

- At the time of the building collapses, there were still vigorous fires, indicating the unchecked fires could have burned for well over an hour.

E.8.3 Capability for Large Fire Reconstruction

- It was possible to reconstruct a complex fire in a large building, even if the building is no longer standing. However, this required extraordinary information to replace what might have been gleaned from an inspection of the post-fire premises. In the case of the WTC tower, this information included floor plans of the fire zones, burning behavior of the combustibles, simulations of damage to the building interior, and frequent photographic observations of the fire progress from the building exterior.
- Proper design and interpretation of laboratory fires over two orders of magnitude smaller (heat release rates of 10 MW and 12 GJ in total heat output) than the WTC fires provided valid information for simulating the WTC fires.
- Conventional office workstations reached a peak burning rate in about 10 min and continued burning for a total of about a half hour. Partial covering of surfaces with inert material reduced the peak burning rate proportional to the fraction covered, but did not affect the total amount of heat release during the entire burning.
- Jet fuel sprayed onto the surfaces of typical office workstations burned away within a few minutes. The jet fuel accelerated the burning of the workstation, but did not affect the overall heat released.
- The FDS was capable of prediction of the room temperatures and heat release rate values for complex fires to within 20 percent, when the building geometry, fire ventilation, and combustibles were properly described. Parallel processing was essential to keep computation times tractable.
- The Fire Structure Interface, developed for this Investigation, was able to map the fire-generated temperature and radiation fields onto and through layered structural materials to within the accuracy of the fire-generated fields and the thermophysical data for the structural components.

E.8.4 Simulations of the WTC Fires

- Insulation damage due to the aircraft impact was the single most important parameter affecting whether a structural member reached a temperature range likely to cause loss of structural strength.
- The fire spread rates in WTC 1 were consistent with a combusted fuel load of 4 psf (20 kg/m²). Higher combusted fuel loadings resulted in slower fire spread rates that did not match the patterns observed in the photographic evidence. Since these fires were ventilation-limited, the flame temperatures would not have varied significantly within a range of reasonable combusted fuel loadings.