

The Pentagon Attack: The Event Time Revisited

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Abstract

Since publication of my paper, “The Pentagon Attack: Problems with Theories Alternative to Large Plane Impact,” questions have arisen about some statements made therein, specifically those concerned with the clock evidence for the event time. This paper reviews the evidence and finds that it is much more convincing for an event time around 9:38 am than for a proposed earlier time around 9:32 am. It is shown, by experiment, that the minute hand of the Heliport clock could easily have moved from a time around 9:38 am back to a time around 9:32 am because of the abrupt deceleration that occurred when the clock hit the ground after falling off the wall.

The Pentagon Event Time

Overview of the Event Time Evidence

The original paper¹ treated the event time superficially for this reason: the time of the event had little bearing on the central finding of that paper. It was not the author’s intention to address the clock evidence at all, but it was added late in the review cycle and with insufficient consideration of other pertinent evidence that is now discussed here.

The paper showed that the physical and eye witness evidence points overwhelmingly to large plane impact. The physical damage component of the evidence is set out in detail in Appendix B. Creating the same damage patterns with explosives would be extremely difficult and highly improbable. Despite this conclusion, the paper did not rule out the use of bombs to explain some of the evidence, such as the smell of cordite reported by a few witnesses and reported deaths and damage in the A and B rings.

From the point of view of rebutting competing theories, particularly the “explosives or bombs only” theory at times propounded by Barbara Honegger,² the event time is of some importance. Honegger presented her evidence and theory, that explosions occurred at the Pentagon about five minutes before the official time of plane impact, at the recent 2011 Toronto Hearings in the absence of any competing presentations from those who maintain that a large plane impacted the Pentagon. This fact provides sufficient reason for a presentation that includes the contrary evidence.

¹ John D. Wyndham, “The Pentagon Attack: Problems with Theories Alternative to Large Plane Impact,” <http://www.journalof911studies.com/volume/2010/Wyndham1.pdf>

² Barbara Honegger, Paper presented at the Toronto hearings, 2011 and “The Pentagon Attack Papers,” Appendix to “The Terror Conspiracy” by Jim Marrs, 2011. See also “The 9/11 Toronto Report, 2012, www.ic911studies.org.

From the evidence she presented, Honegger suggests that the physical damage at the Pentagon occurred at about 9:32 am and can be entirely explained by bombs or explosives. This theory is a step in the direction of the “flyover” or “no plane” theories espoused by the Citizens Investigation Team³ (CIT) and others, although Honegger does not clearly rule out plane impact. However, Honegger makes no effort to explain the physical damage and debris evidence, except for the C ring hole damage. Papers by Legge and Stutt,⁴ Legge and Chandler⁵ and Legge⁶ show that the flyover theory is completely unsupported. The flight data recorder (FDR) data shows the plane descending and hitting the Pentagon at the damage elevation, accurate to within about 2 feet, and the plane path claimed by CIT, north of the CITGO station, is shown to be physically impossible, given the overwhelming witness testimony that the plane was not steeply banked.

It was never suggested in my original paper that the extensive damage and debris could be attributed to bombs or explosives as proposed by Honegger; rather the paper showed that the damage corresponded with large plane impact. The original paper noted that Honegger’s event time evidence had been rebutted by others, in particular Adam Larson. However, one statement in the original paper has been misconstrued as implying support for Honegger’s theory: “The clocks’ discrepancy, disputed by Adam Larson, can be removed if the airplane clock was about 5 minutes fast” (see subsection “Category 5”). This statement was derived from the paper by Legge and Stutt⁴. Those authors were determined to avoid giving the appearance of claiming that the impact time obtained from the FDR file, 9:37:52 am, was necessarily correct. They were at pains to point out that there was no way to prove that the FDR file was authentic though they could find no evidence of tampering. The authors were not aware, at the time, of the excellent analysis by John Farmer, published in 2009, which determined that impact occurred within 3 seconds of their time calculated from the FDR file.⁷ Farmer’s work is described more fully below.

Clearly the remark about the clock’s discrepancy, quoted above, does not support Honegger’s explosives theory, only the possibility of an event time earlier than the official time of plane impact (9:37:46 am). After this possible point of confusion was brought to the author’s attention, a more detailed examination of the clocks’ evidence by the author

³ Ranke, C. and A. Marquis, “National Security Alert”, <http://www.citizeninvestigationteam.com/>

⁴ Frank Legge, and Warren Stutt, “Flight AA77 on 9/11: New FDR Analysis Supports the Official Flight Path...” January, 2011 [http://www.journalof911studies.com/volume/2010/Calibration%20of%20altimeter 92.pdf](http://www.journalof911studies.com/volume/2010/Calibration%20of%20altimeter%2092.pdf)

⁵ Frank Legge and David Chandler, “The Pentagon Attack on 9/11: A Refutation of the Pentagon Flyover Hypothesis Based on Analysis of the Flight Path,” Sept., 2011, <http://stj911.org/contributions/index.html> and its Addendum: <http://www.foreignpolicyjournal.com/2011/12/27/addendum-to-the-paper-refuting-the-pentagon-flyover-hypothesis/>

⁶ Frank Legge, “The 9/11 Attack on the Pentagon: the Search for Consensus”, <http://www.journalof911studies.com/resources/Legge-Letter-June.pdf>

⁷ <http://bluecollarrepublican.files.wordpress.com/2011/02/radar-and-ntsb-time-normalization.pdf> (John Farmer)

cast serious doubt on Honegger's clocks' evidence itself. Farmer's evidence rules out any significant discrepancy between the plane clock and the correct time. Thus the supposition that the plane clock might have been fast by five minutes must be discarded.

The next section summarizes the clock or event time evidence both for an event time around 9:32 am (as compiled by Barbara Honegger), and around the official plane impact time. The 9:38 am evidence is based on a compilation by Adam Larson⁸. In later sections, experimental evidence is presented that shows that the Pentagon wall clock evidence is far from trustworthy.

The Pentagon Clocks and Other Evidence

A. The evidence for an event time around 9:32 am, presented by Barbara Honegger at the Toronto Hearings, and in her article "The Pentagon Attack Papers," is as follows:

- The Heliport wall clock stopped at 9:31:30 am (Ralph Olmholt,⁹ 2004)
- A wall clock from the Navy section stopped at 9:31:40 am (Olmholt, 2004)
- The FAA Timeline initially¹⁰ gave the impact time as 9:32 am (later corrected)
- Alberto Gonzales¹¹ stated, in a Navy lecture, that "The Pentagon was attacked at 9:32 am."
- April Gallop's wristwatch¹² "stopped shortly after 9:30."
- Per Stig Moller,¹³ Denmark's soon-to-be foreign minister, noted the event time as 9:32 am.
- The Naudet brothers WTC1 video gives evidence for a time just after 9:30 am.
- Robert Andrews, Top Civilian at the Pentagon, (using a wristwatch) reported a time of about 9:32 am (as reported by Barbara Honegger).

⁸ Adam Larson, "Part 1: The Elastic Timeline" Nov 2007
<http://frustratingfraud.blogspot.com/2007/11/pentagon-attack-timeline-questions-part.html>,
"Part2: Another Six Back?" Nov 2007
<http://frustratingfraud.blogspot.com/2007/11/another-six-back.html>
"Part 3: 9:32 Evidence Addressed" December 2007
<http://frustratingfraud.blogspot.com/2007/12/932-event-evidence-addressed.html>
"Part 3: Overwhelming Evidence for 9:38" August 2008
<http://frustratingfraud.blogspot.com/2008/08/overwhelming-evidence-for-938.html>

⁹ Olmholt, Ralph. "The Dog Should Have Barked." Pentagon Research.com. December 22 2004

¹⁰ Federal Aviation Administration. Executive Summary - Chronology of a Multiple Hijacking Crisis - September 11, 2001 September 17 2001. <http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB165/faa5.pdf>

¹¹ Lecture at Naval Postgraduate School (quoted by Honegger)

¹² Barbara Honegger in "The Pentagon Attack Papers," Appendix to "The Terror Conspiracy" by Jim Marrs

¹³ <http://forums.randi.org/archive/index.php/t-150423.html>

B. The evidence for an event time around 9:38 am, as compiled by Adam Larson, is as follows:

I. Evidence From Specific Time Pieces (clocks, watches)

- A fallen clock¹⁴ in Room 3E452 (near the "hinge" of collapsed floors) indicates 9:36:27 (from "Pentagon 9/11" by Alfred Goldberg, military historian).
- Kevin Shaeffer:¹⁵ "In a flash, at exactly 9:43 a.m. . . .exploded in a gigantic orange fireball"
- Don Wright:¹⁶ "It was about 9:35 ...came down right over 395 into the Pentagon."
- Donald R. Bouchoux:¹⁷ "At 9:40 a.m. ... the aircraft crossed ... in front of me."
- Vin Narayanan:¹⁸ "At 9:35 a.m. I saw an American Airlines jet flying right at me."
- Captain William B. Durm:¹⁹ "At 9:35 ...we heard over the loudspeaker..."
- Lt. Col. Frank Bryceland:²⁰ "About 9:30 or so —maybe quarter to 10 — we heard and felt the loud explosion "

II. Evidence *Not* From Specific Time Pieces

- Pentagon parking lot entry camera²¹ (testimony by Col. Alan Scott, a NORAD officer) - recorded time is 9:37.
- Security video time stamps²² from Doubletree and CITGO frame the 9:38 am time.
- Flight Data Recorder.²³ The last time recorded in the file is 9:37:49, but Stutt's analysis shows that there are three more subframes, one second each, bringing the final time to 9:37:52.
- 84RADES video²⁴ - Flight 77 disappears from radar at 9:37:12, impact estimated to be 33 seconds later.
- NTSB report,²⁵ "Flight Path Study-American Airlines Flight 77," (dated Feb. 19, 2002) gives an impact time of 9:37:45.

¹⁴ Alfred Golberg et al., "Pentagon 9/11," 2007

¹⁵ Originally published in Shipmate magazine.

¹⁶ <http://stevenwarran.blogspot.com/2007/08/another-eyewitness-to-pentagon-attack.html>

¹⁷ <http://911review.org/Wiki/PentagonAttackWitnessesBlast.shtml>

¹⁸ <http://sl.zetaboards.com/pumpitout/topic/3622757/1/>

¹⁹ <http://history.amedd.army.mil/memoirs/soldiers/documents/responding.pdf> (page 11)

²⁰ <http://history.amedd.army.mil/memoirs/soldiers/documents/responding.pdf> (page 31)

²¹ <http://www.911commission.gov/archive/hearing2/9-11CommissionHearing2003-05-23.htm>

²² <http://frustratingfraud.blogspot.com/2008/08/overwhelming-evidence-for-938.html>

²³ Frank Legge, and Warren Stutt, "Flight AA77 on 9/11: New FDR Analysis Supports the Official Flight Path..." January, 2011
<http://www.journalof911studies.com/volume/2010/Calibration%20of%20altimeter%2092.pdf>

²⁴ <http://www.youtube.com/watch?v=OftgNhQKYus>

²⁵ <http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB196/doc02.pdf>

- John Farmer's analysis²⁶ gives an impact time of 9:37:50 am.
- Arlington County Emergency System²⁷ points to 9:38 am.
- C130 pilot report²⁸ via FAA: "approximately 9:38 am."
- 9:39 News Report – NBC - Jim Miklaszewki's report²⁹ at 9:39:10.
- William Paisley³⁰ saw Jim Miklaszewki's report at 9:39:10. He took a few steps to his office window and immediately saw a billowing, building mushroom cloud of black smoke.

Discussion of Evidence Presented by Barbara Honegger

When presented on its own, as at the Toronto Hearings, Honegger's clock evidence seems persuasive. The strongest part of this evidence, the two fallen wall clocks frozen at 9:31:30 am and 9:31:40 am respectively have a powerful visual impact. This impact, however, is considerably diminished when one learns that there was another fallen wall clock, from room 3E452, whose hands are frozen at 9:36:27 (see Figure 1)! This stopped clock is not mentioned by Honegger.

A number of questions now arise:

- Were the two clocks (and the third clock) giving the correct time before the event occurred?
- Did their fall in any way affect their reading?
- Were the clocks tampered with after the event?

The wall clocks all appear to be electric, battery-operated clocks. If they had been hard-wired, it seems unlikely they could have fallen as they did. The Heliport clock appears to be a Skilcraft Wall Clock³¹ that runs on one AA battery and keeps time with 0.33 second-per-day accuracy (see Figures 3 and 4). Thus, this clock (found outside the Heliport building) could gain or lose 6 minutes in just under 3 years, provided the battery lasted that long and was not changed. If changed, presumably the time would be set correctly again.

²⁶ <http://bluecollarrepublican.files.wordpress.com/2011/02/radar-and-ntsb-time-normalization.pdf>

²⁷ <http://www.arlingtonva.us/departments/fire/edu/about/fireeduaboutafterreport.aspx>

²⁸ <http://www.veoh.com/watch/v14171273CaN9tsfX?h1=C130+Flight+Path+>

²⁹ <http://archive.org/details/nbc200109110912-0954>

³⁰ <http://frustratingfraud.blogspot.com/2008/08/overwhelming-evidence-for-938.html>

³¹ <http://chicagolighthouse.org/programs-and-services/wall-clocks/12quot-series-slimline>



Figure 1: Stopped Clock from Room 3E452 near “Hinge” of Collapsed Floors

The existence of a third wall clock reading 9:36:27 by itself seriously undermines the two wall clocks’ evidence presented by Honegger.

Could the fall have caused the minute hand to move closer to a 9:31:30 am time for two of the clocks, as suggested by Russell Pickering? See the section “Wall Clock Experiments” for an experimental test of this suggestion for a clock virtually identical to the Heliport clock. The result of the experiment is that the minute hand can move back readily, even for a drop of 4 feet, as much as 8 minutes or more (to around the 9:30 am position), depending upon the clock’s orientation when it strikes the floor. This experimental evidence proves Honegger’s claim that the wall clocks’ provide the “ultimate evidence,” to be without foundation.

Could the clocks have been tampered with after the event? Some writers have suggested a high degree of fraud in the Pentagon evidence in order to justify their theories, notably theories in which a large plane does NOT impact the Pentagon. This author doubts any such fraud with the clocks as the clock readings are quite consistent with the minute hands having moved backwards after a fall.

Moving on to Honegger’s FAA evidence, the FAA revised its initial time of 9:32 am to be close to the official, later time. The most likely explanation for this is simply confusion. Those who suggest fraud here should bear in mind that the FAA at one point erroneously reported a crash time for Flight 11 (into WTC 1) of 9:25 am, whereas the actual crash time was 8:46 am. Honegger herself has a slide³² showing 28 individual, mostly different,

³² Barbara Honegger, “INN World Report,” 9/11/11 New York City and “The Pentagon Attack Papers,” May 2011 (26 event times)
http://www.netrootz.com/images/groups/group_30/A5C_PENTAGON_ATTACK_PAPERS.pdf

Pentagon event times, reported almost entirely within a few days after 9/11/2001 by different sources (mainly news outlets). These times range from 9:20 am to just before 10:00 am. For five (5) event times of 9:30 am, the qualifier “about” is used. Eleven (11) event times are in the range 9:36 – 9:40, while nine (9) are in the range 9:43 – 9:45. Honegger’s 9/11 Toronto Report² (page 253) lists only four of the 9:30 times.

The statement by Alberto Gonzales is best discarded since he was not an eyewitness in any way, and there is no knowing where he obtained the 9:32 time he quoted. Perhaps he was aware of the earlier FAA time of 9:32 am.

Honegger’s remaining evidence items all entail time pieces, mainly personal wristwatches, for which there can be no certainty they were set or read correctly. There is no way to know if April Gallop’s wristwatch was giving the correct time before it stopped, or why it stopped. Per Stig Mollers’ statement has been re-translated from the Danish and indicates he never actually looked at his watch, but judged the time from a meeting that was supposed to end at 9:30 am but did not so end. The clock in the firehouse in the Naudet video may have been slow. Robert Andrews stated his watch actually read 9:35 am, but he kept it fast, but how accurate is this testimony? For those interested, Adam Larson has discussed all these cases in detail.⁸

To summarize, there are many problems with Honegger’s choice of evidence which omits the large body of evidence compiled by Adam Larson (see next section). Note also that Honegger’s evidence consists almost entirely of evidence from time pieces (exceptions are the early FAA time, later changed, and the statement by Gonzales which must be dismissed) whose correct initial settings cannot be verified. This is not the case with the evidence compiled by Adam Larson.

Discussion of Evidence Compiled by Adam Larson

As can be seen from the evidence summaries above, Larson’s compilation has been presented here after separation into two groups: I. Evidence From Specific Time Pieces (wall clocks and wristwatches), and II. Evidence Not From Specific Time Pieces. The evidence (I) from wall clocks and wristwatches provides a body of evidence about equal in size to that of Honegger’s. Although indicating times that bracket the official time of about 9:38 am, this evidence admittedly suffers from the same uncertainties as Honegger’s time pieces’ evidence. We shall therefore focus on the second evidence group (II), in which the time does not arise from specific, known time pieces or witnesses.

A week after the attack, NORAD revised the time of impact to be 9:37 am. Col. Alan Scott,³³ a NORAD officer, told the 9/11 Commission in 2003 that the revision was due to an “entry camera for the parking lot, which happened to be oriented towards the Pentagon

³³ National Commission on Terrorist Attacks Upon the United States. Second Public Hearing, panel 1. May 23, 2003. Hart Senate Office Building, Room 216, Washington, DC. Witness: Col. Alan Scott (Ret.). <http://www.911commission.gov/archive/hearing2/9-11CommissionHearing2003-05-23.htm>

at the time of impact, and the recorded time is 9:37.” However, Scott also stated that the video footage was not found until two weeks after 9/11, so NORAD’s initial reason for adjusting the impact time is unclear. The video has been questioned because of irregularities in date and time stamps.

Videos from the CITGO Station and Doubletree Hotel were released in 2006 and show times that bracket the official time: 9:34:10 for Doubletree (3:35 mins behind) and 9:40:36 for CITGO (2:51 mins ahead).

In the case of the Flight Data Recorder (FDR), the “last” frame of decoded data as received from the National Transportation Safety Board (NTSB) gives an official time of 9:37:45 (apparently the mean of two published times, 9:37:44 and 9:37:46). However, as John Farmer and others suspected, there was a missing final section which Warren Stutt was able to reveal and decode. The real final frame allows calculation of impact at 9:37:52, which is 6 seconds later than the official time taken as 9:37:46. Legge and Stutt point out that the plane clock may not have been accurate to the second as GPS was reportedly not fitted or not operating. However the agreement of their time to within 2 seconds of that calculated by Farmer, using an entirely different method, as set out below, appears to rule out any possibility of a 5 minute error in the impact time. The agreement with Farmer also provides support for the view that the FDR file has not been tampered with, as some assert, and represents the true path of the plane

The 84RADES video data has Flight 77 disappearing from radar at 9:37:12, with a likely impact time about 33 seconds later. The radar data cannot give an exact time for impact directly as the plane by then is too low for signals to be observed.

The NTSB report, "Flight Path Study-American Airlines Flight 77," (dated Feb. 19, 2002) gives an impact time of 9:37:45, obtained from the following slightly inconsistent sources: FDR data, radar data from the Federal Aviation Administration’s Air Route Traffic Control Centers, approach control at Washington Dulles Airport and the U.S. Air Force’s 84th Radar Evaluation Squadron. The 9/11 Commission, in its Final Report, cites the NTSB report as its source, but gives the impact time as 9:37:46 [p 96].

In a paper published in 2009, John Farmer³⁴ set out to reconcile the radar data released by the U.S. Air Force’s 84th Radar Evaluation Squadron (84 RADES or the Northeast Air Defense Sector, NEADS), the Federal Aviation Administration (FAA and its various ASR or Air Surveillance Radar sites), the National Transportation Safety Board (NTSB) who supplied FDR data in two formats (CSV or comma-delimited file format and a raw file dump), and live television (TV). Specific FAA ASR sites were IAD (Dulles International Airport) and DCA (Reagan National Airport). Data from all the foregoing sites was reconciled with data from the Southeast Air Defense Sector (SEADS). Farmer’s diligent analysis, accurate to a few seconds, produced an impact time of 9:37:50 (SEADS time) at the Pentagon. The beauty of this work is that the calculated impact time was calibrated by the TV image of flight UAL175 hitting the South Tower. At this moment at least two radar stations were following the aircraft, thus permitting adjustments to be calculated for the

³⁴Farmer, J., <http://bluecollarrepublican.files.wordpress.com/2011/02/radar-and-ntsb-time-normalization.pdf>

timelines of all the relevant radar facilities. The TV record is in public hands and virtually indisputable.

The Arlington County After-Action Report contains first-hand emergency communications data. There was a marked increase in calls about a large plane approaching, then hitting, the Pentagon, beginning just before and after the 9:38 am mark. This is strong evidence against an earlier time of 9:32 am.

The pilot of a C-130H cargo plane was instructed to follow the flight of a plane described as “unknown.” On page 26 of its Final Report, the 9/11 Commission noted that: “At approximately 9:38 A.M., the C130H aircraft reported to Reagan Airport controllers that the aircraft it was following crashed into the Pentagon.” The source is cited as “FAA audio file, Washington Tower, Tyson/Fluky Position, 9:38:52 ... AAL 77; Washington, DC; September 11, 2001.” The C-130H was too far away for the pilot to exactly locate the position of impact when it occurred, but he did so as he approached, eventually stating that the plane hit the west side of the Pentagon.

NBC News was covering the events of 9/11 and had a correspondent, Jim Miklaszewski, in place at the Pentagon. At about 9:39:10, Jim Miklaszewski interrupted the newsroom coverage to announce an “explosion of some kind, here at the Pentagon.” This report, just a little over one minute after the official event time, lends credence to that time.

William Paisley saw Jim Miklaszewski’s NBC report at 9:39:10. Being located at Crystal Park 3, 10th floor, he only needed to take a few steps to his office window to view a large cloud of black smoke coming from the direction of the Pentagon, thus confirming an event time slightly before 9:39 am.

Summary of Evidence Compiled by Honegger and Larson

If the Pentagon wall clocks were set correctly as one would expect, the early times (around 9:32 am) displayed by the two fallen clocks cited by Honegger are completely explainable by the clock hands moving backwards when the clocks impacted the floor (see next section). The stopped clock in Figure 1, which points to 9:36:27 am, sets a lower limit to the time of the event, so that the event occurred at this time or later. There is no way of knowing whether the personal and other time pieces cited by Honegger and Larson were set correctly.

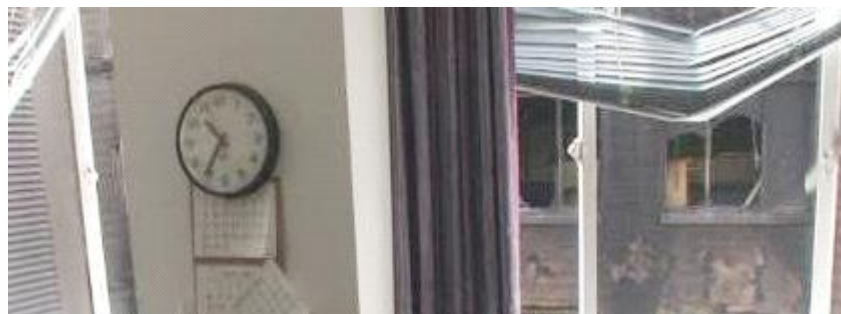


Figure 2: An Undamaged Pentagon Wall Clock

In contrast there is a substantial body of evidence for the 9:38 am time from a variety of sources such as radar and the FDR data. All of this data points to the official time of 9:37:46 am as being accurate to within a few seconds, to the physical damage being caused by a large plane impact rather than explosives, and to a single, main event. Some secondary explosions³⁵ are explainable by other plausible causes.

It seems clear enough to this researcher that the clocks that fell were either damaged (one photo at least shows some evidence for this) or else their batteries were dislodged. A clock³⁶ that remained on the wall, shown in Figure 2, did not stop. Thus no fancy explanation involving electrical disturbances is needed.

³⁵ <http://frustratingfraud.blogspot.com/2007/11/pentagon-attack-timeline-questions-part.html>

³⁶ http://stevenwarran.blogspot.com/2007_01_08_archive.html

Wall Clock Experiments

Introduction

Russell Pickering³⁷ issued the following challenge in 2007: “Set one of these types of [wall] clocks to 9:37 and when the second hand reaches the :44 second mark knock it off the wall at normal clock height. Video or photograph the results. Then see if the minute hand moves back” Adam Larson mentioned that a person or group known as “Mirage of Deceit”³⁸ had tried this experiment and confirmed that the minute hand fell back towards the 6 position, but he was unable to provide a reference. A search on the web located an individual writing under the name “mirageofdeceit” but failed to locate this experiment.

Another individual, “LaBTop,” wrote³⁹ the following on 15/8/08 (8/15/08 in USA):

“I posted somewhere in a thread, no time to look it up now, that I took a similar battery operated clock, put it on 9:38:00 and hooked it on a nail, slammed against the wallboard from behind, clock fell off parallel to the board, and lo and behold, the time reversed to about the same 9:31 time. After that, I was advised not to waste anymore clocks on this experiment. Btw, I posted in several threads pictures of the Pentagon clock and the Heliport room with the other clock. Also in the one containing my experiment.”

Again, the author could find no trace of this experiment or the pictures referred to.

Given the inability to locate any information about previous clock experiments, the author decided to take up Pickering’s challenge himself.

After a brief search on the web for a “Skilcraft wall clock,” the author located a clock that appears to be virtually identical to the Pentagon Heliport wall clock. The clock was for sale on the ReStockIt⁴⁰ website at a sale price of \$21.54 plus \$8.95 for shipping. The clock arrived in 2 days, and was as shown in Figure 3. For comparison a photograph of the two wall clocks cited by Honegger are shown in Figure 4. The purchased clock was identical to the Heliport clock in appearance except for almost imperceptible variations in thickness in some parts of some numerals and in their positions relative to the adjacent black circles. A photo of the clock on the RestockIt website had an additional difference in that the text above the “6” was separated from that numeral by a larger amount of white space. These differences are further discussed in Appendix A.

³⁷ Russell Pickering challenge:

http://z10.invisionfree.com/Loose_Change_Forum/index.php?s=1803054cefd71a5f34b07f5256e279e7&showtopic=15994&st=0&#entry14597293

³⁸ <http://frustratingfraud.blogspot.com/2008/08/overwhelming-evidence-for-938.html>

³⁹ <http://www.abovetopsecret.com/forum/thread381302/pg1>

⁴⁰ [http://www.restockit.com/skilcraft-wall-clock-round-12-3-4-d-brown-case-white-face-\(nsn0468849\).html](http://www.restockit.com/skilcraft-wall-clock-round-12-3-4-d-brown-case-white-face-(nsn0468849).html)



Figure 3 – Skilcraft Wall Clock Purchased from ReStockIt (Model 12 Type A)



Figure 4 – Pentagon Wall Clocks Cited by Honegger and Others

The clock arrived in a box with a see-through plastic or cellophane cover. Included were two means of attaching the clock to a wall: a small picture hook and nail, and a stick-on paper square with a built-in plastic hook. Built into the clock's plastic frame at back was a projection with a small notch for seating on the picture hook. Installed this way, it would not be difficult to knock the clock off the wall. A single AA battery fit into an open portion of a small plastic box containing the clock mechanism. It seems entirely possible that a sharp knock, as in a fall, could eject the battery from its holder, and that the Pentagon clocks may have stopped simply because the battery fell out or dislodged. In some experiments below, the battery did fall out or dislodge. The Heliport clock, however, showed some signs of damage that may have caused the stoppage and damage may also have caused the stoppage of the other clocks.

The Decision to Use a Guide Frame

As shown below, a decision was made to use a guide frame for experiments 3 through 14. The guide frame made it possible to separate out the effects of clock rotation about different axes and show how backward movement of the minute hand was possible. The use of a guide frame does NOT imply the existence of guide frames at the Pentagon, or that the Pentagon clocks' motion when falling was anything but unconfined and random. See **Clock Rotation**.

The experiments were to show whether the clock hands could have moved due to dropping. The fact that they did move to point to earlier times in the experiment proves that the hands might have moved as the result of an impact on 9/11, hence the time shown on the clocks at the Pentagon cannot be relied upon.

Experimental Guidelines

In each experiment a Skilcraft clock was running with an AA battery installed. In each case, the clock was brought down or dropped at a precise reading of 9:37:45. In all cases, (except experiment 14 – explained later), the numeral “6” (30 minute mark on the minute scale) was at the lowest point when the clock was released.

For experiments 3 through 14, the clock was dropped from heights of 4 and 6 feet in a wooden guide frame, landing on a semi-firm cushion. The guide frame kept the clock face vertical, so that the bottom of the clock (“6” position) might hit the “floor” in a way that would illustrate the possibility of backward hand movement (see **Clock Rotation**). Since a large backward movement of the minute hand was often observed under these conditions, it was deemed unnecessary to drop the clock from greater heights on harder surfaces that might have damaged the clock. Experiments 3 through 14 were recorded as movies (.MOV files) using a Nikon Coolpix L3 digital camera. The wooden guide frame is shown in Figure 5. Note that the 8 foot mark is actually only 92 ½ inches above the wooden base on which the cushion is resting.

Two different clocks of the exact same type were tested. Clock A was used for most tests while Clock B, fresh from its box, was used for a few tests to counter arguments that frequent dropping of clock A might affect its behavior in some way. However, both clocks kept excellent time with the unused third clock after the tests were completed and showed no sign that backward movement of the hands had become easier. The results of the experiments are given in Table 1.

Experiments 1 and 2

As a preliminary experiment, the author placed a small, semi-firm cushion on a dining room table, set the clock time to 9:37 and held the clock (A) about one foot above the cushion. At 9:37:45 he brought the clock edge down with moderate force into the cushion. He did this twice, the second time more forcefully in the presence of a witness. The minute hand moved back 2 mins and 3 mins respectively for the two tries while the second hand appeared to keep going.

Encouraged by the clear result of backward movement in Experiments 1 and 2, the author ordered two more clocks with the intention of possibly destroying them. A wooden guide frame was constructed that would ensure that the clocks fell edge down, with clock face vertical, from heights up to almost 8 feet. This was done to separate out the effects of different possible rotations. The Pentagon clocks' rotation, of course, was unconfined.



Figure 5 – Wall Clock Ready to Drop from 4 Feet in Guide Frame

Experiments 3, 4, and 5

Using the wooden guide frame, clock A was dropped from heights of 4 feet. The “floor” beneath the falling clock was the semi-firm cushion (used in experiments 1 and 2) resting on a solid wooden base. The clock minute hand moved backwards by about 5, 9, and 8 minutes respectively. The clock was observed to bounce up about 6 inches after impact, and the face to rotate about a horizontal axis through the center of the clock face and perpendicular to it. In experiment 3, the clock became wedged in the frame opening, indicating a need to modify the frame opening width.

Experiments 6 through 14

Experiments 6 and 7, using a drop of 6 feet, experienced a wedging problem. After modifying the guide frame to eliminate the wedging problem, experiments 8 through 14 used a height of 6 feet, and both A and B clocks. Some large backward movements of the minute hand were observed, depending upon the clocks' orientation upon impact.

Clock B, when released with the numeral 6 (minute scale reading 30) at the lowest point, tended to rotate anti-clockwise. In the final experiment (14) with clock B, the clock was released with a minute scale reading of 25 at the lowest point. The clock then rotated so that the minute scale reading was 29 at the lowest point before impact. The minute hand in this experiment moved back 17 mins.

Clock Rotation

This section discusses the effects of clock rotation, including the wedging problem.

In unrestricted free fall, as in the case of the Pentagon clocks, the clock can potentially rotate about three different axes:

1. A vertical axis through the clock center,
2. A horizontal axis through the clock center perpendicular to the clock face,
3. A horizontal axis through the clock center parallel to the clock face.

For rotation about axis 1, hand movement upon hitting the floor would not be affected. For rotation about axis 2, the hand movement could be augmented or diminished, as explained below. For rotation about axis 3, the hand movement could diminish and be zero, as shown in the wedging problem below.

Rotation about Axis 1: Because of the experimental guidelines and wooden guide frame, rotation about axis 1 was not observed.

Rotation about Axis 2: The minute hand moves back in time only because it has momentum in a vertical plane and can pivot about one end in that plane. If the clock falls in such a way that the numeral "6" is at the lowest point on impact, the minute hand at the release time of 9:37:45 will acquire downward momentum that converts to angular momentum on impact, so that the minute hand will rotate backwards in time. If, however, the clock face rotates during its fall in a vertical plane about a horizontal axis through its center and perpendicular to it, the bottom point of the clock will change, augmenting or diminishing the angular momentum and hence altering the tendency for the minute hand to move.

For example, suppose the clock face rotates so that the 38 reading on the minute scale is at the lowest point upon impact. In this case there would be little or no movement expected. If, however, the clock face rotates so that an earlier minute reading, say 25, is at the lowest point, the backwards movement of the minute hand will be accentuated. This behavior was observed in the experiments, as shown by the graph in Figure 6.

Expt Number	Description	Height of drop (feet)	Force	Result Details (Value on minute scale above impact point) Final lowest value	Time Change in mins (On impact) Final
1	Hold clock A by hand over cushion on dining room table and bring down by moderate force	1	hand motion	(30)	Running -2
2	Same as experiment 1 but bring down with more force	1	hand motion	(30)	Running -3
3	Drop clock A in guide	4	gravity	Wedged (30) Final 29	Stopped -5
4	Drop clock A in guide	4	gravity	Bounce/rotate ← (31) Final 29	Running (-8.75) -9.5
5	Drop clock A in guide	4	gravity	Bounce/rotate ← (32) Final 36	Running (-8) -7.25
6	Drop clock A in guide	6	gravity	Wedged at 45° (30)	Stopped -2.5
7	Drop clock A in guide	6	gravity	Wedged at 45° (32)	Stopped -4.5
8	Drop clock A in guide	6	gravity	Bounce/rotate ← (31) Final 24	Running (-12.75) -14
9	Drop clock A in guide	6	gravity	Bounce/rotate ← (38) Final 39	Stopped (+1) 0
10	Drop clock A in guide	6	gravity	Bounce/rotate → (29) Final 33	Stopped (-16.75) -15.75
11	Drop clock B in guide (first time for new clock)	6	gravity	Bounce/rotate ← (36) Final 37	Running (0) 0
12	Drop clock B in guide	6	gravity	Bounce/rotate ← (33) Final 35	Stopped (-2.75) -4
13	Drop clock B in guide	6	gravity	Bounce/rotate ← (34) Final 33	Running (-2.75) -3
14	Drop clock B in guide (begin low point = 25)	6	gravity	Bounce/rotate ← (29) Final 29	Stopped (-17.75) -17

Table 1: Clock Experiment Results
(Bolded Values are used in Figure 6 Graph)

Rotation about Axis 3: If the clock were to fall flat on its face or back, one would not expect movement of the minute hand in any direction. A partial rotation about axis 3, as in the wedging problem, will diminish the backward hand movement.

The wooden guide frame, as first constructed, had a too wide front opening, so that the clock on occasion fell forward and wedged the plastic clock face cover in the opening. The cover had rounded edges and a smaller diameter than the base. To correct the “wedging” problem, the horizontal width of the front opening was decreased by adding strips of wood to each inner side of the opening. The tilt involved in becoming wedged would reduce the angular momentum of the minute hand about its pivot axis. The act of becoming wedged may also result in a gentler deceleration, further decreasing the possible hand movement.

After eliminating the wedging problem (in experiments 8 through 14), the only rotation observed was that about axis 2. It should be emphasized that constraining the rotation to be about axis 2 does not imply that the Pentagon clocks fell in this way. Clearly the Pentagon clocks were free to rotate about any axis.

Experimental Results

Videos: At URLs <http://www.scientistsfor911truth.org/mempages/Wyndham.html> and http://www.scientificmethod911.org/reviewpages/wyndham_event_time.html can be found videos of experiments 3 through 14.

Table 1: The table gives the description, details and results for each of the 14 experiments. The first four columns are self-explanatory.

Result Details Column: Provides three pieces of information for each experiment:

- Whether the clock became wedged (early experiments only), whether it bounced on impact, whether the clock face had rotated just before the impact, and the direction of rotation (\rightarrow = clockwise, \leftarrow = anti-clockwise).
- The number in parentheses is the value on the minute scale above the impact point at the initial impact. This value is important in understanding the movement of the minute hand.
- The “Final” value given is that on the minute scale at the lowest point after the bounce, when the clock finally came to rest. The small bounce sometimes caused further rotation and minute hand movement.

Time Change Column: Provides three pieces of information for each experiment

- Whether the clock was running after the fall, or stopped due to dislodgement of the battery. In one case the battery became disconnected but remained in the holder. In other cases the battery fell out of the holder.

- The first value, in parentheses, is the time change of the minute hand immediately after the first impact.
- The second value is the final time change observed after the clock came to rest.

Graph Showing Effect of Rotation About Axis 2 (Figure 6)

In Figure 6, the graph shows the effect of rotation about axis 2 on the movement of the minute hand:

- *x-axis*: the reading of the minute marking scale on the clock face for the lowest point just before initial impact (number in parentheses in Result Details column).
- *y-axis*: the amount of movement (a negative value indicates backward movement) of the minute hand (in minutes, after the first impact) for a six foot drop (clocks A and B) (number in parentheses in Time Change column).

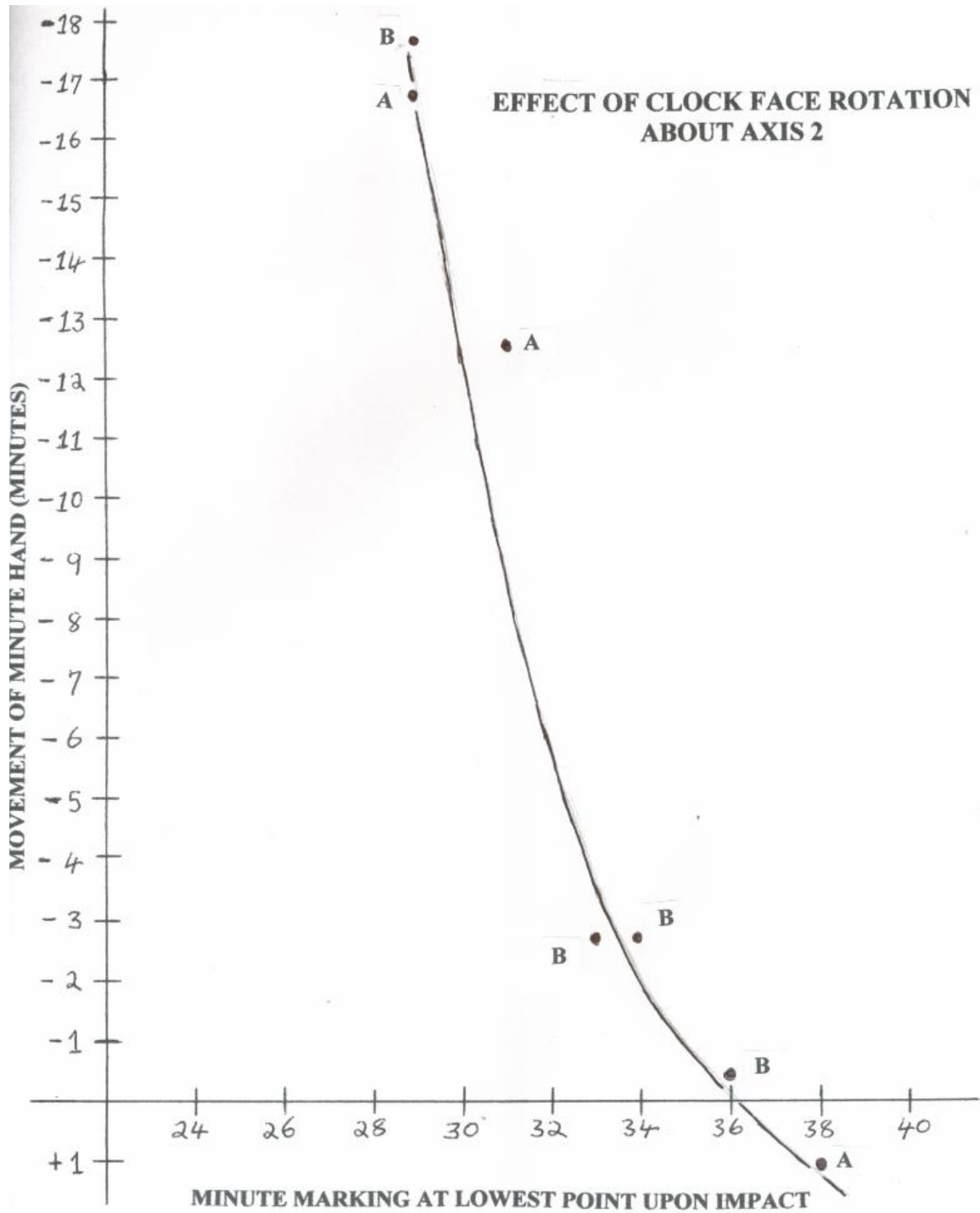
It is seen that the backward movement of the minute hand increases as the lowest point (value on minute scale above impact point) moves to values smaller than 38. The points where the clock wedged are not included, since these would give a spurious, low reading.

The motion of the clock, including rotation during its fall and the bounce, tended to be complex. Plotting the values specified above produces a graph with the least scatter of points. This serves to illustrate the repeatability of the backward minute hand movement, and its main dependence on clock orientation. In the case of the Pentagon clocks, other factors, such as hitting objects, and falling and bouncing without confinement, would have affected their final readings.

The graph indicates a movement of -13 minutes for a 6 foot drop when the 30 minute reading is at the lowest point on impact (no rotation about axis 2). The Pentagon clocks, frozen at about 9:32, or about 6 minutes earlier than the official time of plane impact, may have fallen with clock face rotation in a vertical plane, as well as the clock face departing from the vertical plane, making the backward movement of the minute hand less than that indicated by experiment. But the observed times shown on the Pentagon clocks are consistent with the experimental data that explains the backward movement as caused by the fall. There is thus no basis for suggesting that these clocks correctly showed the time at which they fell.

Interpreting the Experimental Results

The Pentagon clocks were free to fall at random. If they had fallen on their edge, as in the idealized experiments, the backward movement of the minute hand could well have been far greater than that implied by figure 4 (about 6 minutes). In addition, the maximum drop height used in the experiments was only 6 feet, with a landing on a cushion. If the Pentagon clocks were at a higher elevation and landed on a hard surface on their edge, the backwards movement of the minute hand could be even greater than the maximum (18 minutes) observed experimentally. The observed values of about 6 minutes are therefore quite consistent with random clock motion in a fall off the Pentagon walls.



A = Clock A, B = Clock B

Figure 6: Effect of Clock Face Rotation in a Vertical Plane

In some of the experiments the battery was dislodged or fell out of the holder, so that the clock stopped. It was not necessary to damage the clock to produce a large movement backwards of the minute hand.

In interpreting the experimental results, we ignore the behavior of the second hand (red) for these reasons:

- The second hand did not appear to be affected in the experiments, probably because the second hand is very light as suggested by its appearance.
- There is no reason to suppose that the second hand was synchronized with the minute hand for either of the Pentagon clocks in Figure 4, just as there is no reason to suppose that either of these clocks was reading the correct time (to the minute) when the event occurred. However, the author took care to synchronize the minute and second hands of the experimental clock before each test.

From the first experiment, the ease with which the minute hand fell back toward the 6 position clearly indicates that the Pentagon stopped clocks evidence does NOT necessarily point to a time of 9:32 am. Based on the behavior of the Skilcraft clocks tested, clocks virtually identical in appearance to the Heliport clock, one can argue that the stopped clocks in Figure 4 show times that are unreliable, and do not necessarily indicate the times at which they fell off the walls. In addition, the clocks may well have stopped because their batteries became dislodged, rather than because they were damaged. The other stopped clock (Figure 1), it can be surmised, fell in such a way (almost flat on its back, perhaps) so that its minute hand did not suffer deceleration that would move it significantly backwards. If this clock was set correctly before stopping, it probably gives a lower limit of 9:36:27 am for the time of the event.

Honegger's Pentagon wall clock argument fails the test of good evidence. Far from being the "ultimate evidence," a reference to the stopped clocks mentioned by the San Francisco Chronicle when commemorating the 100th anniversary of the Great California 1906 Earthquake, the two stopped Pentagon wall clocks in Figure 4 merely record a very approximate time for the Pentagon event, as early as 9:31 am and perhaps as late as a few minutes before 10:00 am.

Conclusion

The experiments show how much backward movement of the minute hand is possible (18 minutes) with a drop of just 6 feet onto a cushion when the clock can rotate only about a single axis (axis 2). Because the Pentagon clocks in figure 4 were free to rotate about any axis, their actual fall would most likely result in a minute hand movement significantly less than the maximum indicated by the experiments, as figure 4 shows.

The main evidence for a Pentagon event time of around 9:32 am has been shown to consist of readings from wall clocks and personal time pieces. The hitherto strongest part of that evidence, the two stopped Pentagon clocks, is shown by experiment to be untrustworthy because of the ease with which the minute hand of the Heliport clock can move backwards

in time, together with the existence of a third stopped clock frozen at a time close to the official event time. The evidence from other time pieces such as personal watches is unreliable and unverifiable. There is a body of evidence, equal to that for the 9:32 am time, from similar time pieces that give times between 9:35 am and 9:43 am. Because of these uncertainties, the time piece evidence, pro or con, was not used in reaching a conclusion.

In reaching a conclusion the evidence in list II of Adam Larson's compilation was used. In this evidence there are a significant number of independent items that do not depend on individual watches and clocks. These evidence items include analysis of FAA, radar, and FDR data, plus evidence from security cameras, news broadcasts, and a pilot who witnessed the plane crash and a few seconds later reported that it was at the Pentagon. This body of evidence strongly supports the official event time.

In summary, the preponderance of reliable evidence supports a Pentagon event time within seconds of the official time of 9:37:46 am.

Acknowledgments

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Appendix A

Some Objections Answered

Late in the development of this paper, the author received a number of comments and objections, some of which are dealt with in this appendix.

Do the Clock Experiments Ignore Complexity?

The criticism expressed here is that a freely-falling clock can rotate about any of three different axes, but the experiments' use of a guide frame confines the clocks' observed rotation to just one of these axes. This axis is a horizontal axis through the clock center perpendicular to the clock face, designated as axis 2 in the paper. The objection is that this experimental approach is artificial and that further experiments are required to confirm the results of minute hand movement when the clock rotates about other axes.

This criticism, which on the surface may seem reasonable, actually has no real validity. It arises from a failure to understand the logic of the dropped clocks experiment. The experiment was to show whether the hands could have moved due to dropping. The fact that the minute hand did move to point to earlier times in the experiment proves that the hands might have moved as a result of the impact on 9/11, hence the time shown on the clocks at the Pentagon cannot be relied upon.

Because of the way the clock is constructed, the minute hand can rotate only about a single axis relative to the clock face, axis 2. No matter how complex the trajectory of the clock, or how many objects it hits and impulsive blows it receives in its path from wall to floor, all that matters is that when the motion of the pivot end of the minute hand is arrested, the center of mass of the hand has a non-zero velocity component that is both (a) perpendicular to an axis parallel with the length of the minute hand and (b) parallel with the plane of the clock face. We shall call (a) and (b) the *requirements for clock hand movement*. Such a non-zero velocity component, acting through the hand's center of mass implies the existence of linear momentum which is then converted to angular momentum, causing the hand to move.

To illustrate the above with a diagram, let us represent the velocity at any time of the center of mass of the minute hand in three-dimensional space by the vector "r(o)" (see Figure 9).⁴¹ In this figure we shall adopt different axes than the ones previously specified as axes 1, 2 and 3.

The origin where the x, y, and z axes meet coincides with the center of mass of the minute hand. The pivot point for the minute hand lies somewhere on the x axis extended in the negative direction. The minute hand itself lies along the x axis, with the tip on the positive x axis. The clock face lies in, or is parallel to, the x, y plane. The z axis is perpendicular to the clock face. The vector "r(o)" is resolved into three velocity components, "x(o)", "y(o)", and "z(o)".

⁴¹ From <http://math.arizona.edu/~calc/Text/Section13.1.pdf>

When the motion of the pivot point is arrested, velocity components “ $x(o)$ ” and “ $z(o)$ ” have no effect on the minute hand’s movement, since the hand cannot move in the x or z directions. The “ $x(o)$ ” velocity component has a direction through the pivot point, while the “ $z(o)$ ” velocity component has a direction perpendicular to the clock face.

However, velocity component “ $y(o)$ ”, if non-zero, will cause movement of the hand. The “ $y(o)$ ” component fulfills both the (a) and (b) requirements for hand movement.

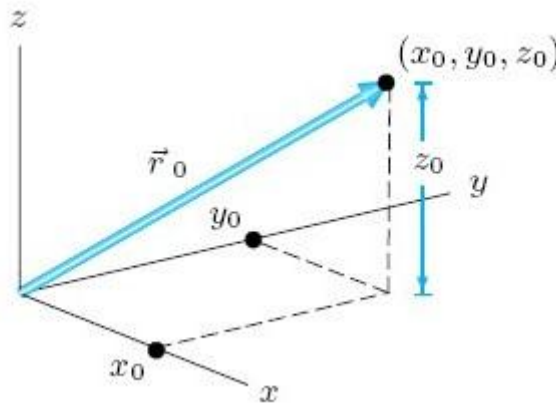


Figure 9 – Velocity vector representation of the minute hand’s motion

To summarize, while a free-falling clock’s motion is complex, no further experiments are needed to illustrate the potential of the minute hand to move when the pivot point’s motion is arrested by an impulsive blow upon collision with the floor or some other object. All that is required is that a non-zero “ $y(o)$ ” component of the velocity exist at that time. Whether such a component does exist depends on the clock’s actual orientation upon collision. Since the orientation of the Pentagon “falling” clocks is completely unknown, it would be irrelevant and a waste of time to try to model the different possible rotations of the clock about the previously-mentioned three axes, 1, 2 and 3. Since it has been amply demonstrated that the minute hand does move, it can be concluded that the times displayed by the “frozen” clocks are untrustworthy.

As in many physical experiments, it is not necessary to model every possible case to demonstrate a point. A well-designed experiment focuses on the crux of an issue and uses logic and reason to extend the results to other situations. The answer to the question “Do the clock experiments in this paper ignore complexity” is “No.”

Why Did the Pentagon Wall Clocks Stop?

Another criticism raised is this: Can we assume that the Pentagon clocks stopped because they fell off the wall? Did they stop instead from “blast” effects? The latter question immediately raises another: What are the possible “blast” effects that this critic is envisioning?

This paper has presented some details about four Pentagon wall clocks:

- The Heliport wall clock stopped at 9:31:30 am (Figure 4).
- A wall clock from the Navy section stopped at 9:31:40 am (Figure 4).
- A fallen clock in Room 3E452 (near the "hinge" of collapsed floors) indicates 9:36:27 (Figure 1).
- An undamaged clock still hanging on the wall and running (Figure 2).

The first two clocks, shown in Figure 4, are the ones cited by Honegger. In the above list of clocks, the one for which we have the most information is the Heliport wall clock.⁴²

The description of the Heliport clock by the Smithsonian is that it was knocked from the wall by the blast of flight AA 77's impact. The description notes the impact time as 9:38 am and states that "apparently the clock was six minutes slow."

The description⁴³ of the wall clock from the Navy section states that the clock was "frozen at the time of impact" by AA Flight 77 but does not say that the clock fell off the wall or note the discrepancy between the clock's reading and the official time of impact.

The clock from Room 3E452, published as a photograph in the book "Pentagon 9/11," is described in the book as above, but with this additional sentence: "The 9/11 Commission determined that the plane hit the building at 9:37 am." This is very close to the reading on the clock. The round object to the upper left of the clock is, judging by its diameter, most certainly the clock's transparent cover which probably popped off due to the jar of a fall. This is physical evidence that this clock fell. It probably fell flat on its back, hence there was no "y(o)" velocity component to move the minute hand appreciably. Finally, the clock still hanging on the wall and running in Figure 2 tends to rule out an electromagnetic pulse explanation for why the clocks stopped.

⁴² The description given by the Smithsonian Institute which now houses the clock is: "**Pentagon helipad clock - Gift of Dennis Young. See <http://amhistory.si.edu/september11/collection/record.asp?ID=19>**.

Description: This Skilcraft electric wall clock, which hung in the Pentagon helipad fire station, was knocked to the ground by the impact of American Airlines flight 77 crashing into the Pentagon.

Context: When terrorists flew American Airlines flight 77 into the Pentagon, the crash nearly took the nearby Pentagon helipad firehouse with it. The concussion caused the ceiling of the firehouse to collapse, temporarily trapping firefighter Dennis Young in the fallen debris. The blast also knocked this clock from the wall, freezing it at 9:32. The airplane actually struck the Pentagon at 9:38 am; apparently the clock was six minutes slow.

⁴³ "A Clock frozen at the time of impact when a hijacked commercial airliner crashed into the Pentagon on Sep. 11. The terrorist attack caused extensive damage to the Pentagon. American Airlines FLT 77 was bound for Los Angeles from Washington Dulles with 58 passengers and 6 crew. All aboard the aircraft were killed, along with 125 people in the Pentagon. U.S. Navy Photo Courtesy of DoD Photographer Staff Sgt. Larry A. Simmons." See http://www.navy.mil/view_single.asp?id=2480Pentagonclock BBC

By far the most likely reason that the first three clocks stopped is that they were battery operated (hard-wired clocks would most likely not have been knocked off the walls) and that their batteries dislodged or fell out. In the clock experiments in this paper, the single AA battery in the clocks fell out or was dislodged (electrically disconnected) because of a 4 to 6 foot fall onto a cushion, arguably a much more gentle fall than that experienced by the Pentagon clocks. This happened about 50% of the time, so that fact that the three Pentagon clocks stopped after presumably more jarring falls is not surprising.

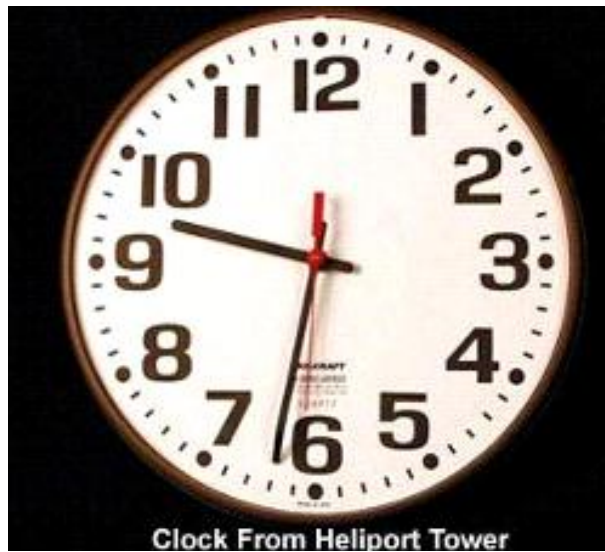
We discount an electromagnetic pulse resulting from the impact as the cause of stoppage for reasons given above. The result of a blast would most likely be some physical movement of the clocks resulting in an impact with objects or the floor. It is difficult to envision other blast effects, so this question is best left for the critic who suggested this possibility in the first place.

Is the Clock Mechanism Important?

As noted in the Introduction to the section “Wall Clock Experiments,” there are slight differences in the appearance of the clocks used in the experiment (Figure 3) and the Heliport clock (Figure 4). The clock pictured on the ReStockIt website is also slightly different from both the purchased clock and the Heliport clock (see Figure 10). These external differences are small, and do not necessarily imply a difference in the clock mechanisms. But the question arises: “Could the mechanisms in the experimental clocks and the Heliport clock be different in a way that affects the conclusions drawn from the experiments?” Another question asked is this: “Were any of the clocks disassembled to establish why the hands could move without physically turning the time set screw?” The answer to this last question is “No.”

It is common knowledge that the minute hands of most clocks can be set by moving the hands themselves rather than adjusting the time set screw at the back of the clock. If the hands can be moved manually, it is not surprising that they will move when linear momentum of the hand is abruptly converted to angular momentum. Given this common behavior of clocks, it would likely be a waste of time to determine why the clock hands can move when a small force is applied to the minute hand.

The first question above, “are the mechanisms of the experimental clocks and the Heliport clock identical?,” would best be answered by applying to the manufacturer for details of the clocks’ design history. But given the way the clock hands can be set manually, this question also seems to be a blind alley. Both the above questions do not appear to have much relevance, and in any case they are beyond the scope of this paper.



(a)



(b)



(c)

**Clocks: (a): Heliport, (b): Purchased, (c) RestockIt Website Photo.
The website clock has extra white space between numeral "6" and the text above it.
Figure 10**