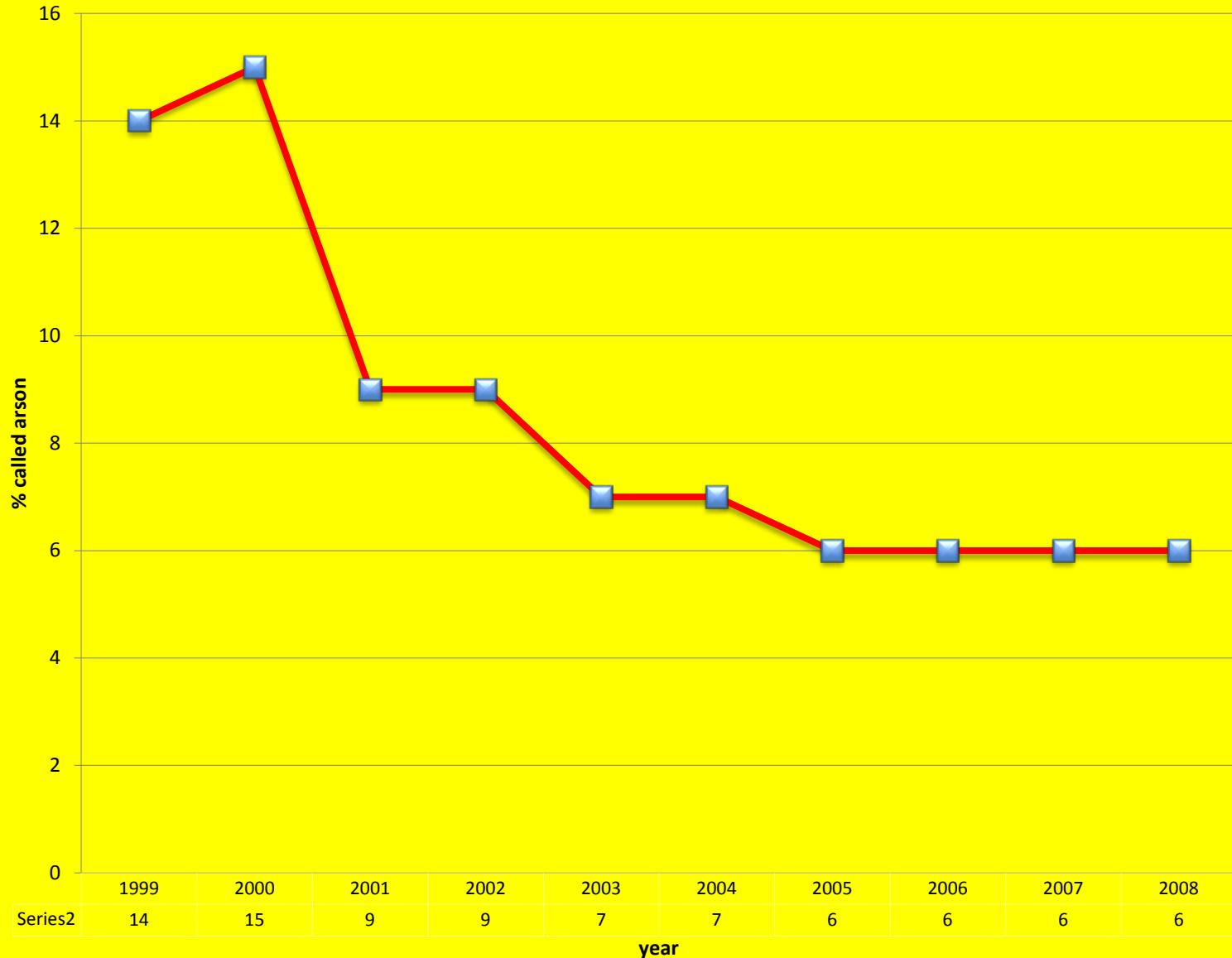


## Major Causes of Home Structure Fires 2003-2007

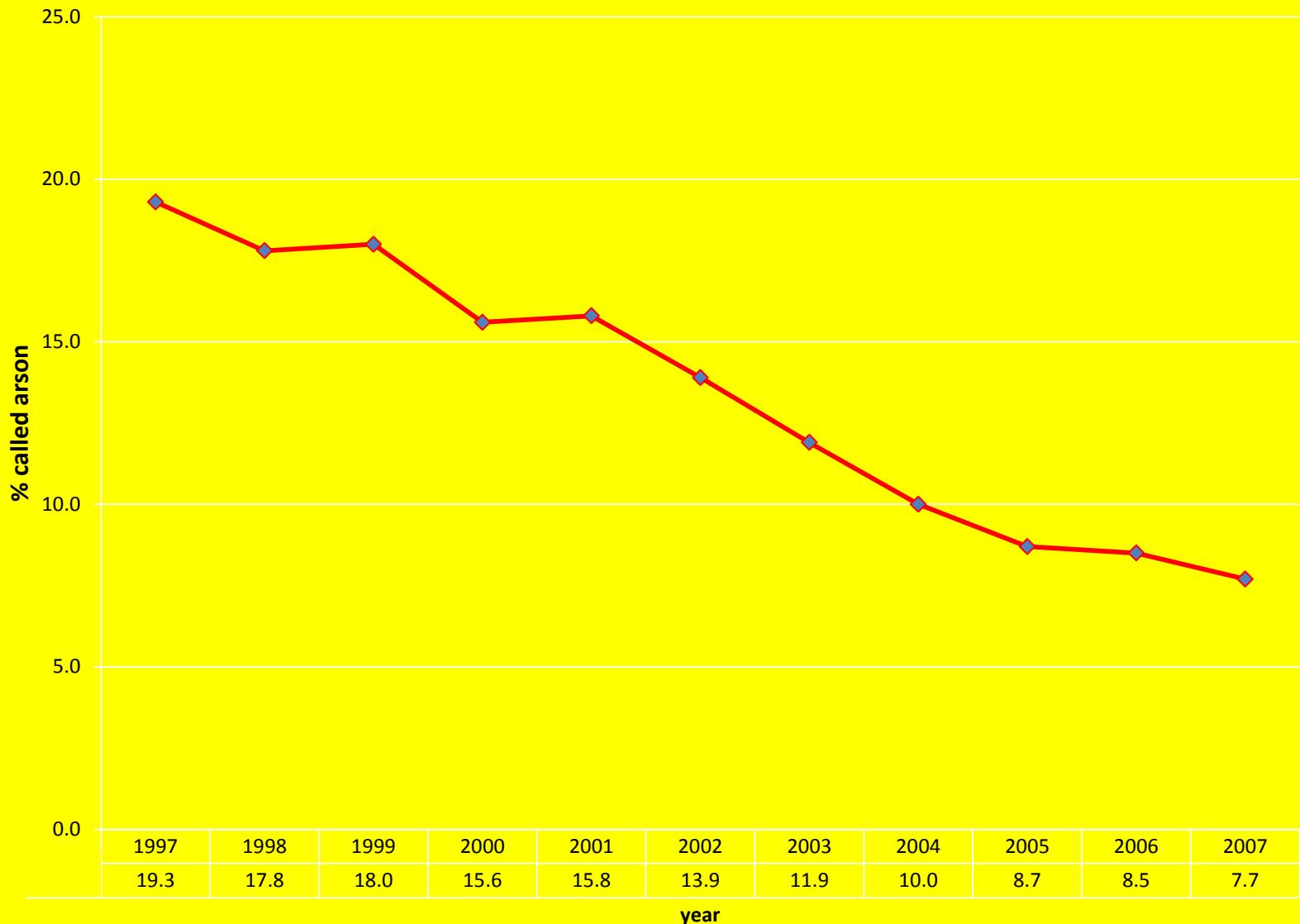


***8% Intentional***

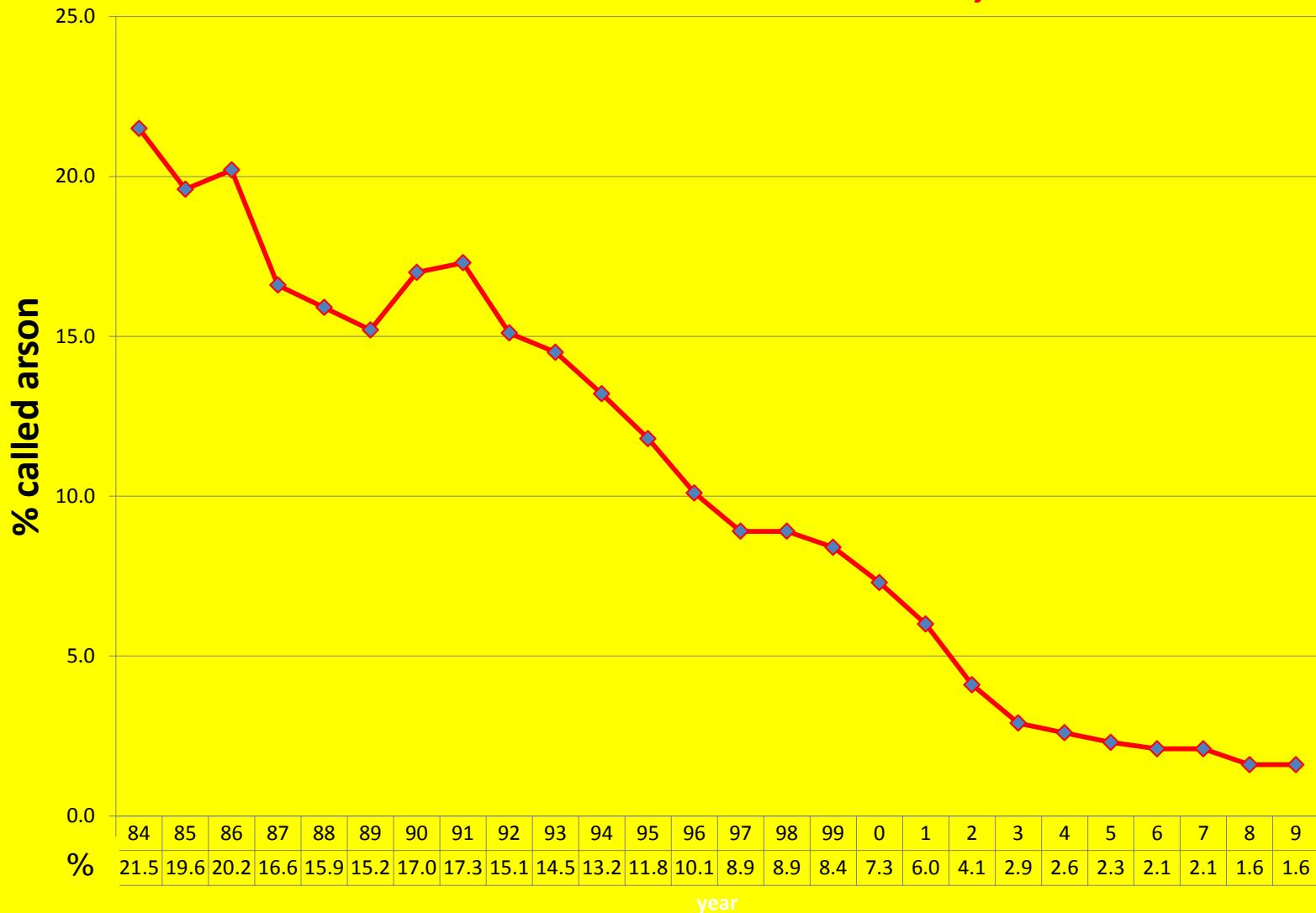
## Arson in the US-1999-2008



## Arson Fires in Texas, 1997-2007



# Arson Fires in Massachusetts, 1984-2009



# *Challenges*

Multidisciplinary field

physics, chemistry, toxicology,  
engineering, building design

Laboratory work

standards – ASTM 1990

Field work

dangerous, dirty, strenuous



# *Fire Origin and Cause Determination*

Requires determining where the fire originated. Recent research has revealed astonishingly high error rates for this fundamental task.



# *Mythology*

- Many previously held myths about fire behavior have been debunked, but
- The myth that the lowest and deepest char signifies the origin remains.

2005

Fire origin

accuracy experiment,

Las Vegas, NV

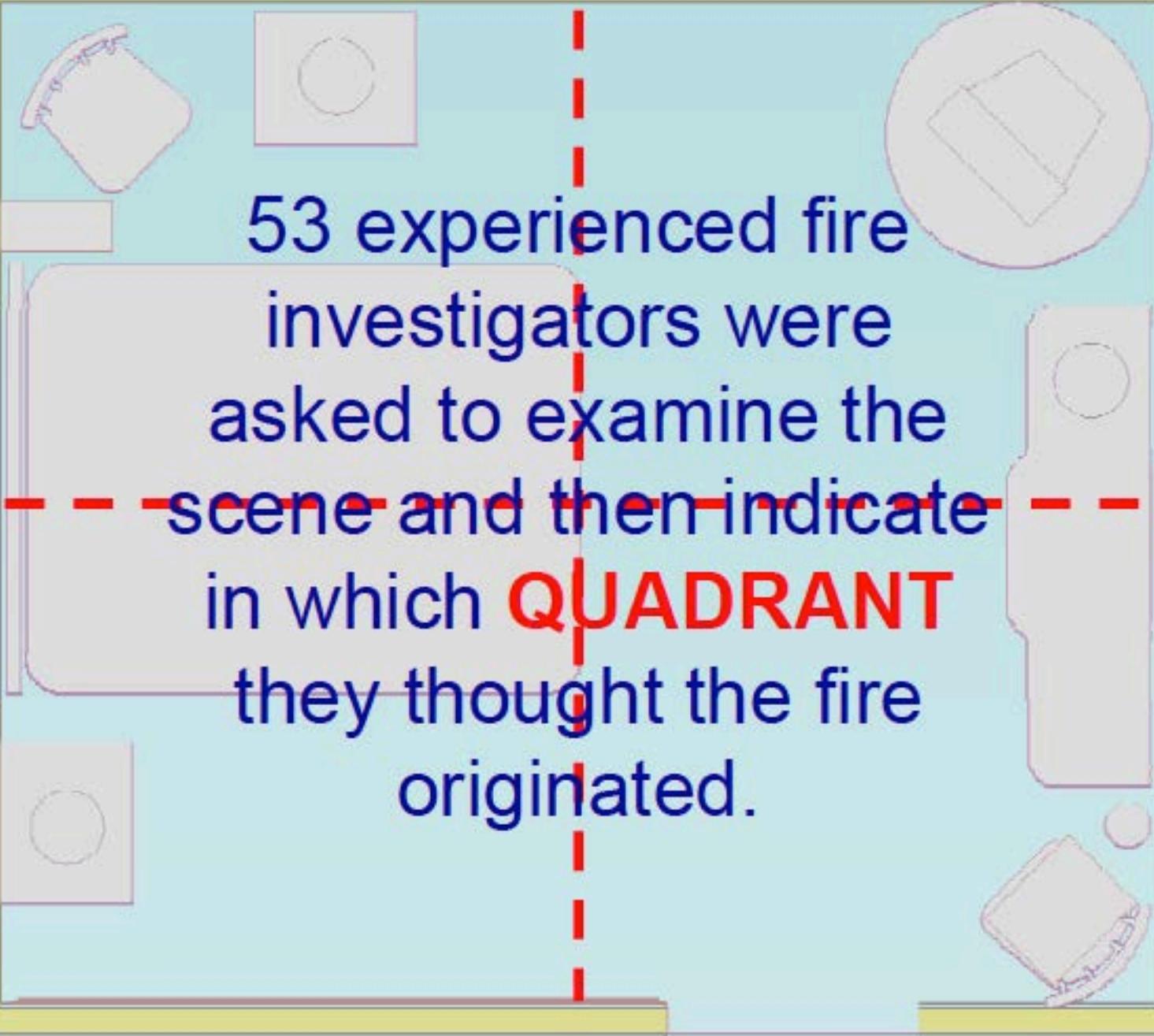




E.W. Garman, AIA



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53 experienced fire investigators were asked to examine the scene and then indicate in which **QUADRANT** they thought the fire originated.

Where did most  
investigators think the  
origin was located?



The actual origin



S.W. Carman, ATF

3 got it right...

That's 5.7% !

**NOT ONE** person  
determined the  
*actual point of origin*

Same results obtained for  
the second burn cell, but  
a **different** 3 investigators  
correctly identified the  
quadrant of origin.



# Exercise Repeated in 2007

- Slightly better results, but for a fire that burned longer than 3 minutes, the accuracy was 25%--no better than chance.

# *Fire Origin and Cause Determination*

If the correct origin is not determined, the cause determination is also likely to be incorrect. This translates into significant problems for the justice system, including wrongful convictions.



# *Needed Expertise*

Sadly, the vast majority of fire investigators today do not possess a college degree, much less a degree in a physical science. Most cannot describe simple combustion reactions. Many do not understand the concept of heat release.



# *Needed Expertise*

We can attempt to train investigators to adopt a scientific approach, but training is difficult if the investigator lacks the fundamentals of a science education.

The only adequate remedy is to offer compensation sufficient to attract college graduates.



# *Calls for Scientific Rigor*

NAS 2009:

...much more research is needed on the natural variability of burn patterns and damage characteristics and how they are affected by the presence of various accelerants.



many of the rules of thumb that are typically assumed to indicate that an accelerant was used (e.g., “alligatoring” of wood, specific char patterns) have been shown not to be true. **Experiments should be designed to put arson investigations on a more solid scientific footing.**



*DOJ 1977:  
“Although burn  
indicators are widely  
used to establish the  
causes of fires, they have  
received little or no  
scientific testing.”*



*“a program of carefully planned scientific experiments should be conducted to establish the reliability of currently used burn indicators.”*



# *Challenges to Overcome*

Multidisciplinary, complex field in need of more scientific rigor

Better educated experts are needed in fire scene investigation

Qualitative experience knowledge into quantitative data – we need to better understand uncertainties and error rates.

