

based on the television broadcasts are estimated to be ± 1 s, it can be seen from Table 5–1 that the two aircraft impact times derived by NIST and LDEO now agree within the combined uncertainties.

Table 5–1. Times for major events on September 11, 2001.

Event	Relative Time from Visual Analysis	NIST Time (Adjusted from Television Broadcasts)	Time Reported in the FEMA Study	Time Reported in LDEO Analysis (Appendix B)
First aircraft impact	8:46:25 a.m.	8:46:30 a.m.	8:46:26 a.m.	8:46:29 a.m.
Second aircraft impact	9:02:54 a.m.	9:02:59 a.m.	9:02:54 a.m.	9:02:57 a.m.
Collapse of WTC 2	9:58:54 a.m.	9:58:59 a.m.	9:59:04 a.m.	9:59:07 a.m.
Collapse of WTC 1	10:28:17 a.m.	10:28:22 a.m.	10:28:31 a.m.	10:28:34 a.m.
Collapse of WTC 7	5:20:47 p.m.	5:20:52 p.m.	5:20:33 p.m.	5:20:42 a.m.

The times listed in Table 5–1 for the collapses of the two towers and WTC 7 that are based on the television records and the revised LDEO analysis differ by up to 13 s. The differences for the towers are due to different definitions used for the collapse times. The times based on visual analysis refer to the time when the collapse of a tower first became visually evident, while the times based on seismic records indicate the time when sufficient falling debris struck the ground to cause a seismic signal. The differences between the two times were estimated to be approximately 8 s for WTC 2 and approximately 12 s for WTC 1, based on videos of the collapses. When the times required for falling debris to reach the ground were subtracted from the LDEO times, the collapse times agreed within the reported uncertainties.

The relative time for the collapse of WTC 7 was estimated by NIST as follows. Figure 5–1 shows a long-distance photograph taken shortly after the east penthouse on the roof of WTC 7 began to sink into the building. As discussed in Section 5.7, this penthouse began to disappear into the building 6.9 s before the entire building began to fall. The camera used for this photograph recorded digital timestamps with the photographs. The photographer who shot the image took numerous photographs on September 11, including shots of the towers earlier in the morning. By using the tower shots, it was possible to accurately determine the difference between the timestamps and the relative time. When this difference was accounted for, the relative time for the photograph was calculated to be 5:20:41 p.m. The photograph was then compared with an untimed video clip showing the collapse of WTC 7. A frame taken from the clip is shown on the bottom of Figure 5–1. The close agreement between the two images indicates the video frame was taken very close to the same time. In the video, the full collapse of WTC 7 started 6.2 s after the video frame shown in Figure 5–1, yielding the relative collapse time of 5:20:47 p.m.

The probable reason for the time difference between the NIST time and the LDEO result with regard to the collapse of WTC 7 is discussed in Appendix B. The seismic signal that was 10 s prior to the time derived from the television broadcasts was likely due to the falling of debris from the structural damage that preceded the descent of the east penthouse.

For this Investigation, the times used were those adjusted from the television broadcasts (Column 3).