

## **Reconstructing the Fire Scene**

### **Filling Information Gaps With Visual Forensics: A Case Study**

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*Determining the origin and cause of a fire can be extremely difficult, especially when the fire scene is badly damaged as a result of the fire and its overhaul. Conclusions are often reached as to the origin and cause of a fire based on presumption and supposition and many times with a view toward economic recovery. An accurate reconstruction of the fire scene including the location of fuel loads in the hypothesized area of origin is crucial in order to test the hypothesis to determine if it is consistent with all known facts. The hypothesis must be consistent with known fuels, potential ignition sources and fire spread.*

*Computer modeling is helpful; however, it relies exclusively on data describing the size of rooms, their openings and their juxtaposition with other rooms, corridors, windows, doors, etc. Mark Nordstrom of RaptorGraphics, LLC has developed a technique of reconstructing dimensional site data in a total burn fire scene. He is able to do this with very limited before-fire data and the article which he has written and which is published on our website entitled Filling Information Gaps with Visual Forensics: A Case Study, explains how he was able to reconstruct a warehouse after a total burn where even the foundation was removed prior to his involvement in the case. His reconstruction relied upon such information as minimal post fire measurements, an old survey, a single aerial photograph as well as various photographs taken during and after the fire. His reconstruction of the warehouse was accurate enough to provide data for computer modeling which ruled out the plaintiff's origin and cause hypothesis. Furthermore, his work withstood the rigors of deposition and court room testimony.*

*As lawyers and fire investigators, we must learn to think outside of the box in evaluating and testing our opponent's hypothesis with regard to origin and cause. We must leave no stone unturned and not give up until we have made use of all resources within our means. The article by Mark Nordstrom is a good example of using cutting edge technology to unravel the mystery of fire causation.*

Over the past fifteen years, RaptorGraphics has forensically "reconstructed" many fire scenes using three-dimensional digital modeling. These highly accurate and realistic recreations are supported by methodical research of both pre and post-fire site information. Such images, animation and interactive virtual media are used to visualize, understand and explain the pre-fire environment as well as to animate the fire event itself.

These recreations are only as valid as the data upon which they are based. Oftentimes, particularly in the event of a large fire, the property itself is destroyed by fire or remediation and the data concerning its structure and layout is destroyed along with it. This article profiles just one case study of how our three-dimensional digital site model

served as a pivotal part of a favorable defense resolution where missing information about the property could have otherwise led to an opposite result.

In 2001, a three-alarm fire ripped through a township warehouse resulting in property losses in excess of three million dollars. The fire was suspicious. The property owner was in financial straits, there was little inventory in the building, and the fire patterns simply were not consistent with the available fuel loads. The insurance carrier ultimately denied coverage based on arson, but after the building was demolished, the owner filed a bad faith action. The plaintiff (building owners) advanced several theories of fire origin and cause which the insurer's investigators purportedly did not consider. The defendant insurer's defense team asked MDE Forensic Laboratories (MDE), a Seattle-based fire investigation firm to investigate the validity of plaintiff's fire scenarios. To do so, MDE needed to understand in detail the layout of the alleged area of origin. Only from an accurate facility layout could MDE perform a series of Fire Dynamic Simulation (FDS) computational fire models. Unfortunately, complete dimensional data was not available on the property and it had long since been destroyed.

RaptorGraphics was brought in to assist MDE. In terms of dimensional building data, this was truly a "cold case." The warehouse was the original "Crane" bathroom fixture manufacturing complex which had been sold, converted and renovated over decades. Even the foundation of this 253,000 square foot facility no longer existed. The post-fire investigation provided no overall measurements of the facility, and only few post-event measurements from a one section of the building. Aside from these limited measurements, RaptorGraphics had an aerial photograph taken weeks prior to the fire, a blue print of parts of the original structure and various photographs taken during and after the fire event.

First, they used a technique to overlay a digital model of the "known" portion of the building footprint over the aerial photograph. Then they established a "virtual" camera location and lens that matched that of the "real" camera that had taken the aerial photograph. From there, they were able to sequentially recreate the relevant portions of the facility, including roofs, skylights, doors, windows and building features that were critical to analyzing potential origin and spread scenarios. Numerous building dimensions in the model were then verified by cross-referencing post-event photographs and measurements. By way of this reiterative process, the dimensions of the digital 3D model began to "approach a solution". In the end, RaptorGraphics was able to demonstrate that critical building dimensions were accurate to within less than six inches.

Using the dimensional data taken directly from the completed model, MDE performed approximately twenty computational fire models. However, none of them could support the plaintiff's origin and cause theories. The work of both RaptorGraphics and MDE survived the scrutiny of numerous depositions and courtroom testimony, and eventually led to a favorable resolution for the insured.

Forensic three-dimensional digital reconstruction offers tools and solutions far beyond the recreation of fire loss events and illustrative courtroom media.

RaptorGraphics has established a highly functional relationship between the physical and virtual worlds that, among other things, can be used to determine missing information that is no longer available at the site. It is a scientifically valid process that will find an ever-increasing and diverse role in precisely visualizing, understanding and litigating loss-related matters.