

Table 2–1 captures the time line for the impact and the events that followed immediately.

Table 2–1. Time line for events immediately following the aircraft strike on WTC 1.

Time(s)	Observation
0:00	Plane struck tower.
0.03	Bright flash at front of plane.
0.20	Tail disappeared into building.
0.43	Dust cloud began to form on north face, appeared to be ignited.
0.67	Dust cloud apparent near the center of the east face.
1.43	Dust cloud appeared in vicinity of mechanical floors (108 and 109) near the center of the north face.
1.77	Dust clouds appeared at mechanical floors (108 and 109) at two locations on either side of center of the east face.
3.43	Fire appeared from behind southeast corner.
4.40	Area of fire evident on the east face.
9.43	Fireballs appeared to extinguish.
18.56	Substantial but diminishing fires on north and east faces.

The timing and appearance of the fireballs indicated that they were ignited inside the building. A calculation based on the oxygen contained within the building on the floors into which the fuel tanks entered indicated that up to 15 percent of the available jet fuel could have burned inside the building in this immediate event. These fires quickly depleted the available oxygen. The resulting pressure wave forced large amounts of unburned fuel through openings either created by direct impact of the aircraft and/or debris or windows blown out as a result of the overpressure generated inside the building by the fire itself. The presumably atomized fuel burned when it mixed with air outside of the building. The largest fireball formed on the north face, suggesting that the largest amount of jet fuel was blown backwards through the opening created by the aircraft entry. If roughly another 15 percent to 20 percent of the jet fuel burned outside the building as in WTC 2 (Section 2.4.1), then about two thirds of the jet fuel remained inside the building to burn later or just flow away from the fire zones.

Measurements and calculations estimated that the thermal expansion from a fire in a partially enclosed space could generate overpressures between about 1 lb/in² and 5 lb/in². For a window and frame area of over 10 ft², this amounts to thousands of pounds of pressure, more than enough to cause displacement.

2.2.2 Estimated Aircraft Speed

The speed of American Airlines Flight 11 as it entered the tower was estimated as 683 ft/s $\pm$ 50 ft/s, or 466 mph $\pm$ 34 mph (NIST NCSTAR 1-2B).

2.2.3 Observed Impact Damage

The aircraft struck near the center of the north face of WTC 1, centered on the 96th floor with wings impacting from the 93rd to the 99th floors (Figure 2–2). The impact created a hole about 15 ft wide by 4 stories high at its widest points. The aircraft fragments continued into the building to destroy portions of the concrete floor systems on the 94th through 97th floors. In addition to numerous windows broken out by the impact on the north face, there were about 15 windows blown out on the east side of the 94th floor