

quickly and to higher temperatures than the columns. The elevated temperatures in the floor elements led to their thermal expansion, sagging, and weakening, which resulted in failure of floor connections and/or buckling of floor beams.

- Sufficient breakdown of connections and/or beams resulted in loss of lateral support and buckling of at least one of the critical columns supporting a large-span floor bay on the eastern side of the building on or below Floor 13. This was the initiating event of the collapse.
- The initial local failure progressed upward to the east penthouse. As the large floor bays became unable to redistribute the loads, the interior structure below the east penthouse collapsed into WTC 7.
- Triggered by damage due to the falling debris and loss of lateral support to adjacent interior columns, the failure progressed westward in the region of Floors 7 through 14, where the floors had been weakened by fires. This ultimately resulted in the collapse of the entire structure.

The Investigation Team then proceeded to examine this hypothesis more closely and to consider possible alternative collapse initiating processes.

3.3 HYPOTHETICAL BLAST SCENARIOS

Considerable effort was expended to compile evidence and to determine whether intentionally set explosives might have caused the collapse of WTC 7 (NIST NCSTAR 1-9, Appendix D). As a minimum, the explosive material would have had to cause sufficient damage to a critical column or truss that it became unable to carry its service load or that a lateral deflection would cause it to buckle.

Six combinations of explosive location and column/truss sections and two implementation scenarios were considered. In the first scenario, there was ample time for optimized preparation of the structure (including possible preliminary cutting of structural members) and use of the minimum mass of explosives. In the second scenario, the explosive charge was to be placed in the shortest possible time, which was to be no more than a 7 h to 8 h time frame.

SHAMRC, a software program that is used for analysis of explosive detonations, shock propagation and structure loads due to blast and fragments, was used to simulate pressure histories from hypothetical blasts. The pressure histories were then used to determine whether windows would have broken, which would have provided visible evidence of a charge detonation to observers outside the building. SHAMRC has a proven record of accuracy for explosive weights of less than 500 g (1 lb) to more than 4×10^6 kg (4,000 tons). A validated Shard Fly-Out Model (SFOM) was used to predict window breakage. Simulations were performed for differing degrees of partitioning of a tenant floor.

Attention focused on a single hypothetical blast scenario. This scenario involved preliminary cutting of Column 79 and the use of 4 kg (9 lb) of RDX explosives in linear shaped charges. The other scenarios would have required more explosives, or were considered infeasible to accomplish without detection. Calculations were also performed for a lesser charge size of 1 kg (2 lb) to evaluate threshold explosive requirements for window fragility.