The Star Wars Beam Weapons

and

Star Wars Directed-Energy Weapons (DEW)

(A focus of the Star Wars Program)

by

Dr. Judy Wood and Dr. Morgan Reynolds

(originally posted: October 17, 2006)

Page 1: The Bathtub

At the time this article was being developed, many people expressed disbelief that energy weapons existed outside of science fiction until they were reminded of the Star Wars Program, also known as the Strategic Defense Initiative (SDI)*. The name of this article was chosen as a reminder that energy weapons do exist and have been developed over 100 years. Most of this technology is classified information. It can also be assumed that such technology exists in multiple countries. The purpose of this article was to begin to identify the evidence of what happened on 9/11/01 that must be accounted for. In doing so, the evidence ruled out a Kinetic Energy Device (bombs, missiles, etc.) as the method of destruction as well as a gravity-driven "collapse."

*SDI was created by U.S. President Ronald Reagan on March 23, 1983.[1] It is thought that SDI may have been first dubbed "Star Wars" by opponent Dr. Carol Rosin, a consultant and former spokeswoman for Wernher von Braun. However, Missile Defense Agency (MDA) historians attribute the term to a Washington Post article published March 24, 1983, the day after the Star Wars speech, which quoted Democratic Senator Ted Kennedy describing the proposal as "reckless Star Wars schemes."[2] Before it was named the "Star Wars Program (SDI) in 1983, it was the Advanced Space Programs Development.[3]

12/12/10 -- Dr. Judy Wood

[1]Strategic Defense Initiative, Wikipedia,
[2]Sharon Watkins Lang. SMDC/ASTRAT Historical Office. "Where Do We Get Star Wars?", *The Eagle*. March 2007.
[3] Robert M. Bowman, former Director of Advanced Space Programs Development for the U.S. Air Force in the Ford and Carter administrations.

[Note: References and Sources will be posted and figure numbers will be corrected (in sequential order) when this paper is finished .]

This page last updated, December 15, 2006

I. Foreword *Top*

This website is under construction. Due to the seriousness of this issue, we felt it was important to present the analysis and data as soon as possible. (Following the murder of my student, Michael Zebuhr, a truly extraordinary human being, I received an email stating, "we've done it before and we will do it again if need be.") Therefore, expect this website to be added to and updated over the next several days. Michael told me, "Whatever happens, don't ever stop pursuing this. It's too important." Michael, this is for you.

17 October 2006
Ambrose I. Lane talks with special guest Dr. Judy Wood about her evidence for the use of high-energy weapons in destroying the WTC Towers. "*We Ourselves*" with host Ambrose I. Lane Sr. on The Power XM Channel 169, archive, (mp3-1)(mp3-2)(mp3-3)

29 November 2006
Judy Wood narrates these pages web pages on "The Dynamic Duo" with Jim Fetzer
Genesis Communications Network, gcnlive.com, archive, (mp3-1)(mp3-2) (mp3)

6 December 2006
Morgan Reynolds discusses these pages on "The Dynamic Duo" with Jim Fetzer
Genesis Communications Network, gcnlive.com, archive, (mp3)(mp3)

II. Introduction *Top*

If we are to understand what happened to the World Trade Center (WTC) buildings, we need to start with the evidence. The best theory about what happened to the WTC should explain all the real evidence.

So what types of evidence are available?

1. Current visual evidence (are the Twin Towers gone?)

2. Eyewitness testimony (What did witnesses of diverse credibility say they thought they saw and heard, interviewed how many days after the event?)

3. Physical evidence in the form of actual physical items (carefully preserved?, chain of custody? tampering?, evaluation methods documented?, access to materials by other scientists?)

4. Photographs (validity of the object(s) in question?, how placed there?, subsequent tampering?, photographer?, chain of custody?, photo raw or manipulated?)

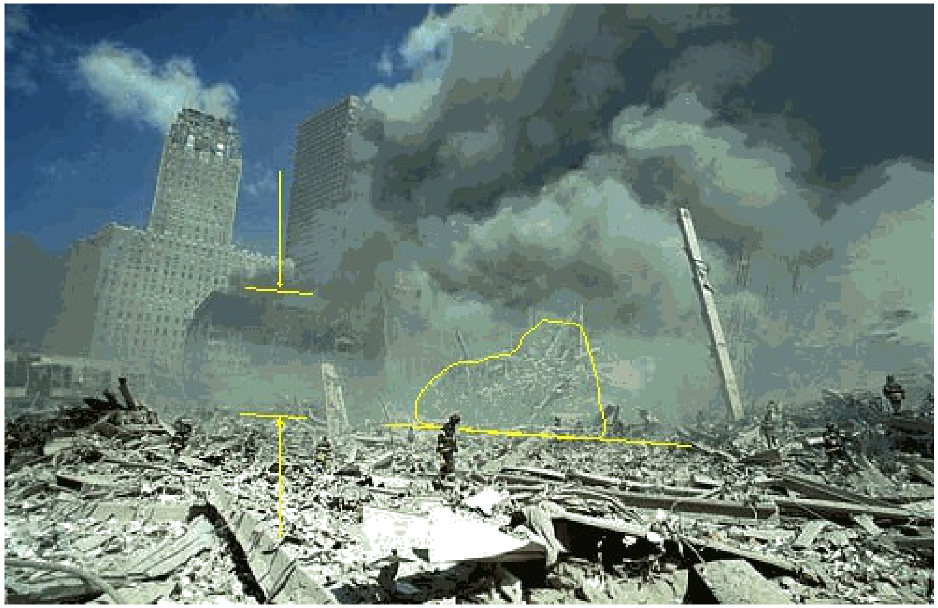
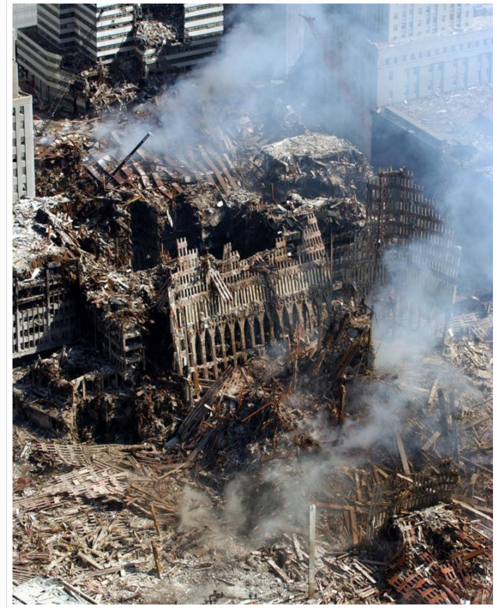
5. Video footage (same questions apply as with photos) and

6. Expert witness testimony (credentials?, credibility?, quality of analysis?).

The quality, credibility and validity of different pieces of evidence varies. The strongest evidence is physical evidence and the strongest physical evidence is undisputed and corroborated by other evidence. Valid physical evidence should form a consistent whole and yield an integrated picture of what happened.

A nearly limitless supply of photos and videos of the actual destruction and aftermath of the WTC event on 9/11 forms a rich database of physical evidence. These photos, for the most part, are undisputed, mutually reinforcing and consistent with other types of evidence. Only in rare cases, like *alleged molten metal* flowing from an upper floor of WTC 2 shortly before its complete destruction, are photos and videos disputed and uncorroborated.

Figure 1. (old Figure 01.) The WTC twin towers towering over the skyscrapers of lower Manhattan.
Source

Now you see it.	Now you don't.	
		
Figure 2. The height of the towers is compared to the height of WTC6 and the "rubble pile" shown in Figure 17. *(1978) [Source]*	**Figure 3.** This photo was taken was take around noon on 9/11/01, showing the height of WTC6 compared to the "rubble pile" of WTC1 which is appears in the foreground. **Where did the building go?** *(9/11/01) [Source] and [here]*	**Figure 4.** A view of the vacant lot where WTC1 stood just the day before. **Where did the building go?** *(9/12/01)*

The World Trade Center (WTC) towers did not "collapse" on 9/11/01; they were pulverized (blown up) before that was even a possibility. Below, we will discuss how this was done.

III. Bathtub Top

The World Trade Center was built on *terra firma* protected by an underground "bathtub" or foundation ring down to bedrock seven stories below the surface of lower Manhattan. This sturdy enclosure some call the "slurry wall" shielded the foundation of the Twin Towers as well as WTC buildings 3 & 6. According to Wall Street Journal architecture critic, Ada Louise Huxtable, this structure "…saved lower Manhattan from the waters of the Hudson River" (WSJ 9-28-06, p. D8). Many observers worried about whether the wall would continue to do its job to prevent flooding but "To the relief of the engineers, there is no evidence that the 70-foot-deep retaining wall around the basements has been damaged or breached, although the collapse of the towers left one section perilously unsupported."*New York Times* (*link*) In the SPIKE TV documentary about the iron workers at Ground Zero, one remarked, "You know, it was amazing, it didn't really damage [that much] ... if they had fallen over sideways, could you imagine the damage to Lower Manhattan?" (*video1*)(YouTube) (*video2*)

Figure 5. (old Figure 1.) There was no significant damage to the bathtub on 9/11. This picture looks west-northwest, from the center of the WTC 1 footprint.
Source:

Figure 6. (old Figure 2.) WTC Station Platform after the event; this PATH train wasn't crushed.
Source:

On September 11 the bathtub mysteriously remained without significant damage despite two quarter-mile tall towers allegedly collapsing on it. How did the bathtub avoid significant damage despite a million tons of WTC material supposedly slamming into it? Even if no material directly hit the bathtub, serious seismic impacts on bedrock would have damaged walls, wall corners and tunnels under WTC leading under the Hudson River because of motion similar to that caused by an earthquake. The bathtub was not built to withstand such colossal impact, we may be assured, because New York is not an active seismic zone (see Figure 26). Although a disputed number, each tower weighed an estimated 500,000 tons and the official story insists airplane damage and fires caused each tower to collapse symmetrically into its own footprint. No bathtub structure could remain unscathed after a mountain of quarter-mile high material was dropped on it twice. The intact bathtub appears to contradict the official theory of a gravity-driven collapse in which virtually the entire weight of the Twin Towers would crash into the bathtub.

Figure 7-11 show diagrams of the PATH (Port Authority Trans Hudson) rail lines from New Jersey under the Hudson and up into the bottom of the bathtub of the World Trade Center. The south rail lines that run from New Jersey and the north lines return to NJ. The base of the bathtub is bedrock and the Twin Towers, rail lines and tunnels were anchored to that bedrock. If the bedrock were dramatically shaken, fissures in the tunnels would allow water to back up into the bathtub.

- ## *Design and purpose* Top

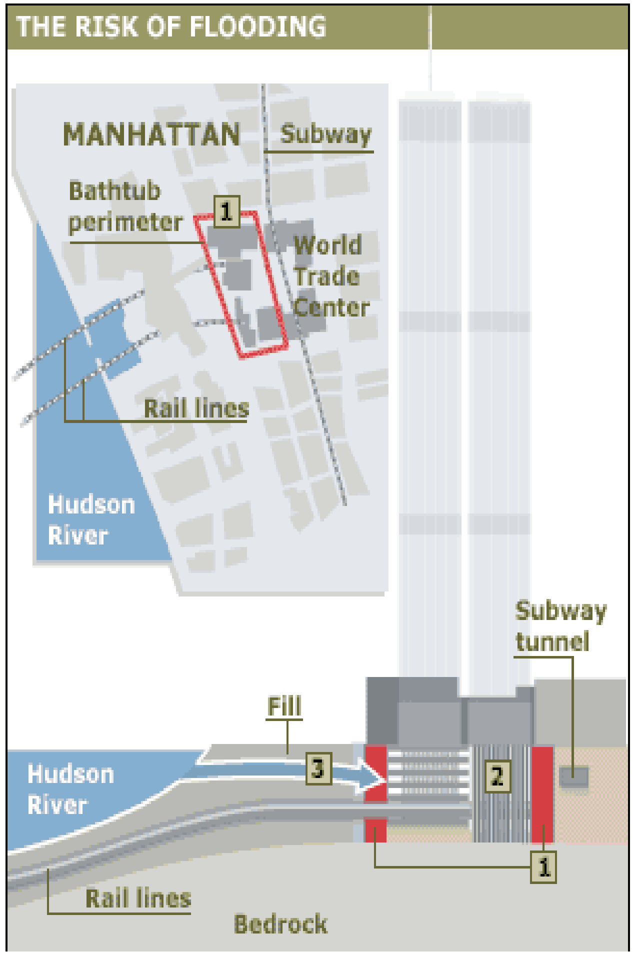
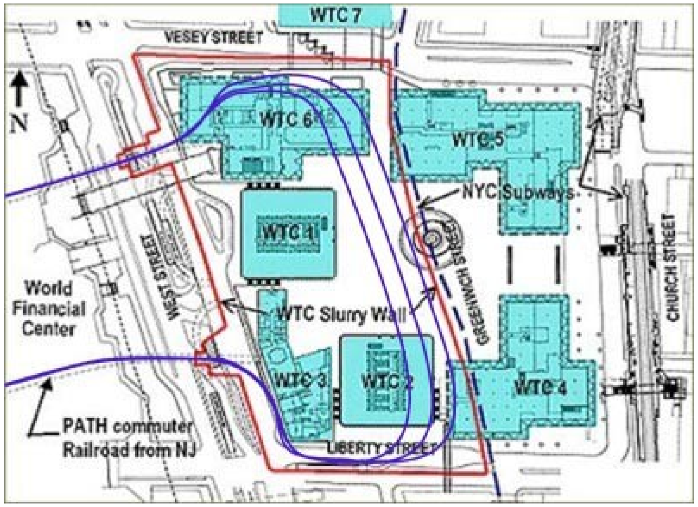


Figure 7. (old Figure 3.)

1. Slurry walls form water-tight bathtub.
2. PATH rail lines pass under WTC 2.

3. Even cracks in the bathtub would allow water inside.
   adjusted from source

Figure 8 shows an overhead view of the WTC with the PATH commuter railroad lines under the Hudson, the walls of the bathtub in red and the subway line adjacent to the main WTC bathtub indicated by the dashed blue line. Figure 9 shows how stout the bathtub design was, and therefore how important this strong structure was to the WTC. For example, the tension tie-backs were embedded in 30-35 feet of bedrock. You can see many of the ends of tie-backs sticking out on the west wall of the bathtub in Figure 5.



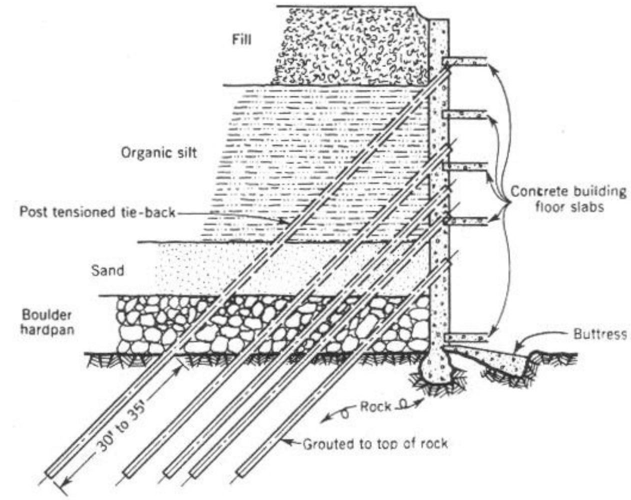
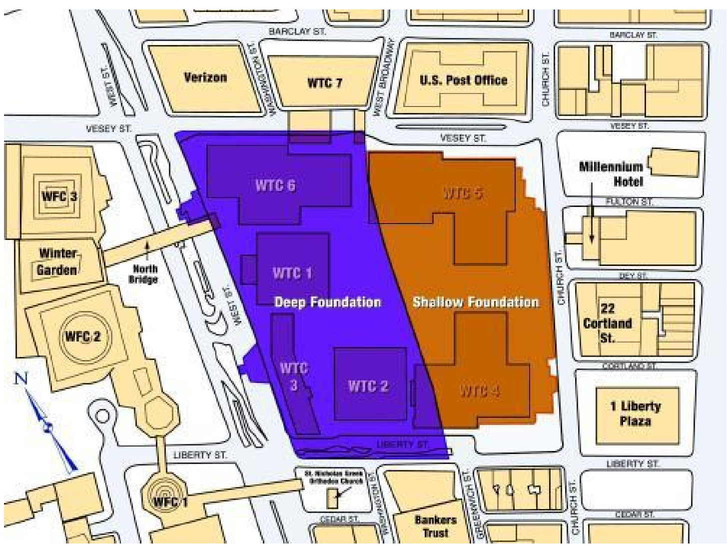


Figure 8. (old Figure 4.) A more detailed map of the rail lines and WTC complex.

adjusted from source:

Figure 9. (old Figure 5.) Typical section shows placement of tie-backs during construction. After concrete floor slabs were cured, tension on tie-backs was released.

Source:



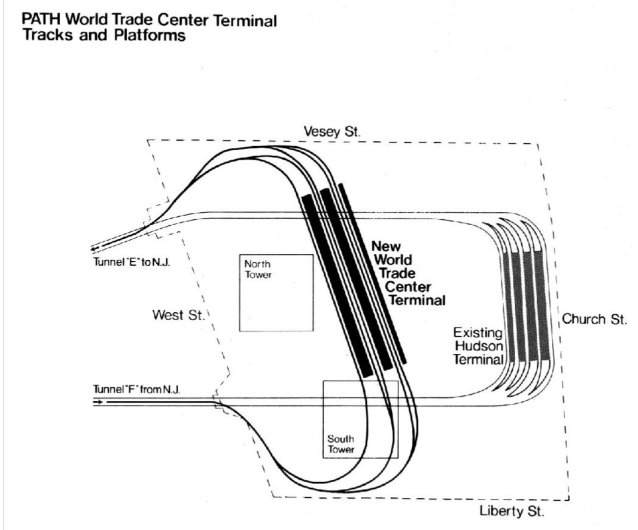
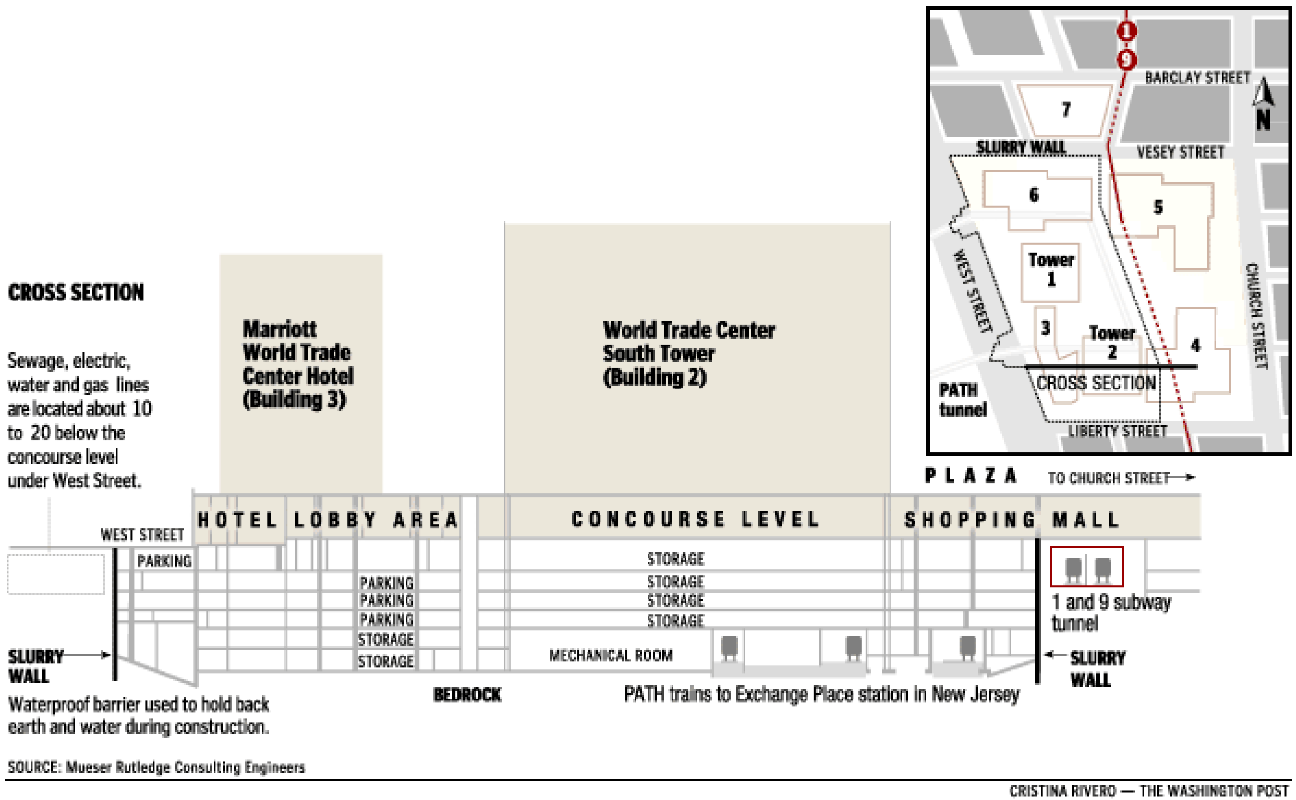


Figure 10. (old Figure 6(a).) Map of the deep foundation (big bathtub) and shallow foundation (little bathtub).

Figure 11. (old Figure 6(b).) Detail of the PATH WTC terminal and tracks.

Source:	Source:

Figure 10 shows the two bathtubs under the WTC complex, with the Twin Towers within the deep bathtub and buildings 4 and 5 mostly within the shallow foundation. The subway went north-south through the shallow bathtub. The figure also identifies neighboring buildings like the WFC complex, the Verizon building, US Post Office, Bankers Trust and others. Note WTC 7 was not in either bathtub. Figure 11 shows the loop that PATH trains take within the big bathtub. Figure 12 shows a cross section of the WTC lower levels. The PATH trains turn beneath WTC 2 and the station platforms run parallel to the bathtub east wall, with the subway on a higher level on the other side of the big bathtub.



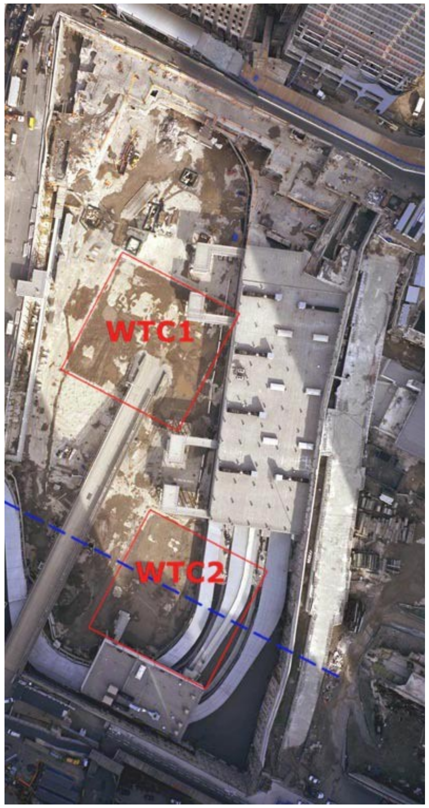


Figure 12. (old Figure 7(a).) Cross section of the WTC complex, highlighting buildings 2 and 3 and the seven subbasements. Note the shopping mall at the ground level, on the right, below WTC4 and above the PATH and subway rail lines.

adjusted from source

Figure 13. (old Figure 7(b).) An overview shows the PATH rail lines and terminal on bedrock in the big bathtub. The subway line and platform are to the right of the big bathtub wall, August 2005, no tracks or terminals were

	relocated. *adjusted from source:*

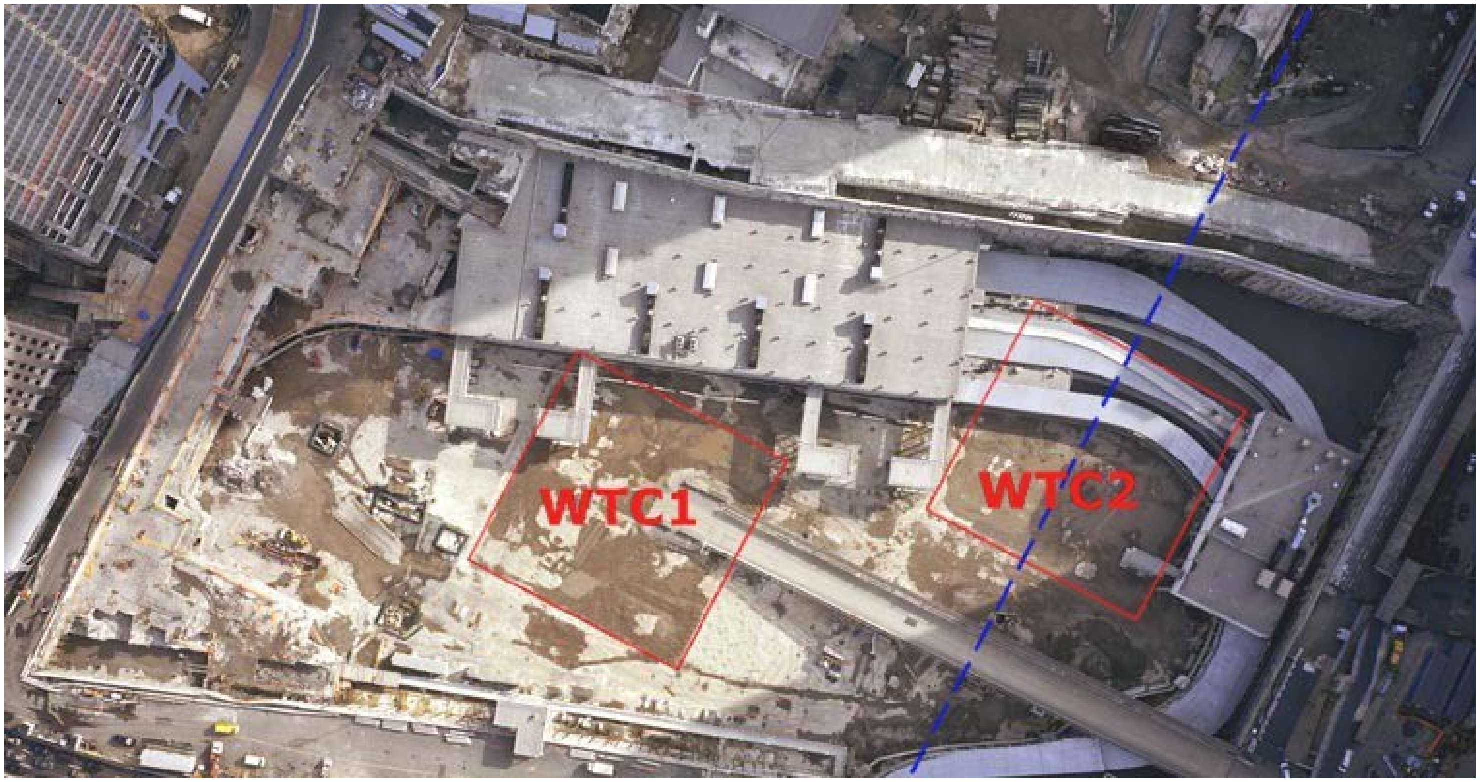


Figure 14. (old Figure 8.) The Ground Zero site as of August 2006, showing the location of the buildings relative to the bathtub walls.
Adjusted from here:

Figure 14 shows an overhead view of the new PATH complex as of August 2006 at Ground Zero, with the west wall at the top of the photo. This gives a graphic look at how large the PATH layout is within the big bathtub. The rail lines and platforms remain in their original locations, suggesting that the underground damage to PATH was not devastating (see Figure 6).

Figure 15. (old Figure 9.) The nearly cleaned-out bathtub. (March 15, 2002)
Source:

Figure 15 shows Ground Zero and the big bathtub with the shallow bathtub in the foreground, lending another perspective. Some superficial damage to the top of the bathtub is visible in the foreground along the eastern wall, beneath where WTC 4, a 9-story building, once existed.

- ## *Evidence of Little Damage* Top

The big bathtub suffered only minimal damage. There was no functional damage, only superficial: (*source*)

PATH trains resumed operation November 2003, only two years after 9/11. Water is visible in Figure 6, for example, but there was no flooding from the Hudson River, the water came from fire hoses cooling down molten metal for 99 days [reference] and the water had to go somewhere.

Figure 16. (old Figure 10.) No damage to bathtub.
Source:

Figure 17. (old Figure 11. WTC Station Platform before 9/11.)
Source:

Figure 18. (old Figure 12.) WTC Station Platform after the event; this PATH train wasn't crushed.
Source:

Figure 19. (old Figure 13.) WTC Station Platform November 23, 2003.
Source:

Figure 17 shows a PATH train in the big bathtub before 9/11, Figure 18 after 9/11 shows minor non-structural platform damage, probably water damage, and figure 19 shows the updated platform and cars which look rather similar.

Figure 20. (old Figure 14.) PATH train tunnel shortly after 9/11.
Source:

Figure 21. (old Figure 15.) A clean bathtub.

Source:

Figure 20 shows a PATH train tunnel with no structural damage, probably outside the bathtub. Figures 21 and 22 show a clean bathtub.

Figure 22. (old Figure 16.) Overhead view of clean bathtub.
Source:

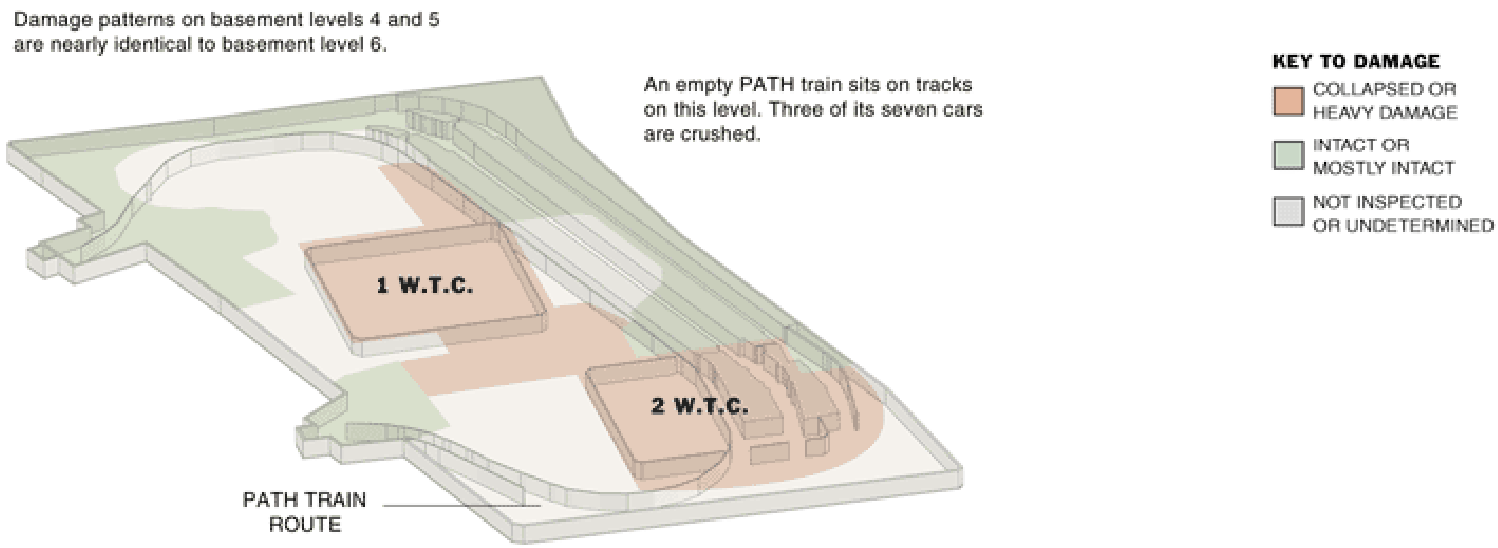


Figure 23. (old Figure 17.) Four of the seven PATH train cars under WTC were not damaged.
Source:

Figure 23 shows a New York Times sketch of alleged damage to the underground portion of the WTC within the bathtub. It seems odd that the center of the PATH platforms were "not inspected or undetermined." Why? Figure 6 above, for example, shows no structural damage at that section of the platform, only water damage. We are not entirely confident that the NYT sketch is an accurate picture of the damage pattern in the bathtub. Interestingly, the west or Hudson side of each tower is damage-free, according to the NYT. Also, the PATH tunnel entrances, rigidly connected to the bathtub and bedrock, are "intact or mostly intact." Only three of seven PATH cars were damaged. While NYT uses the term "crushed," it seems unlikely that three cars could be totally crushed yet leave train four cars intact (see Figure 6).

Outside the bathtub east wall and in the shallow bathtub, even the subway suffered surprisingly little: -"Considering the devastation near the trade center, and the fact that the tunnels were only five feet below the road surface in some places, complete tunnel collapses were not as extensive as some engineers had feared." *Subway*:

Figure 24. (old Figure 18(a).) Warner Bros. store contents from WTC mall.
Source:

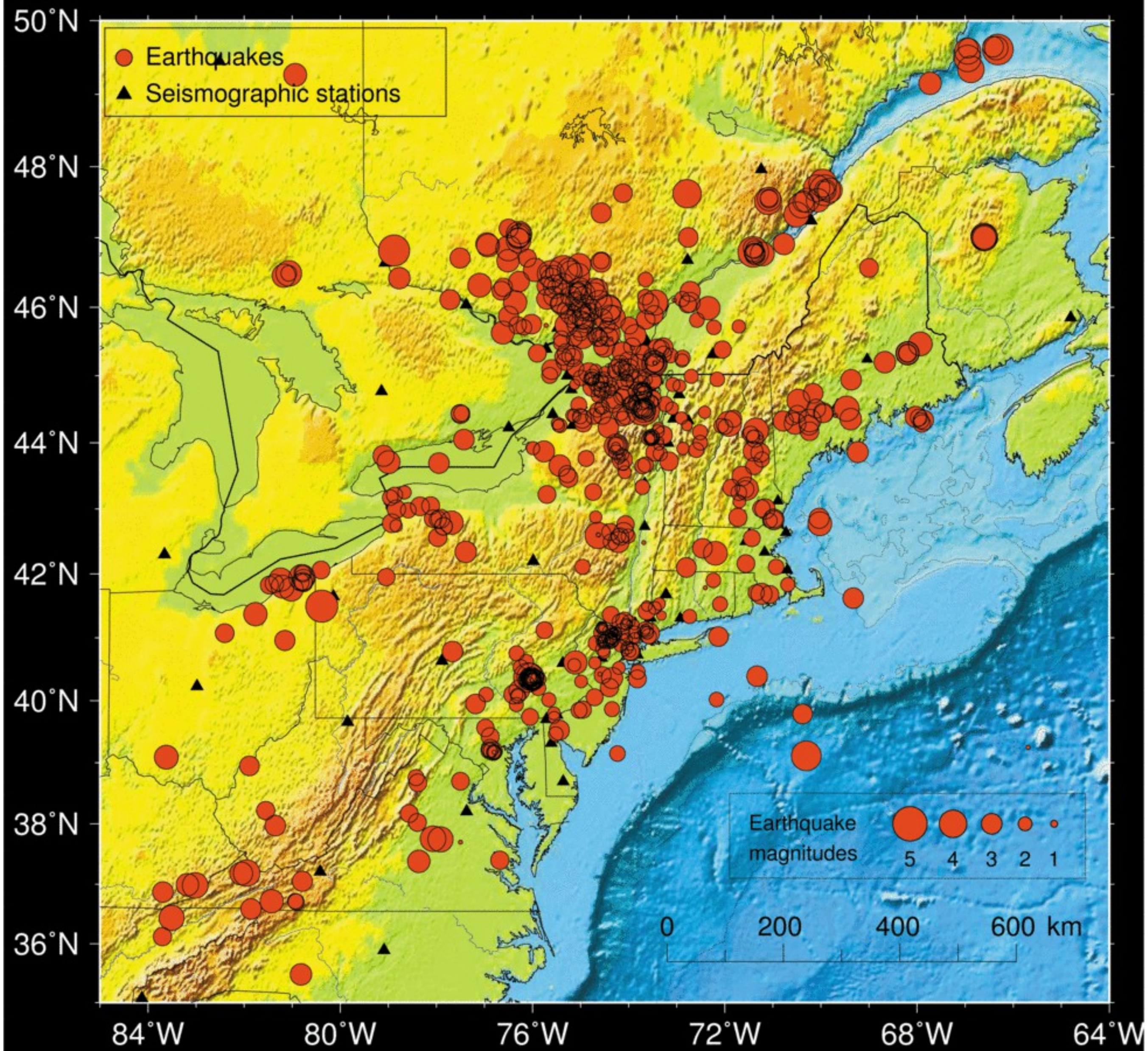
Figure 25. (old Figure 18(b).) Warner Bros. figures from WTC mall.
(*Source)*

Figure 24 shows store contents from the Warner Bros. store in the WTC shopping mall at the concourse level (first subbasement). Figure 25 shows figures recovered from the Warner Bros. store at the World Trade Center mall kept at hangar 17 at JFK international airport. Roadrunner does not have a scratch on him despite surviving destruction of WTC 2 above him. As shown in the cross section Figure 12 above, the shopping mall is the first floor to be impacted at the base of WTC 2.

IV. Earthquakes *Top*

New York is not located in a major earthquake zone (see Figure 26 below), so designers would not anticipate designing and building with the likelihood of surviving major earthquakes.

Earthquakes in NE United States and Canada 1990 - 2003



Earthquake locations by the Lamont Cooperative Seismographic Network, US Geological Survey and the Geological Survey of Canada.
August 2004, Won-Young Kim, Lamont-Doherty Earth Observatory of Columbia University, <www.ldeo.columbia.edu/LCSN>.

Figure 26. (old Figure 19.) Earthquakes by location and magnitude, indicated by circles; locations of seismographic stations shown by triangles.
Source: and here

≅ ***Results of January quake in NYC and the 9/11 signal comparison*** *Top*

Figure 27 shows the amount of ground movement from a 2.4 Richter scale earthquake that hit NYC in January, 2001. The data appear to be "raw," that is, unsmoothed and unmanipulated. For example, the amplitude of the earth's movement is nearly double the 8 micrometers of the diagram. Figure 28 shows a similar diagram for the destruction of WTC 1 on 9/11. The data appear very different from those in Figure 27, smoother, fewer spikes, less complex, and with no distinctive S and P waves…should also have a delay between the two waves. (See Figure 29.)

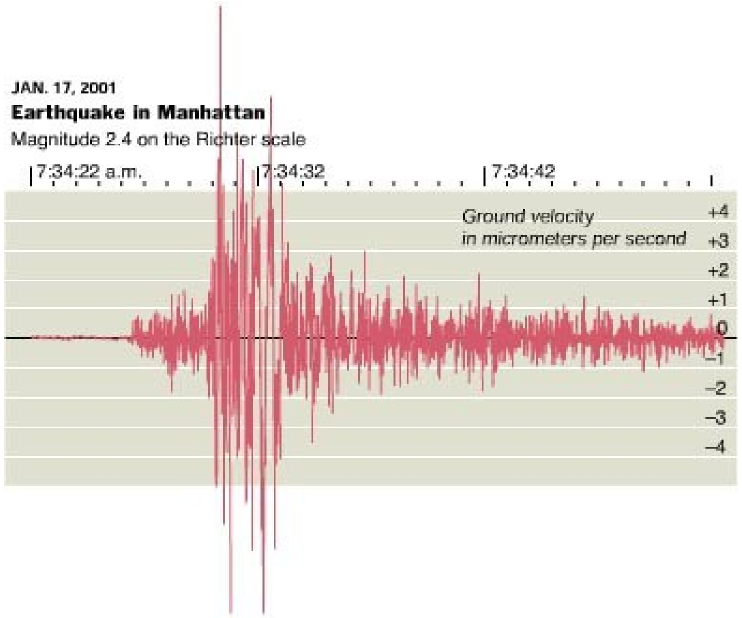


Figure 27. (old Figure 20(a).) Earthquake in Manhattan (S & P waves), Jan. 17, 2001, Magnitude = 2.4.
Source:

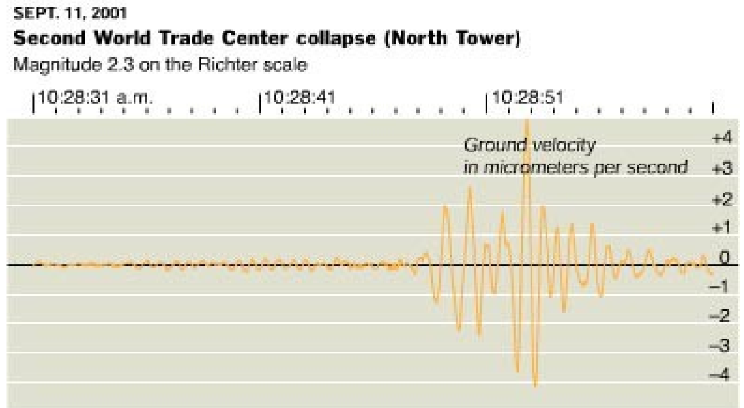


Figure 28. (old Figure 20(b).) The destruction of WTC1, Sept. 11, 2001, Magnitude = 2.3. Does this diagram look similar to 20(a)?
Source:

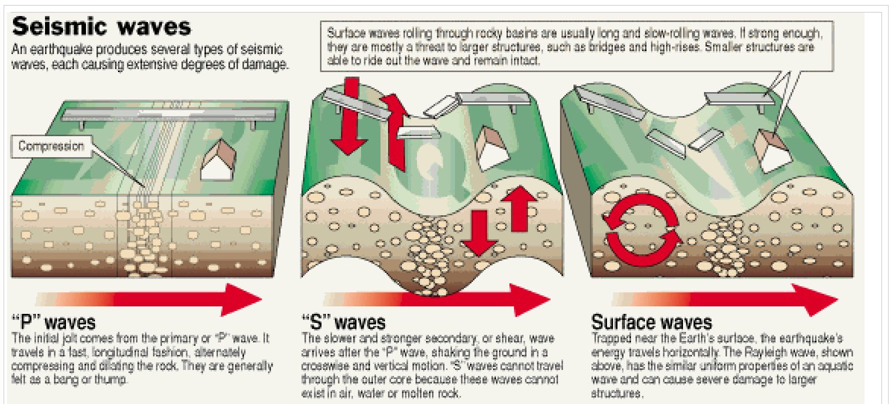


Figure 29. (old Figure 20aa.) about P-waves and S-waves
adjusted from Source:

Most importantly, the amplitude of the 9/11 disturbance is less than half that of the January earthquake, despite a similar peak Richter reading. It is almost as if the data from 9/11 have attenuated, that peak movements have been reduced by some kind of filtering process. Does this difference reflect real data, that is, differences in real phenomena accurately recorded? Or have the data been filtered asymmetrically or differently? Or have the data been completely manufactured? We do not know, but for the sake of the analysis we use the Richter values reported. Could they have been lower than reported? Yes.

- ## *Kingdome vs. Twin Towers* Top

The Seattle Kingdome was demolished on March 26, 2000. Built of reinforced concrete, it had a 720-foot outer diameter, a footprint of 407,000 square feet, stood 250 feet tall and weighed an estimated 130,000 tons. The implosion "created the equivalent of a magnitude 2.3 earthquake, with no vibration damage to adjacent structures" (Liss, p. 108).

Figure 30. (old Figure 21(a).) Finishing the interior of the Kingdome.
Source:

Figure 31. (old Figure 21(b).) Kingdome with the Olympic Mountains across Puget Sound.
Source:

Figure 32. (old Figure 21(c).) Demolition of the Kingdome.
Source:

Figure 33. (old Figure 21(d).) The Kingdome left a debris pile 30 feet high, 12% of its former height.

	Source:
Video 1. Here is a video of the Kingdome demolition. (*mpg*) *(courtesy of Portland Indymedia)*	

Each twin tower, by contrast, had 43,000 square feet, just over a tenth of the Kingdome footprint, and weighed an estimated 500,000 tons, or nearly 4x the Kingdome. Both the footprint and the weight of the twin towers were an order of magnitude different from the Kingdome, yet the Lamont-Dougherty station at Columbia University only reported a peak of 2.3 Richter scale reading for WTC 1 and 2.1 for WTC 2, about the same as the Kingdome.

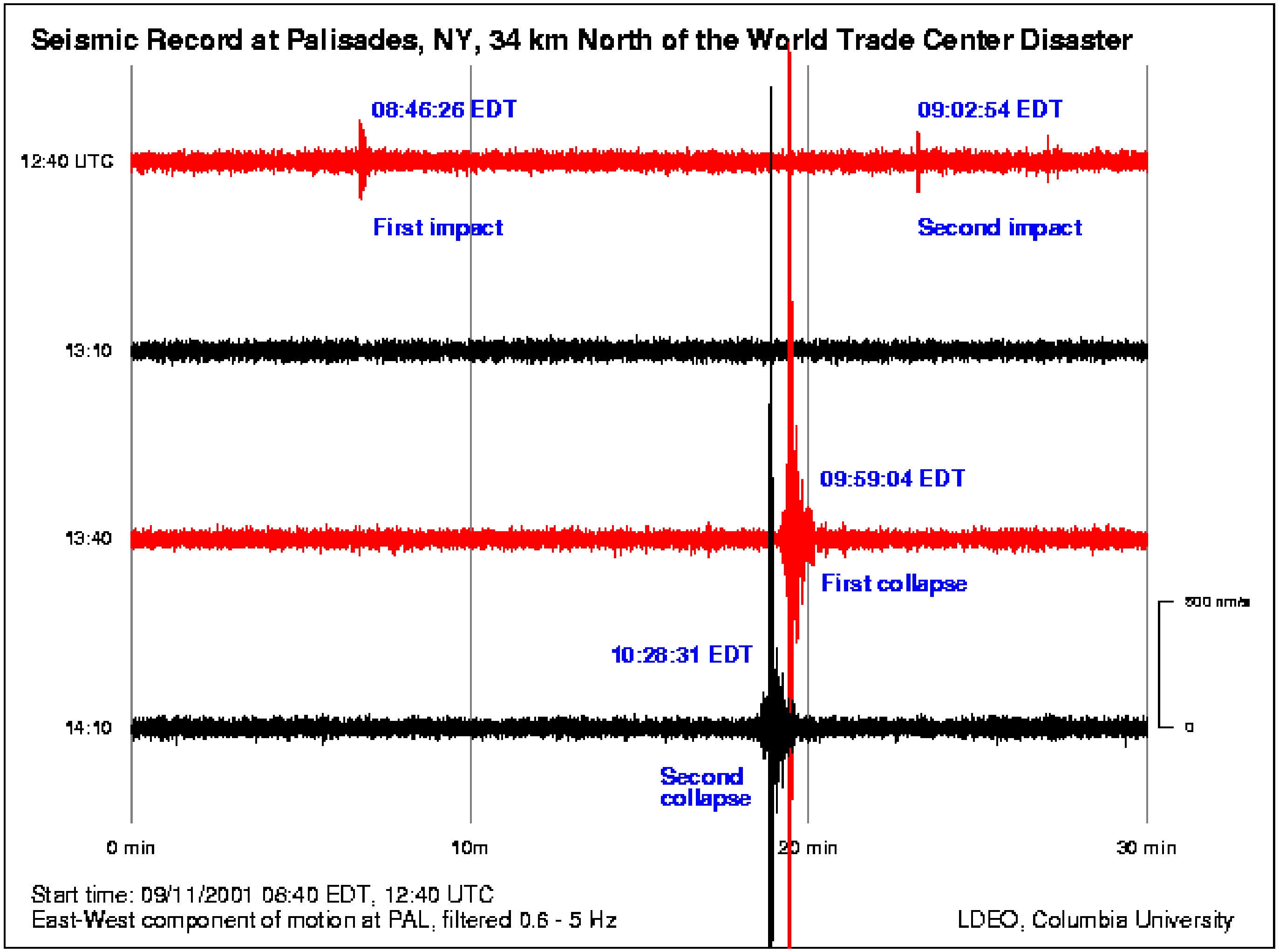


Figure 34. (old Figure 22.) Seismic record at Palisades, NY. The vertical axis is the east-west ground speed in nm/s . The horizontal scale is time, showing a thiry-minute interval. The top red line starts at 8:40 AM EDT and records a siesmic disturbance at 8:46:26 EDT. At 9:02:54 EDT, there is a smaller and shorter disturbance. The second line is a continuation of the first line and begins at 9:10 AM EDT and shows no disturbance. The third line begins at 9:40 AM and shows a major seismic event at 9:59:04 EDT. The fourth line is a continuation and begins at 10:10 AM and shows a major seismic event at 10:28:31 EDT.

UTC = Coordinated Universal Time, also known as Greenwich Mean Time (GMT) where 8:40 AM EDT = 12:40 UTC.

Source:

Although these data seem to be corrupted by unknown filters and a complicit Lamont-Doherty will not release the raw data, a reading similar to the Kingdome would be impossible if the twin towers were destroyed by conventional means (bottom up) because much greater weight would have slammed into a much smaller chunk of land and therefore would have shaken the ground far more than the Kingdome did. Each tower's collapse should have registered at least four on the Richter scale given two orders of magnitude difference between the twin towers and Kingdome dimensions. The apparent fact that the Richter reading peaked at 2.3 and the disturbance lasted only 8 seconds indicates an extraordinary high-energy weapon was used top-down to preserve the bathtub and surrounding structures. And where are the data from the other recording stations shown in Figure 35? Are they being withheld?

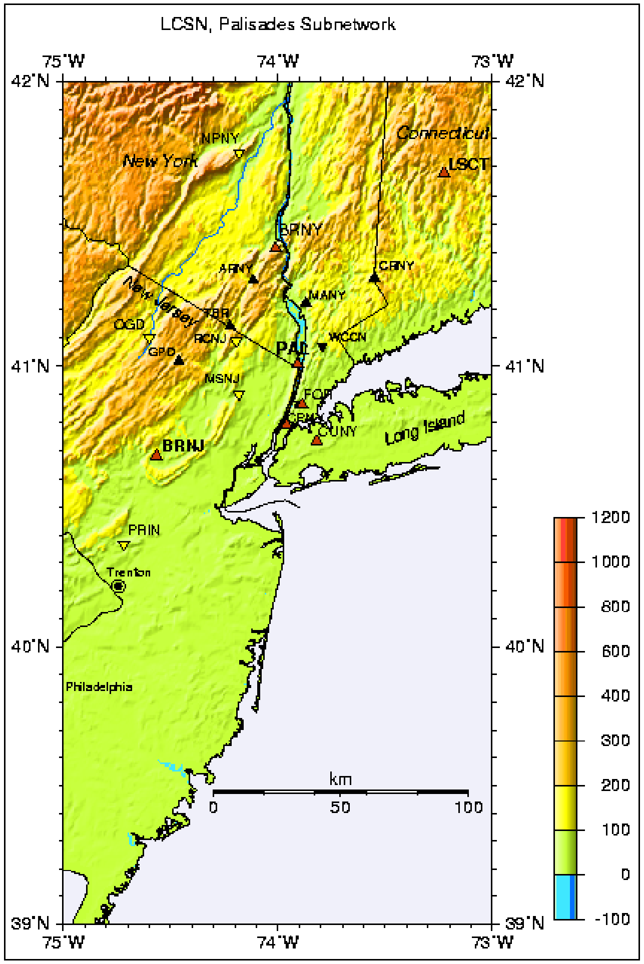


Figure 35. (old Figure 23.) Location of seismic recording stations in the New York City area. [*Source*]

The Star Wars Beam Weapons

and

Star Wars Directed-Energy Weapons (DEW)

(A focus of the Star Wars Program)

by

Dr. Judy Wood and Dr. Morgan Reynolds

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Page 2: Seismic Signal Strength

At the time this article was being developed, many people expressed disbelief that energy weapons existed outside of science fiction until they were reminded of the Star Wars Program, also known as the Strategic Defense Initiative (SDI)*. The name of this article was chosen as a reminder that energy weapons do exist and have been developed over 100 years. Most of this technology is classified information. It can also be assumed that such technology exists in multiple countries. The purpose of this article was to begin to identify the evidence of what happened on 9/11/01 that must be accounted for. In doing so, the evidence ruled out a Kinetic Energy Device (bombs, missiles, etc.) as the method of destruction as well as a gravity-driven "collapse."

*SDI was created by U.S. President Ronald Reagan on March 23, 1983.[1] It is thought that SDI may have been first dubbed "Star Wars" by opponent Dr. Carol Rosin, a consultant and former spokeswoman for Wernher von Braun. However, Missile Defense Agency (MDA) historians attribute the term to a Washington Post article published March 24, 1983, the day after the Star Wars speech, which quoted Democratic Senator Ted Kennedy describing the proposal as "reckless Star Wars schemes."[2] Before it was named the "Star Wars Program (SDI) in 1983, it was the Advanced Space Programs Development.[3]

12/12/10 -- Dr. Judy Wood

[1]Strategic Defense Initiative, Wikipedia,
[2]Sharon Watkins Lang. SMDC/ASTRAT Historical Office. "Where Do We Get Star Wars?", *The Eagle*. March 2007.
[3] Robert M. Bowman, former Director of Advanced Space Programs Development for the U.S. Air Force in the Ford and Carter administrations.

This page last updated, November 8, 2006

Shortcuts: Jump to: ***WTC*** Jump to: *KINGDOME:* Jump to: ***Extrapolation*** Jump to: ***Comparison of Potential Energy***	**Audio:** **29 November 2006**, Judy Wood narrates these pages web pages on "The Dynamic Duo" with Jim Fetzer, Genesis Communications Network, gcnlive.com, archive (mp3-1)(mp3-2) (mp3). **6 December 2006**, Morgan Reynolds discusses these pages on "The Dynamic Duo" with Jim Fetzer, Genesis

Jump to: ***Bankers Trust***	Communications Network, gcnlive.com, archive, (mp3)(mp3)

V. WTC and Kingdome *Top*

Careful data on the Kingdome demolition on March 26, 2000 are available. They allow us to estimate what the earthquake-equivalent impact of the Twin Tower destruction should have been. The Kingdome data are pre-9/11 and unlikely to be politically corrupted.

Bedrock conditions are important in affecting earthquake-equivalent (Richter) readings. If a structure is anchored directly to bedrock, its demolition will yield a higher Richter than if it were not anchored in bedrock. Why? Because if not anchored to bedrock, the energy released by demolition is dissipated via the earth "cushioning" materials. If anchored to bedrock, the released energy directly impacts bedrock, "pinging" the earth directly without any dampening, allowing the signal to carry better to recording stations. It would be like hitting your mattress with a hammer versus hitting a tuning fork. Which one carries a stronger signal to its base?

The Kingdome was not anchored in bedrock. If the Kingdome Richter value was a 2.3 reading transferred through soft material, a building with 30x the potential energy anchored directly in bedrock should have transferred a much higher signal to earthquake monitoring instruments. Amazingly, the south tower reading of 2.1 was lower than the Kingdome's 2.3 despite the tower having 30x the potential energy and being anchored in bedrock. The difference in these Richter readings imply the Tower had only 60% of the potential energy of the Kingdome instead of the real range of 3,000%, an absurd implication. And the fact that the Towers were anchored in bedrock means that the energy release should have rung through to recording instruments loud and clear.

	WTC	Kingdome
steel (tons)	100,000	-
concrete (yd^3)	-	-
windows	-	-
electric cables (miles)	6,000	-
heating ducts (miles)	**198**	
floors	110	-
base dimensions (feet)	**208** by **208**	-
base (ft^2)		
Weight (tons)	**500,000**	**130,000**
elevators	103	
Height (ft)	1362,	250

	1368	
Source		

(See Appendix A for data and data sources.)

- ***WTC:*** *Top*

Opening - Termination dates (WTC1: Dec. 1970-Sept.2001) (WTC2: Jan. 1972-Sept.2001) **World Trade Center Statistics:** **200,000 tons** of steel **425,000 cubic yards** of concrete **43,600** windows **12,000 miles** of electric cables Had its **own zip code**, 10048 **Each Tower:** Had **110 floors** **208 ft** by **208 ft** at base Weight of **500,000 tons** **1,368 ft high** (north tower) **1,362 ft high** (south tower) Contained **198 miles** of heating ducts **97 elevators** for passengers, 6 for freight
Source

Note: 425,000 yd^3 x 3^3 (ft^3/yd^3)x (110)lb/ft^3 x (ton/2,000 lbs)= 631,125 tons
Assuming this value is for both towers, one tower would be 316,000 tons.

- ***KINGDOME:*** *Top*

(March 27, 1976 - March 26, 2000)

(See Appendix A for data and data sources.)

Height of Dome: 250 ft. to apex; Height of Cylinder: 133 ft., 6 in. to top ring Diameter of dome: 660 ft., inner diameter
Source

DIMENSIONS: Site: 23.9 acres (includes building and one parking lot). Building area: 9.34 acres. Roof area: 7.85 acres. Height: 250 feet. Diameter: 660 feet (inside wall); 720 feet (encompassing outside ramps). Volume: 67 million cubic feet within outside columns. Exhibit space: 190,400 square feet (Arena & 100 level concourse).. Structural steel: 443 tons. Concrete: 52,800 cubic yards.
Source

Building area: 9.34 acres Roof area: 7.85 acres Height: 250 feet Diameter: 660 feet (inside wall) 720 feet (exterior walls) Volume: 67 million cubic feet Exhibit space: 190,400 square feet Weight: 130,000 tons Structural steel: 443 tons Concrete: 52,800 cubic yards

Source

Check:
Note: 52,800 yd^3 x 3^3 (ft^3/yd^3)x (152)lb/ft^3 x (ton/2,000 lbs)= 108,346 tons
108,346 tons + 443 tons = 109,000 tons

From the Seattle Times

Dust choked downtown for nearly 20 minutes, blocking out the sun and leaving a layer of film on cars, streets and storefronts. The dust cloud reached nearly as high as the top of the Bank of America Tower and drifted northwest about **8 miles an hour**.

---(snip)---

Carefully placed explosives - **4,461 pounds in all** - collapsed the **25,000-ton roof** like a cake taken out of the oven too soon. More than **21 miles of detonating cord** exploded in a flash. The Dome's roof ribs and columns looked like they had been electrified with lightning.

Rapid puffs of smoke followed, and the massive roof ribs that formed the Dome's 20 arches buckled first in three pie-shaped wedges. Then came the remaining three roof wedges, followed instantly by explosions in the support columns and in the roof's tension ring, which had held the roof together by exerting 8 million pounds of force around its base.

While nearly all of the Dome, which once weighed about **130,000 tons**, collapsed in on its own "footprint," **chunks of concrete flew onto rooftops**. The force of the blasts broke windows at the Salvation Army and Turner Construction buildings on Fourth Avenue South, and at F.X. McRory's steakhouse on South King Street. Residents of the nearby Florentine Condominiums had been taken to the restaurant earlier that morning, but no one was injured.

A small army of street sweepers went into action moments after the blast. Businesses around the Dome were quick to reopen, with little damage reported. Engineers will survey adjacent buildings and structures over the next few days to assess any damage.

The implosion registered a magnitude **2.3 on the Richter scale** - a barely detectable ground motion that naturally visits the region once or twice a month. Scientists will use ground-vibration data from the implosion to learn more about the Seattle fault, which runs a few blocks south of the Kingdome.

By afternoon, the job of pulverizing and hauling away the Kingdome was under way, **with hydraulic jackhammers** breaking columns into chunks. A couple hundred people gathered close to the site, taking pictures and searching for bits of the building to take home.

The rubble is **flatter** than expected, only reaching about **30 feet high near the perimeter** of the 9-acre Dome site. The Dome once stood 250 feet high.

Source

If the WTC had 425,000 cubic yards of lightweight concrete (72% the weight of normal concrete), then there were 631,000 (?) tons of concrete in the complex. This is a crude cross-check on the weight of the towers and the WTC and suggests that 500,000 tons is not an exaggeration.

Note: 425,000 yd^3 x 3^3 (ft^3/yd^3)x (110)lb/ft^3 x (ton/2,000 lbs)= 631,125 tons
Assuming this value is for both towers, one tower would be 316,000 tons.

If the Kingdome had 52,800 cubic yards of normal concrete, then there were 109,000 tons of concrete in the dome. Therefore, the 130,000 ton estimate of the Kingdome's weight seems reasonable.

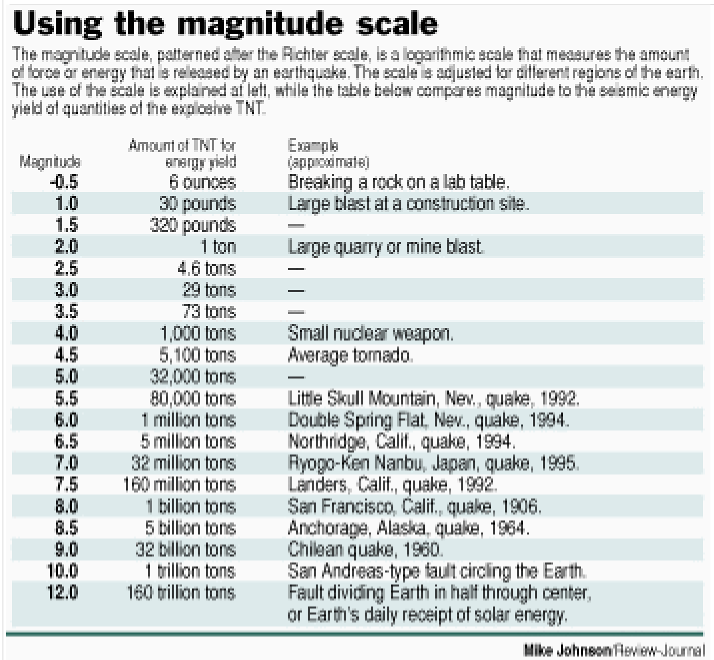
Note: 52,800 yd^3 x 3^3 (ft^3/yd^3)x (152)lb/ft^3 x (ton/2,000 lbs)= 108,346 tons
108,346 tons + 443 tons = 109,000 tons

The following account of the Kingdome demolition contrasts sharply with the destruction of the Twin Towers, as shown below:

1. "Dust choked downtown [Seattle] for nearly 20 minutes" yet ultra-fine dust plagued lower Manhattan weeks and months.

2. Dust "drifted northwest about 8 miles an hour," the pace of stragglers at the end of a 26-mile marathon, yet people running full speed could not outrun the pyroclastic-like dust from the Twin Tower destruction [see Figure 86 on page 6].

3. "Carefully placed explosives—4,461 pounds in all—collapsed" the Kingdome which would imply 17,158 pounds to just bring down a tower over a quarter-mile-high but would not pulverize it nor guarantee falling within its own footprint. If we adjust for the tower's height of center of mass, potential energy…67 tons of explosives would be required in this amount imply a 3.5 Richter reading [insert chart], far above the 2.3 reported for WTC 1 and equivalent to 67 tons of required explosives. Yet this would not pulverize and would leave an enormous rubble pile to jackhammer into smaller pieces, not in evidence.



Using the magnitude scale

The magnitude scale, patterned after the Richter scale, is a logarithmic scale that measures the amount of force or energy that is released by an earthquake. The scale is adjusted for different regions of the earth. The use of the scale is explained at left, while the table below compares magnitude to the seismic energy yield of quantities of the explosive TNT.

Magnitude	Amount of TNT for energy yield	Example (approximate)
-0.5	6 ounces	Breaking a rock on a lab table.
1.0	30 pounds	Large blast at a construction site.
1.5	320 pounds	—
2.0	1 ton	Large quarry or mine blast.
2.5	4.6 tons	—
3.0	29 tons	—
3.5	73 tons	—
4.0	1,000 tons	Small nuclear weapon.
4.5	5,100 tons	Average tornado.
5.0	32,000 tons	—
5.5	80,000 tons	Little Skull Mountain, Nev., quake, 1992.
6.0	1 million tons	Double Spring Flat, Nev., quake, 1994.
6.5	5 million tons	Northridge, Calif., quake, 1994.
7.0	32 million tons	Ryogo-Ken Nanbu, Japan, quake, 1995.
7.5	160 million tons	Landers, Calif., quake, 1992.
8.0	1 billion tons	San Francisco, Calif., quake, 1906.
8.5	5 billion tons	Anchorage, Alaska, quake, 1964.
9.0	32 billion tons	Chilean quake, 1960.
10.0	1 trillion tons	San Andreas-type fault circling the Earth.
12.0	160 trillion tons	Fault dividing Earth in half through center, or Earth's daily receipt of solar energy.

Mike Johnson/Review-Journal

Figure xx.
Adopted from this Chart Source:

4. Jackhammers?

Figure 21(a).
Source:

Figure 21(b).
Source:

Figure 21(c).
Source:

Figure 21(d).
Source:

Figure 21 (repeat from page 1). Kingdome video (courtesy of Portland Indymedia): *(mpg)*
Source

- ### *Extrapolation* *Top*

"Dust choked downtown for nearly 20 minutes" (not days?)

The dust drifted northwest about 8 miles an hour. (8 mph is about an 8-minute mile, the speed a straggler might be running on the last leg of a 26-mile marathon. In NYC on 9/11, no one could out-run the rapidly expanding dust cloud. [reference]

The rubble height was 30 out of the original 250 feet height. 30ft/250ft = 12%
110 x 12% = 13.2 stories for the WTC

4,461 lbs x (500,000/130,000) = 17,158 lbs = (40 people) x (10 lbs each trip) x (43 trips).
But it's not pulverized, nor is it controlled into its own footprint. Explosives only get the chunks down on the ground where they can be broken up and hauled away,.

21 miles of detonating cord x (1368/250) = 115 miles of detonating cord, extrapolating from relative height

" with hydraulic jackhammers breaking columns into chunks" =>> not pulverized!

"...chunks of concrete flew onto rooftops?"

See appendix XX where only aluminum cladding landed on neighboring rooftops.

- ***Comparison of Potential Energy*** Top

If each tower was made of 100,000 tons of steel and had a total weight of 500,000 tons, then the steel is only 20% of the mass. So, if they pulverize all but the steel in the lower 36 floors, then the lower 36 floors are fairly light. I went through those numbers and found it is 36 floors of only steel that is equivalent to the Kingdome's PE. I.e. The bottom 36 floors of a 110 floor-building (where the entire 110 floors weighs 100,000-tons) has the same PE as the Kingdome.

The Kingdome does not have its weight evenly distributed. There is more density lower down, so one would expect the center of gravity to be lower than the geometric center. This would produce a lower potential energy (PE) than what I used. But, also, the WTC was heavier on the lower floors than the upper floors, which would also produce a slightly lower center of gravity as well as a slightly lower PE. So, the ratio of the WTC's-PE to the Kingdome's-PE is a reasonable approximation.

We know that each WTC tower did not slam to the earth and register as a 3.8 Magnitude earthquake. We also know that a lot of the building came down as dust.

So, if we assume every floor contains $1/110^{th}$ of the building's total mass, the bottom 20 floors of WTC1, alone, have the same potential energy as the Kingdome. But, when the event was all over, we didn't see the lower floors stacked up like pancakes that had slammed to the ground. What happened to all the concrete and marble? What happened to all the glass? What happened to all the desks? But, what we did see was a bunch of steel beams. So, if we were only left with steel beams, how many floors worth of steel would have the same PE as the Kingdome?

The weight of all the structural steel in the building is 100,000-tons [REFERENCE needed], which is 20% of the weight of the entire building. If we assume every floor contains $1/110^{th}$ of the building's total mass of structural steel, just the steel in the bottom 36 floors of WTC2 has the same PE as the Kingdome.

So, as an approximation, the structural steel of WTC2 makes up $36/110^{th}$ of $1/5^{th}$ the total mass of the building, or 6.5% of the building's mass. If this mass is evenly distributed over 36 floors, it will have the same proportional potential energy relative to the Kingdome that could be expected to cause the equivalent of a 2.1 earthquake when it slammed to the ground. Is this reasonable, considering the debris remaining after the event?

30X … log of 30 yields 1.5, which must be added to 2.3 Richter for Kingdome to yield 3.8 Richter.

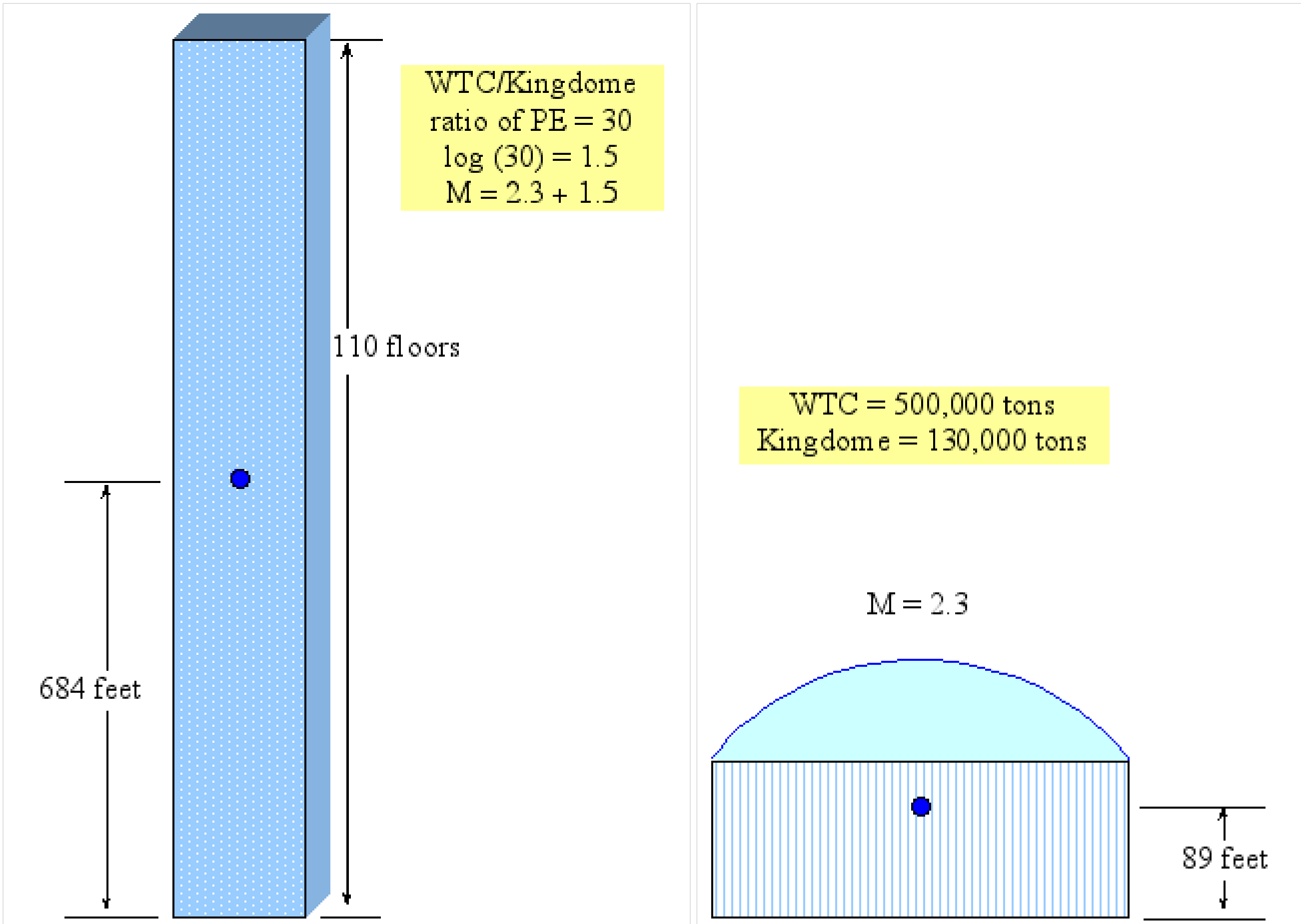


Figure 23(a). WTC

Figure 23(b). Kingdome

Figure 23. WTC and the Kingdome with approximate Potential Energy (PE).

Log of 1 is zero…for WTC1 lower 20 stories,…yields same earthquake.

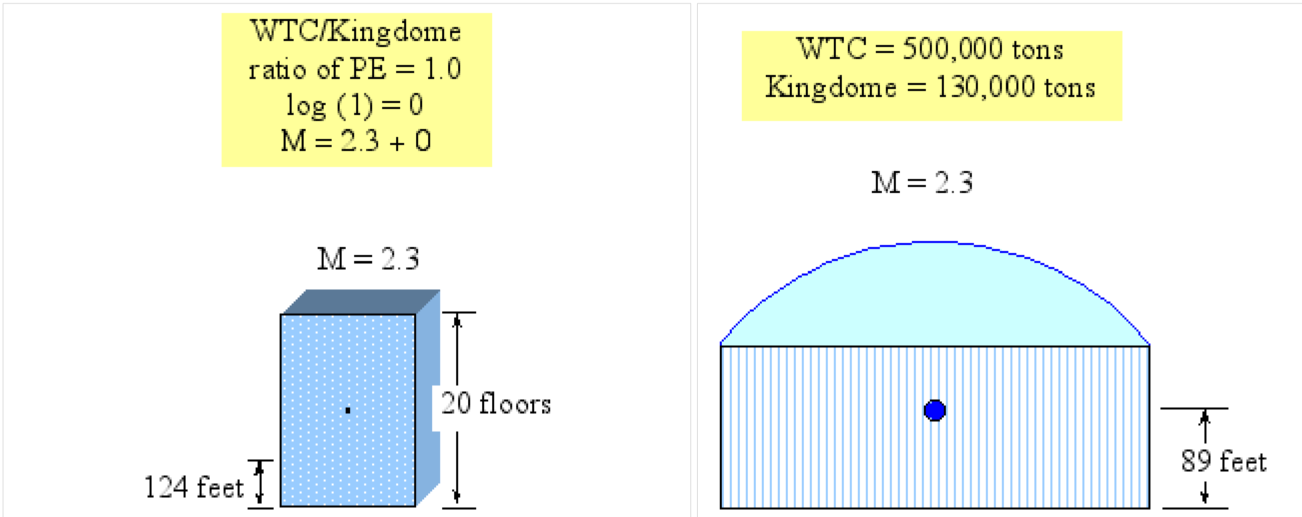


Figure 24(a). normal WTC1 floors

Figure 24(b). Kingdome

Figure 24. Twenty floors in WTC1 footprint with PE equal to the Kingdome. (2/11th of the height and 2/11th of the mass of WTC1 would have the same PE as the Kingdome.)

Log of 0.63 is -0.2…for WTC2 lower 16 stories,…yields 2.1 earthquake.

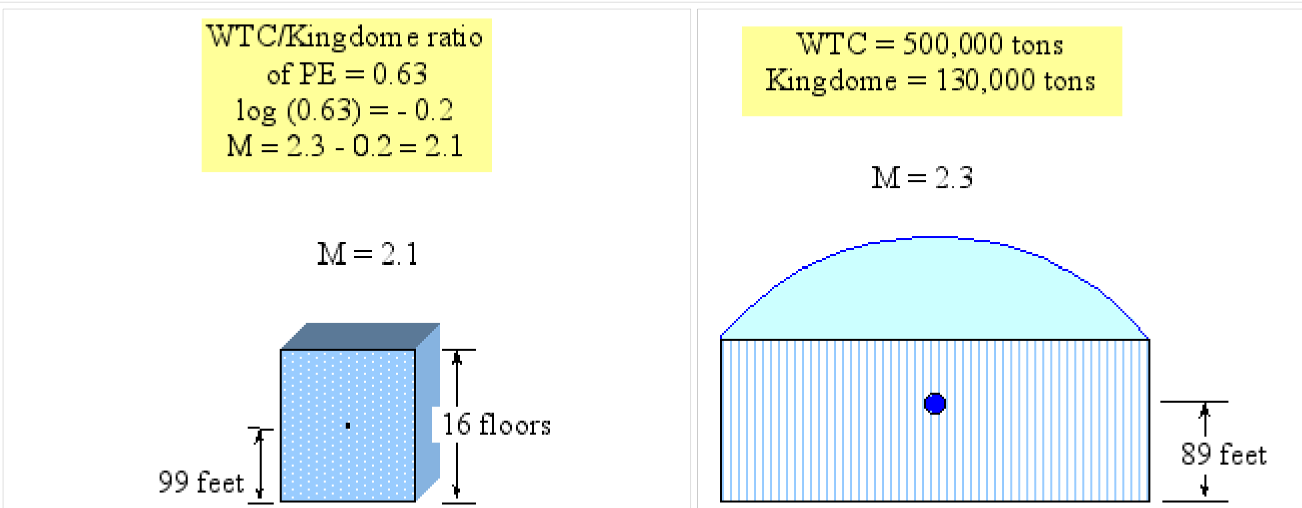


Figure 25(a). normal WTC2 floors

Figure 25(b). Kingdome

Figure 25. Sixteen floors in WTC2 footprint with PE equal to the Kingdome. (14.5%of the height and 14.5% of the mass of WTC2 would have the same PE as the Kingdome.)

Transition from total pulverization to gravity fall of large solids.

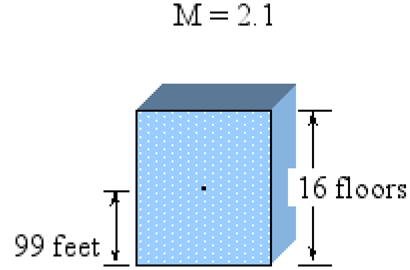


Figure 26(a) normal WTC2 floors

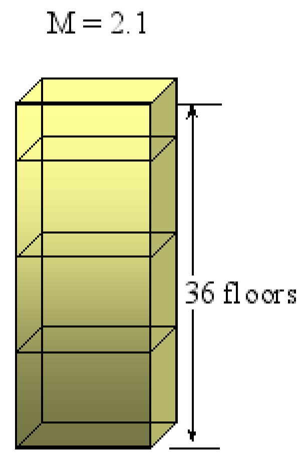


Figure 26(b) only the structural steel from these floors

Figure 26(a). If 15% of the mass, evenly distributed over the lower 20 floors, (15% of the building's height). or **(b) 6.5%** of the mass of the entire building's mass is evenly distributed over the lower 36 floors of WTC2 (32% of the building's height), it would have the same PE as the Kingdome.

≅ ***Bankers Trust*** Top

Figure 27. Note that solid debris appears to have hit only the lower half of this 40-story building (Bankers Trust). However, the top few floors appear to have had their windows blown out.
Source

Figure 28. The tower is being peeled downward. Dark explosions shoot up, while white ones explode outward. Above the white explosions the building has vanished while the lower part awaits termination.
Source

+

The Star Wars Beam Weapons
and
Star Wars Directed-Energy Weapons (DEW)
(A focus of the Star Wars Program)

by
Dr. Judy Wood and Dr. Morgan Reynolds
(originally posted: October 17, 2006)

Page 3: Dustification

At the time this article was being developed, many people expressed disbelief that energy weapons existed outside of science fiction until they were reminded of the Star Wars Program, also known as the Strategic Defense Initiative (SDI)*. The name of this article was chosen as a reminder that energy weapons do exist and have been developed over 100 years. Most of this technology is classified information. It can also be assumed that such technology exists in multiple countries. The purpose of this article was to begin to identify the evidence of what happened on 9/11/01 that must be accounted for. In doing so, the evidence ruled out a Kinetic Energy Device (bombs, missiles, etc.) as the method of destruction as well as a gravity-driven "collapse."

*SDI was created by U.S. President Ronald Reagan on March 23, 1983.[1] It is thought that SDI may have been first dubbed "Star Wars" by opponent Dr. Carol Rosin, a consultant and former spokeswoman for Wernher von Braun. However, Missile Defense Agency (MDA) historians attribute the term to a Washington Post article published March 24, 1983, the day after the Star Wars speech, which quoted Democratic Senator Ted Kennedy describing the proposal as "reckless Star Wars schemes."[2] Before it was named the "Star Wars Program (SDI) in 1983, it was the Advanced Space Programs Development.[3]

12/12/10 -- Dr. Judy Wood

[1]Strategic Defense Initiative, Wikipedia,
[2]Sharon Watkins Lang. SMDC/ASTRAT Historical Office. "Where Do We Get Star Wars?", *The Eagle*. March 2007.
[3] Robert M. Bowman, former Director of Advanced Space Programs Development for the U.S. Air Force in the Ford and Carter administrations.

This page last updated, June 25, 2007
(Video added, Figure 39)

Shortcuts:	Audio:
Jump to: *What steel was shipped to China?*	**29 November 2006**, Judy Wood narrates these pages web pages on "The Dynamic Duo" with Jim Fetzer, Genesis

Jump to: *Dustification of material*

Jump to: *Snowballs and Bullet Holes*

Jump to: *WTC3, Bill Biggart's last photos*

Jump to: *fuming*

Jump to: *Dust*

Jump to: *Bubbler-Volcano*

Jump to: *How much Dust would a building make?*

Jump to: *Kingdome debris*

Jump to: *WFC2 and WFC3*

Communications Network, gcnlive.com, archive (mp3-1)(mp3-2) (mp3).

6 December 2006, Morgan Reynolds discusses these pages on "The Dynamic Duo" with Jim Fetzer, Genesis Communications Network, gcnlive.com, archive, (mp3)(mp3)

The World Trade Center (WTC) towers did not "collapse" on 9/11/01, they were pulverized (Blown to Kingdom Come) before a gravity-driven collapse was even a possibility. Below, we discuss how this was done.

VI. Pulverized to dust *Top*

The government maintains that the Twin Towers were each hit by aircraft and the subsequent fires weakened the steel in the upper stories, initiating a gravity-driven "pancake collapse," as illustrated in Figure 30. There are many problems with this hypothesis. The most obvious problem with it is the near free-fall speed of the destruction of these buildings (see Billiard Balls). A second problem is the paucity of remaining material. Where are the concrete floors? Where is the office furniture? Where is the office machinery? Where are the filing cabinets? Where is the wall board? Where are the bookcases? They were not there, so most of it appears to have turned to dust, as illustrated in Figure 31.

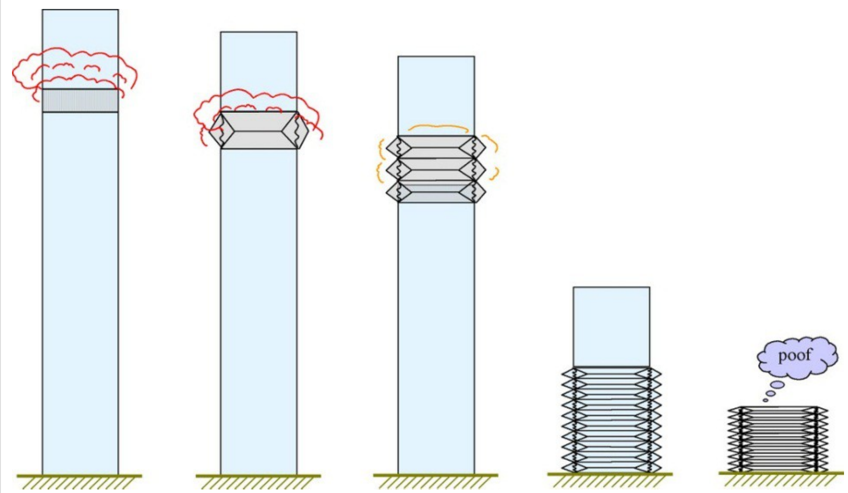


Figure 30. An illustration of what a "pancake collapse" would look like. The rubble pile should be at least 1/8 of the original building height (12.5%).
Source

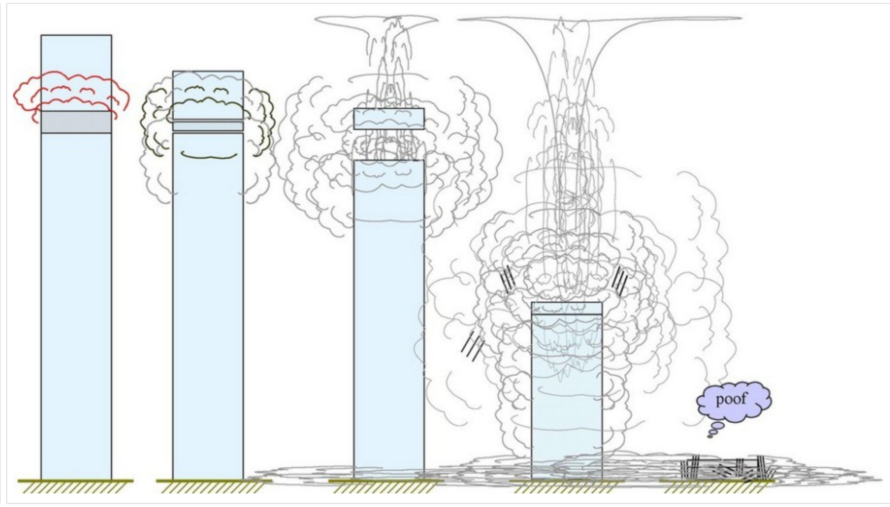


Figure 31. An illustration of what the actual destruction looked like. The rubble pile was no more than 2% of the original building height. Both towers went "poof."
Source

Figure 32. Mostly unburned paper mixes with the top half of the Twin Towers. As seen a block away, a large portion of the towers remains suspended in air. This dust looks deeper than one inch. Most of the curb looks filled in.
Source: Terry Schmidt

- ***What steel was shipped to China?*** Top

It was widely reported that a substantial amount of WTC steel was sold as scrap, put on barges, and shipped to China to be melted down. But Figure 33 shows how little steel was on the ground shortly after destruction of the WTC towers. There is evidence that steel was transported to Fresh Kills Island to be stored. This steel may or may not have been subsequently shipped to China. But it could not be a large amount of steel.

Figure 33. The remains of WTC2 are in the foreground. Immediately behind WTC2 is where WTC3 (Marriott Hotel) once stood. Where did it go? In the background (upper-left) the

World Financial Center (WFC) buildings have blown-out windows and other damage. The remains of WTC6, an 8-story building, towers over the remains of WTC1.
Source

This photo is dated 9-13-2001. The sun is from the east (right side of picture), so it appears this was taken on the morning of 9/13. While it has been reported that much of the steel was removed from the site, sold to China, and loaded onto barges, and sent to China to be melted down, the steel could not have been removed this fast. So, if it was not shipped to China overnight, where did the steel go? Most of it was not on the ground, initially; so it had to have been suspended in the air.

- ***Dustification of material*** *Top*

Figure 34. Building turns to dust.
Source

Figure 35. Steel beams appear to disintegrate into steel dust.
Source

Figure 36. Steel columns disintegrate into steel dust with WTC7 and water tower in the foreground.
Source

Figure 37. The same steel-dust phenomenon from another source and perspective.
[*Source,*]

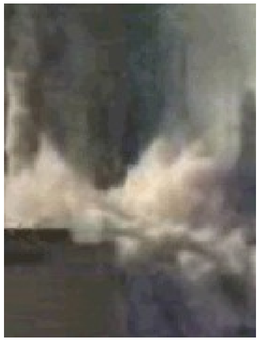


Figure 38(a). A video clip of steel turning to steel dust. (gif)
Source

Figure 38(b). Another video of steel turning to steel dust, although CNN’s Aaron Brown calls it smoke. (avi)(mpg)
Source

Figure 38(c). (gif) People run by as steel "wheatchex" turn to dust and the building turn to dust. This is not science fiction. (terrorize.dk) *Source*

Figure 39. "In the current compilation we can see from CNN a video clip of steel turning to steel dust. CNN's Aaron Brown calls it 'smoke.'
...Finally you can see more NASA shots of the 911 WTC taken from the PBS - American Experience documentary "New York Center of the World." Episode 8. The final comment is that of Paul Goldberger, an architecture critic."
URL

Thanks for Video by chrisbornag

≅ ***Snowballs and Bullet Holes*** *Top*

Figure 40(a) (same as Figure 28). The tower is being peeled downward. Dark explosions shoot up, while white ones

Figure 40(b). The building appears to be dissolving into powder. We don't we see any solid parts of a falling building,

explode outward. Above the white explosions the building has vanished while the lower part awaits termination. *Source*	here. [*Source*]

Figures 40(a) and 40(b) show WTC2 dissolving into powder. An interesting detail is what appear to be "bullet holes," with dense perimeters, distributed throughout the dust cloud. These bullet holes seem to be at the origin of the rapidly-expanding dust cloud.
(other examples)

Figure 314(b). Steel wheatchex turn into a brown blob. Small circles identify a few bullet holes.

Figure

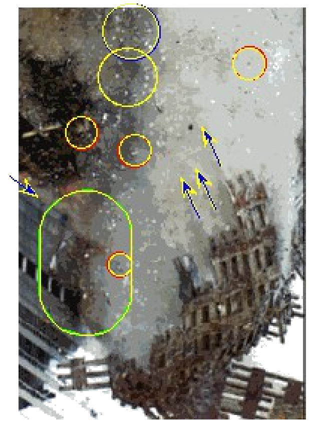


Figure 314(c). Large oval isolates brown "seahorse" shape in the zone where the building appears to be coming apart.

314(a). As WTC2 is destroyed, disintegrating steel "wheatchex" showered down on WTC3, the Marriott Hotel.
Figure 314. Caught in the act?
(Note: We are currently questioning the authenticity of this photo. However the source for it is the NIST report.)

≅ *WTC3* *Top*

Figure 315(a). One of Bill Biggart's last pictures, perhaps his next to last picture.
Source

Figure 315(b). Bill Biggart's last picture.

Figure 315. WTC3 was partly destroyed in bizarre fashion during the destruction of WTC2. (Special thanks to Bill Biggart for this very valuable piece of the puzzle.)
Source

Figure 55(b). WTC3 was reduced to this 3-4 story high if narrow debris stack. A lower section of WTC1's west wall lays across the West Side Highway.
(9/13/01) *Source*

Figure 313. Most of WTC3 disappeared during the destruction of WTC1. The pedestrian walkway over the West Side Highway was connected to something that is no longer there. The remains of WTC2 can be seen near the center of the photo and the remains of WTC1 are partly visible in the lower right corner.
(9/27/01) *Source*

"Building vapor" wafts up from the WTC1 and WTC2 "piles." Where is it coming from? It resembles steam off of a manure pile. It does not seem to originate from a single point, but rises over a wide zone, like a haze in a fairly uniform fashion.

Figure 41a. "Fumes" from the site were visible for days.
Source

Figure 41b. Aluminum cladding and paper lay in the street, but where is the steel? And why isn't more of the paper on fire? It won't be on fire for long if that fireman gets his fire hose working. Why is it only paper that survived and not office furniture and equipment? Most of this paper must have been in steel filing cabinets and bookshelves.
Source: (Reuters)

The twin towers together had an estimated 30,000 computers for nearly 50,000 workers. So, 45,000 filing cabinets would not be an unreasonable estimate. It is reported that 200 complete bodies were recovered out of the nearly 3,000 victims, which is about 1/15th. At the same ratio, we would expect 3,000 complete filing cabinets of the 45,000 should have survived intact. Yet only one shrunken filing cabinet was reportedly found (see figure 94, StarWarsBeam page 6).

- ***Dust*** *Top*

	
Figure 42. Mostly unburned paper mixes with the (former) top half of the Twin Towers. As seen a block away, a large portion of the towers remain suspended in air. This dust looks deeper than one inch. Most of the curb looks filled in. *Source: Terry Schmidt*	**Figure 43.** It's a pretty dark place! *Source*

Figure 44. WTC1 smoke obscures WTC 2 destruction. It's like a total eclipse of the sun.
Source

Figure 45. Does this look more like a pancake collapse, a volcano, or a dust fountain "bubbler"?
Source

Figure 02. The destruction of WTC2 envelops lower Manhattan in a blizzard of ultra-fine dust.
Source

Figure fruit. Dust covers an abandoned produce stand in lower Manhattan.
Source

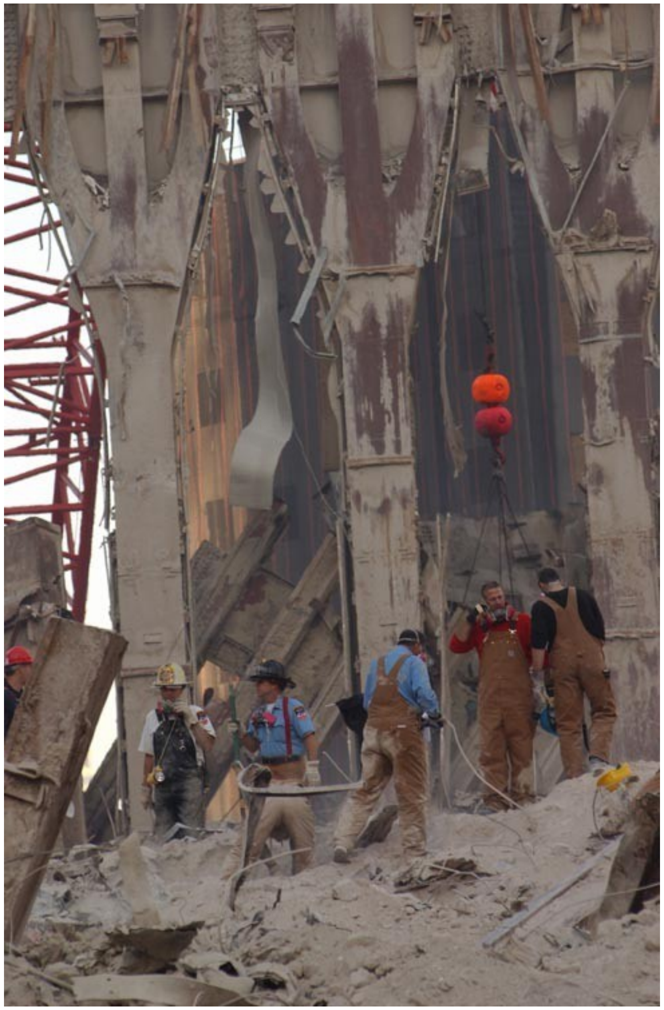


Figure 46. Scooping up the building.

Source

Figure 47. GZ workers walk in thick dust atop the rubble pile, hardly higher than the lobby level.
Source

Figure 48. The black building in the foreground is the Bankers Trust Building (130 Liberty Street), which has a total volume of approximately 28% of the total volume of one WTC tower. So two WTC towers had seven times the volume of the Bankers Trust Building. How could seven collapsed Bankers Trust buildings leave so little debris?
(182.5*ft* x 182.5*ft* x 40*floors*) vs. 2x(207*ft* x 207*ft* x 110*floors*)
Source

How much Dust would a building make? Top

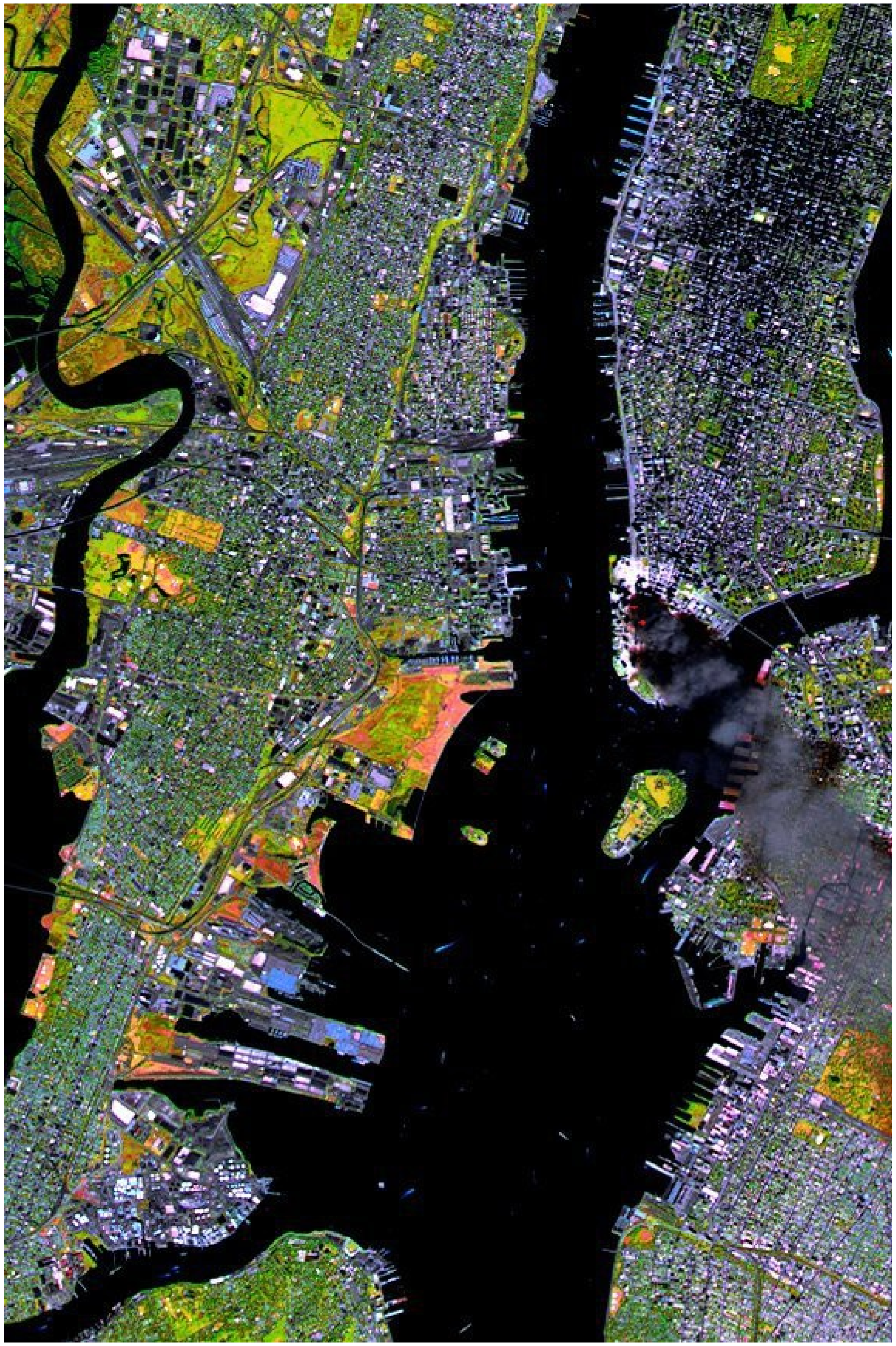


Figure 50. Ground-level view of the enormous quantity of dust wafting skyward. Conventional demolition dust does not do this.
Source:

Figure 49. Satellite, color-coded image shows the enormous

Figure 51. This is a photograph taken from the

quantity of dust from the WTC destruction. *Source*	International Space Station (at 10:30 AM on 9/11/01 according to the source). We believe it was taken on 9/12/01 and will update this when this information is verified. Source: (Note: This photo may be correct, but we are currently questioning the authenticity of this photo and the reported date because of (a) the source for it and (b) several questionable anomalies.)

If a WTC tower were completely turned to dust, how much dust might we expect?

Suppose the building's materials were reduced to 10% of its original volume.
Volume of one WTC tower = (207 *ft*) x (207 *ft*) x (1368 *ft*)
Dust Volume (from one WTC tower) = (1/10) x $\text{Volume}_{\text{tower}}$ (approx.)
One square mile = (5280 *ft*) x (5280 *ft*)
Dust Volume for one WTC tower (approx.) = (1/10) x $(207/5280)^2$ x (1368x12 *inches*) = 2.52 *inches* deep over 1 square mile, or equivalent to 1-*inch* deep over 2.52 square miles.
An area of 2.52 square miles would be a radius of 0.896 miles. Note that the area would include both land and water.

Suppose the building's materials were reduced to only 5% of the original volume.
Dust Volume for one WTC tower (approx.) = (1/20) x $(207/5280)^2$ x (1368x12 *inches*) = 1-*inch* deep over 1.26 square miles,
An area of 1.26 square miles would be a radius of 0.634 miles.

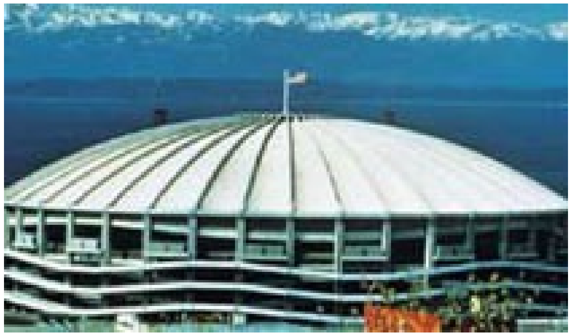
These calculations suggest that the towers had enough material to yield dust about an inch deep and cover approximately a square mile in lower Manhattan, plus the dust carried over the Hudson River, the East River, Brooklyn, the Upper Bay, and into the upper atmosphere. So where did all the dust come from? It looks like it all came from the towers.

- ***Kingdome debris*** *Top*

Other WTC data are consistent with an intact bathtub and low Richter reading. Conventional demolitions do not send dust far above the original building height, contrary to what we saw at the WTC. Figure 52 shows the Seattle Kingdome demolition.

Visual evidence and the comments of experienced scrap guys verify an incredibly small stack.

Kingdome debris….



(a) The Seattle Kingdome.
Source

(b) The Kingdome implosion starts.
Source

(c) The right and left sides are "pulled" first to fold the building inward.
Source

(d) The dust expands.
Source

(e) The cylindrical wall collapses.
Source

(f) The dust barely goes higher than the original height of the Kingdome.
Source

(g) The pile of rubble that remains includes all of the beams and concrete. Contrary to the WTC, all of the valuable furniture and fixtures had already been removed.
Source

(h) The building wasn't pulverized. It was merely cut into nice size pieces to load onto trucks. Look at how tiny the people are relative to the rubble pile.
Source

Figure 52. Here is a video of the Kingdome demolition. (mpg) *(courtesy of Portland Indymedia)*

- ## *WFC2 and WFC3* [Top]

In addition to the dramatic dustification of the WTC buildings, many windows appear they were blown out from the inside, as seen in Figures 29(a) and 29(b). But, perhaps they shattered without being blown in or out. The World Financial Center buildings (WFC) are on the west side of West Street, across from the WTC. The Winter Garden, between WFC2 and WFC3, was destroyed by steel debris. However, WFC2 suffered no structural damage to the facade, only blown windows. WFC3 suffered structural damage to the southeast corner, but no steel beams hit above approximately the 20th floor. Figure 29(b) shows exercise equipment inside WFC2 where the windows are blown/shattered.

Figure 29. Note the blown out windows at the WFC. There appears to be no other damage to the façade of WFC2 on left. *Source*	**Figure 299.** (September 16, 2001) View from the WFC2 exercise room. *(9/16/01) Source*

The Star Wars Beam Weapons
and
Star Wars Directed-Energy Weapons (DEW)
(A focus of the Star Wars Program)

by
Dr. Judy Wood and Dr. Morgan Reynolds
(originally posted: October 17, 2006)

Page 4: Holes

At the time this article was being developed, many people expressed disbelief that energy weapons existed outside of science fiction until they were reminded of the Star Wars Program, also known as the Strategic Defense Initiative (SDI)*. The name of this article was chosen as a reminder that energy weapons do exist and have been developed over 100 years. Most of this technology is classified information. It can also be assumed that such technology exists in multiple countries. The purpose of this article was to begin to identify the evidence of what happened on 9/11/01 that must be accounted for. In doing so, the evidence ruled out a Kinetic Energy Device (bombs, missiles, etc.) as the method of destruction as well as a gravity-driven "collapse."

*SDI was created by U.S. President Ronald Reagan on March 23, 1983.[1] It is thought that SDI may have been first dubbed "Star Wars" by opponent Dr. Carol Rosin, a consultant and former spokeswoman for Wernher von Braun. However, Missile Defense Agency (MDA) historians attribute the term to a Washington Post article published March 24, 1983, the day after the Star Wars speech, which quoted Democratic Senator Ted Kennedy describing the proposal as "reckless Star Wars schemes."[2] Before it was named the "Star Wars Program (SDI) in 1983, it was the Advanced Space Programs Development.[3]

12/12/10 -- Dr. Judy Wood

[1]Strategic Defense Initiative, Wikipedia,
[2]Sharon Watkins Lang. SMDC/ASTRAT Historical Office. "Where Do We Get Star Wars?", *The Eagle*. March 2007.
[3] Robert M. Bowman, former Director of Advanced Space Programs Development for the U.S. Air Force in the Ford and Carter administrations.

This page last updated, December 20, 2006

Shortcuts: Jump to: *laydown* Jump to: *To Murray and Church Streets* ·Jump to: *Locations* Jump to *overhead* Jump to *Missing Wall* Jump to: *WTC6* Jump to: *WTC6-inside* Jump to: *WTC5* (fuselage)	**Audio:** **29 November 2006**, Judy Wood narrates these pages web pages on "The Dynamic Duo" with Jim Fetzer, Genesis Communications Network, gcnlive.com, archive (mp3-1)(mp3-2) (mp3). **6 December 2006**, Morgan Reynolds discusses these pages on "The Dynamic Duo" with Jim Fetzer, Genesis

Jump to: *WTC4* ·Jump to: *Going underground* (The Hole in the Street) Jump to *Hole #2* Jump to *Hole#1* Jump to *Mall Rescue* Jump to *Hot Spot*	Communications Network, gcnlive.com, archive, (mp3)(mp3)

VII. Holes *Top*

Buildings 5 and 6 had mysterious holes in them. Because of the verticality of these holes, their cause could not have been conventional explosives. WTC6, an eight-story building, lost about half of its volume and there was remarkably little debris left at the bottom of building. What happened? No one has attempted to explain these mysterious holes.

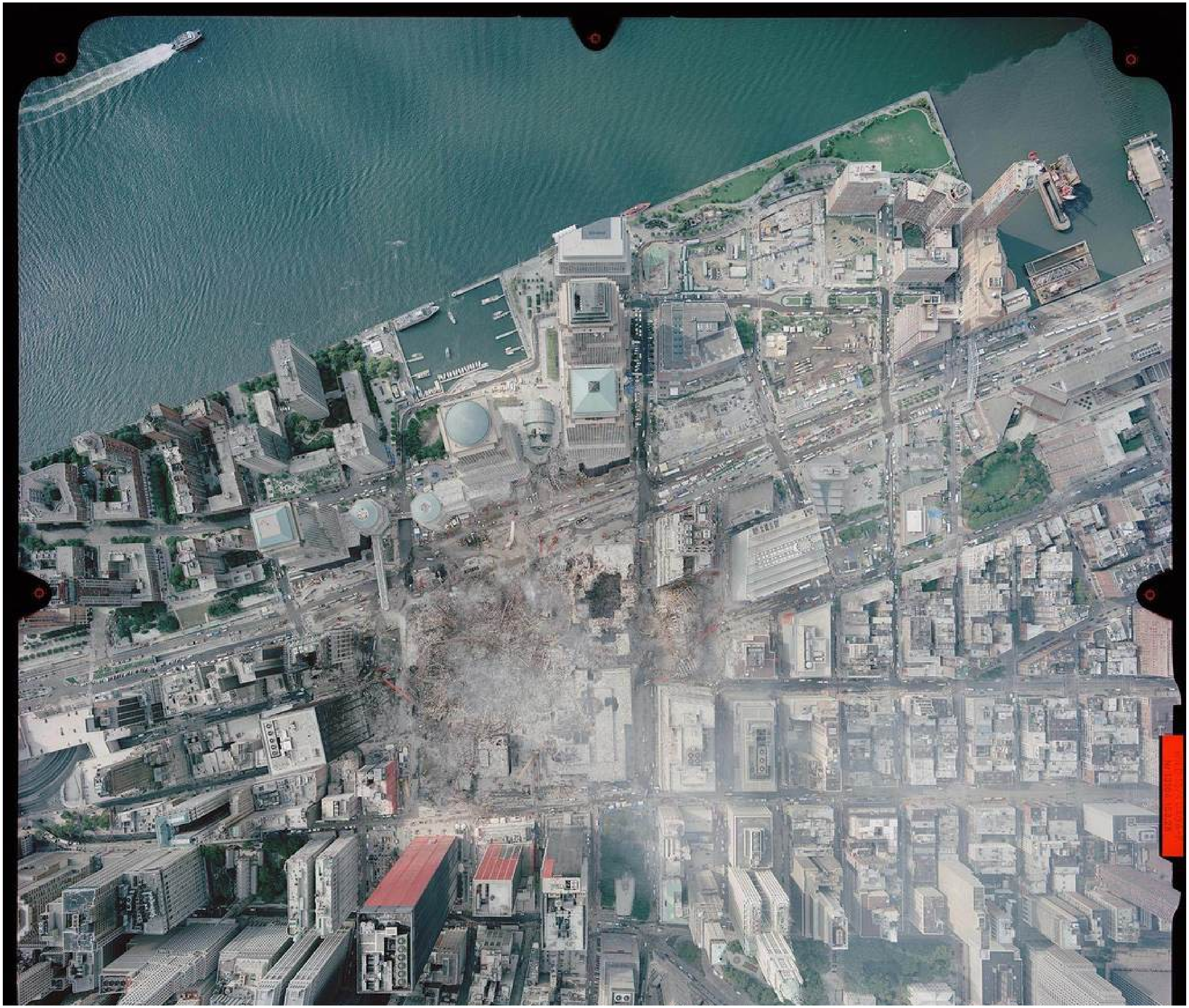


Figure 54. Every building that was destroyed had a prefix of WTC. There was surprisingly little collateral damage to nearby buildings that were not targeted. The WTC buildings that were not totally destroyed had multiple circular holes visible at Ground Zero -- especially in buildings WTC5 and WTC6. *(high-resolution)*
(9/23/01) Source: USGS/NOAA

Figure 55(a). Notice how straight the vertical holes were that cut down through WTC6.
(9/??/01) Source

Figure 55(a) looks west/northwest. Notice the substantial steel debris from the lower floors of WTC1 lying in the West Side Highway. This debris fell short of damaging the WFC2 façade, which only suffered broken windows (see Figure 29). The diagonal path of the steel "wheatchex" in the street look as if they leaned back, jumped out of the bathtub, tried to do a pirouette, and plopped down in the middle of the West Side Highway, almost ready for loading onto trucks. The coherence of this wall from WTC 1 laid out in West street in single thickness suggests that thermite was not used on this wall. Why? Because thermite would have cut steel, sent it tumbling down, creating a scattered trash pile of steel, and likely sending steel beams into adjacent buildings.

The north side of the outer wall of WTC1 is standing unsupported, leaning toward WTC6. The east side of the remaining WTC1 wall appears to be the highest standing section of unsupported wall that remains. A "pancake collapse" would have crushed (destroyed, buckled) these outer walls, yet they remain standing at attention like a soldier. The floors connected to this outer wall seemed to have slipped away as if they had never existed. How could the floors be torn away from the walls, while the walls stay erect, unbuckled, and unsupported? It appears that that the floors were pulverized and simply disappeared. There is debris at the lobby level near the standing walls but there are no floor "pancakes" stacked up.

Figure 55(b). The remarkable "lay down" of steel wheatchex from the lower stories of WTC1 on West Street (West Side Highway). The WTC3 debris pile is in the background, next to the unsupported WTC2 wall.
(9/13/01) Source

Figure 55(c). The three steel wheatchex stabbed into West Street in the foreground and the remains of WTC3 in the background, in front of the west wall of WTC2.
(9/15/01) Source

Figure 56. This photo highlights the depth of the hole in WTC6. The "smoke" or pulverized dust from debris appears to have diminished in comparison to Figure 55(a). While there is abundance of aluminum cladding on the roofs of buildings 5 and 6, there is little or none in the holes.
(9/??/01) Source

Figure 56 shows the remains of WTC6 just north of where WTC1 was standing. The vertical holes in WTC6 (U.S. Customs Building) have the shape of cylindrical core samples in soil. What could have done this? Explosives (dynamite, RDX, etc.)? Thermite? Mini-nukes? Beam weapon? Whatever it was produced vertically straight holes while doing little apparent horizontal damage to the balance of the interior of WTC6. In addition, the parking garage below WTC6 remained essentially undamaged, as Figure 1 on page 1 and Figure 304 below shows.

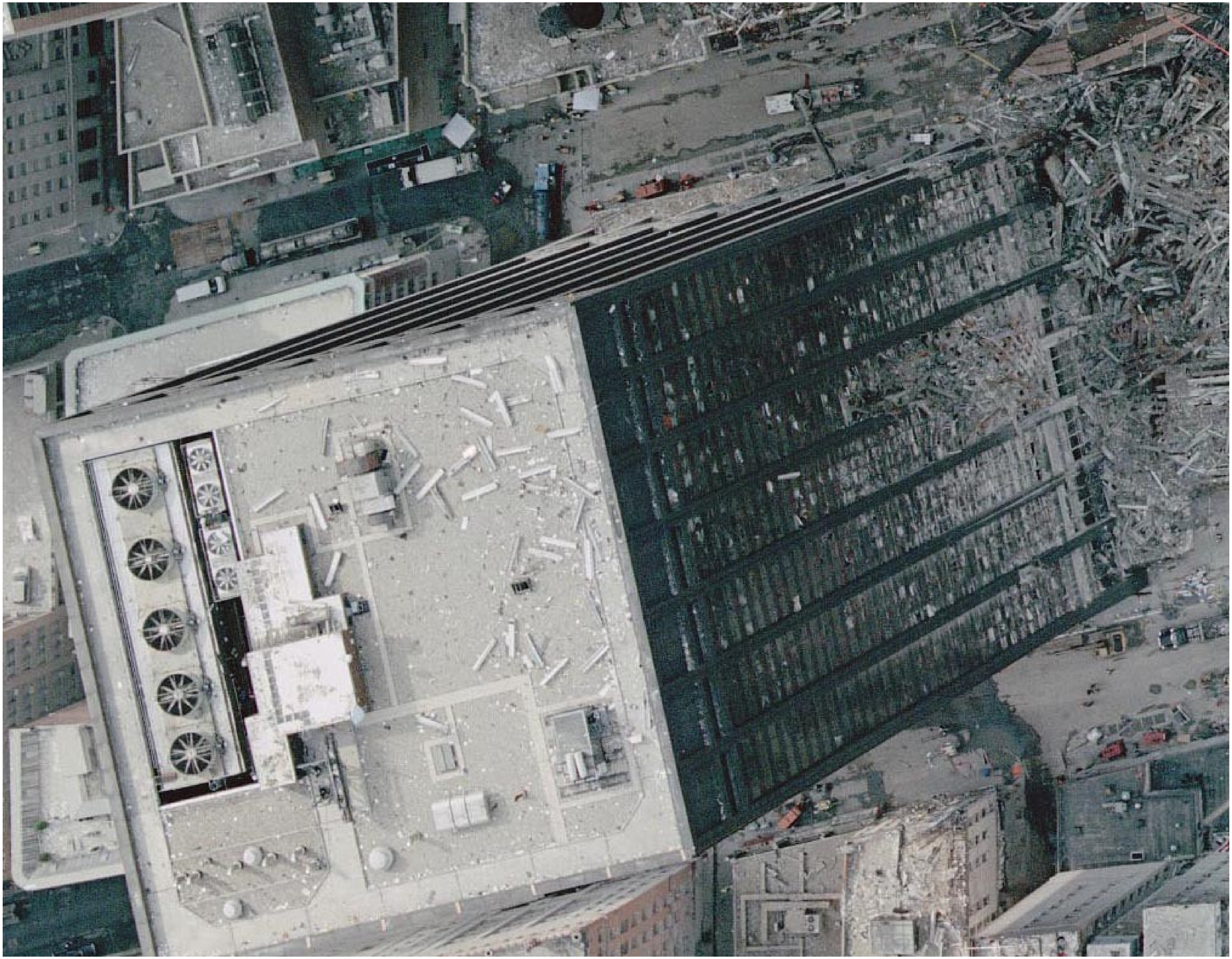
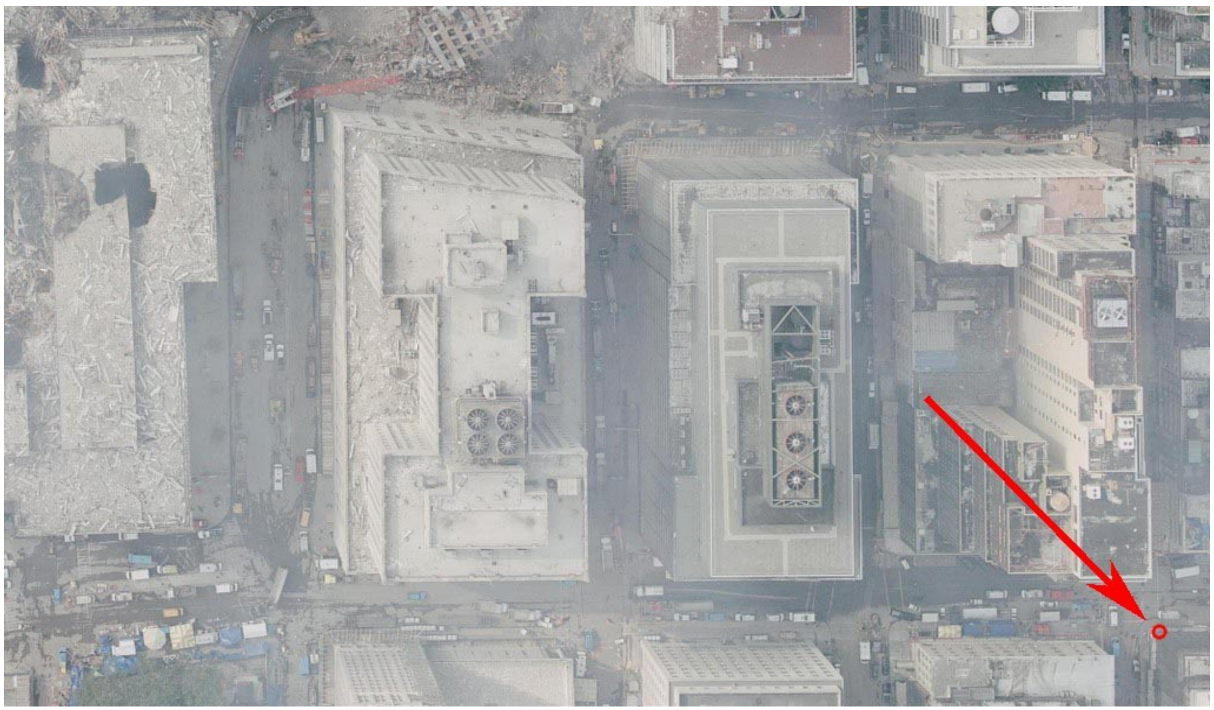


Figure 11. Banker's Trust, a 40-story building, had pulverized dust and some WTC aluminum cladding on its roof -- plus some damage mostly confined to its lower floors. This same pattern prevails in other damaged buildings adjacent to the WTC complex. (See Figure 9, below.) This is surprisingly little damage following destruction of 110-story buildings directly across the street. Why is there no serious damage to the adjacent buildings above the 20th floors of those buildings? Such damage is less than 20% of the height of a Twin Tower. What would explain why this? Disintegration and pulverization into talcum-powder-sized dust above the 20th floors would explain this.
(9/23/01) Source: USGS/NOAA

To Murray and Church Streets Top



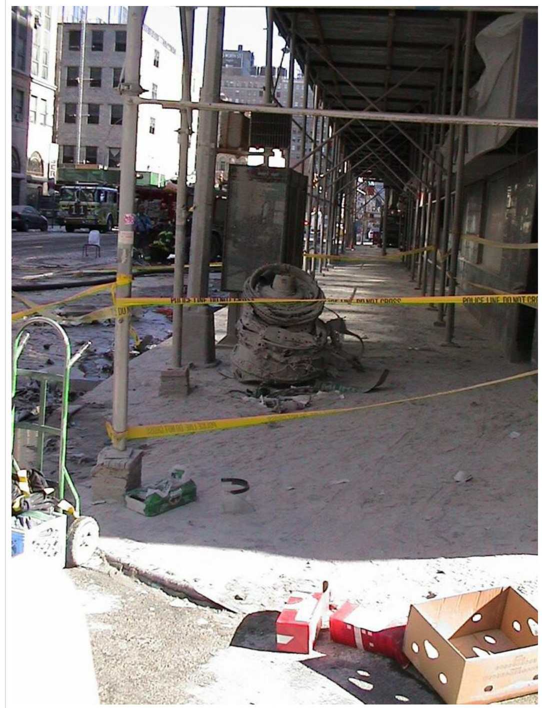


Figure 9(a). WTC5 on the left, the U.S. Postal Service building, and the two buildings to the right (north) of the postal building, have only modest dust and a few pieces of aluminum cladding on their roofs. A jet engine piece was found at the corner of Murray and Church Streets as indicated in Figure 9.

Figure 9(b). How could this piece fly through WTC2, over WTC5 and two more buildings, drop into that intersection by clearing the tallest building, land under scaffolding, not

(9/23/01) Source: USGS/NOAA (mouseover to remove red arrow)	gouge the street or any building and not bump into any scaffolding supports? The Flight 175 engine piece apparently came in for a soft landing. ***(9/??/01)*** Source

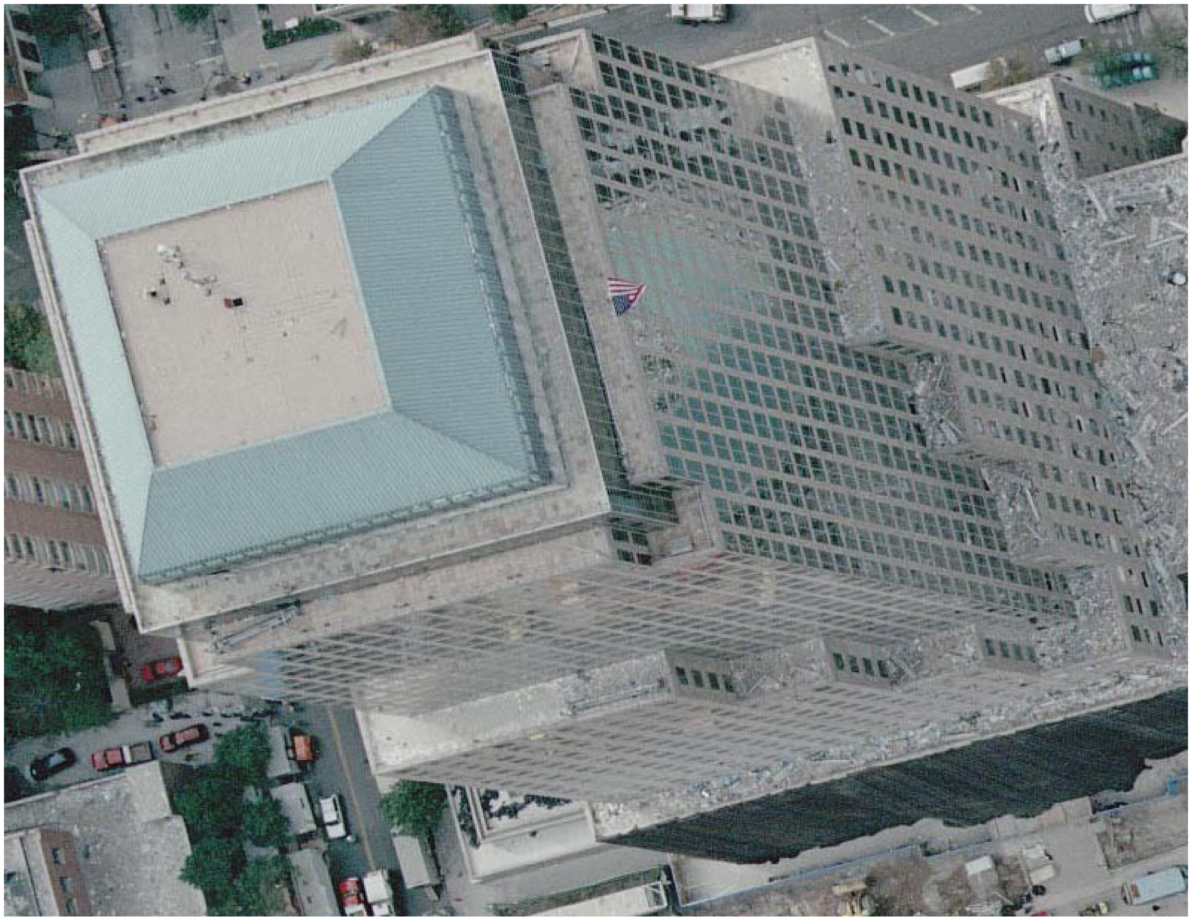
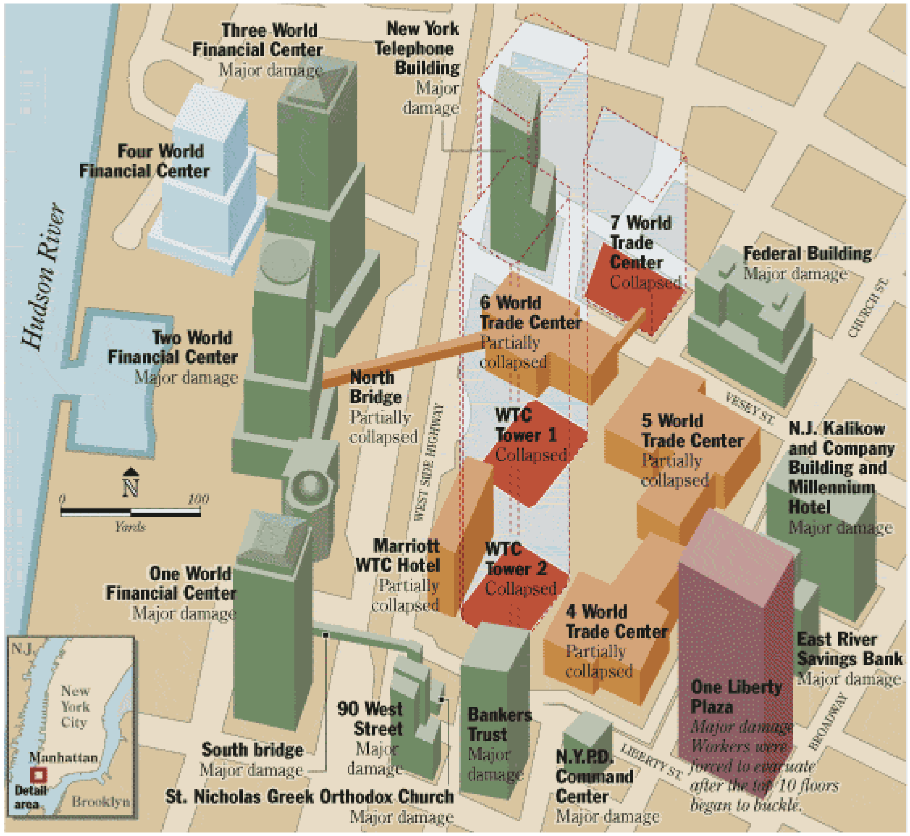


Figure 10. WFC2 had only pulverized dust and WTC aluminum cladding on its roofs. WFC2 suffered only window damage only to its lower floors, despite the destruction of a 1/4-mile high building across the street.
(9/23/01) Source: USGS/NOAA

Locations [Top]



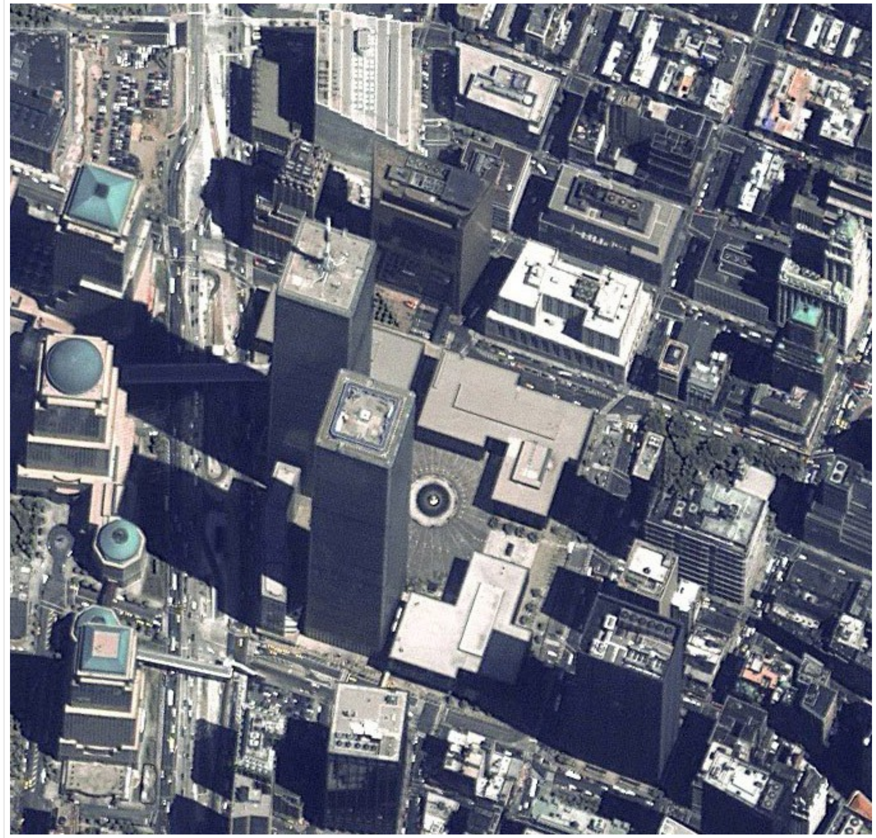


Figure 59(a).	Figure 59(b)

Figure 59(a) maps the WTC area, with each WTC building, some surrounding buildings, and streets labeled. Figure 59(b) is a photograph of the WTC complex and surrounding buildings and streets from the same perspective.

Overhead[Top]

Figure 57(a). Some debris has been cleared, but the pulverized dust is still emerging. If most of the steel from the upper floors of WTC1 and WTC2 was pulverized, then how much steel was really shipped as scrap to China? Does anyone have these figures or the receipts?
(9/23/01) Source: USGS/NOAA

Missing Wall Top

Figure 57(b). A view over the dome of WFC2 shows the damage to WTC6 in the center of the photo. To the left is the

collapsed WTC7. Its debris stack is at least five stories high. To the right of WTC6 is the remaining north wall of WTC1 which leans toward WTC6. Where did the wall go? Where did the top 100 floors of the north wall go? They did not fall on WTC6 or WTC7 because there are no steel wheatchex there. Some of the core of WTC1 remains, but where is the rest of the core? The amount of steel on the ground barely covers the ground.
(9/??/01) Source *(Thanks to spooked for this picture.)*

Figure 01. The WTC twin towers towering over the skyscrapers of lower Manhattan.
Source

Figure Vesey1. Looking east on Vesey Street from the West Street intersection after WTC1 was destroyed, the Verizon building is on the left, WTC7 is behind the Verizon building, and WTC6 is on the right. It looks like you could drive down Vesey Street in a four-wheel Jeep. Obviously most of WTC1 didn't fall into Vesey Street.
(9/11/01) *Source*

Figure Vesey2. Another view looking east on Vesey Street. The Verizon building on the left suffered minor damage from a piece of WTC1 steel. A Jeep can traverse this debris which is mainly aluminum cladding and paper. Where did WTC1 go?
(9/11/01) *Source*

Figure lobby(a). The lobby of WTC1 before 9/11.
(9/??/01) Source
(Thanks to spooked for this picture.)

Figure lobby(b). The lobby of WTC1 after 9/11.
(9/??/01) Source

WTC6 Top

Figure 63(a). Red box outlines the region of Figure 63.

Figure 63(b). Red box outlines the region of Figure 63 and locates WTC buildings.

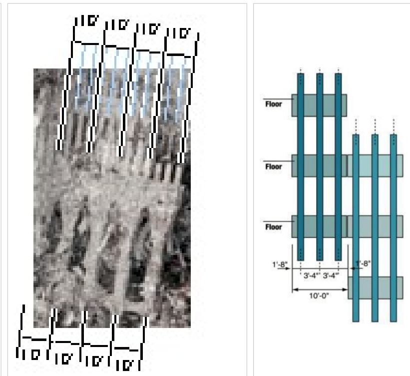


Figure 63(c). Left, pitchforks/wheatchex dimensions, right, wheatchex dimensioned in assembled group

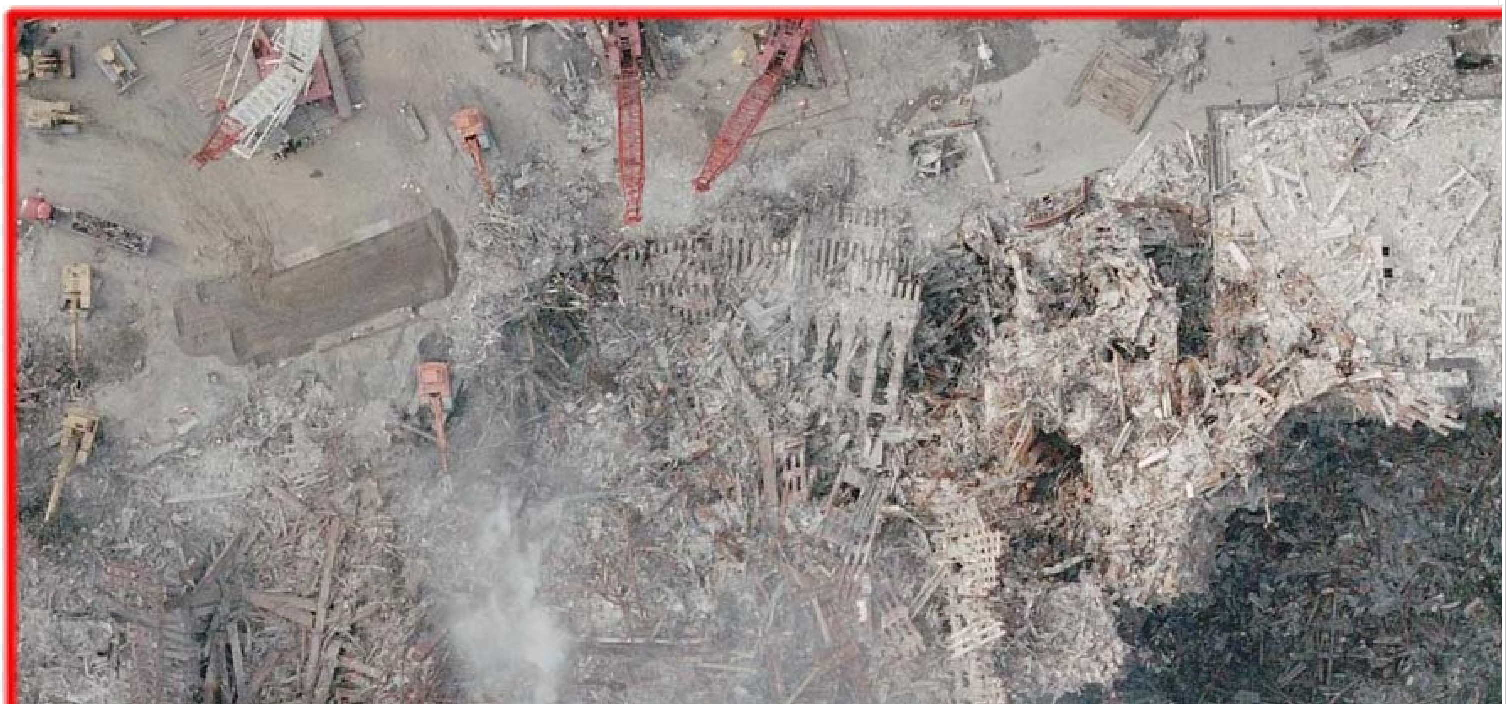


Figure 63. This shows the vertical cut-outs in the center of WTC6. To the left of WTC6 are the remains of WTC1. Note the fairly consistent diameter of the holes. The holes are essentially empty: little debris visible inside the holes. *(9/23/01) Source: USGS/NOAA*	You can locate the object above in the large photo (top center, near cranes) and use it as a scale. (click to enlarge)

Figure 63 above is an overhead view of WTC6. This photo shows not a single cut-out but a cluster of vertical cut-outs that coalesce together and form a scalloped border. No collapsed floors are visible at the bottom of the hole and the heart of the building is gone. A bomb cannot do this. The debris inside the building is minimal and it all is at ground level, no deeper. The base of the north wall of WTC1 is to the left of WTC6, and you can see the remains of a cluster of core columns in the center of the WTC1 footprint. The debris from WTC1 is almost non-existent, dwarfed by the remains of the 8-story WTC6.

By contrast, look at Figure 59(b) above to see how much taller than WTC1 was than WTC6 before 9/11: 110 vs. 8 floors. WTC6 almost looked like a one-story building prior to 9/11, because it seemed so small in comparison to WTC1.

The vertical cut-outs in WTC6 approximate the shape of circles (viewed from above), each with a diameter of approximately 24-feet, as measured and calculated from the known dimensions of the steel "wheatchex." Where did the core material of the building go? Was it disintegrated and pulverized into a fine dust? If so, then how?

WTC6-inside Top

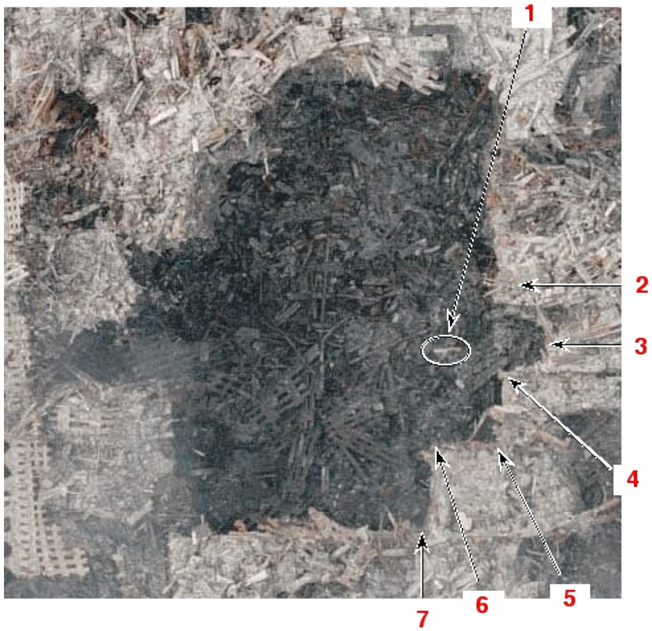


Figure 63z(a). Overhead view of WTC6, with labels at particular points that identify the corresponding location in Figure 63z.

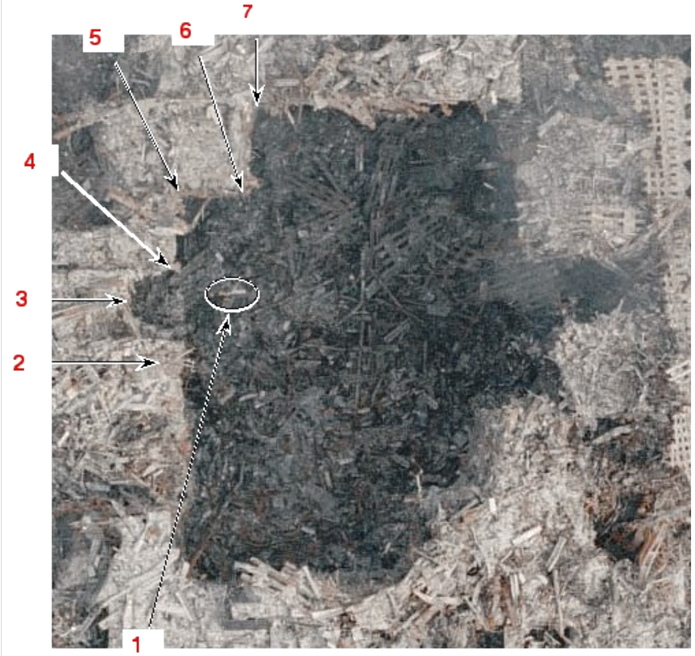


Figure 63z(b). The same photo rotated 180° more naturally matches the corresponding points in Figure 63z.

Figure 63z. Inside the 8-story WTC6 hole.
(photo filed 9/27/01) Source

Figure 63z was taken from inside WTC6. The vertical cut-outs seen in Figure 63 do indeed appear to go completely to the ground floor, with relatively little debris remaining. The number of floors within the building can be counted and eight floors are visible (counting floors on the far side, top-down, appears easiest). The evidence suggests that all 8 floors somehow were pulverized or "disappeared." What could be the cause?

WTC5 Top

Figure 62(a). Red box outlines the region of Figure 62.

Figure 62(b). Red box outlines the region of Figure 62 and locates WTC buildings.

Figure 62(c). Fuselage part atop WTC5

Photograph by Gene Corley

(10/25/01) Source: more info:

Figure 62(c). Alleged location of fuselage part.

Figure 62. A close-up of WTC5 and its mysterious holes, shortly after the event.
(9/23/01) Source: USGS/NOAA

Figure 62 shows the roof of WTC5, with considerable aluminum and some steel wheatchex on the left (south) and top (west). What could cause these holes? WTC5 is not adjacent to a Twin Tower, as WTC4 and WTC6 were. Thus WTC5 was less likely to suffer damage from the destruction of a Twin Tower than WTC4 and WTC6 were, as shown by Figure 75 on page 6. A piece of aircraft fuselage was allegedly found on the roof of WTC5. Can you find the fuselage piece in Figure 62? If not, you're not alone. When did a fuselage piece shown in Figure 62(c) arrive on the roof of WTC5?

The fuselage piece in Figure 62(d) made popular by Popular Mechanics is located between the two raised roof sections of WTC5. This location in the large picture is identified by a circle and arrow in the small photo, Figure 62(d). There is only one aircraft item, the rest is aluminum cladding and other building debris.

WTC4 Top

Figure 61(a). Red box outlines the region of Figure 61.

Figure 61(b). Red box outlines the region of Figure 61 and locates WTC buildings.

Figure 61. The remains of WTC4, a 9-story building, are at the lower left and the remains of WTC5, a 9-story building, are on the right. The main part of building 4, a 9-story building, virtually disappeared, leaving the north wing standing.
(9/23/01) Source: USGS/NOAA

Figure 61 is a zoomed out view with WTC5 to the right (north) and the remains of the north wing of WTC4 near the bottom. The main part of WTC4 disappeared with virtually no debris left on the ground. Additional views of WTC4 are shown in Figure 78 on page 6. The "new" left-hand (south) side of the remaining wing of WTC4 is remarkably vertical and linear, appearing to have been cut straight down through the building from above. What could have made such a straight cut through WTC4, slicing off a large portion of the building?

Figure 61(c). The north wing of WTC4, as viewed from Church Streed, looking west, appears surgically removed from the main body of WTC4, which has essentially dissappeared. If WTC2 fell on it and squashed the main building, where is the part of WTC2 that did this?

Figure 60(a). Red box outlines the region of Figure 60.


Figure 60(b). Red box outlines the region of Figure 60 and locates WTC buildings.


Figure 60(c). Yellow box locates north wing of WTC4.

Figure 60(d). Yellow box locates hole in Liberty Street by WTC2.

Figure 60. WTC4 footprint at the bottom, the remaining WTC4 north wing on the right, and the WTC2 footprint above.
(9/23/01) Source: USGS/NOAA

Figure 60 shows the remains of the south tower and WTC4. The entire footprint of WTC2 is visible, but no core columns are visible. The debris stack is hard to assess, but we can see the base of the "trident" columns (or "pitchforks" in the ground) at the lobby level. Seeing these exposed "pitchforks" indicates that there is not much debris remaining from the 110-story building. Little of the main part of WTC4 remains. About 20 floors from the east wall of WTC2 lie in the place where WTC4 used to be. Near the upper-left corner of the photo, the south wall of WTC2 leans over Liberty Street, and the mysterious black hole in the street can be seen through the missing wheatchex. This bizarre hole in Liberty Street appears to be the same phenomenon as the holes in WTC5 and WTC6.

- ## *Going underground* Top

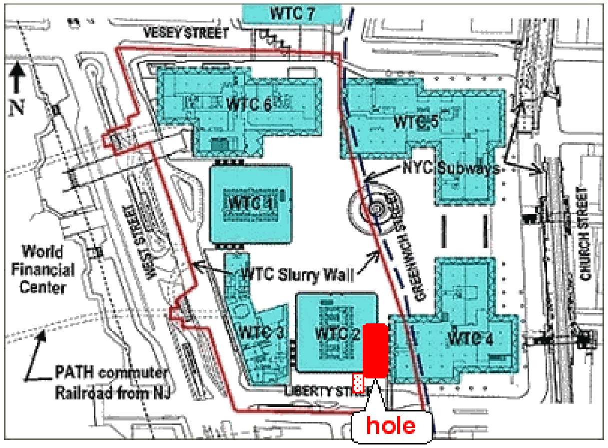


Figure 302(a). Solid red box locates Figure 302.

Figure 302(b). Figure 302 is located in zone 2, above. Overhanging debris was removed before ladder was lowered into hole 2.

Figure 302. Ground Zero workers near a stepladder in hole 2 in Liberty Street, identified by the guide in Figure 302(b). The remaining wall of WTC2 is in the background. ***(photo filed 9/18-19/01)*** Source	

In Figure 302 there is some strange "toasted" steel. The worker by the ladder stares down at several pieces of discolored steel beams, and may be saying, "What the h**l is this?" There is a long red beam that rises from the lower-right corner that looks wavy like a serpent. Before the steel disintegrates, does it crinkle, become wavy, or shrivel? Near the tip of the "serpent" described above, there is a vertical piece of material that has a gold-copper appearance. Below the ladder, there are two similar gold pieces that are highly reflective. The WTC2 shows a strange pattern where the lower portion of a steel column is missing, but not its upper portion. Was gravity acting up at that point? In the background, behind the ladder, you can see a section of intact sidewalk with almost no debris on it. This is at the base of the 110-story South Tower, yet the sidewalk was not crushed by falling debris.

Now we're going below ground level so let's review what we've been told:

- We were shown WTC7 collapsing in 6.6 seconds and it looked like a conventional controlled demolition (CD).
- Then WTC landlord Larry Silverstein dropped an even bigger hint about WTC7 having been "pulled," oddly enough by FDNY, just in case we missed it.
- Then we were told about "raging fires" that melted steel, then that the "raging fires" merely weakened the steel enough to cause a "progressive collapse."
- We were also told that much of the steel went to China, so we should pine for data we don't have instead of looking at the data we do have.
- More recently we were told about molten metal pouring out of a window, a story for which there are no eyewitnesses (yet).
- And we no longer hear that all three buildings "fell down" but that all three buildings "collapsed" in free-fall time.
- After our credulity has been strained beyond all limits, why should we believe that there were pools or even "ponds" of molten metal in the basements? Where is the evidence?

Rising dust and vapor from zones in the rubble continued for weeks. This phenomenon needed an explanation. Pools of molten metal provided a plausible explanation, but is it a correct explanation?

Hole #2 Top

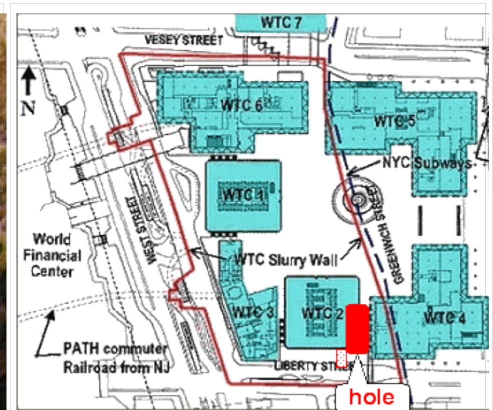


Figure 300(a). Solid red box locates Figure 300.

Figure 300(b). Figure 300 is located in zone 2, above. Overhanging debris was removed before ladder was lowered into hole

2.

Figure 300. GZ workers descend into the subbasements below WTC2. While there is extensive damage, there is little building debris at the bottom of the hole. There is no sign of molten metal. A worker in the distance walks along a massive core column.
(photo filed 9/18/01) [Source]

Figure 300 looks down into the basement of WTC2 in zone 2 in shown in Figure 300(b). This is adjacent to the southeast corner of the bathtub wall which was damaged at the top. There seems to be a wet floor or puddle of water. There is no steam rising. There clearly is no molten metal visible in this section of the basement.

Hole #1 [Top]

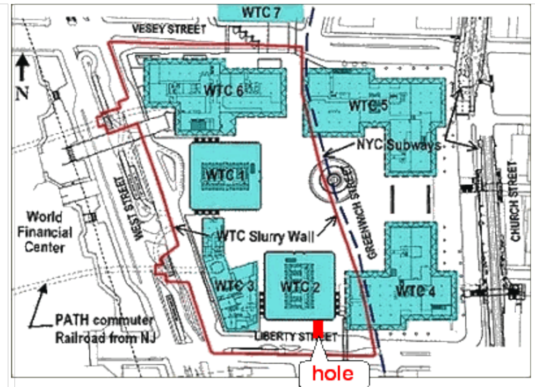


Figure 303(a). Solid red box locates Figure 300.

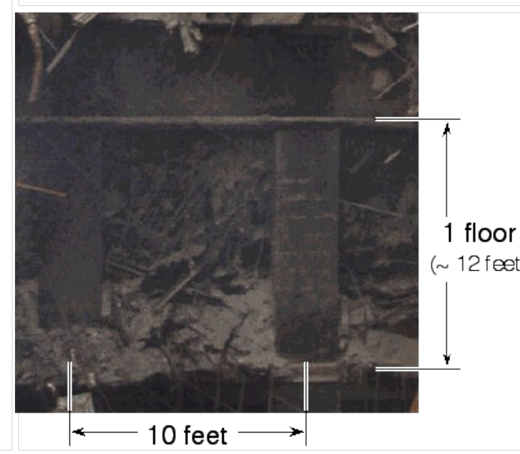


Figure 303(b). Spacing of columns underground and approximate floor height.

Figure 303(c). Figure 303 is located in zone 1, above. Overhanging debris was removed before ladder was lowered into hole 1.

Figure 303. This hole adjacent to WTC2 (zone 2 in Figure 303(c)) is through sidewalk and pavement. This hole contains more debris than the hole discussed in Figure 300 above. It looks as if the debris fell in the hole. Note the scale, shown to the right.
(photo filed 9/21/01) *Source*

Figure 303 shows a hole outside the wall of WTC2 closest to Liberty street and exhibits a number of anomalous effects. One example is the missing lower portion of that beam on the right end. The three outer columns in the center of the picture have a strange flanged appearance as if they had unfolded, and they look cooked. It looks as if a steel wheatchex dove into the hole. The fact that you can only see the tip of the wheatchex shows how far down the hole goes.

The WTC2 columns are "pitch fork handles" at the lobby level, spaced on 10-foot centers. A six-foot person could lay between the columns with his feet against one column and reach out and almost touch the adjacent column. Large cars and trucks can fit between these columns. Therefore the column unwrapping effect is huge. Similar to figure 302, there are "serpent-like" steel beam remnants hanging over the hole. They look as though they stopped short of complete disintegration. The metal in the lower right corner of the picture, with a camouflage appearance, looks deformed and dissolved as if attacked by acid. There is a large amount of material distributed throughout that looks as if it were run through a paper shredder. In the lower levels, concrete rebar is exposed apparently because the concrete attached to it was pulverized.

Mall Rescue *Top*

Figure 311. "Hmmm...where do we start looking?" GZ workers begin to search in the mall in first subbasement level.
(photo filed 9/19/01) [Source]

Figure 312. "OK, here we go. Let's just start looking." This photo was taken inside the mall. The store sign "innovation" is visible on the left.
(photo filed 9/19/01) *[Source]*

The GZ workers in Figures 311 and 312 are not crawling on their hands and knees through dense debris in ruined subbasements. They are walking upright and not ducking beneath low-hanging ceilings. Does this look like a 1/4-mile tall tower crash-landed or pancake-collapsed into the basement?

The lower portion of the steel from the east wall of WTC2, shown in Figure 60, is spread over the ground where the main section of WTC4 once stood. The mall is the first floor below all this steel, yet the mall was not crushed.

Figure 304. Why are they still hosing down the "pile" in March 2002? There appears to be smoke, dust, or vapor rising from the pile. Why? The light streaks across the photo appear to be reflections off the window of the photographer's aircraft.
(return to above) ***(photo filed 3/15/02)*** *Source*

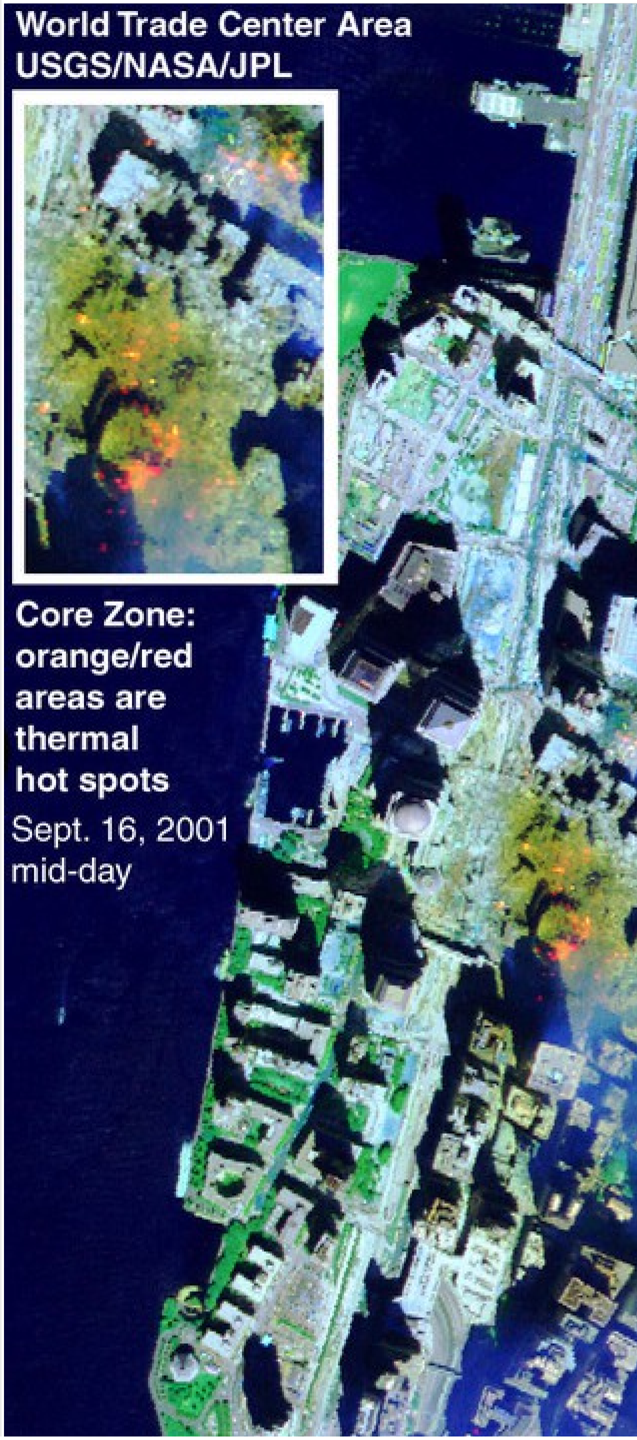
Figure 309. The southeast corner of big bathtub is in the background. Why are they hosing down the pile? A reader suggests that policemen are waiting to do forensic investigation.

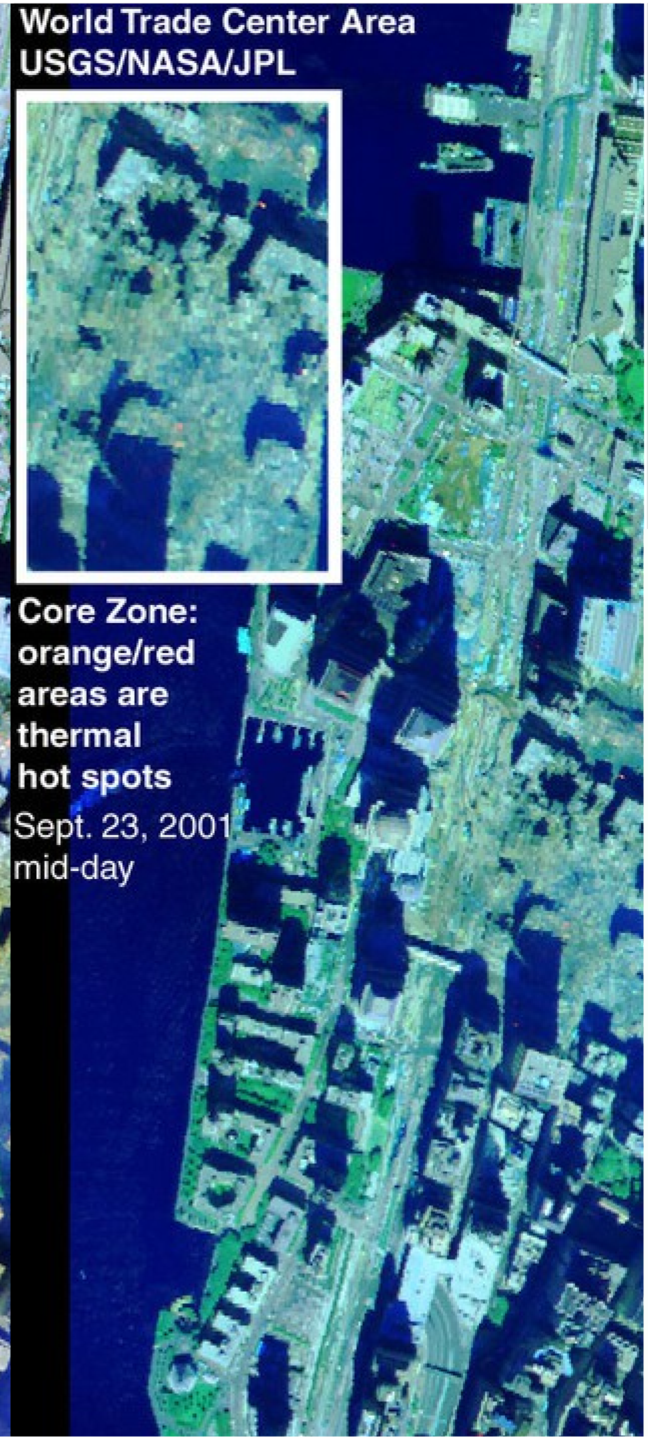
(photo filed 3/15/02) *Source*

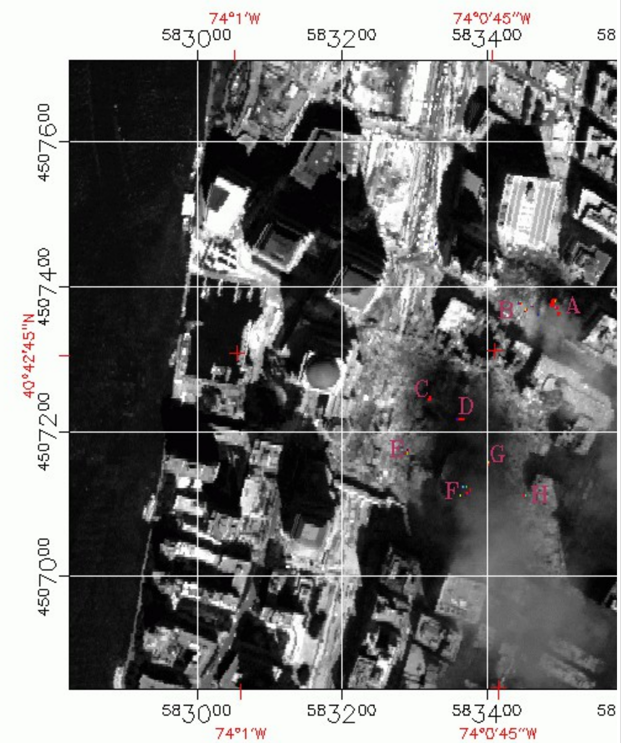
Figure 308. The southeast corner of the big bathtub again. Dust or smoke rises from the pile. The workers are wearing respirators, not simple dust masks, six months after 9/11. The dust or haze is very fine and does not settle out like regular dust would behind a vehicle on a dirt road. The policemen apparently are sifting through debris, looking for body parts
(photo filed 3/15/02) *Source*

Hot Spot? *Top*

It has been widely reported that molten metal burned at Ground Zero (GZ) for up to 99 days despite continuous water poured on them and numerous rain storms. Supposedly, this is a smoking gun for controlled demolition. But, are these stories true?







AVIRIS Hot Spot Mapping 09/16/200
Color Coded Hot Spots on B/W Image Bac
UTM projection, zone 18

Figure Heat(a). The official government image of thermal hot spots at Ground Zero five days after the "attacks."
(9/16/01) *Source* *and* *here*

Figure Heat(b). The official government image of thermal hot spots at Ground Zero 12 days after the event.
(9/23/01) *Source* *and* *here*

Figure Heat(c). The hot spots are labeled A through G at Ground Zero five days after the "attacks."
(9/16/01) *Source*

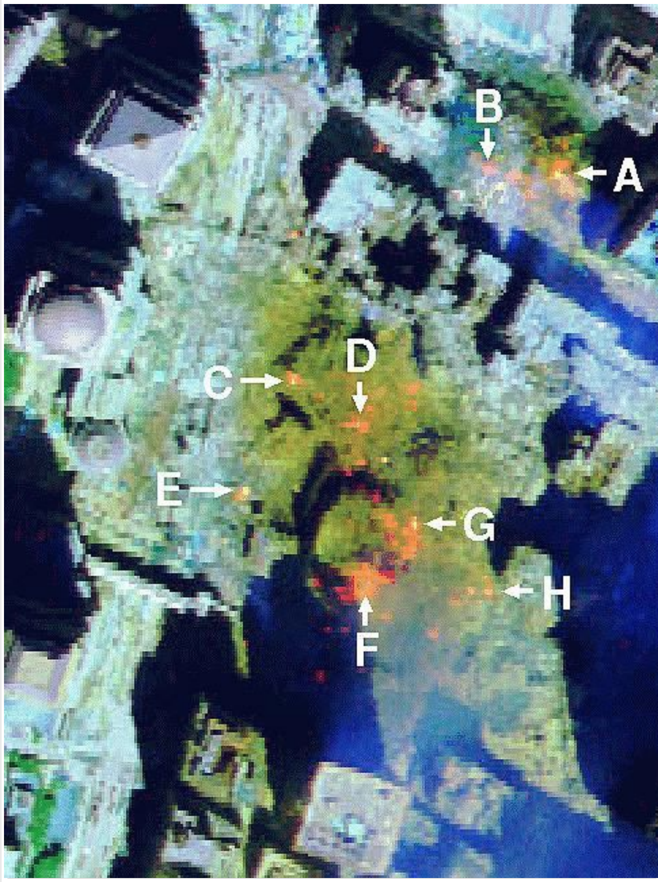


Figure Thermal(a). Thermal map excerpt taken September 16, 2001. Zone F was the largest hot spot.
(9/16/01) *Source* *and* *here*

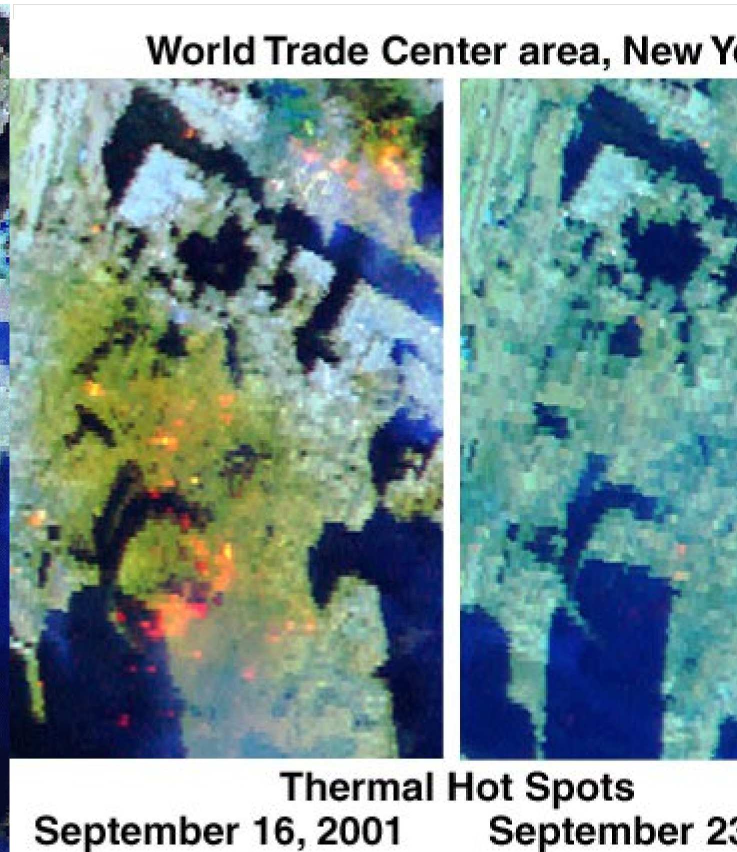


Figure Thermal(b). Thermal map excerpt taken September 23, 2001.
(9/23/01) *Source* *and* *here*

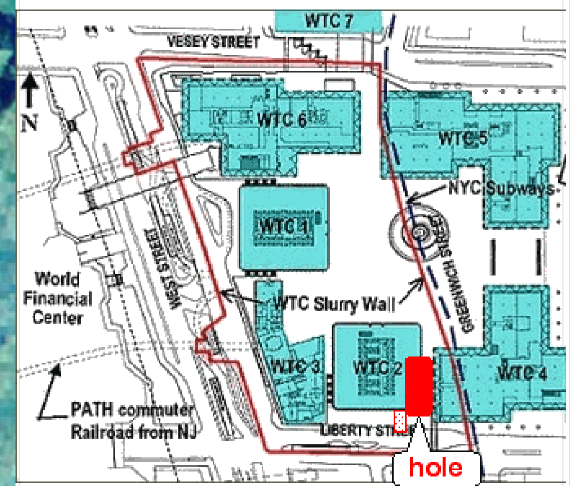


Figure Thermal(c). Solid red box locates the F hole shown in Figure Thermal (a) and (b). This is the same location shown in Figure 302 and 300.
Source *and* *here*

Figure Thermal (a) shows thermal imaging of WTC on September 16, 2001, and F is the largest hot spot. We understand that the raw data came from NASA and then these images were produced by USGS using the NASA data. How reliable are these data? Assume the data are valid for the sake of argument. Figure Thermal(b), September 23, 2001, shows no large hot spots anywhere, casting doubt on the stories of long-lived molten metal. So, if the imaging data are reliable, then the hot spots disappeared within two weeks, not 99 days. But there are reasons to suspect that the imaging data are false. A spot like F would seem to be the most likely location to find molten metal, yet this spot coincides with hole 2 as shown in Figure 300 above, where we found no evidence of molten metal. Instead it appears to be a damp basement.

There are other reasons to doubt the stories of "pools of molten metal." First, the stories of molten metal come from interested parties like the head of Tully Construction and Controlled Demolition, Inc. Second, there are no photos of molten metal that we believe are reliable. Third, there are no photos of the solidified molten metal after it cooled either in place or being carried out. There's no evidence of molten metal before, during, or after. Fourth, the molten metal may be a cover story to hide the grim truth. Vehicle dust kicked up on a dirt road does not take six months to settle out. Dust from traditional controlled demolition settles out quickly, even after being jack-hammered and pushed around. But the dust at the WTC was so ultra-fine that hosing it down would have been a wise thing to do. It is quite possible that GZ workers were not hosing down molten metal but were hosing down ultra-fine dust and the fumes of molecular dissociation. (See this figure.)

The Star Wars Beam Weapons

and

Star Wars Directed-Energy Weapons (DEW)

(A focus of the Star Wars Program)

by

Dr. Judy Wood and Dr. Morgan Reynolds

(originally posted: October 17, 2006)

Page 5: Toasted Cars

At the time this article was being developed, many people expressed disbelief that energy weapons existed outside of science fiction until they were reminded of the Star Wars Program, also known as the Strategic Defense Initiative (SDI)*. The name of this article was chosen as a reminder that energy weapons do exist and have been developed over 100 years. Most of this technology is classified information. It can also be assumed that such technology exists in multiple countries. The purpose of this article was to begin to identify the evidence of what happened on 9/11/01 that must be accounted for. In doing so, the evidence ruled out a Kinetic Energy Device (bombs, missiles, etc.) as the method of destruction as well as a gravity-driven "collapse."

*SDI was created by U.S. President Ronald Reagan on March 23, 1983.[1] It is thought that SDI may have been first dubbed "Star Wars" by opponent Dr. Carol Rosin, a consultant and former spokeswoman for Wernher von Braun. However, Missile Defense Agency (MDA) historians attribute the term to a Washington Post article published March 24, 1983, the day after the Star Wars speech, which quoted Democratic Senator Ted Kennedy describing the proposal as "reckless Star Wars schemes."[2] Before it was named the "Star Wars Program

(SDI) in 1983, it was the Advanced Space Programs Development.[3]

12/12/10 -- Dr. Judy Wood

[1]Strategic Defense Initiative, Wikipedia,
[2]Sharon Watkins Lang. SMDC/ASTRAT Historical Office. "Where Do We Get Star Wars?", *The Eagle*. March 2007.
[3] Robert M. Bowman, former Director of Advanced Space Programs Development for the U.S. Air Force in the Ford and Carter administrations.

This page last updated, July 11, 2007

Shortcuts:

Jump to *Introduction*
Jump to *Diane Sawyer Video*
Jump to: *Peeling Appearance*
Jump to *Other Anomalies*

Jump to *Lower Manhattan (picture)*
Jump to *FDR Drive*
Jump to *Toasted Interior (picture)*

Jump to *Towed?*

Jump to *Burning Cars*
Jump to *Missing Windows*
Jump to *Toasted Parking Lot*
Jump to *Intersection*
Jump to *Jet Fuel (kerosene) Fires*
Jump to *News Video*

See also *More Toasted Cars*
(on a page not yet in this series).

Audio:

29 November 2006, Judy Wood narrates these pages web pages on
"The Dynamic Duo" with Jim Fetzer, Genesis Communications Network, gcnlive.com, archive (mp3-1)(mp3-2) (mp3).

6 December 2006, Morgan Reynolds discusses these pages on
"The Dynamic Duo" with Jim Fetzer, Genesis Communications Network, gcnlive.com, archive, (mp3)(mp3)

VIII. Toasted Cars Top

Diane Sawyer Video Top

1400 VEHICLES melted NEAR WTC

Figure 1. "This is an interview by Diane Sawyer of a Fireman who witnessed these Melted cars, and he

states that where these cars were,
there were no Fires around!!!"

(0:00:50) URL, posted July 10, 2007, by
neverknwo

Preliminary transcript:

Diane Sawyer: And I've got Don Dayo (?) in here with me, we're dividing up all the duties, here, and he's been down to the scene, and also J.D. Hopfer (?) who says he's just a volunteer who came in here from California and was around the area.

I just wanted to know how much fire is there. You said you were just at Ground Zero. How much fire is left?

J.D. Hopfer (?):
Well at Building Seven there was no fire there whatsoever, but there was one truck putting water on the building. But, it's collapsed completely. And then, the other building, that there were some flames still coming up was in World Trade Center One, not a lot.

Diane Sawyer: You said you saw melted tour busses? Melted cars?

J.D. Hopfer (?): The cars that were right down there, ...it was just unbelievable. They were twisted and melted into nothing. The build... the debris is just unbelievable. And then you can see fire trucks and police vehicles that were down there early, that um, all their windows, their windshields, are completely blown out -- from, ...it must have been from when debris dropped.

Introduction Top

A reported 1400 vehicles were damaged on 9/11. [Reference] These vehicles had peculiar patterns of damage and some were as far away as FDR Drive (about 7 blocks from the WTC, along the East River). Vehicles had missing door handles for example, windows blown out, window frames deformed, melted engine blocks, steel-belted tires with only the steel belts left, and vehicle front ends destroyed with little or no effect on the back end of the vehicles. What could have caused such extraordinary damage? Portions of cars burned while paper nearby did not.

Figure 64. Peculiar wilting of car doors and deformed window surrounds on FDR Drive.
Source:

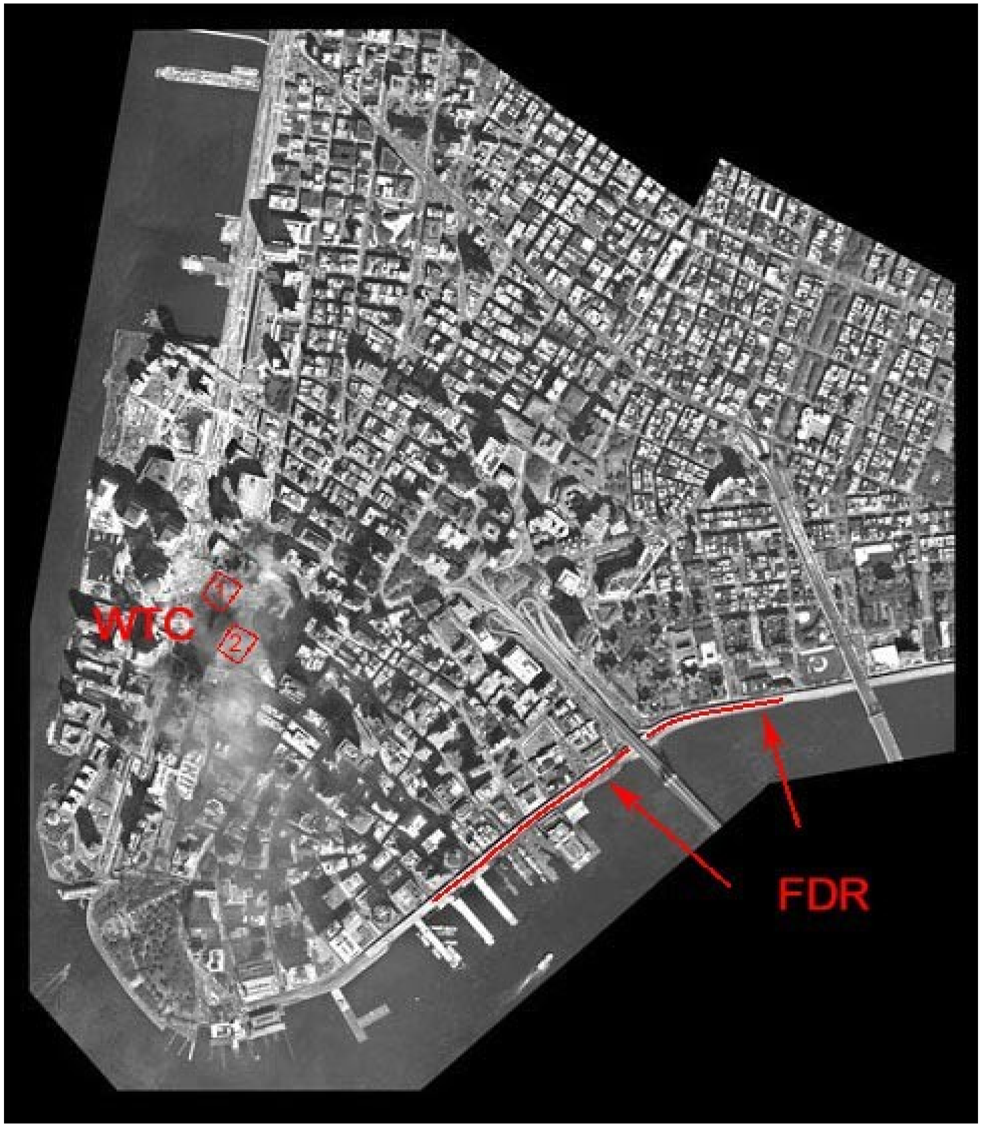


Figure 65. Map of lower Manhattan shows the WTC and FDR Drive a half mile or more apart. Arial view of lower Manhattan. *(mouse over to remove arrows and labels)*
[Source]

Figure 65a. Notice the dust-covered car in front of the toasted police car. There is also debris on the pavement away from the main part of the road. They probably couldn't clean it very well because the toasted cars were there.
Source:

Figure 65b. Notice the dust-covered car behind the toasted police car. There is also debris on the pavement away from the main part of the road. So, it appears the roadway has been washed already.
Source:

Figure 65c. Notice the two dust-covered cars under the bridge. How did the dust fall there? Obviosly there were strong enough air currents to put it there. It's interesting how the drying pavement looks like it does after its been treated for snow and ice. (This is thought to be the entrance ramp to the Brooklyn Bridge from southbound FDR Drive.)
Source:

Figure 66. Toasted cars in a lot near the WTC.

Source:

Figure 67. Blistered car on FDR Drive with unburned upholstery and unburned plastic window molding.

Source:

Figure 68. Front half of a car burned with a shiny, unburned rear end.

Source:

Figure 69. What burned and dragged these cars and mangled the left rear wheel? Where are the door handles?

Source:

Figure 70. What was this thing across the street? Was it a car? Was it a van? What caused that line of burn marks on the hood of the car in the foreground on the right? In the left foreground, the remains of a vehicle sit atop a white sedan. Are we looking at the front or the back end? It looks like the front end and if it is, its engine is missing. We can see daylight through the wheel well.
Source:

≅ *Peeling Appearance* Top

Many vehicles had their outer surface peeled away like a sardine can. In some instances, clearly there is more than peeling paint was involved. It appears that the sheet metal delaminated as though something caused the material to melt or disintegrate at a certain depth. In some cases it appears that there was more heat damage inside than outside and vice versa.

Figure 71. What happened to the axles, wheels, and tires? On the doors, it appears that a heavy layer of paint peeled down from the top, yet the paint on the lower part of the doors has not been peeled away. Wow did the wheel get under the rear suspension?
Source:

Figure 72. The car with the flat tire appears to have "wilted" from heat, from the top down, leaving a peeling appearance on the back end. The SUV on its right is missing all its window glass except for the windshield. The vehicle on the far right has no trace of tires, no door handles, no tail lights, and no windows. Why?
Source:

Figure 73. The peeling on the side door appears to be delaminated. Sheet metal is not laminated, so why would it do this?

Source:

Figure 74. Why does this ambulance have melted inside doors? The inside looks to have suffered more heat damage than the outside. What would cause that?
Source

Figure 75. Oddly enough, there were also toasted cars

Figure 76. This is the same vehicle shown in the

at the Pentagon on 9/11. *Source*:	previous figure after the fires were extinguished. Why is the passenger door burned? Note how the hood is curled up. *Source*:

Other Anomalies [Top]

The pictures below document a wide variety of damage to vehicles, including total incineration of vehicles, toasted and disappeared engine blocks, steel-belted tires with no rubber and only steel belts, deformed wheels, missing grills, broken and missing vehicle windows and mirrors, no door handles, wilted doors, and unburned paper next to burning cars.

Figure firetruck. A badly damaged fire truck. Where did its engine go? The bottom of the tire has turned to goo below a distinct horizontal line in the tire.

Source:

Figure hazmat. A FDMY Hazmat truck in front of WTC6 on West Street. The remaining upper part of the truck has been peeled and evaporated in areas. The upper part of the cab is gone and the engine block seems to have disappeared. The photo was taken on 9/11 after WTC1 disappeared but before WTC7 collapsed.
(9/11/01) Source:

Figure 66(e). Why would the front of this fire truck wilt?
Source:

Figure 66(h). Is there something attractive about engine blocks? Why not gasoline fuel tanks?
Source:

Figure 77. The mail truck parked on the left side of the street looks burnt. Why? (Click on photo for enlarged view.) The building on the left is the USPS Federal Building and on the right is WTC7. WTC5 is on fire at the end of the street. Why? If this area is hot enough for spontaneous combustion, why isn't the paper on fire? The cars on the right side of the street are also toasted.
Source:

Figure flip. Why is this car upside down? A burned out SUV with missing windows and toasted front end is parked in front of WFC2 on West Street but will not be moving under its own power.
(9/12/01) Source:

≅ ***Lower Manhattan*** Top

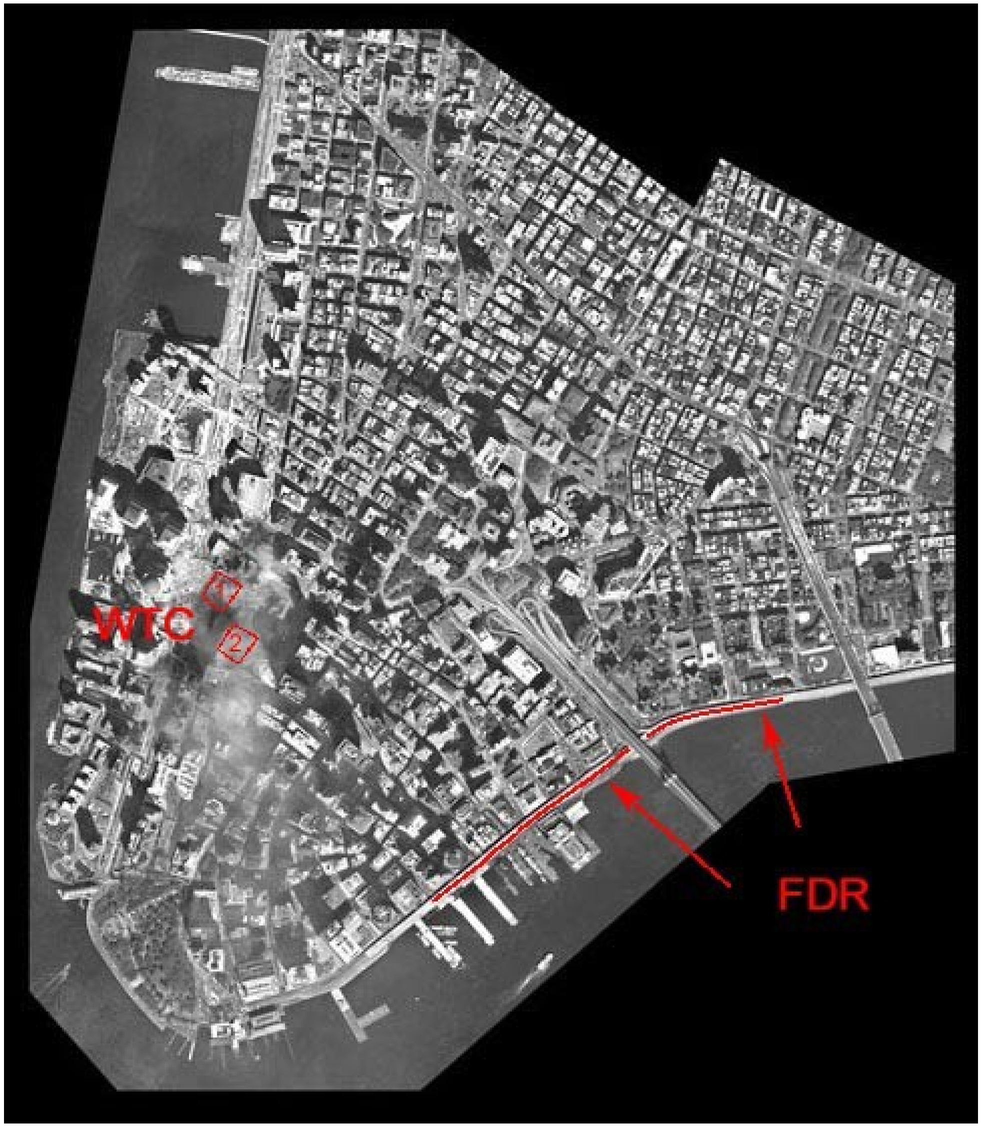


Figure Map. Arial view of lower Manhattan.
(mouse over to remove arrows and labels)
Source

≅ ***FDR Drive*** Top

Figure 66(a). Cars along FDR drive were randomly toasted. These cars are at least 1/2 mile away from the WTC. Note the waviness of the tire tracks. What happened?
Source:

Figure 66(b). Wheels appear to have steel-belts from the tires still on them.
Source:

Figure 66(c). Did one car run under the other during the event or were they stacked after the event? The marks in the pavement suggest they were pushed to the side of the road.
Source:

Figure 66(d). The remains of a steel-belted tire without the rubber. This is a close-up of the figure above.
Source:

Figure 66(j). The front end of this FDNY car is toasted and mildly deformed, while the door appears undamaged and the window glass is intact. The debris on this car suggests it was near the WTC.
Source:

Figure 66(f). While the bodies of these toasted vehicles still exist, they've been incinerated. All of the softer materials inside and out have disappeared.
Source:

Figure 66(k). This ***Toasted Interior*** was consumed except for the fire extinguisher.
Source:

Figure 66(l). The front half of car 2723 is toasted, but check out the new wax job on the back. Notice the missing front door handle and the untouched back door handle.
Source:

Figure 66(m). What happened to the top half of car 1250? The doors are crinkled up, but the rear tire looks OK.
Source:

Figure 66(n). There is extensive damage to the front of car 2723, including no door handle on the driver's door. There is an unusual, unburned circular area on the rear door.
Source:

- ***Towed?*** *Top*

In the debate over toasted cars ignited by this article, some have argued that the wrecked vehicles on FDR drive were damaged at the WTC and were loaded up and transported and dumped on FDR drive for storage. First, there is no evidence that this was done. Second, it makes no sense to load up wrecks, transport them, only to dump them in a busy thoroughfare for storage. These wrecks would have had to be picked up yet again and transported again. If vehicles were truly moved from the WTC to FDR Drive, we wonder why WTC steel beams were not stacked up on FDR drive, as well, if it was such a good storage area. Third, governments may be stupid, but we doubt they could be this inefficient. If reported, it would have been a minor scandal. Fourth, we might be wrong about the facts here, but it looks like the motive for this speculation about shifting wrecks around lower Manhattan is to protect the official story or thermite story or other pet theories. We fail to see any other explanation for such a "forced" interpretation for these photographs. Fifth, marks on the roadway suggest that some of these vehicles were pushed to the side of the roadway until they could be removed. For example, see this figure. This is a more natural explanation for why some of the cars appear to have been moved from where they were damaged rather than all the way from the WTC.

- ***Burning Cars*** *Top*

Figure 66(g). This fire seems to be very selective.

Source:

Figure 66(i). A minivan is consumed by flames. The fire rages inside the vehicle, contained by the remaining windows. The fire appears more intense at the front where the engine is.
Source:

Figure onfire1. The tires and even the pavement under the car are on fire. The windows appear to be intact

Figure onfire2. A fire rages, apparently on Vesey Street, sending up thick black smoke. These may be the

with no visible interior fire. There is line of fire along the trunk lid. The right front fender is deformed and has turned white. *Source*	vehicles that eyewitness Rebecca O. described as she ran past WTC6 during the destruction of WTC2. *Source*

≅ ***Missing Windows*** *Top*

Figure 66(o). Why doesn't the paper burn?

Source:

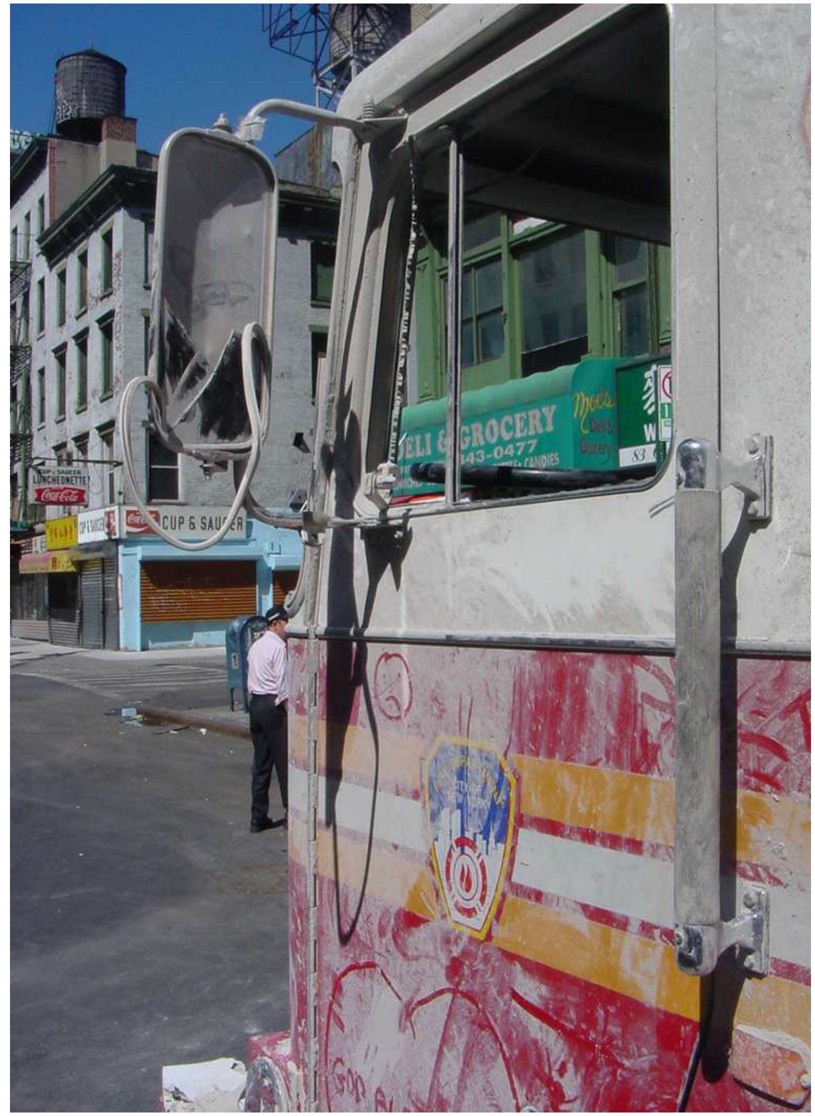


Figure 66(p). No window? What happened to the rear-view mirror?
Source:

Figure 66(q). Why is the rubber window gasket hanging outward?
Source:

Figure 66(r). Sans windows. (But nice tire!)
Source:

Figure 66(s). Why is the paper shredded but nothing else apparently disturbed?
Source:

Figure 66(t). What blew out the windows without damaging the rest of the fire truck?
Source:

Figure 66(u). The window gasket is on the outside. What blew out the windows? What dislodged the front grill?
Source:

Figure 66(v). It didn't blow out just the middle portion of the windows; it blew out the windows all the way back to the frame where it was mounted.
Source:

Figure 66(w). Hosing down the windowless fire truck.
Source:

Figure 66(x). Final cleaning of the windowless fire truck. Notice its grill is missing.
Source:

Figure 66(y). What could have caused such extensive damage to this car? Has the passenger side shoulder harness survived? Where's the steering wheel?
Source:

Figure 66(z). Why is this fire truck burnt? It is missing its front grill, headlights, and related front end bright-work. Where are the tires?
Source:

Most of the 1400 toasted cars had some, if not all, windows missing. What would cause this? Figure yy, below, shows a silver convertible with its top apparently intact but missing some of its window glass. If the windows were blown out from pressure inside, we would expect the convertible top to have been torn or blown off. This suggests that the windows were not blown out by internal pressure, but may have been shattered by some other mechanism.

	
Figure yy. The cars parked in the back suffered extensive damage. The car on the left and on the far right look like they have had their engines eaten. The cars in the foreground experienced less damage, but many windows are missing, however partial and whole windows also remain. *(9/12/01) Source:*	**Figure 78.** Why is this windshield crumpled up? Curiously, the interior of the car does not appear to contain anything that crashed through the windshield. *Source*:

Toasted Parking Lot Top

Figure toast1. afterWTC2 was destroyed there don't appear to be any fires.
(9/11/01) Source:

Figure toast2a. The cloud from the destruction of WTC1 rolls toward the parking lot.
(9/11/01) Source:

Figure toast2b. Just after WTC1 is destroyed, fires start to burn the vehicles in the large lot, but not the paper. Why?
(9/11/01) *Source*:

Figure toast3. The vehicle fires increase in strength as sunling begins to emerge through the clearing dust cloud.
(9/11/01) *Source:*

Figure toast4. The air upwind of the WTC has visably become clearer. The vehicle fires continue increasing and flames can be seen.
(9/11/01) *Source*:

Figure 5. The air has cleared after the destruction of WTC1. This area would be first to clear as it is upwind of the WTC. The fire in the toasted lot has increased in strength, consistent with it having just been started.
(9/11/01) Source:

		
Figure toast6. Sunlight begins streaming through the intersection. *(9/11/01)* Source:	**Figure toast7** The intersection and the grasssy lot are covered with paper and dust that did not burn. So, what caused the vehicles to suddenly catch fire? *(9/11/01)* Source:	**Figure toast8.** How did these cars catch on fire? *(9/11/01)* Source:

Figure street9(a). Gone with the Wind
At the corner of West and Vesey, looking south toward the WTC complex. WTC1 was just destroyed and the people are cautiously emerging from their hiding places and slowly approaching the site with puzzled looks on their faces. "Where'd it go?" This appears to be about the same time as that of the previous three figures.
(9/11/01) Source:

Figure street9(b). Gone with the Wind
A view west along Vesey street across the West St. intersection. The toasted parking lot is on the right in the distance. This is after WTC1 was destroyed. Sunlight is visible on WFC3 (on left). Paper in the foreground is not on fire. Why are vehicles in the parking lot on fire at some distance away?
(9/11/01) Source:

Figure toast10. Toasted cars in the lot northwest of the WTC complex. There is little visible rust, so the photo was probably within a day or two of 9/11/01.
(9/?/01) Source: (WRH)

Figure toast11. Not much visible rust, yet.
(9/?/01) Source:

Figure toast12. The rust is noticeable
(9/23/01) Source: (JW cut down from NOAA)

Figure toast13. A lot more rust
(9/?/01) [Source](#):

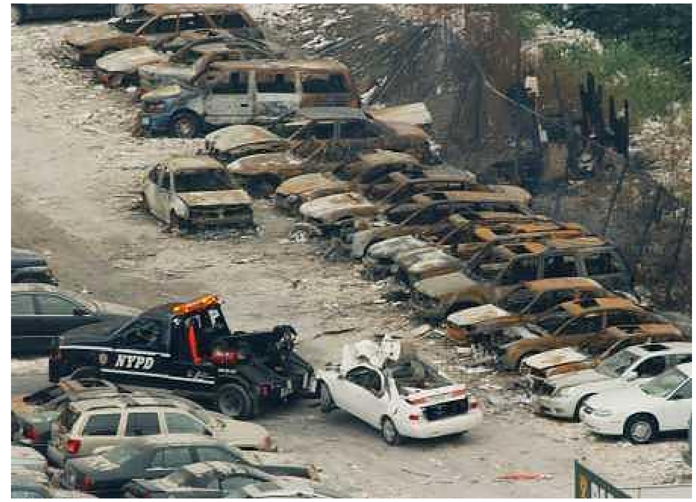


Figure toast14. Towing finally begins.
(9/?/01) [Source](#):

Figure toast15. Presumably these cars are finally being towed away from that lot. Those wheels look fairly good which means they probably aren't steel. *(9/?/01)* *Source*:	**Figure toast16.** The background is near the WTC *(9/?/01)* *Source*:

See also *More Toasted Cars*
(on a page not yet in this series).

Jet Fuel (Kerosene) Top

		
Figure 64. Peculiar wilting of car doors and deformed window surrounds on FDR Drive. Kerosene fires cannot do this. *Source*:	**Figure 67.** These fires do not melt or significantly weaken steel. *Source: Century wood stoves*	**Figure 67k.** Kerosene fires do not melt or significantly weaken steel. *Source: Dyna-Glo kerosene heater: website*

Source: *website*	*Source*: *Omni-Directional Radiant Kerosene Heater*	*Source*: *website*

Figure 68m. Testimony about toasted cars
Source: link

"Reddy Heater," Forced Air Heaters Portable - Kerosene, 40,000 BTUs R40 by Desa International Heating, Multi fuel use (i.e. Kerosene, Diesel #1 and #2, JP8, and **Jet A fuel**). *Source*: *website*	All-Pro Portable Kerosene Torpedo Heater, heats 29,000 ft.^{3} building All-Pro kerosene outdoor construction heaters are for use only with kerosene, No. 1 & 2 diesel fuel oil, JP-8 fuel or **Jet A fuel**. 165,000 BTU Kerosene Outdoor Torpedo / Salamander Heater *Source*:

One of our readers called the factory, Desa International to find the grade of steel used and reported, "These heaters are made with steel that is 16 -18 gage." Thanks L.

Figure 67w. How could alleged jet-fuel and trash-can fires melt or significantly weaken steel in the WTC towers?
In 1975 Fires burned 6 floors of WTC1 for 180 minutes (floors 9-14) with no fire sprinklers. *(source)*
In 2001 Fires burned 5-6 floors of WTC1 for 102 minutes (floors 94-98) with fire sprinklers.
In 2001 Fires burned 6-7 floors of WTC1 for 56 minutes (floors 78-84) with fire sprinklers.

See also *More Toasted Cars*
(on a page not yet in this series).

The Star Wars Beam Weapons
and
Star Wars Directed-Energy Weapons (DEW)

(A focus of the Star Wars Program)

by
Dr. Judy Wood and Dr. Morgan Reynolds
(originally posted: October 17, 2006)

Page 6: Other

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12/12/10 -- Dr. Judy Wood

[1]Strategic Defense Initiative, Wikipedia,
[2]Sharon Watkins Lang. SMDC/ASTRAT Historical Office. "Where Do We Get Star Wars?", *The Eagle*. March 2007.
[3] Robert M. Bowman, former Director of Advanced Space Programs Development for the U.S. Air Force in the Ford and Carter administrations.

This page last updated, December 15, 2006

Shortcuts: Jump to: **IX. Bankers Trust** Jump to: **X. Planes Ordered to Land** Jump to: **XI. Explosions** Jump to: **XII. WTC7 versus the Twin Towers** Jump to: *Traditional CD doesn't do this* Jump to: **XIII. Eyewitness testimony** Jump to: **XIV. Technique** Jump to: *Tipping*	**Audio:** **29 November 2006**, Judy Wood narrates these pages web pages on "The Dynamic Duo" with Jim Fetzer, Genesis Communications Network, gcnlive.com, archive (mp3-1)(mp3-2) (mp3). **6 December 2006**, Morgan Reynolds discusses these pages on "The Dynamic Duo" with Jim Fetzer, Genesis Communications Network, gcnlive.com, archive, (mp3)(mp3)

IX. Bankers Trust

Figure 70. From FEMA report: [Link(pdf)] (archived)

Figure 71. Bankers Trust Building on Liberty Street, across from WTC2. (FEMA picture)

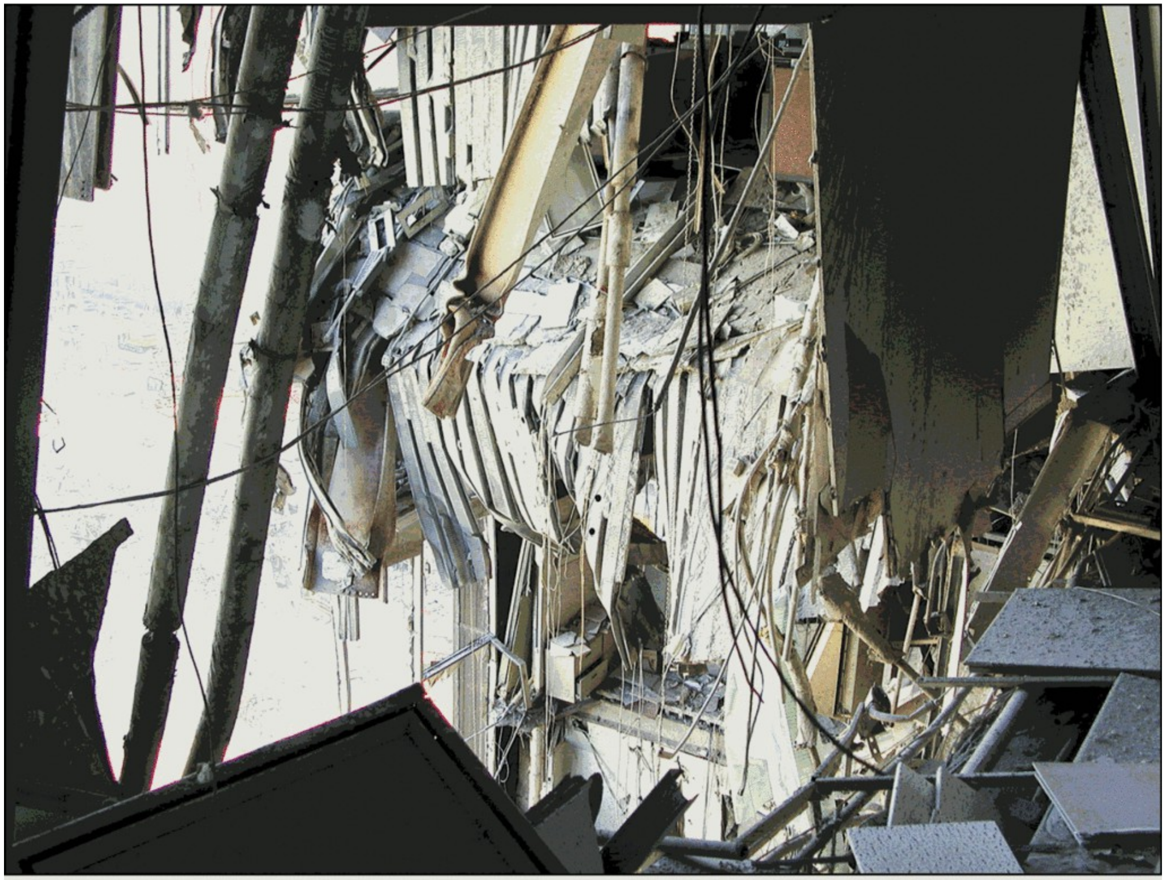


Figure 6-10 Area of collapsed floor slab in bays between C-8, E-8, C-7, and E-7, from the 15th floor.

Figure 72. From FEMA report: (Fig6-10.) Why is this beam shriveled up? This seems to be a common theme. [Link(pdf)] (archived)

X. Planes Ordered to Land

≅

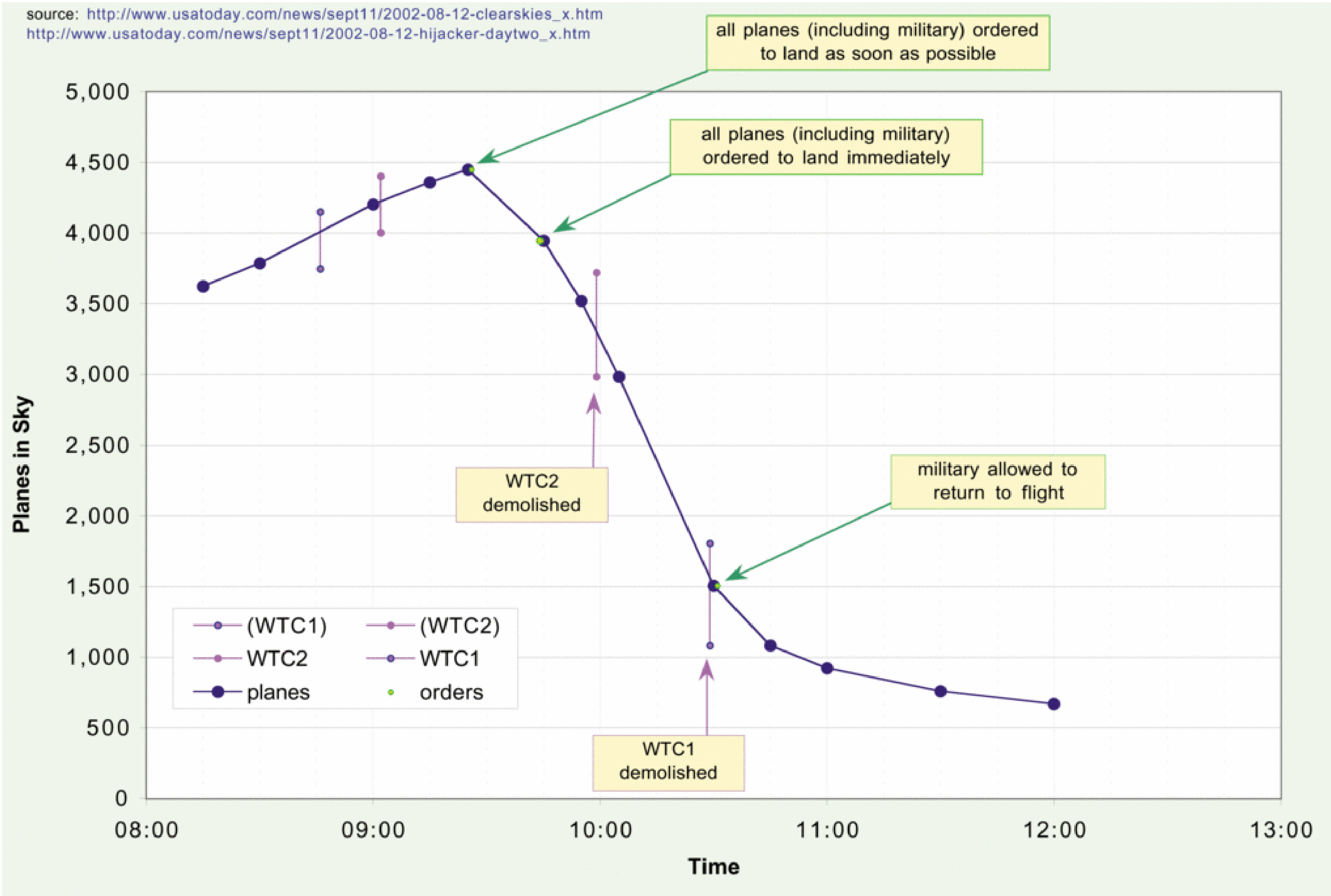


Figure 73. Timeline of events

[The timeline info to be moved to an Appendix-1]

http://www.cooperativeresearch.org/timeline.jsp?timeline=complete_911_timeline&day_of_9/11=dayOf911&startpos=200

(9:26 a.m.): Rookie FAA Manager Bans All Take Offs Nationwide, Including Most Military Flights? Mineta Asserts He Issues Order Minutes

Later
9:30 a.m.: United Flights Are Instructed to Land Immediately; American Follows Suit
(9:45 a.m.): Senior FAA Manager, on His First Day on the Job, Orders All Planes Out of the Sky Nationwide
(After 9:55 a.m.): Langley Fighters Receive Vague Order to Protect White House
10:31 a.m.: Military and Law Enforcement Flights Resume
10:31 a.m.: NEADS Does Not Pass Along NORAD Shootdown Order

XI. Explosions

[explosive testimony: thank and reference DRG and quote sample testimonies]

Figure 82. Getting it started

squibs

Figure 83. Decoy squibs?

XII. WTC7 versus the Twin Towers

What does CD look like?

Figure 84(a). Scooping up the building.

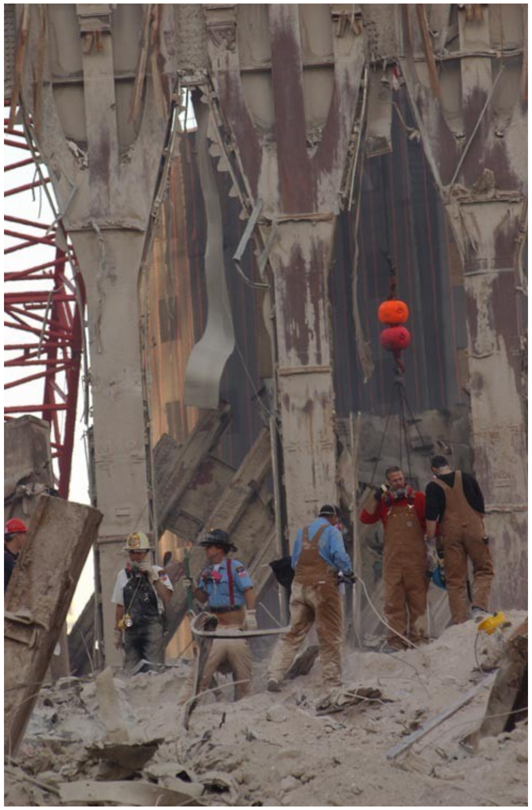


Figure 84(b).

Figure 85(a).

Figure 85(b) Traditional CD doesn't do this.

Figure 85(c).

≅ *Traditional CD doesn't do this.*

Figure 86(a).

Figure 86(b).

Figure 86(c).

"Office fires can't do that"

from "Blown to Kingdom Come"

Rubble "pile"?

Figure 87(a).

Figure 87(b).

Figure 87(c).

Figure 87(d). On the afternoon of 9/11/01 the "rubble pile" left from WTC1 is essentially non-existent. WTC7 can be seen in the distance, revealing the photo was taken before 5:20 PM that day.

Figure 87(e). The "rubble pile" from WTC1 is essentially non-existent. The ambulance is parked at ground level in front of WTC1. WTC6, which had been an eight-story building, towers over the remains of WTC1.

Figure 88(a). WTC6 from across Vesey street. WTC6 is an eight-story building and it dwarfs the rubble pile of WTC1.

Figure 88(b). You can see the remains of WTC1 on the other side of WTC6. (WTC6 is in the foreground.) The amount of rust on beams adjacent to the hole in WTC6 is impressive.

Figure 89(a).

Figure 89(b).

Figure 89(c).

Camelot! (Camelot is where it only rains at night and the leaves all fall into neat little piles.)

Figure 90. WTC7. An excellent job, for sure! No parts spattered on adjacent buildings.

Figure 91. WTC7 left a bigger pile than either WTC1 or WTC2. Note how small the people are relative to the "pile."

Figure 92. WTC7 was <u>not</u> completely pulverized. Note the wall-board that remained on the surface.

Clearly WTC7 was not taken down by conventional CD. We are noting that the destruction of WTC7 was different than WTC1 and WTC2. But, what happened to WTC7 is beyond the scope of this article.

Conventional CD doesn't totally pulverize buildings

Figure 93(a). Indy's Market Square Arena goes out in clouds of smoke, collapsed in less than 15 seconds. The blast was heard up to 25 miles away.
Monday, July 09, 2001

Pedro Perez © The Seattle Times

Figure 93(b). What remains of the Kingdome

Figure 94. This file cabinet "probably survived because it was in the basement." Click on picture for video (courtesy of thewebfairy.com).

(a) *source*

(b) *source*

(c) *source*

(d) *source*

Figure 95. Note the print on these compressed pieces of paper.

XIII. Eyewitness testimony

WORLD TRADE CENTER TASK FORCE INTERVIEW

EMT PATRICIA ONDROVIC

Interview Date: October 1, 2001

I guess that's North Park. It's a big green, grassy area, and there's nothing there. As I was running up here, two or three more cars exploded on me. They weren't near any buildings at that point, they were just parked on the street. The traffic guys hadn't gotten a chance to tow anything yet, cause this was all during the first hour I guess of this thing happening. So there were still cars parked on the street that were completely independent of that. Three cars blew up on me, stuff was being thrown. I went home all bruised that day. Thank God it was only bruises. I just ran into this park along with a bunch of other people, and stuff was still blowing up, I don't think I looked back, but you couldn't see anything, everything was just black. I was running and I was falling over people, cause people were crawling on the ground cause they couldn't see anymore. I just kept on running north. I could smell water, so I just kept on running towards the water, cause I knew that my coat was on fire, and I figured well, if I can see a boat over the water, I'm just gonna jump onto the boat and take that thing to Jersey, cause no one wants to blow up Jersey. Stuff is still blowing up behind me, as I'm running. I can hear stuff exploding. I could hear rumbling, the street under me was moving like I was in an earthquake. I've been in those, so I know what they feel like. It felt like an earthquake. There was no where safe to go. As I was running north in this park, and then I could start seeing again a little bit, and I just kept looking in the sky. Cause the captain was saying there's another plane heading in our direction, I was looking for another plane. I saw something in the sky, it was a plane, but it was way out. It looked like it was over Jersey or something, then it wasn't there anymore. I saw a small fireball, and it was gone. I saw two other planes. One came in one way, and the other came in the other way, and there was a plane in the middle that was way far off in the distance. Then the plane in the middle just disappeared into a little fire ball. It looked like the size of a golf ball from where I could see it. And the other two planes veered off into opposite directions. I just kept on running north. About fifteen blocks later, I had no idea that that was just the first tower that had come down.

Patricia Ondrovic's transcript, or here — archived copy

Killtown's interview with Patricia Ondrovic — archived copy

FIREFIGHTER FERNANDO CAMACHO WTC2 Explosions

We went across the lobby of the hotel, going north, and we exited and made a right going towards the second tower, the **south tower**. We must have walked about 100-200 feet to revolving doors, **which led into a hallway to where the mall was.** I could see maybe 20, civilians and I believe Ladder 25, which was about another 100 to 150 feet ahead of us. **As we came in through the revolving doors, the lights went out. A second or two later everything started to shake. You could hear explosions.** We didn't know what it was. We thought it was just a small collapse.

As I looked straight ahead of me, I saw total darkness. **Everything was coming our way like a wave. The firefighters that were ahead of us and the civilians that were ahead of us totally disappeared.** We turned around. We were all pretty much within ten feet of each other: lieutenant, chauffeur, roof, OV, can. As we turned around, I ran probably maybe ten feet and that's when the body of the building or body of the collapse hit, and we were flying through the air basically. I must have flown 30, 40 feet through the air. Then total quiet. You couldn't breathe. You couldn't see anything.

http://www.flcv.com/firemen.html

Firnando Camacho's transcript archived copy

XIV. Technique

How'd "they" do it?

==>> What was the order of events and what were the events?

- ***Order***

Here it is:

1. WTC5 (?)

In the Rick Seigel film, 911eyewitness, a broad and diffuse puff of "smoke" is seen rising from "near the base" of WTC2, shortly before it goes "poof." Could "they" have been warming up the gizmo, giving it the final "proof of concept" test drive, using WTC5?

2a. WTC2

2b. WTC3 (the first part)

2c. WTC4

3a. WTC1

3b. WTC3 (finishing the job)

3c. WTC5 (the holes appeared during the destruction of WTC1)

3d. WTC6 (the whole job?, the holes appeared during the destruction of WTC1)

4. WTC7 (the encore presentation)

- ***Tipping***

Figure 74(a). Was the top deliberately tipped over? Note the diagonal shearing of the building, ending at the upper right edge (upper blue arrow) where it detonates as the building tips. In the video, there is a large chunk of "wheatchex" that is left standing, momentarily. The appearance is rather odd and warrants further study.

Another tipping video.

(Note how good this face looks in this photo above compared to the photos Jones uses of this same face that were to have been taken before this photo was taken.)

In the above video, it can be seen that the initial detonations on the left side are all along the floor that is pointed out by the red arrow. I would expect that the floors which align with the lower blue arrow (on the right)

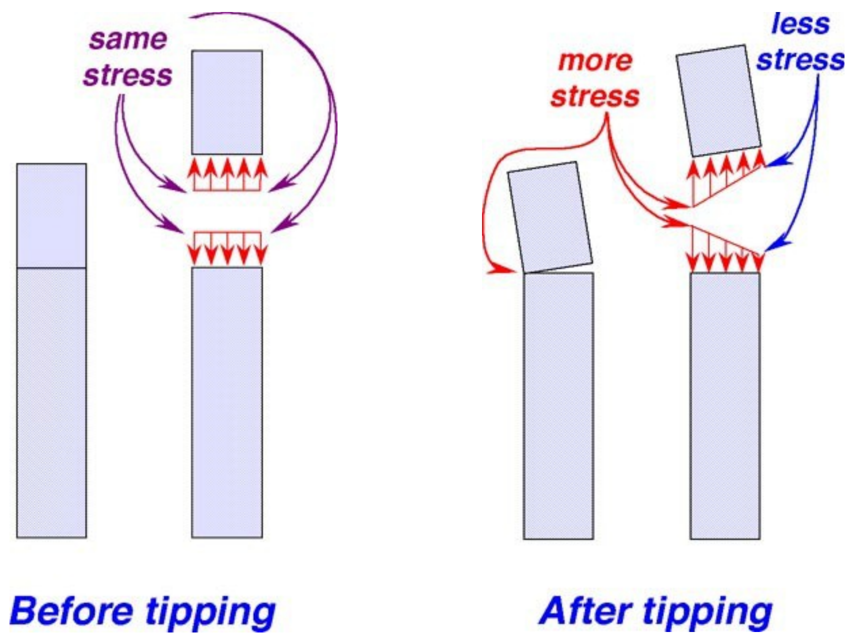


Figure 74(b). **Figure 74(c).**

With less stress (upper right arrow of Figure 74(a)), why is it failing and why is it exploding?

A few years ago, I thought this was equivalent to, "oops, we got the wires crossed." And, I thought it was an excellent "save." But now, from the above videos, it is fairly clear that a "save" could not be orchestrated within the time in which this event took place. It must have been planned this way! But, why?

Figure 74(d). Demolition starts bad: the top 300 feet of WTC 2 tilted as much as 23° before being Blown to Kingdom Come.

Figure 74(e). No one had ever attempted to demolish a building nearly the size of a twin tower, and smoke from WTC 1 helped to distract and cover up problems in destroying WTC 2.

Figure 74(e).
Source

WTC2 "fell" first and the top tipped first, before it "fell." Why?

It appears that this was done to minimize damage. Note the following diagrams.

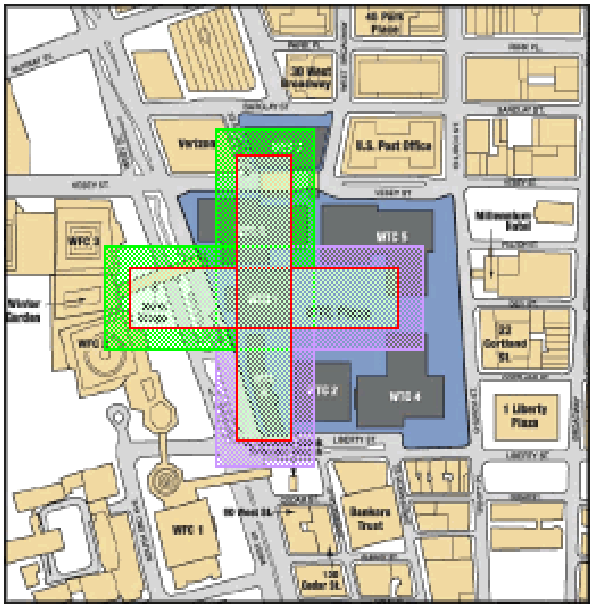


Figure 75(a). Error zone for WTC1
(mouse over to remove error zone)

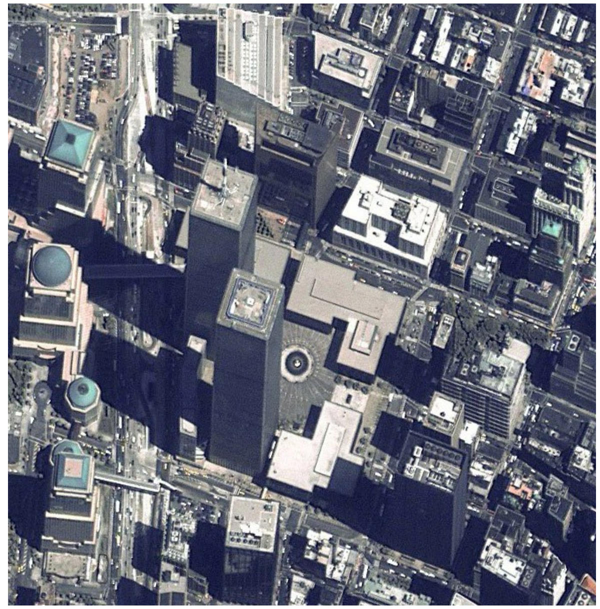


Figure 75(b). Satellite Photo
(mouse over for building names)

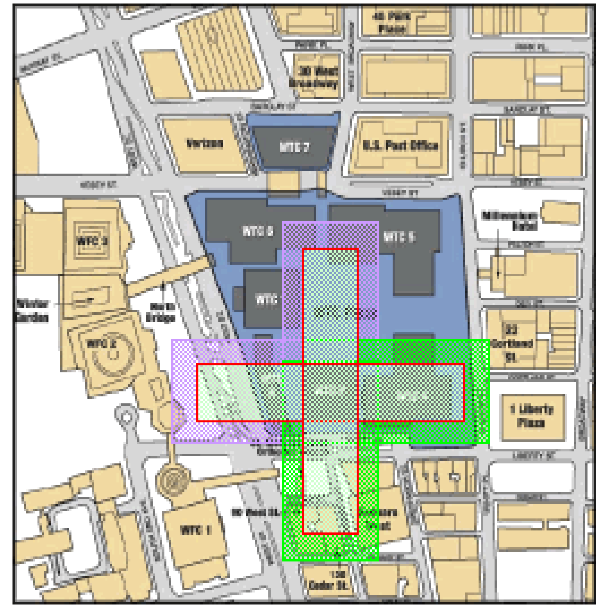


Figure 75(c). Error zone for WTC2
(mouse over to remove error zone)

Map adopted from http://www.debunk911myths.org/

Realizing this is the first time a quarter-mile high building has been destroyed in this manor, the "easiest" approach is desired in the event of a learning curve.

Considering Figure 75(a), if WTC1 is destroyed first, it would be good to stay away from WTC2 (purple zones right and down, Figure 75(a)) to avoid complicating the situation for the subsequent job. However, if WTC1 tips north, it risks damaging the Verizon building and WTC7. If WTC1 tips west, it risks damaging WFC2 and WFC3.

Considering Figure 75(c), if WTC2 is destroyed first, it would be good to stay away from WTC1 (purple zones left and up) to avoid complicating the situation for the subsequent job. However, if WTC2 tips south, it risks damaging the Bankers Trust building. But if WTC2 tips east (to the right), it only risks damaging WTC4.

Because of its close proximity to WTC2, it can be assumed that WTC4 will be destroyed anyway (collateral damage)(green zone). Similarly, because of its close proximity to WTC1, it can be assumed that WTC6 will be destroyed anyway (collateral damage)(green zone). So, to minimize damage, the optimum choice would be to destroy WTC2, first, while tipping the top portion to the east. If that tip of WTC2 is "Blown to Kingdom Come," the remaining portion of the building may be more manageable.

How much to tip

If the top portion of WTC2 is allowed to tip to the east (where it can be destroyed), the remaining portion of the building is a shorter, more manageable, size. So, if one were to pick the level at which the building would be "hit," the choice would be based on the maximum that would fall within the error zone ("spill-over zone"). For WTC2, the error zone (or spill-over zone) was much larger than for WTC1 (see above).

Figure 76. If WTC2 fell on it and squashed the main building, where is the part of WTC2 that did this?

Figure 77(a). Near the corner of Church and Liberty immediately after the event.

Figure 77(b). Near the corner of Church and Liberty shortly after the event.

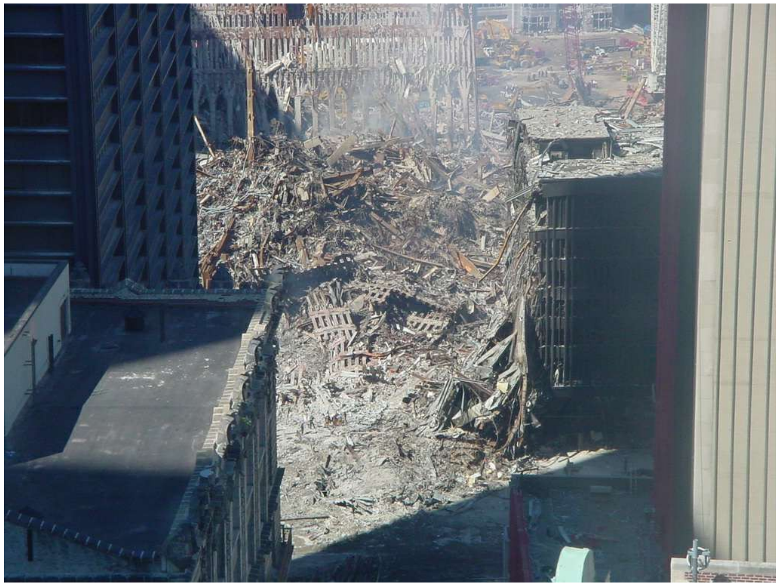


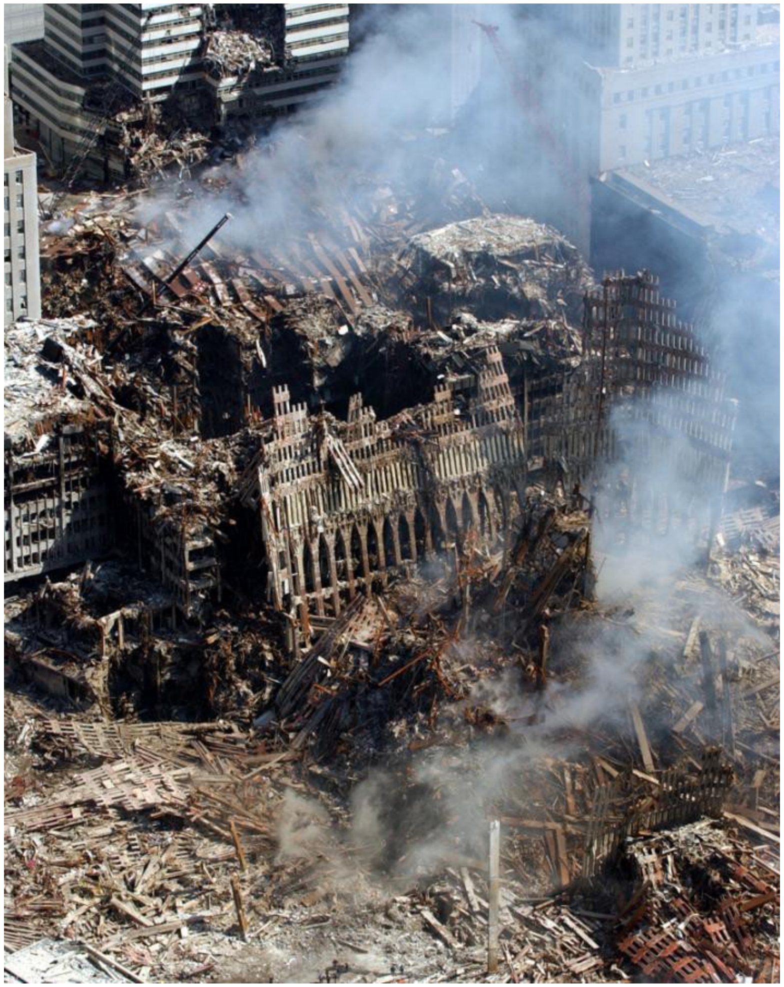
Figure 78(a).

Figure 78(b).

Figure 78. How can WTC2 falling on WTC4 pulverize both? It's unbelievable what a clean cut there is, separating WTC4's north wing. If WTC2 slammed into WTC4 with enough force to pulverize both, it certainly would have produced an equivalent earthquake much greater than that of the Seattle Kingdome.

Figure 79(a).

Figure 79(b).



The red circles show regions where there are holes into the sub-basements. The purple circles show regions of probable holes.

Figure 80(a).

Figure 80(b). Hole in the street picture

Figure 80(c). Holes

Figure 81. These look like healthy beams, not damaged/failed beams. These folks are suspended only a few stories above the ground. (little to no rubble pile below them)

The Star Wars Beam Weapons

and

Star Wars Directed-Energy Weapons (DEW)

(A focus of the Star Wars Program)

by

Dr. Judy Wood and Dr. Morgan Reynolds

(originally posted: October 17, 2006)

Page 7: The Conclusions

At the time this article was being developed, many people expressed disbelief that energy weapons existed outside of science fiction until they were reminded of the Star Wars Program, also known as the Strategic Defense Initiative (SDI)*. The name of this article was chosen as a reminder that energy weapons do exist and have been developed over 100 years. Most of this technology is classified information. It can also be assumed that such technology exists in multiple countries. The purpose of this article was to begin to identify the evidence of what happened on 9/11/01 that must be accounted for. In doing so, the evidence ruled out a Kinetic Energy Device (bombs, missiles, etc.) as the method of destruction as well as a gravity-driven "collapse."

*SDI was created by U.S. President Ronald Reagan on March 23, 1983.[1] It is thought that SDI may have been first dubbed "Star Wars" by opponent Dr. Carol Rosin, a consultant and former spokeswoman for Wernher von Braun. However, Missile Defense Agency (MDA) historians attribute the term to a Washington Post article published March 24, 1983, the day after the Star Wars speech, which quoted Democratic Senator Ted Kennedy describing the proposal as "reckless Star Wars schemes."[2] Before it was named the "Star Wars Program (SDI) in 1983, it was the Advanced Space Programs Development.[3]

12/12/10 -- Dr. Judy Wood

[1]Strategic Defense Initiative, Wikipedia,
[2]Sharon Watkins Lang. SMDC/ASTRAT Historical Office. "Where Do We Get Star Wars?", *The Eagle*. March 2007.
[3] Robert M. Bowman, former Director of Advanced Space Programs Development for the U.S. Air Force in the Ford and Carter administrations.

This page last updated, April 12, 2007

Shortcuts:

Jump to: **XV. Does Such Technology Exist?**

Jump to: *LASER development*

Jump to: *microwaving*

Jump to: *antimatter weapons*

Jump to: *testing*

Jump to: *video*

Jump to: *no Collapse video*

Jump to: *Dr. Douglas J. Beason*

Jump to: **XVI. Conclusions**

Jump to: *beam weapons and directed-energy weapons*

Jump to: **XVII. Acknowledgements**

Jump to: **XVIII. Additional Reading Material and References**

Audio:

29 November 2006, Judy Wood narrates these pages web pages on "The Dynamic Duo" with Jim Fetzer, Genesis Communications Network, gcnlive.com, archive (mp3-1)(mp3-2) (mp3).

6 December 2006, Morgan Reynolds discusses these pages on "The Dynamic Duo" with Jim Fetzer, Genesis Communications Network, gcnlive.com, archive, (mp3)(mp3)

XV. Does Such Technology Exist?

≅

Figure 96(a). microwave oven
First discovered 1945 by Percy Spencer
First Radarange 1947 by Raytheon.

Figure 96(b). Laser pointers are so common that they have become key chain ornaments
*First demonstrated in mid 1950s (1951, 1951, 1954, 1957, 1958).

Figure 96(b). Laser pointers are available in different wavelengths

*The "LASER" was in concept form as early as 1905 and 1917, but came to the "proof of concept stage" in 1953 with microwave energy but not with visible light until 1957. So, it was only fair to consider the range from 1953-1957 as the true "proof of concept" time. The concept was around since 1917, but not proven. You can say that it was technically proven in 1953, but truly proven by November 1957 by Gordon Gould, graduate student of Dr. Charles Townes. It was first demonstrated in mid 1950s (1951, 1951, 1954, 1957, 1958).

References for this technology: here and here

Figure 97(a). This does not look like a prototype.
(screen capture from video below):

Figure 97(b).
(screen capture from video below):

≅ *Microwaving Iraq*

Link

Link

Figure 98. Iraq - laser weapons documentary

References related to above video:

Microwaving Iraq

http://www.willthomas.net/Convergence/Weekly/Microwaving_Iraq.htm
http://www.willthomas.net/Convergence/Weekly/Microwave_Weapons.htm

downloadable segments:

03_Myers-

	Rumsfeld_DEW.wmv (6.6 Mb) 03_Myers-Rumsfeld_DEW.mov (17.5 Mb)

The statements by Secretary of Defense Donald Rumsfeld and General Myers excerpted from the aboved archived press conference from 2003 are especially revealing:

JOURNALIST: Mr. Secretary, can I ask you a question about some of the technology that you're developing to fight the war on terrorists, specifically directed energy and high-powered microwave technology? When do you envision that you can weaponize that type of technology?

DONALD RUMSFELD (appearing noticeably uncomfortable with the question): In the normal order of things, when you invest in research and development and begin a developmental project, you don't have any intention or expectations that one would use it. On the other hand, the real world intervenes from time to time, and you reach in there and take something out that is still in a developmental stage, and you might use it.

JOURNALIST: But you sound like you're willing to experiment with it.

GENERAL MYERS: Yeah, I think that's the point. And I think we have from the beginning of this conflict… I think General Franks [commander of U.S. forces in Iraq] has been very open to looking at new things, if there are new things available, and has been willing to put them into the fight, even before they've been fully wrung out… And we will continue to do that.

Thanks to a reader for this transcript.

Toasted Cars

One is in Iraq and one is on FDR Drive

Additional information of interest.

Video:
http://www.rainews24.it/ran24/inchieste/video/guerre_stellari_english.wmv

Transcript:
http://www.rainews24.it/ran24/inchieste/documenti/guerrestellari_iraq_eng.rtf

Star Wars in New York (livevideo_: Octopus Part 2

≅ *Antimatter Weapons*

Excerpt from antimatter weapons.

"These two characteristics are still valid today and entirely justify the interest in antimatter. The first, is that the release of usable energy per unit mass is greater in annihilation than in any other nuclear reaction. One proton-antiproton annihilation releases 300 times more energy than a fission or fusion reaction. The second, is that when antimatter is brought in the proximity of matter, annihilation starts by itself, without the need of a critical mass as in fission, and without the ignition energy needed in fusion."

Excerpts from the following article

[Air Force pursuing antimatter weapons]
Program was touted publicly, then came official gag order
Keay Davidson, Chronicle Science Writer
Monday, October 4, 2004

"The energy from colliding positrons and antielectrons "is 10 billion times ... that of high explosive," Edwards explained in his March speech. Moreover, 1 gram of antimatter, about 1/25th of an ounce, would equal "23 space shuttle fuel tanks of energy." Thus "positron energy conversion," as he called it, would be a "revolutionary energy source" of interest to those who wage war.

It almost defies belief, the amount of explosive force available in a speck of antimatter -- even a speck that is too small to see. For example: One millionth of a gram of positrons contain as much energy as 37.8 kilograms (83 pounds) of TNT, according to Edwards' March speech. A simple calculation, then, shows that about 50-millionths of a gram could generate a blast equal to the explosion (roughly 4,000 pounds of TNT, according to the FBI) at the Alfred P. Murrah Federal Building in Oklahoma City in 1995. "

"I think," he said, "we need to get off this planet, because I'm afraid we're going to destroy it."

≅ ***Testing***

Player Preference

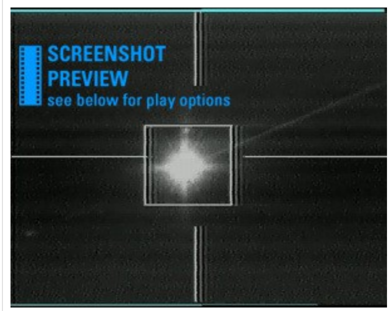
Windows Player
56K | Cable/DSL | T1 or Higher

Quicktime
56K | Cable/DSL | T1 or Higher

09.30.2004

The Tactical High Energy Laser, built by Northrop Grumman Corporation for the U.S. Army, shot down multiple mortar rounds Aug. 24, proving that laser weapons could be applied on the battlefield to protect against common threats.

In tests representative of actual mortar threat scenarios, the



Player Preference

Windows Player
56K | Cable/DSL

Quicktime
56K | Cable/DSL

01.16.2004

THEL Multiple-Rocket Shootdown

In tests at the White Sands Missile Range, the Northrop Grumman-built THEL, jointly developed by the U.S. Army and the Israel Ministry of Defense, has shot down 25 Katyusha rockets, singly and in salvos.

THEL testbed destroyed both single mortar rounds and mortar rounds fired in a salvo at White Sands Missile Range, N.M. Source:Northrop Grumman	Source:Northrop Grumman

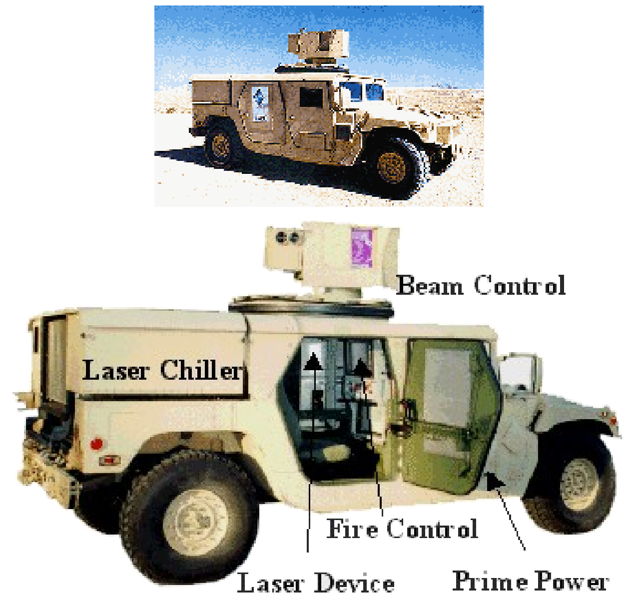
Figure 99. Videos of shootdowns using a High Energy Laser

Video (wmv)
The Star War in Iraq
Maurizio Torrealta e Sigfrido Ranucci, RaiNews 24
May 19, 2006

Transcript (rtf)

Source: uruknet

VideoLaser-based unexploded ordnance and landmine neutralization system



Source: Zeus-Sparta

"War from Space"
(google video)

(May need a newer-version web browser.)

Link

For more evidence, please see the information on the page, Appendix 2.

- ***video***

Star Wars in New York 911 Octopus Part Two
This video began playing by itself so has been removed. Please use the links to view it.
32:37 URL Video

- ***No Collapse***

9/11 Truth: Structural Failures vs. Controlled Demolitions
This is a video **response** to Preview of New 9/11 Truth Documentary "Improbable ImprobableCollapseResponse" alternate: ImprobableCollapseResponse (mov) (mpg)

Douglas Beason

Figure Beason. Douglas Beason
(click on picture to play audio)
October 18, 2005
(mp3)
Source: Full, segments

Excerpts, from revereradio.net

Thanks to Andrew Johnson for recording this.
http://www.checktheevidence.com/audio/911/

Source (9/11/01)

New weapons and how they may change war subject of talk Thursday at Museum

The E-Bomb: How America's New Directed-Energy Weapons Will Change the Way Future Wars Will be Fought (mp3)
November 29, 2005
link

DR. J. DOUGLAS BEASON, Col. (USAF, ret.), a key architect and leading expert of directed-energy research for the past twenty-six years, holds a Ph.D. in laser-technology physics. He has served at the White House, working for the President's Science Advisor in both the Clinton and Bush administrations. Today he is on the Board of Directors of the Directed Energy Professional Society, and at Los Alamos National Laboratory he is Director of Threat Reduction. Dr. Beason is the author of twelve books, including some popular fiction techno-thrillers, and over one hundred scholarly papers and other works. He is a Fellow of the prestigious American Physical Society.

Figure example.
Source

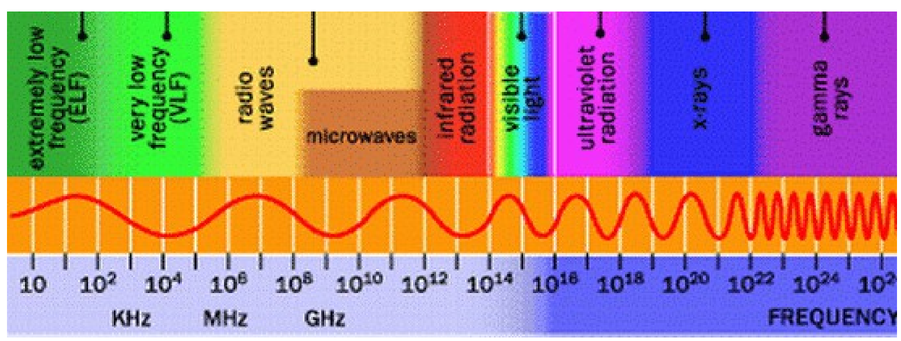


Figure 100. There are a lot of wavelengths here to pick and choose from or "mix and match" (i.e. it need not be just one frequency).

Why did Donald Rumsfeld, in January 2001, have a premonition predicting 9/11?

In January 2001, a commission led by Donald Rumsfeld warned of growing threats to U.S. space assets from so-called "rogue states." The commission cited the dangers of a Pearl Harbor-style attack in space. It recommended that the President be given the option of putting weapons in space to protect U.S. assets. The article noted that Rumsfeld, upon taking over as defense secretary, "put in place many of his commission's recommendations."
Source: FAS, other

XVI. Conclusions

Here are the principal data that must be explained:

1. The Twin Towers were destroyed faster than physics can explain (at free fall speed "collapse").
2. They underwent mid-air pulverization and were turned to dust before they hit the ground.
3. The protective bathtub was not significantly damaged by the destruction of the Twin Towers.
4. The rail lines, the tunnels and most of the rail cars had only light damage.
5. The WTC mall survived well, witnessed by Warner Bros. Road Runner and friends.
6. The seismic impact was minimal, far too small based on our comparison with the Kingdome controlled demolition.
7. The Twin Towers were destroyed from the top down, not bottom up.
8. The demolition of WTC7 was whisper quiet and the seismic signal was no greater than background noise.
9. The upper 80 percent, approximately, of each tower was turned into fine dust and did not crash to the earth.
10. The upper 90 percent, approximately, of WTC7 was turned into fine dust and did not crash to the earth.
11. File cabinet with folder dividers survived.
12. Office paper was densely spread throughout lower Manhattan, unburned, often along side burning cars.
13. Vertical round holes were cut into buildings 4, 5 and 6, plus a cylindrical arc into Bankers Trust and into Liberty street in front of Bankers Trust.
14. All planes except top secret missions were ordered down until 10:31 a.m. (when only military flights were allowed to resume), after both towers were destroyed, and only two minutes after WTC 1 had been destroyed.

15. Approximately 1,400 motor vehicles were towed away, toasted in strange ways, during the destruction of the Twin Towers.
16. The order and method of destruction of each tower minimized damage to the bathtub and adjacent buildings.
17. Twin Tower control without damaging neighboring buildings, in fact all seriously damaged or destroyed buildings had a WTC prefix, and no others.
18. The north wing of WTC 4 was left standing, neatly sliced from the main body which virtually disappeared.
19. The WTC1 and WTC2 rubble pile was far too small to account for the mass.
20. The WTC7 rubble pile was too small and contained a lot of mud.
21. Eyewitness testimony about toasted cars, instant disappearance of people by "unexplained" waves, a plane turning into a mid-air fireball, electrical power cut off moments before WTC 2 destruction, and the sound of explosions.
22. There were many flipped cars in the neighborhood of the WTC complex near trees with full folliage.

* The possibility that a technology exists. Since invention of the microwave for cooking in 1945 and laser beam in 1955*, commercial and military development of beam technology has proceeded apace, so use of high-energy beams are likely

What theories are available to explain these phenomena?
We can identify seven theories:

a. Natural causes such as earthquakes and hurricanes
b. Arson
c. The official theory of airplane impact, fires and weakened steel collapsing
d. Conventional demolition with explosives such as RDX, dynamite, etc.
e. Demolition via thermite or its variants

f. Fission or fusion nukes (and clean bombs)

g. Beam weapons, energy weapons, directed-energy weapons (DEW)

No one proposes that an earthquake destroyed the Twin Towers from the top down. The theory is contradicted by nearly all the data above. For example, no earthquake can toast cars in inexplicable patterns.

In fact, the data refute theories a to e–natural, arson, official, conventional and thermite demolition–in particular the intact bathtub, minimal seismic impact, and "dustification" prove nothing close to 1 million tons of material slammed down on the WTC foundation and its sub-basements. The debris stacks left where the Twin Towers once stood hardly covered the ground. The rescue dogs and workers did not climb up a tall pile but had to repel down to search for survivors. The arson and thermite theories fail to explain every data point, but all the unburned paper in particular refute any high-temperature based hypothesis.

The nuclear theory fails because an explosion powerful enough to turn most of each tower to dust would have seriously damaged the bathtub, probably flooded lower Manhattan, and spiked a high Richter reading. It violates a number of data points, including the observed top-down disintegration. And if a nuke were at the top, it could not progressively destroy lower floors and there were only a few steel beams tossed onto adjacent buildings and none above the 20th floor. Lots of aluminum cladding was tossed onto neighboring buildings' roofs but no steel beams. How could a nuke be so selective? It could not. Nor can a nuke explain the toasted cars.

All the data are consistent with an energy weapon. For example, consider the round holes in buildings 5 and 6 and in Liberty Street. A directed-energy weapon by definition could cut into buildings, destroy material and leave discrete boundaries in the buildings. We know of no other explanation that has been offered for these peculiar holes. Similarly, some 1,400 cars were toasted in inexplicable patterns, and no alternative explanation to energy displacement has been offered.

Beam Weapons, Energy Weapons, and Directed Energy Weapons (DEW):

We have used the terms "beam-field weapons" and "directed energy weapons" to refer to unconventional weapons (exotic weapons) that are energy weapons. We broadly define DEW as **E**nergy that is **D**irected and is used as a **W**eapon. The full range of these weapons is classified information, so we make no limits or distinction of categories within the realm of energy weapons, as doing so would imply specific knowledge of all that is available. In the following paragraph, we have listed some of the possibilities we are aware of.

Our critics have accused us of insisting that beam weapons did their damage from outer space, yet we make no claim about whether the directed energy weapon operated from a space-, air-, or ground-based platform. Nor do we make any claim about what wavelength(s) was used, what the source(s) of energy was, whether it involved interference of multiple beams, whether it involved sound waves, whether it involved sonoluminescence, whether it involved antimatter weapons, whether it involved scalar weapons, whether it was HAARP (more here and here), whether it involved a nuclear process (e.g. NDEW, more info), whether it involved conventional directed energy weapons (conDEW), whether it involved improvised directed energy weapons (iDEW), nor what kind of accelerator was used, nor do we claim to know what the serial numbers of the parts that were in the weapon(s).

What we do claim is that the evidence is consistent with the use of energy weapons that go well beyond the capabilities of conventional explosives and can be directed.

In August 2006, we began looking at the bathtub which protected the WTC and it led us to look at more data. The data told us what destroyed the twin towers. The data told us that directed-energy weapons must exist. We were not aware that the US military had directed-energy weapons. After we concluded that some sort of energy weapon was used, we looked for evidence that such weapons exist and found it, as documented here. Developers and manufacturers of DEWs are listed here, along with some examples of their product line, which is available in the public domain. As Sherlock Holmes declared,

"When you have eliminated all which is impossible, then whatever remains, however improbable, must be the truth."

XVII. Acknowledgements

The authors wish to thank a number of people for their help in solving this mystery. We especially want to thank Bill Biggart's widow, Wendy, and his good friend Chip East, for sharing with us those last photos taken by Bill Biggart along with the story about them. Somehow, I know that Bill knew just how valuable those pictures would turn out to be. Thank you Bill Biggart! And thank you Wendy and Chip for seeing that these images were made available to us.

Thanks to Spooked, for always being there and for being a rational human being. You beautifully demonstrated that it was always OK to disagree and that disagreement only meant that at least one of us was missing critical information. It has been an honor to work with you.

XVIII. Additional Reading Material and References

DEW Sponsors and Department of Defense Contractors

References

Misc. notes to include elsewhere.

Thus, the weapon appears to have bored through the building to the ground level – but no farther. Removing a significant portion of the mass of WTC6 left a more manageable problem to remove the remainder of WTC6, which was a tricky challenge to avoid damaging the bathtub and parking garage [reference from S].

Final note:

Figure 101. But, clearly the bathtub survived. This is a view from the footprint of WTC1. Notice the parking structure that was under WTC6 survived.

This page last updated, November 08, 2006

The Star Wars Beam Weapons
and
Star Wars Directed-Energy Weapons (DEW)
(A focus of the Star Wars Program)

by
Dr. Judy Wood and Dr. Morgan Reynolds

(originally posted: October 17, 2006)

Appendix 1

At the time this article was being developed, many people expressed disbelief that energy weapons existed outside of science fiction until they were reminded of the Star Wars Program, also known as the Strategic Defense Initiative (SDI)*. The name of this article was chosen as a reminder that energy weapons do exist and have been developed over 100 years. Most of this technology is classified information. It can also be assumed that such technology exists in multiple countries. The purpose of this article was to begin to identify the evidence of what happened on 9/11/01 that must be accounted for. In doing so, the evidence ruled out a Kinetic Energy Device (bombs, missiles, etc.) as the method of destruction as well as a gravity-driven "collapse."

*SDI was created by U.S. President Ronald Reagan on March 23, 1983.[1] It is thought that SDI may have been first dubbed "Star Wars" by opponent Dr. Carol Rosin, a consultant and former spokeswoman for Wernher von Braun. However, Missile Defense Agency (MDA) historians attribute the term to a Washington Post article published March 24, 1983, the day after the Star Wars speech, which quoted Democratic Senator Ted Kennedy describing the proposal as "reckless Star Wars schemes."[2] Before it was named the "Star Wars Program (SDI) in 1983, it was the Advanced Space Programs Development.[3]

12/12/10 -- Dr. Judy Wood

[1]Strategic Defense Initiative, Wikipedia,
[2]Sharon Watkins Lang. SMDC/ASTRAT Historical Office. "Where Do We Get Star Wars?", *The Eagle*. March 2007.
[3] Robert M. Bowman, former Director of Advanced Space Programs Development for the U.S. Air Force in the Ford and Carter administrations.

Jump to References and other reading material
Jump to Possibilities via Google

- ***Appendix A***

  - ***WTC:***

(WTC1: Dec. 1970-Sept.2001)
(WTC2: Jan. 1972-Sept.2001)

World Trade Center Stats:
200,000 tons of steel
425,000 cubic yards of concrete
43,600 windows
12,000 miles of electric cables
Had its **own zip code**, 10048

Each Tower:
Had **110 floors**
208 ft by **208 ft** at base
?Weighed **500,000 tons**
1,368 ft high (north tower)
1,362 ft high (south tower)
Contained **198 miles** of heating ducts
97 elevators for passengers, 6 for freight

http://www.infoplease.com/spot/wtc1.html

Note: 425,000 yd^3 x 36^3 (in^3/yd^3)x (0.086 x 60%)lb/in^3 x (ton/2,000 lbs)= 511,583 tons
Assuming this value is for both towers, one tower would be 256,000 tons.

- ***KINGDOME:***

(March 27, 1976 - March 26, 2000)

Height of Dome: 250 ft. to apex;
Height of Cylinder: 133 ft., 6 in. to top ring
Diameter of dome: 660 ft., inner diameter

http://mlb.mlb.com/NASApp/mlb/sea/history/ballparks.jsp

DIMENSIONS:
Site: 23.9 acres (includes building and one parking lot).

Building area: 9.34 acres. Roof area: 7.85 acres. Height: 250 feet. Diameter: 660 feet (inside wall); 720 feet (encompassing outside ramps). Volume: 67 million cubic feet within outside columns. Exhibit space: 190,400 square feet (Arena & 100 level concourse).. Structural steel: 443 tons. Concrete: 52,800 cubic yards.
http://www.kingdome.org/

Building area: 9.34 acres Roof area: 7.85 acres Height: 250 feet Diameter: 660 feet (inside wall) 720 feet (exterior walls) Volume: 67 million cubic feet Exhibit space: 190,400 square feet Weight: 130,000 tons Structural steel: 443 tons Concrete: 52,800 cubic yards
http://seattletimes.nwsource.com/kingdome/k_gravity.html

Check:
52,800 cubic yards x [(36)3 in3/yd3] x (0.86 lb/in3) x (1 ton/2,000 lb) = 105,928 tons
105,928 tons + 443 tons = 106,371 tons

From the Seattle Times

Dust choked downtown for nearly 20 minutes, blocking out the sun and leaving a layer of film on cars, streets and storefronts. The dust cloud reached nearly as high as the top of the Bank of America Tower and drifted northwest about **8 miles an hour**.

---(snip)---

Carefully placed explosives - **4,461 pounds in all** - collapsed the 25,000-ton roof like a cake taken out of the oven too soon. More than 21 miles of detonating cord exploded in a flash. The Dome's roof ribs and columns looked like they had been electrified with lightning.

Rapid puffs of smoke followed, and the massive roof ribs that formed the Dome's 20 arches buckled first in three pie-shaped wedges. Then came the remaining three roof wedges, followed instantly by explosions in the support columns and in the roof's tension ring, which had held the roof together by exerting 8 million pounds of force around its base.

While nearly all of the Dome, which once weighed about **130,000 tons**, collapsed in on its own "footprint," **chunks of concrete flew onto rooftops**. The force of the blasts broke windows at the Salvation Army and Turner Construction buildings on Fourth Avenue South, and at F.X. McRory's steakhouse on South King Street. Residents of the nearby Florentine Condominiums had been taken to the restaurant earlier that morning, but no one was injured.

A small army of street sweepers went into action moments after the blast. Businesses around the Dome were quick to reopen, with little damage reported. Engineers will survey adjacent buildings and structures over the next few days to assess any damage.

The implosion registered a magnitude **2.3 on the Richter scale** - a barely detectable ground motion that naturally visits the region once or twice a month. Scientists will use ground-vibration data from the implosion to learn more about the Seattle fault, which runs a few blocks south of the Kingdome.

By afternoon, the job of pulverizing and hauling away the Kingdome was under way, with hydraulic jackhammers breaking columns into chunks. A couple hundred people gathered close to the site, taking pictures and searching for bits of the building to take home.

The rubble is **flatter** than expected, only reaching about **30 feet high near the perimeter** of the 9-acre Dome site. The Dome once stood 250 feet high.

http://archives.seattletimes.nwsource.com/cgi-bin/texis.cgi/web/vortex/display?slug=4012219&date=20000327

≅ *Appendix B*

Building	Number of Floors	Height (feet)	Weight (tons)
WTC1	110	1368	500,000
WTC2	110	1362	500,000
WTC3	22	(274)	
WTC4	9	(112)	
WTC5	9	(112)	
WTC6	8	(99)	
WTC7	47	(585)	
Bankers Trust	40	(497)	
Kingdome	(20)	250	130,000

Table 1. Buildings, and selected information.

≅ *Appendix C*

≅

[The timeline info to be moved to an Appendix?]

http://www.cooperativeresearch.org/timeline.jsp?timeline=complete_911_timeline&day_of_9/11=dayOf911&startpos=200

(9:26 a.m.): Rookie FAA Manager Bans All Take Offs Nationwide, Including Most Military Flights? Mineta Asserts He Issues Order Minutes Later

FAA Administrator Jane Garvey. *[Source: FAA]*

Time magazine later reports that Jane Garvey, head of the FAA, "almost certainly after getting an okay from the White House, initiate[s] a national ground stop, which forbids takeoffs and requires planes in the air to get down as soon as is reasonable. The order, which has never been implemented since flying was invented in 1903, applie[s] to virtually every single kind of machine that can takeoff-civilian, military, or law enforcement." Military and law enforcement flights are allowed to resume at 10:31 a.m. (see 10:31 a.m.) A limited number of military flights-the FAA will not reveal details-are allowed to fly during this ban. [Time, 9/14/2001] Garvey later calls it "a national ground stop ... that prevented any aircraft from taking off." [US Congress, 9/21/2001] Transportation Secretary Norman Mineta later says he was the one to give the order: "As soon as I was aware of the nature and scale of the attack, I called from the White House to order the air traffic system to land all aircraft, immediately and without exception." [US Congress. Senate. Committee on Commerce, Science and Transportation, 9/20/2001] According to Mineta, "At approximately 9:45 ... I gave the FAA the final order for all civil aircraft to land at the nearest airport as soon as possible." [9/11 Commission, 5/23/2003] At the time, 4,452 planes are flying in the continental US. A later account states that Ben Sliney, the FAA's National Operations Manager, makes the decision without consulting his superiors, like Jane Garvey, first. It would be remarkable if Sliney was the one to make the decision, because 9/11 is Sliney's first day on the job as National Operations Manager, "the chess master of the air traffic system." [USA Today, 8/13/2002] When he accepted the job a couple of months earlier, he had asked, "What is the limit of my authority?" The man who had promoted him replied, "Unlimited." [USA Today, 8/13/2002] Yet another account, by Linda Schuessler, manager of tactical operations at the FAA Command Center where Sliney was located, says, "... it was done collaboratively ... All these decisions were corporate decisions. It wasn't one person who said, 'Yes, this has got to get done.'"[Aviation Week and Space Technology, 12/17/2001] About 500 planes land in the next 20 minutes, and then much more urgent orders to land are issued at 9:45 a.m. (see (9:45 a.m.)). [USA Today, 8/13/2002; Time, 9/14/2001; USA Today, 8/13/2002; US Congress, 9/21/2001; Aviation Week and Space Technology, 6/3/2002; Newsday, 9/23/2001; Associated Press, 8/19/2002; Newsday, 9/10/2002]

Entity Tags: Jane Garvey, Ben Sliney, Norman Mineta, Federal Aviation Administration, Linda Schuessler

9:30 a.m.: United Flights Are Instructed to Land Immediately; American Follows Suit

United Airlines begins landing all of its flights inside the US (Note: All planes nationwide were already ordered down at 9:26 a.m. (see (9:26 a.m.)) and told to land in a reasonable amount of time. Now they're told to land immediately.) American Airlines begins landing all of their flights five minutes later. [Wall Street Journal, 10/15/2001]

Entity Tags: United Airlines, American Airlines

(9:45 a.m.): Senior FAA Manager, on His First Day on the Job, Orders All Planes Out of the Sky Nationwide

FAA National Operations Manager Ben Sliney. *[Source: Publicity photo]*

Ben Sliney, FAA's National Operations Manager, orders the entire nationwide air traffic system shut down. All flights at US airports are stopped. Around 3,950 flights are still in the air. Sliney makes the decision without consulting FAA head Jane Garvey, Transportation Secretary Norman Mineta, or other bosses, but they quickly approve his actions. It's Sliney's first day on the job. [USA Today, 8/13/2002; USA Today, 8/13/2002; MSNBC, 9/22/2001; CNN, 9/12/2001; New York Times, 9/12/2001; Associated Press, 8/12/2002; Associated Press, 8/19/2002; Newsday, 9/10/2002; USA Today, 8/13/2002; Washington Post, 9/12/2001] Seventy-five percent of the planes land within one hour of the order. [USA Today, 8/12/2002] The 9/11 Commission will later remark that this "was an unprecedented order" that the "air traffic control system handled ... with great skill." [9/11 Commission, 7/24/2004, pp. 29] The Washington Post has reported that Mineta told Monty Belger at the FAA: "Monty, bring all the planes down," even adding, "[Expletive] pilot discretion." [Washington Post, 1/27/2002] However, it is later reported by a different Post reporter that Mineta did not even know of the order until 15 minutes later. This reporter "says FAA officials had begged him to maintain the fiction." [Slate, 4/2/2002]

Entity Tags: Federal Aviation Administration, Norman Mineta, Jane Garvey, Monty Belger, Ben Sliney

(After 9:55 a.m.): Langley Fighters Receive Vague Order to Protect White House

The Langley F-16s headed to Washington are told that all planes in the US have been ordered to land (that command was given at 9:45 a.m.). According to the New York Times, at some point after this, someone from the Secret Service gets on the radio and tells the pilots, "I want you to protect the White House at all costs." [New York Times, 10/16/2001] F-16 pilot Honey (who is apparently Captain Craig Borgstrom) gives a similar, though less dramatic, account. At some point after the F-16s had set up a defensive perimeter over Washington, the lead pilot (again, Borgstrom) receives a garbled message about Flight 93 that isn't heard by the other two pilots. "The message seemed to convey that the White House was an important asset to protect." Honey says he is later told the message is, "Something like, 'Be aware of where it is, and it could be a target.'" Another pilot, codenamed Lou, says Honey tells him, "I think the Secret Service told me this." [Longman, 2002, pp. 76] Both Lou and Honey state they are never given clear and direct orders to shoot down any plane that day. [Longman, 2002, pp. 222]

Entity Tags: Craig Borgstrom, Secret Service

10:31 a.m.: Military and Law Enforcement Flights Resume

The FAA allows "military and law enforcement flights to resume (and some flights that the FAA can't reveal that were already airborne)." All civilian, military, and law enforcement flights were ordered at 9:26 a.m. to land as soon as reasonably possible. [Time, 9/14/2001] Civilian flights remain banned until September 13. Note that the C-130 cargo plane that witnessed the Flight 77 crash (see 9.36 a.m.) and which came upon the Flight 93 crash site (see 10:08 a.m.) right after it had crashed was apparently not subject to the grounding order issued about an hour earlier.

Entity Tags: Federal Aviation Administration

10:31 a.m.: NEADS Does Not Pass Along NORAD Shootdown Order

According to the 9/11 Commission, NORAD Commander Major General Larry Arnold instructs his staff to broadcast the following message over a NORAD chat log: "10:31 Vice President [Cheney] has cleared us to intercept tracks of interest and shoot them down (see 10:14 a.m.) if they do not respond, per CONR CC [General Arnold]." NEADS first learns of the shootdown order from this message. However, NEADS does not pass the order to the fighter pilots in New York City and Washington. NEADS leaders later say they do not pass it on because they are unsure how the pilots should proceed with this guidance. [9/11 Commission, 6/17/2004] The pilots flying over New York City claim they are never given a formal shootdown order that day.

Entity Tags: Richard ("Dick") Cheney, Northeast Air Defense Sector, Larry Arnold

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≅ *Appendix D*

Eyewitness testimony

WORLD TRADE CENTER TASK FORCE INTERVIEW

EMT PATRICIA ONDROVIC

Interview Date: October 1, 2001

I guess that's North Park. It's a big green, grassy area, and there's nothing there. As I was running up here, two or three more cars

exploded on me. They weren't near any buildings at that point, they were just parked on the street. The traffic guys hadn't gotten a chance to tow anything yet, cause this was all during the first hour I guess of this thing happening. So there were still cars parked on the street that were completely independent of that. Three cars blew up on me, stuff was being thrown. I went home all bruised that day. Thank God it was only bruises. I just ran into this park along with a bunch of other people, and stuff was still blowing up, I don't think I looked back, but you couldn't see anything, everything was just black. I was running and I was falling over people, cause people were crawling on the ground cause they couldn't see anymore. I just kept on running north. I could smell water, so I just kept on running towards the water, cause I knew that my coat was on fire, and I figured well, if I can see a boat over the water, I'm just gonna jump onto the boat and take that thing to Jersey, cause no one wants to blow up Jersey. Stuff is still blowing up behind me, as I'm running. I can hear stuff exploding. I could hear rumbling, the street under me was moving like I was in an earthquake. I've been in those, so I know what they feel like. It felt like an earthquake. There was no where safe to go. As I was running north in this park, and then I could start seeing again a little bit, and I just kept looking in the sky. Cause the captain was saying there's another plane heading in our direction, I was looking for another plane. I saw something in the sky, it was a plane, but it was way out. It looked like it was over Jersey or something, then it wasn't there anymore. I saw a small fireball, and it was gone. I saw two other planes. One came in one way, and the other came in the other way, and there was a plane in the middle that was way far off in the distance. Then the plane in the middle just disappeared into a little fire ball. It looked like the size of a golf ball from where I could see it. And the other two planes veered off into opposite directions. I just kept on running north. About fifteen blocks later, I had no idea that that was just the first tower that had come down.

http://abclocal.go.com/images/wabc/2005/OndrovicPatricia_EMT.pdf

FIREFIGHTER FERNANDO CAMACHO WTC2 Explosions

We went across the lobby of the hotel, going north, and we exited and made a right going towards the second tower, the **south tower**. We must have walked about 100-200 feet to revolving doors, **which led into a hallway to where the mall was.** I could see maybe 20, civilians and I believe Ladder 25, which was about another 100 to 150 feet ahead of us. **As we came in through the revolving doors, the lights went out. A second or two later everything started to shake. You could hear explosions.** We didn't know what it was. We thought it was just a small collapse.

As I looked straight ahead of me, I saw total darkness. **Everything was coming our way like a wave. The firefighters that were ahead of us and the civilians that were ahead of us totally disappeared.** We turned around. We were all pretty much within ten feet of each other: lieutenant, chauffeur, roof, OV, can. As we turned around, I ran probably maybe ten feet and that's when the body of the building or body of the collapse hit, and we were flying through the air basically. I must have flown 30, 40 feet through the air. Then total quiet. You couldn't breathe. You couldn't see anything.

http://www.flcv.com/firemen.html

- *Appendix E*

≅ ***Energy***

Could this have something to do with Zero-Point energy?

John Hutchison in "Free Energy - The race to Zero Point" Shows more about the Hutchison Effect and footage of it in action. Levitation of objects, fusion of metal and wood and other bizarre effects.

≅ ***Appendix F, nuke related***

nukes

≅ ***Appendix G***

≅ ***Appendix H***

Final note:

Figure 100. But, clearly the bathtub survived. This is a view from the footprint of WTC1. Notice the parking structure that was under WTC6 survived.

References and other reading material:

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Dr. Richard M. Roberds
Air University Review, July-August 1984
http://www.airpower.maxwell.af.mil/airchronicles/aureview/1984/jul-aug/roberds.html

BEAR (Beam Experiments Aboard a Rocket) Project. Volume 1: Project Summary
Authors: G. J. Nunz; LOS ALAMOS NATIONAL LAB NM
Report Date: 01 JAN 90
http://www.stormingmedia.us/79/7958/A795833.html

"The BEAR experiment successfully demonstrated operation of an NPB accelerator and propagation of the neutral beam as predicted in space, obtained first-of-a-kind NPB space physics data, and demonstrated the ability of the BEAR accelerator to survive recovery and to continue operating normally. No unanticipated phenomena were encountered that would significantly delay further development of NPB technology for defensive, space-based weapon systems."

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TECHNOLOGICAL OPTIONS FOR ENHANCING US MILITARY CAPABILITIES
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Peter Clarke
EE Times
(06/06/2001 2:02 PM EDT)
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(12/4/20001)
http://www.firehouse.com/news/2001/12/4_APmissing.html

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Date: January 26, 2004
http://www.sciencedaily.com/releases/2004/01/040126073254.htm

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Microwave beam weapon reportedly to be deployed in Iraq
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Silicon Strategies
(09/21/2004 9:43 AM EDT)
http://www.eetimes.com/showArticle.jhtml?articleID=47900605

Beam weapons almost ready for battle
Directed energy could revolutionize warfare, expert says
By Leonard David
Senior space writer
Space.com
Updated: 1:10 p.m. ET Jan 11, 2006
http://www.msnbc.msn.com/id/10805240/

The first US 747-400 Airborne Laser aircraft under construction at a Boeing production facility. (AFP)
US hails airborne laser as weapons milestone
Last Update: Sunday, October 29, 2006. 10:06am (AEDT)
http://abc.net.au/news/newsitems/200610/s1775995.htm

By ROXANA HEGEMAN, Associated Press Writer Sat Oct 28, 12:37 AM ET

WICHITA, Kan. - The U.S. Missile Defense Agency rolled out an airborne laser aircraft on Friday, the latest development in a missile-defense system that was once ridiculed as a "Star Wars" fantasy.

In a ceremony at the Boeing Co.'s Integrated Defense Systems facility in Wichita, the agency announced it was ready to flight test some of the low-power systems on the ABL aircraft, a modified Boeing 747-400F designed to destroy enemy missiles.

Lt. Gen. Henry "Trey" Obering III, director of the Missile Defense Agency, said he embraced early critics' comparison of the laser-equipped plane to the Star Wars movies.
(retreived on October 29, 2006)
http://news.yahoo.com/s/ap/20061028/ap_on_re_us/airborne_laser

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Space Based Laser [SBL]
by Federation of American Scientists (FAS)
Last Updated December 02, 2005 2:40:54 P.M.
http://www.fas.org/spp/starwars/program/sbl.htm

Weapons in Space
by Federation of American Scientists (FAS)

http://www.fas.org/main/content.jsp?formAction=325&projectId=9

Neutral Particle Beam (NPB)
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http://www.stormingmedia.us/keywords/space_based.html

Directed Energy Weapons

http://www.stormingmedia.us/keywords/directed_energy_weapons.html

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Weaponization of Space: Understanding Strategic and Technological Inevitabilities
Authors: Thomas D. Bell; AIR WAR COLL MAXWELL AFB AL
JAN 1999
http://www.stormingmedia.us/13/1355/A135524.html

Space-Based Attack Weapons
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USAF Detachment 8 Continues US Research Into EMP-Microwave Weapons
Posted 07-Mar-2006 09:09
http://www.defenseindustrydaily.com/nonlethal_weapons/index.php

"The Air Force is awarding a $24 million to be split among these eight companies. DID lists the companies involved in the current contract, and also notes previous contracts along similar lines that extend back to 1994"

US military scores laser success
Tuesday, 5 November, 2002, 23:53 GMT
http://news.bbc.co.uk/2/hi/technology/2407807.stm

"The US army has, for the first time, shot down an artillery shell in flight using a high-powered laser weapon. ...Two years ago, it successfully shot down a Katyusha rocket, but in Monday's test it managed to destroy a shell moving at a higher speed. ... The test took place at the White Sands missile range in New Mexico."

"Lasers were behind the space-based missile defence shield idea, labelled "Star Wars", first suggested by US President Ronald Reagan in 1983. "

DoD News Briefing
Secretary of Defense William S. Cohen
Monday, April 28, 1997 - 8:45 a.m. EDT
http://www.defenselink.mil/transcripts/1997/t042897_t0428coh.html

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Scientific American: Feature: A Unified Theory
Steven Weinberg
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http://holtz.org/library/ToFile/Unified%20Physics%20by%202050%20December%201999.htm

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MILITARY SPACE

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07/08/2005 - MSNBC: Arabs claim comet probe is ‘space weapon’ (Deep Impact)
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02/15/2005 - MSNBC.com: Missing: One Russian spy satellite
04/16/2004 - MSNBC.com: The war of words over war in space
03/14/2004 - MSNBC.com: NASA Anxious of New Military Chief of Russian Space
Summer 2004 - Air & Space Power Journal: “The space campaign space-power theory (from James Oberg) applied to counterspace operations”, by Brent D. Ziarnick
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06/12/2001 - American Legion: Space War
03/1999 - MISSILES FOR ALL: The New Global Threat
07/1984 - Pearl Harbor in Space

Articles by James Oberg

Possibilities for Controlled Demolition (via Google)

	low# Links	high#	date (yy/mm/dd)
Google for thermite and CD (without WTC, Jones, 911, 9/11, mini-nukes)	7	11	06-12-08
Google for thermate and CD (without WTC, Jones, 911, 9/11)	13	20	06-12-03
Google for "nano-enhanced" (thermite or thermite) and CD	2	7	06-12-03

	low# Links	high#	date (yy/mm/dd)
Google fore "directed-energy weapons" and CD	145	456	06-12-03
Google for "beam weapon" and CD	91	215	06-12-03
Google for "space based weapons" and CD	76	131	06-12-03

The Star Wars Beam Weapons

and

Star Wars Directed-Energy Weapons (DEW)

(A focus of the Star Wars Program)

by

Dr. Judy Wood and Dr. Morgan Reynolds

(originally posted: October 17, 2006)

Appendix 2

At the time this article was being developed, many people expressed disbelief that energy weapons existed outside of science fiction until they were reminded of the Star Wars Program, also known as the Strategic Defense Initiative (SDI)*. The name of this article was chosen as a reminder that energy weapons do exist and have been developed over 100 years. Most of this technology is classified information. It can also be assumed that such technology exists in multiple countries. The purpose of this article was to begin to identify the evidence of what happened on 9/11/01 that must be accounted for. In doing so, the evidence ruled out a Kinetic Energy Device (bombs, missiles, etc.) as the method of destruction as well as a gravity-driven "collapse."

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12/12/10 -- Dr. Judy Wood

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This page last updated, November 07, 2006

Appendix A: Space Based Laser [SBL]		***Appendix E***

Appendix B: Lasers and Missle Defense		Appendix F
Appendix C		Appendix G
Appendix D		Appendix H

Many people insist that energy weapons only exist in science fiction stories. Here are a few examples of energy weapons that do exist.

Source: http://www.fas.org/spp/starwars/program/sbl.htm

- ***Appendix A: Space Based Laser [SBL]***

Space Based Laser [SBL]

The potential to intercept and destroy a missile over enemy territory soon after launch, rather than over friendly territory, makes the development of a boost phase intercept (BPI) capability very desirable. In concert with ground based theater missile defense (TMD) systems already under development, the U.S. continues to investigate BPI concepts for BMD systems.

The SBL program could develop the technology to provide the U.S. with an advanced BMD system for both theater and national missile defense. BMDO believes that an SBL system has the potential to make other contributions to U.S. security and world security as a whole, such as inducing potential aggressors to abandon ballistic missile programs by rendering them useless. Failing that, BMDO believes that the creation of such a universal defense system would provide the impetus for other nations to expand their security agreements with the United States, bringing them under a U. S. sponsored missile defense umbrella.

An SBL platform would achieve missile interception by focusing and maintaining a high powered laser on a target until it achieves catastrophic destruction. Energy for the sustained laser burst is generated by the chemical reaction of the hydrogen fluoride (HF) molecule. The HF molecules are created in an excited state from which the subsequent optical energy is drawn by an optical resonator surrounding the gain generator.

Lasers have been studied for their usefulness in air defense since 1973, when the Mid Infrared Advanced Chemical Laser (MIRACL) was first tested against tactical missiles and drone aircraft. Work on such systems continued through the 1980s, with the Airborne Laser Laboratory, which completed the first test laser intercepts above the earth. Initial work on laser based defense systems was overseen by the Defense Advanced Research Projects Agency (DARPA), but transferred to the newly created Strategic Defense Initiative Organization (SDIO) in 1984. Work continues today under the auspices of the BMDO, the successor to the SDIO.

The SBL program builds on a broad variety of technologies developed by the SDIO in the 1980s. The work on the Large Optics Demonstration Experiment (LODE), completed in 1987, provided the means to control the beams of large, high powered lasers. The Large Advanced Mirror Program (LAMP) designed and built a 4 meter diameter space designed mirror with the required optical figure and surface quality. In 1991, the Alpha laser (2.8 mm) developed by the SDIO achieved megawatt power at the requisite operating level in a low pressure environment similar to space. Numerous Acquisition, Tracking, and Pointing/ Fire Control (ATP/ FC) experiments both completed and currently underway will provide the SBL platform with stable aimpoints. Successes in the field of ATP include advances in inertial reference, vibration isolation, and rapid retargeting/ precision pointing (R2P2). In 1995 the Space Pointing Integrated Controls Experiment offered near weapons level results during testing.

Most recently, the Alpha LAMP Integration (ALI) program has performed integrated high energy ground testing of the laser and beam expander to demonstrate the critical system elements. The next step is an integrated space vehicle ground test with a space demonstration to conclusively prove the feasibility of deploying an operational SBL system.

Future plans include orbiting the SBL Readiness Demonstrator (SBLRD) in order to test all of the systems together in their intended working environment. Designs for the SBLRD satellite call for four major subsystems: the ATP system; providing acquisition, tracking, targeting, stabilization, and assessment capabilities; the laser device, providing the optical power, and beam quality, as well as maintains nozzle efficiency; the optics and beam control systems, enhancing and focus the beam, augmenting the capabilities of the laser device; and the space systems, providing a stable platform, storage of the reactants, and furnish electrical power (but do not power the laser).

The SBLRD is intended to demonstrate the capability to perform boost phase Theater Missile Defense from space. The objectives of the space demonstration include gaining performance information critical to the development of an operational SBL system, as well as gain a general understanding of operating such a system.

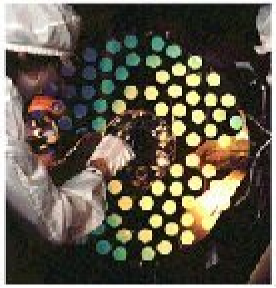
BMDO and the Air Force agreed to transfer the execution of the SBLRD project and the related SBL technology developments to the Air Force. BMDO retained overarching SBL architecture responsibilities.

Alpha High Energy Laser (HEL)

Megawatt class power levels were first achieved by the Mid-Infrared Advanced Chemical Laser (MIRACL) originally sponsored by the Navy, later by DARPA, and then by BMDO. Because the design was intended for sea level operation, the MIRACL laser does not achieve the optimum efficiency necessary for space-based operation. DARPA launched the Alpha laser program, with the goal of developing a megawatt level SBL that was scaleable to more powerful weapon levels and optimized for space operation. In this design, stacked cylindrical rings of nozzles are used for reactant mixing. The gain generation assembly achieves higher power by simply stacking more rings. In 1991, the Alpha laser demonstrated megawatt class power levels similar to MIRACL, but in a low pressure, space operation environment. Alpha demonstrates that multi-megawatt, space-compatible lasers can be built and operated.

Large Advanced Mirror Program (LAMP)

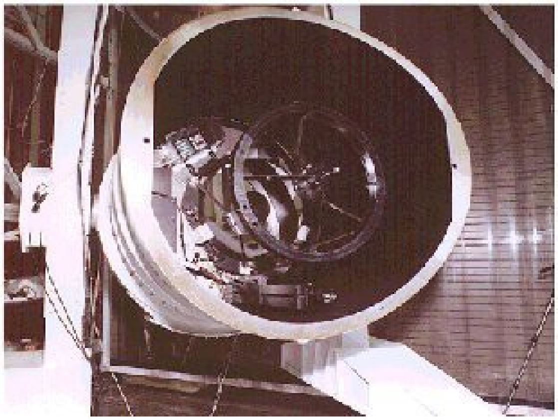
To demonstrate the ability to fabricate the large mirror required by an SBL, the Large Advanced Mirror Program (LAMP) built a lightweight, segmented 4 m diameter mirror on which testing was completed in 1989. Tests verified that the surface optical figure and quality desired were achieved, and that the mirror was controlled to the required tolerances by adaptive optics adjustments. This mirror consists of a 17 mm thick facesheet bonded to fine figure actuators that are mounted on a graphite epoxy supported reaction structure. To this day, this is the largest mirror completed for use in space. This LAMP segmented design is applicable to 10 m class mirrors, and the Large Optical Segment (LOS) program has since produced a mirror segment sized for an 11 m mirror. The large dimension of this LOS mirror segment approximates the diameter of the LAMP mirror



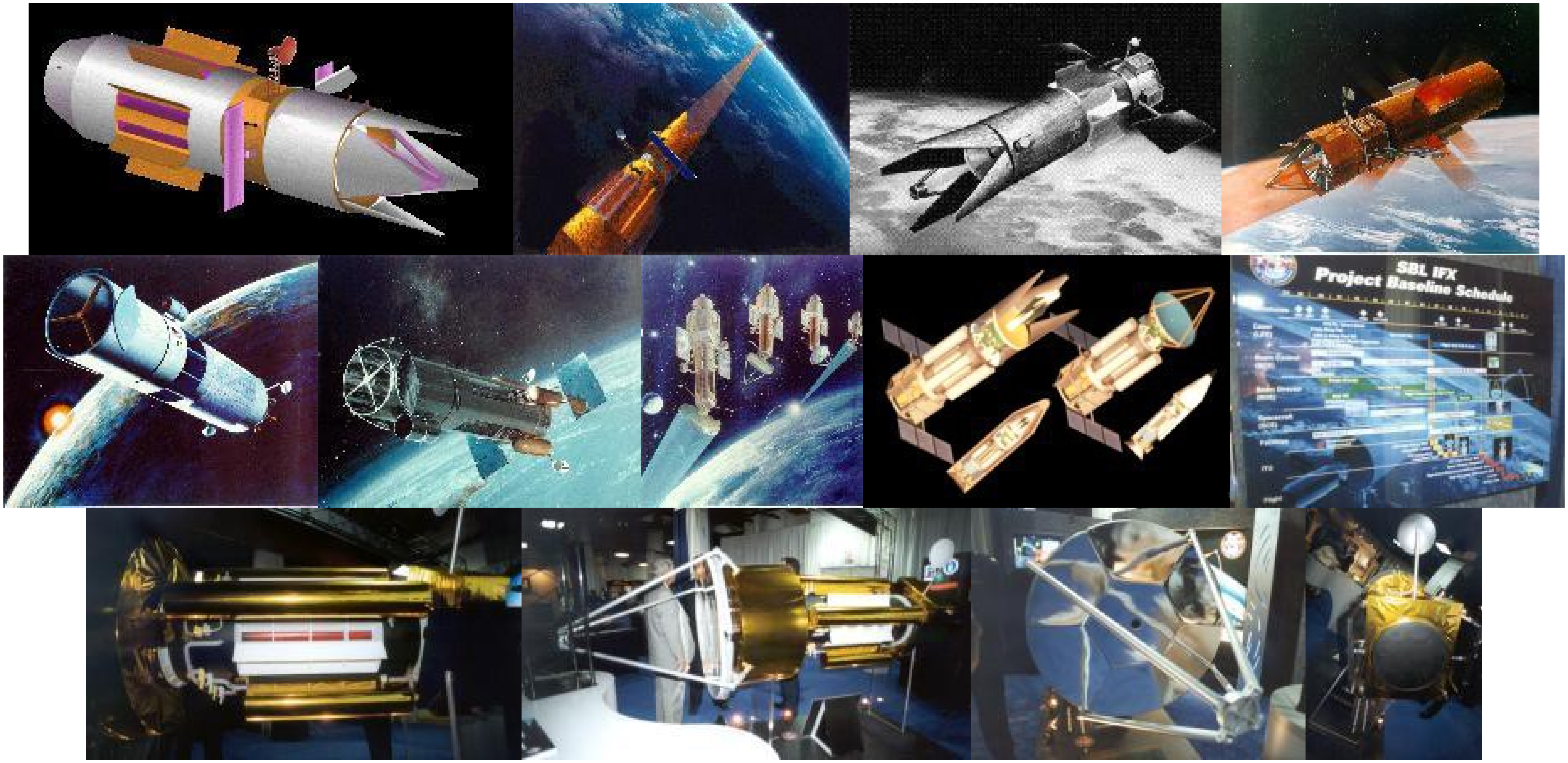
Beam Control- Large Optics Demonstration Experiment (LODE) and ALI

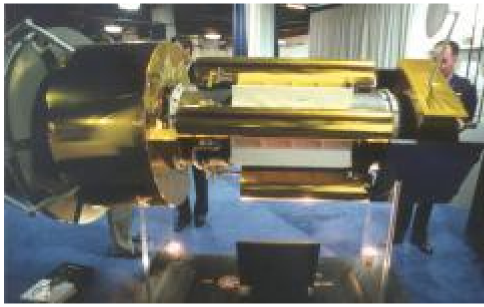
The ability to control a beam was demonstrated at low power under the Large Optics Demonstration Experiment (LODE) in 1987. The current high power beam control technology is now being integrated with the Alpha laser and the LAMP mirror in a high power ground demonstration of the entire high energy laser weapon element. This is known as the Alpha-LAMP Integration (ALI) program.

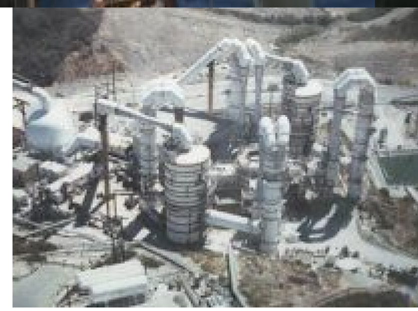
Acquisition, Tracking, Pointing (ATP)



The ATP technologies required (sensors, optics, processors, etc.) have been validated through a series of component and integrated testing programs over the last decade. In 1985, the Talon Gold brassboard operated sub-scale versions of all the elements needed in the operational ATP system including separate pointing and tracking apertures, an illuminator, an inertial reference gyro system, fire control mode logic, sensors and trackers. Talon Gold achieved performance levels equivalent to that needed for the SBL. In 1991, the space-borne Relay Mirror Experiment (RME), relayed a low-power laser beam from a ground site to low-earth orbit and back down to a scoring target board at another location with greater pointing accuracy and beam stability than needed by SBL. The technology to point and control the large space structures of the SBL was validated in 1993 by the Rapid Retargeting and Precision Pointing (R2P2) program that used a hardware test bed to develop and test the large and small angle spacecraft slewing control laws and algorithms. The Space Pointing Integrated Controls Experiment (SPICE) demonstrated in 1995 near weapon scale disturbance isolation of 60-80 db and a pointing jitter reduction of 75:1. In 1998, the Phillips-Laboratory-executed High Altitude Balloon Experiment, (HABE) will demonstrate autonomous end-to-end operation of the key ATP-Fire Control (FC) functions in a realistic timeline against actual thrusting ballistic missiles. HABE will use a visible low-power marker beam as a surrogate to the megawatt HF beam and measure beam pointing accuracy, jitter and drift against a fixed aimpoint on the target.


SBL IFX
Project Baseline Schedule



Current SBL planning is based on a 20 satellite constellation, operating at a 40° inclination, intended to provide the optimum TMD threat negation capability. At this degree of deployment, kill times per missile will range from 1 to 10 seconds, depending on the range from the missile. Retargeting times are calculated at as low as 0.5 seconds for new targets requiring small angle changes. It is estimated that a constellation consisting of only 12 satellites can negate 94% of all missile threats in most theater threat scenarios. Thus a system consisting of 20 satellites is expected by BMDO to provide nearly full threat negation.

SBLRD Characteristics
Weight: 17,500 kg Length: 20.12 m
Diameter: 4.57 m Mirror Diameter: 4.0 m

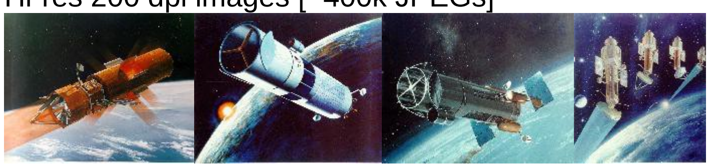
- Hydrogen fluoride chemical energy powered laser.
- On board surveillance capabilities.
- Super reflective mirror coatings allowing for uncooled optics.
- Concurrent NMD / TMD capability.

Resources

- **Space-Based Laser Project Office** - AF SMC
- LASERS IN SPACE TECHNOLOGICAL OPTIONS FOR ENHANCING US MILITARY CAPABILITIES by Mark E. Rogers, Lieutenant Colonel, USAF November 1997 Occasional Paper No. 2 Center for Strategy and Technology Air War College Maxwell Air Force Base, Alabama
- Lasers and Missile Defense: New Concepts for Space-based and Ground-based Laser Weapons, William H. Possel, Lt Col, USAF -- CSAT Occasional Paper No. 5 *Center for Strategy and Technology* Air War College, July 1998

- Laser Options for National Missile Defense Steven G. Leonard; Mark L. Devirgilio (Faculty Advisor) *Air Command and Staff College* 1998 - The Space Based Laser (SBL) can meet the NMD requirements. A 24 SBL satellite constellation can kill 20 Taepo Dong 2 missiles launched anywhere in the world at anytime. Each SBL satellite is projected by BMDO to weigh 17,500 kilograms. Using the Aerospace Corporation's historical cost verses weight information, which shows that satellites average cost is roughly $50,000 per pound, the first satellite in this constellation would approach $2 billion dollars.
- SPACE BASED LASER INTEGRATED FLIGHT EXPERIMENT The U.S. Air Force contracted with an industry joint venture on February 08, 1999 for the Space Based Laser Integrated Flight Experiment (SBL IFX). The award constitutes the first increment of a Cost Plus Award Fee/Cost Plus Fixed Fee contract valued at approximately $2-3 billion once completed.
- Space Based Laser Readiness Demonstrator Acquisition Approach Space and Missile Systems Center Advanced Systems Directorate -- 01 September 1998
- MEMORANDUM FOR ALL POTENTIAL OFFERORS 10 Jul 98
- Draft Request for Proposal 10 Jul 98
- STATEMENT OF OBJECTIVES DRAFT - 10 Jul 98
- SBL Glossary of Terms 10 July 1998
- INFORMATION PROTECTION GUIDE [DRAFT] 10 July 1998
- SECURITY GUIDANCE 10 July 1998
- Interest in "Other than Prime" for the SBLRD Contract(17 Jun 98)
- DRAFT STATEMENT OF OBJECTIVES 9 June 1998
- Interim Request for Proposal Release 15 Jun 98
- Teaming within Space Based Laser (SBL) Project Competition 9 Feb 98
- STATEMENT OF OBJECTIVES (23 Jan 98)
- DRAFT TECHNICAL REQUIREMENTS DOCUMENT (TRD) 23 January 1998
- Answers to Questions Submitted at Industry Day- 26 Aug 97 (11 Sep 97)
- SBL Technologies Request for Information 11 Sep 97
- SBL Technologies Request for Information 11 Aug 1997
- SBL Technologies Request for Information 29 July 1997

  Hi-res 200 dpi images [~400k JPEGs]



- ***Appendix B***

- ***Appendix C***

The Star Wars Beam Weapons

and

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by

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(originally posted: October 17, 2006)

Appendix 3

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This page last updated, November 07, 2006

Source: http://www.fas.org/spp/starwars/program/docs/occppr05.htm

- ***Lasers and Missle Defense***

LASERS AND MISSILE DEFENSE:

NEW CONCEPTS FOR SPACE-BASED AND GROUND-BASED LASER WEAPONS

by

William H. Possel, Lt Col, USAF

July 1998

Occasional Paper No. 5

Center for Strategy and Technology

Air War College

Air University

Maxwell Air Force Base, Alabama

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July 1998

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The Author

Lieutenant Colonel William H. Possel, USAF, has directed space system acquisitions and operations throughout his military career. Prior to the Air War College, he was Director of Production for the Titan IV space booster. His other assignments included tours with the Secretary of the Air Force for Special Projects, with responsibility for managing classified satellite technology programs and directing satellite operations at two mission ground stations. In addition, he served as a project officer for ground-based high-energy laser experiments as well as experiments on the Space Shuttle. Lt. Col. Possel has a bachelor's degree in physics from the University of Cincinnati and a master's degree in engineering physics from the Air Force Institute of Technology. He is a graduate of Squadron Officer School, Air Command and Staff College, and the Advanced Program Management Course at the Defense Systems Management College. A 1998 graduate of the Air War College, Lt. Col. Possel conducted this research under the auspices of the Center. His current assignment is the Program Manager of the Atlas space launch vehicle, Space and Missile System Center, Los Angeles Air Force Base, California.

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To put together a research paper of this magnitude in less than a year would not have been possible without the support of many experts. I would like to acknowledge Dr. Dustin Johnston of the Schafer Corporation, Mr. Larry Sher, Mr. William Thompson of the Air Force Research Laboratory, Phillips Research Site, and fellow classmate Lt Col Ken Barker, all of whom graciously provided useful information and insightful comments. My Air War College faculty advisors, Dr. William Martel and Col (Ret) Theodore Hailes, gave me invaluable encouragement and assistance. My deepest thanks and appreciation go to my ever-patient family, my wife, Marie, and daughters, Angela and Therese for their support and understanding. They have continually provided me with love and understanding. That being said, I alone am responsible for any inadequacies in this paper.

Abstract

Is the Department of Defense (DOD) pursuing the correct investment strategy for space-based laser weapons? Recent advances in lasers, optics, and spacecraft technologies may bring high-energy laser weapons to a sufficient level of maturity for serious consideration as space weapons against the

theater ballistic missile threat. However, these technological advances also make other architectures possible, such as the use of terrestrial laser sources with space-based relay mirrors or a mixed force of space-based lasers with orbiting relay mirrors. An important question is how these dramatic technology improvements have affected the strategic employment concepts for high-energy laser weapons.

This study presents a comparison of competing space-based architectures given the progress made with high-energy lasers, large optics, and atmospheric compensation techniques within the past several years. Three space-based architectures are evaluated against the potential ballistic missile threat: space-based lasers, ground-based lasers in conjunction with orbiting mirrors, and a combined approach using space-based lasers with orbiting mirrors. The study evaluates the technological risks and estimates the development and deployment costs. In addition, technology development programs are described for each of the architectures so that the high-risk areas will be better understood.

The conclusion of this study is that the most technologically sound and cost-effective architecture is to use space-based lasers with orbiting mirrors. This approach not only minimizes the overall technological risk but also reduces the total weight and, therefore, cost of placing these weapon systems on orbit.

I. Introduction

The United States Air Force (USAF), in conjunction with the Ballistic Missile Defense Organization, is struggling to determine the best investment strategy for space-based high-energy lasers as weapons against ballistic missiles. The debate is crucial not only because the technology has dramatically improved over the past few years, but also because defense procurement budgets continue to decline. Selecting this investment strategy presents a challenge for policy makers due to competing technical, fiscal, and political factors. The Air Force is studying only one high-energy laser architecture that uses space systems, which is the space-based laser concept. Other potential options, although not currently under consideration, consist of ground-based lasers with orbiting relay mirrors or a hybrid system using space-based lasers with orbiting mirrors. This assessment of the current laser and optics technology and an evaluation of the competing architectures will provide insights into the best investment strategy for the United States. [1]

The laser is perhaps the most important optical invention in the last several decades. Since its invention in the early 1960s, the laser has proved to be an extremely useful device not only for the scientific and commercial communities, but also for the military. At first it was considered to be “a solution without a problem,” because as with many inventions, the technology appeared before the vision. Today, the laser is at the heart of an extensive array of military applications: range finders, satellite communications systems, remote sensing, target designation, and laser radar-based navigational aids.[2] The employment of laser-guided munitions in Operation Desert Storm brought new meaning to the idea of “precision engagement,” and represents just one example of how the laser has shifted to become “a solution.”[3] In fact, numerous countries are now developing their own laser technologies for weapons applications.[4] Since the early 1990s, lasers have demonstrated the capability to produce sufficient energy to merit serious consideration, even by the most ardent skeptics, as potential weapons against the ballistic missile threat.[5] That vision for new and smarter uses of lasers is rapidly catching up with the technology.

Today, the Air Force is proceeding with the development of the Airborne Laser (ABL) program, which is designed to acquire, track, and destroy theater ballistic missiles.[6] The USAF is committed to the ABL as the near term weapon of choice for destroying theater ballistic missiles while they are still over enemy territory. This may be the first step toward building a space-based laser weapon system.[7]

In addition to the ABL, the Ballistic Missile Defense Organization (BMDO) is funding a program to demonstrate the feasibility of a high-energy laser weapon in space. This program, the Space-Based Laser Readiness Demonstrator, which is estimated to cost $1.5 billion, is a subscale version of a proposed space-based laser weapon system for theater ballistic missile defense.[8] Congress continues to debate not only the usefulness of this concept but also its implications for the Antiballistic Missile (ABM) treaty. A number of lawmakers believe that the laser weapon provides such a valuable defense that it is worth abrogating the treaty.[9]

The underlying assumption with the current concept of laser weapons is that the entire weapon platform must be deployed in space because this is the most technologically feasible and cost-effective approach. But several other options are conceptually possible. One alternative architecture involves placing the laser device on the ground and employing optical systems, which are basically large mirrors, to relay the laser beam to the target. Another option that merits consideration entails using a combination of space-based lasers and optical relay mirrors in order to reduce the number of costly laser platforms.

A number of tough questions need to be asked and thoroughly explored. Are laser platforms orbiting the earth the most technologically realistic and cost-effective means of destroying ballistic missiles? Can the mission be achieved more efficiently with orbiting mirrors to relay the laser beam from the ground or from a smaller number of space-based lasers to the target? Are there insurmountable technological problems with any of these approaches? If these approaches are feasible, are there any remaining significant technological shortfalls and what is the most effective way of overcoming them?[10]

The purpose of this study is to conduct an independent assessment of the competing system architectures that utilize space-based assets for missile defense. The foundation of the analysis is three evaluation criteria: technological feasibility, technological maturity, and relative cost. This study also provides an overview of the ballistic missile threat and an understanding of the proliferation of missiles and missile vulnerability. The types and material characteristics of ballistic missiles determine how much laser energy is required to destroy them, and therefore the size and number of laser weapons. Following this discussion is a summary of the critical technologies required for an effective laser weapon system and what technologies have actually been demonstrated to date. The purpose is to give the reader an appreciation of how far the technology has developed and the remaining technological complexities that must be confronted.

This evaluation of the system architectures examines three alternatives for high-energy laser weapon concepts that use space assets: a space-based laser system, a ground-based laser with orbiting mirrors, and a combination of space lasers and orbiting mirrors. Based on the current missile threat and the energy required to destroy missiles, this analysis considers the requirements for each weapon constellation. Following each overview of these architectures, this study presents an analysis of the technology and technology development programs that are needed for these programs. The cost for each architecture will be analyzed with a cost model that reflects experiences with previous space mission programs, and thus will support a comparison of the relative costs of these different architectures.

The broad objective of this study is to establish a framework that will help Air Force policy makers make prudent decisions about the proper direction for funding technology development programs. This study addresses which high-energy laser weapon system concept (space-based laser, ground-based laser with orbiting mirrors, or a hybrid of fewer space-based lasers with supporting orbiting mirrors) is the most effective, technologically achievable, and affordable for the United States.

II. Evaluation Criteria

Laser weapon architecture studies conducted in the 1980s focused on defense against a massive Soviet ICBM attack, but the likelihood of this threat has significantly diminished.[11] The prominent scenario for laser weapon employment has changed from strategic defense to theater or national missile defense. Now the architectures are designed primarily to defend the US and its allies against ballistic missiles carrying weapons of mass destruction from rogue states and terrorist groups. Given these changes in the strategic challenges facing the United States, this is the right time for a new look at the options.

Technology Evaluation Criteria

This study will use a five-point scoring system, similar to the method applied today in government source selections, to evaluate the technological aspects of three space-based laser weapon architectures.[12] Although qualitative in nature, this numerical scoring system allows a relatively straightforward method of comparing the strengths and weaknesses of each concept.

One measurement looks at the technological feasibility of a concept, asking whether this technology concept violates the laws of physics, and whether it requires a significant breakthrough or is within reach of today's technology.

Table 1. Technological Feasibility Evaluation Criteria

Score	Assessment, Description
1	Violates the laws of physics, will never be possible
2	Requires multiple new breakthroughs
3	Major technological breakthroughs, challenges remain
4	No breakthroughs required, engineering issues remain
5	Minor technological and/or engineering issues remain

The other factor in the evaluation is technological maturity. If the technology is achievable, then the question is how much additional investment is required, in terms of development time, before it can be fielded. Several aspects will be considered, including the magnitude of the improvements required, the degree of integration risk, and the environmental limitations of testing these technologies in a zero-gravity environment.

Table 2. Technological Maturity Evaluation Criteria

Score	Description
1	Will require more than 15 years to develop
2	Between 10 to 15 years to develop
3	Between 5 to 10 years to develop
4	Less than 5 years to field
5	Possible to implement today

Cost Assessment Approach

At the risk of understatement, cost continues to be such a key factor in new space programs today that it strongly influences whether a program will proceed to the next stage of development. Numerous studies have examined past space programs in an attempt to understand the factors that influence the cost of these programs. Of all the factors, the three most influential are payload type, weight, and technological readiness.[13] Table 3 presents a range of costs for a variety of space systems.

Table 3. Range of Costs for Space Systems[14]

Type of Space System	Typical Range of Specific Cost ($K/kg)
Communication Satellites	70 - 150
Surveillance Satellites	50 - 150
Meteorological Satellites	50 - 150
Interplanetary Satellites	>130

The two previous tables on evaluation criteria focused on technological feasibility and maturity. A cost estimate for high-technology space programs must consider special factors that relate to technological readiness. One significant cost factor that past high-technology programs have experienced is the fact that technological risks increase program costs. How much the costs actually increase depends on the extent to which the technology has been demonstrated and tested in a space environment.[15]

Table 4. Levels of Technological Readiness[16]

Readiness Level	Definition of Readiness Status	Added Cost
1	Basic principle observed	25%
2	Conceptual design formulated	25%
3	Conceptual design tested	20-25%
4	Critical function demonstrated	15-20%
5	Breadboard model tested in simulated environment	10-15%
6	Engineering model tested in simulated environment	<10%
7	Engineering model tested in space	<10%
8	Fully operational	<5%

An additional cost is that of placing the platform in orbit because launch costs, especially for space lasers, are likely to be a significant factor. The cost of transporting a satellite into low earth orbit ranges from $9,400 to $32,400 per kilogram.[17] The Space Shuttle and Titan IV are in the class of the launch vehicles that are required to put space-based laser platforms into orbit. For these launchers, the cost for putting low-earth payloads into orbit is $11,300 and $18,400 per kilogram, respectively.[18] The typical costs for geosynchronous earth orbits are $14,000 to $30,800 per kilogram,[19] but these costs may be reduced by as much as fifty percent with the Air Force's proposed Evolved Expendable Launch Vehicle.[20]

While higher fidelity cost models for space systems are available, these are beyond the scope of this paper.[21] Therefore, the crucial aspect of this discussion is the relative cost comparison of the three architectures, which for this purpose will be based solely on weight, technological readiness, and launch costs.* Before examining the different laser systems, the next section

* The costs estimates in this paper do not include mission operations and refueling or replacing the satellites. A rule-of-thumb is that these costs run between 10 to 25 percent of the total program costs.

examines the ballistic missile threat and the vulnerabilities of ballistic missiles as part of an evaluation of these alternative architectures.

III. Ballistic Missile Vulnerabilities

Desert Storm highlighted the significant threat posed by ballistic missiles, particularly to our allies, and perhaps to the United States in the future. Even though Iraqi missiles were inaccurate and conventionally armed, these weapons created a significant menace and had significant political effects on the conduct of the war.[22] Today, there is a significant danger of ballistic missiles carrying weapons of mass destruction given the number of rogue states that are developing missile technology as well nuclear, chemical, and biological weapons. According to the testimony of a science advisor to former President Reagan before the Senate Governmental Affairs subcommittee on proliferation, “Today, opportunities for developing countries to acquire long-range ballistic missiles are at an all-time high.”[23] Not only do well-developed countries such as China, Russia, and France possess missiles, but smaller countries also are either developing the technology or importing ballistic missiles.

Missile Threats

Ballistic missiles appear to be the preferred weapon for rogue countries to terrorize neighboring states. These countries observed the effect that the Iraqi ballistic missiles had on the coalition forces during Desert Storm, particularly in nearly drawing Israel into the war. Even though most of the missiles are inaccurate and have a relatively low military utility, to rogue states they present an attractive means of intimidating neighboring countries without the large costs required for conventional forces. It is also a matter of prestige and a symbol of national power both inside and outside of their country.

Missiles can hit their targets, usually cities, within minutes of launch, are relatively inexpensive and, until Desert Storm, do not face active defenses.[24] Some 36 countries have been identified as possessing ballistic missiles of some type, and 14 nations have the capability to build them.[25] These missiles, which range in size from large intercontinental ballistic missiles (ICBMs) to small Scud missiles, are dispersed worldwide.

The world's major powers possess the most technologically advanced missiles. While Russia and China both possess ICBMs capable of striking North America, the threat of either country launching such an attack against the U.S. is extremely low. India has developed a space-launch vehicle that could be modified for use as an ICBM.[26] These programs fuel concerns that these countries might provide assistance to other nations that seek to develop new ballistic missiles.[27]

There is increasing concern with the rapid proliferation of short-range ballistic missiles (SRBMs) and medium-range ballistic missiles (MRBMs). North Korea's Scud Bs and Scud Cs, both of which are short-range missiles, could easily hit cities in South Korea and Japan. North Korea is also developing the Taep'o-dong II missile with a range estimated between 7,500 kilometers and 10,000 kilometers. With a range of 7,500 kilometers, the Taep'o-dong II could reach Alaska or Hawaii, and if the longer-range estimate is correct, these missiles could strike the western reaches of the continental United States.[28] Some experts predict the missile may be operational by the year 2000.[29]

Missile technology is a profitable export item for several nations. A number of countries are willing to export complete systems, technologies, and developmental expertise for the income that is generated by foreign sales. China, North Korea, and several industrialized states in Europe are supplying ballistic missiles and missile-related technologies, which further increases the number of nations with ballistic missile capabilities.[30] Iran possesses submarine launched cruise missiles (SLCMs) through its purchases of Kilo class submarines from Russia. The United Nations has attempted to curtail the sale of missile technology through the Missile Technology Control Regime (MTCR).[31]

The addition of weapons of mass destruction to a missile's warhead radically increases the threat. Ballistic missiles that are armed with nuclear, chemical, or biological warheads could provide nations with an effective tool for conducting asymmetric warfare. Following Desert Storm, rogue states realized that ballistic missiles have great political significance, especially since they are becoming readily available and are being combined with weapons of mass destruction. This combination adds a new dimension to the threat to the United States and its allies.[32]

An additional problem is that India, Pakistan, and several Middle Eastern countries have refused to sign the Nuclear Nonproliferation Treaty (NPT), and are suspected of exporting nuclear technology. While China adheres to the treaty, it has not adopted the export policies of the Nuclear Suppliers Group and continues to sell nuclear energy and research-related equipment to countries with nuclear weapons programs.[33] Many countries have offensive chemical weapons programs; the most aggressive of which are Iran, Libya, and Syria, all of which refused to sign the Chemical Weapons Convention (CWC).[34] A summary of ballistic missile proliferation is shown in Table 5.

Table 5. Ballistic Missile Capabilities by Country[35]

	SRBM	MRBM	IRBM	ICBM	Cruise Missile	Nuclear	BW	CW	NPT	CWC	MTCR
Argentina	X				X	Capability			X	X	X
Belarus	X			X	X	X			X	X	
Brazil	X					Capability				X	X
China	X	X	X	X	X	X	X	X	X	X	
India	X		X		X	X	X	X		X	
Iran	X	X			X	Develop	X	X	X	X	
Iraq	X	X			X	Develop	X	X	X		
Libya	X				X		X	X	X		
N. Korea	X	X	Develop				X	X	X		
Russia	X	X	X	X	X	X	X	X	X	X	X
Syria	X	X					X	X	X		
Ukraine	X			X	X	X			X	X	

In view of this growing threat to the United States, the DOD, with strong support from Congress, is pursuing a number of defensive systems that are designed to counter these missiles. The Ballistic Missile Defense Organization is developing a family of missile defense systems for the specific purpose of defeating ballistic missile attacks. In view of the diversity of missiles owned by countries that are hostile to the United States, there is a growing realization that no single system can accomplish the entire mission. What is emerging is an integrated approach in which the United States is designing lower-tier defenses to intercept missiles at low altitudes within the atmosphere and upper-tier systems to intercept missiles outside the atmosphere and at long ranges. The Army's Patriot system, which was used during Desert Storm, demonstrated the political and military value of a lower-tier ballistic missile defense.[36] A high-energy laser is a potential weapon for the upper-tier defense.

Ballistic Missile Vulnerabilities from Lasers

The view in DOD is that high-energy laser weapons represent the most promising response to the increased threat posed by ballistic missiles.[37] Unlike the larger intercontinental ballistic missiles, the fact that small ballistic missiles are constructed with lighter weight materials and thinner outer skins increases their vulnerability to laser weapons. Indeed, a laser beam is probably the ideal instrument for destroying a ballistic missile. With its tremendous speed, lack of recoil, and extremely long range, the laser offers the potential to destroy missiles during the boost phase, which would have the added benefit of keeping possible nuclear, biological, or chemical warheads on the enemy's side of the border.

The key factor in designing a cost effective weapon architecture is determining the exact amount of laser energy required to destroy a missile. In order for a laser weapon to destroy a ballistic missile, the missile skin must be heated, melted, or vaporized. For a laser to disable a missile, it must concentrate its energy on certain parts of the missile and hold the beam steady for a long enough time to heat the material to the failure point. The effectiveness of the laser depends on the beam power, pulse duration, wavelength, air pressure, missile material, missile velocity, and the thickness of the missile's skin.[38] If the laser could specifically target the electronic circuits, which are used for guidance control, it would render the missile incapable of staying on course.[39] These circuits are relatively easy to destroy but difficult to target precisely. Another kill mechanism is to melt a section of the material surrounding the missile's fuel tank and detonate the fuel. A third and more realistic approach is to heat the missile skin until internal forces cause a failure of the skin around the fuel tank. This type of failure produces a rupture of the missile given the enormous internal pressure in the fuel tank. It also requires the least amount laser energy to destroy the missile.[40]

How much energy is required to rupture the skin of a missile depends on the material and thickness of the missile skin.[41] Table 6 presents a list of different ballistic missiles with their range, burn time, skin material, and skin thickness. The energy from the laser must be focused on the target long enough for the skin material to absorb the radiation and cause the missile fuel tank to rupture before the heat dissipates. A general value for this energy (called “lethal fluence”) is one kilojoule per square centimeter, although the exact fluence value varies slightly for each missile.[42]

Table 6. Missile Vulnerability Parameters[43]

Name/Country of Missile	Range (km)	Missile Burn Time (sec)	Material	Thickness (mm)
Scud B (Russia)	300	75	steel	1
Al-Husayn (Iraq)	650	90	steel	1
No Dong-1 (North Korea)	1000	70	steel	3

SS-18 (Russia)	10,000	324	aluminum	2

This table illustrates some of the parameters required to determine the exact amount of energy that must be absorbed by the missile to cause a structural failure. If one calculates that the missile skin has ninety percent reflectivity (meaning that only ten percent of the laser energy on target is absorbed), the laser fluence on the missile would need to be ten times greater.[44] Yet, laser weapons will be required to produce even greater amounts given the energy that is lost to atmospheric absorption, thermal blooming, laser beam jitter, and pointing errors.

IV. Current State of Laser Weapon Technology

By virtue of their ability to destroy a missile at the speed of light, high-energy lasers are extremely attractive weapons against ballistic missiles. With the development of the first lasers in the early sixties, military scientists have been pushing laser technology to achieve greater laser power, better optics, and improved target acquisition, tracking, and pointing technologies. The next section presents an overview of the current state of laser weapon technologies that are critical to understanding the technological risks that are associated with fielding any laser weapon system.

Lasers

In 1917, Albert Einstein developed the theoretical foundation of the laser when he predicted a new process called “stimulated emission.” It was not until 1958 that A. Schawlow and C. H. Townes actually built a device that utilized this theory and successfully exploited Einstein's work. Following the birth of the first laser, a myriad of lasers with different lasing materials and wavelengths were rapidly developed. All of the lasers that are under consideration for weapons applications were designed and built in the pioneering days of the laser that occurred between the early 1960s and into the late 1970s.[45]

Three laser systems are being considered for space-based and ground-based laser weapons. These are all chemical lasers and involve mixing chemicals together inside the laser cavities to create the laser beam. Chemical reactions create excited states of the atom or molecule and provide the energy for the laser.[46] The competing lasers are hydrogen fluoride (HF), deuterium fluoride (DF), and chemical oxygen iodine (COIL).

Hydrogen Fluoride Laser. The hydrogen fluoride laser operates much like a rocket engine. In the laser cavity, atomic fluorine reacts with molecular hydrogen to produce excited hydrogen fluorine molecules. The resulting laser produces several simultaneous wavelengths in the range of 2.7 microns and 2.9 microns. The laser beam, at these wavelengths, is mostly absorbed by the earth's atmosphere and can only be used above the earth's atmosphere.[47] This laser is the leading contender for the Space-Based Laser (SBL) program.

The Ballistic Missile Defense Organization continues to support the hydrogen fluoride laser for space-based defenses.[48] The Alpha program, originally funded by Defense Advanced Research Projects Agency (DARPA) in the 1980s, then the Strategic Defense Initiative Office (SDIO), and now BMDO, has successfully demonstrated a megawatt power laser in a low-pressure, simulated space environment.[49] The design is compatible with a space environment, is directly scalable to the size required for a space-based laser, and produces the power and beam quality specified in the SDIO plan in 1984.[50] This laser has been integrated with optical systems from the Large Advanced Mirror Program, described later, and has been test fired at the TRW San Juan Capistrano test facility in California.[51]

Deuterium Fluoride Laser. The deuterium fluoride laser operates on the basis of the same physical principles as the hydrogen fluoride laser. Rather than molecular hydrogen, deuterium (a hydrogen isotope) reacts with atomic fluorine. The deuterium atoms have a greater mass than hydrogen atoms and subsequently produce a longer wavelength laser light. The deuterium fluoride laser wavelengths, 3.5 to 4 microns, provide better transmission through the atmosphere than the hydrogen fluoride laser.[52] However, the principal drawback of the longer wavelength is that larger optical surfaces are required to shape and focus the beam. This type of laser has been refined and improved since the 1970s.

The Mid-Infrared Advanced Chemical Laser (MIRACL), built by TRW Inc., is a deuterium fluoride laser that is capable of power in excess of one megawatt.[53] The system was first operational in 1980 and since then has accumulated over 3,600 seconds of lasing time.[54] This laser system has been integrated with a system called the SEALITE Beam Director, which is a large pointing telescope for high-energy lasers, and in 1996 successfully shot down a rocket at the U.S. Army's High-Energy Laser Systems Test Facility at the White Sands Missile Range.[55]

Chemical Oxygen Iodine Laser. Another relatively new and promising laser, the chemical oxygen iodine laser, or COIL, which was first demonstrated at the Air Force Weapons Laboratory in 1978. The lasing action is achieved by a chemical reaction between chlorine and hydrogen peroxide that produces oxygen molecules in an electronically-excited state. Excited oxygen molecules transfer their energy to iodine atoms by collisions, which raises the iodine atoms to an excited state. The excited iodine atom is responsible for lasing at a wavelength of 1.3 microns, which is shorter than the output of the hydrogen fluoride or deuterium fluoride laser. One significant advantage of this laser is that the shorter wavelength allows for smaller optics than the other lasers.[56] In addition, this wavelength of light transmits through the atmosphere with less loss from water vapor absorption than the hydrogen fluoride laser.[57] These advantages have accelerated the funding and development of the COIL.

This laser, which was selected by the Air Force for the Airborne Laser missile defense system, will be placed in the rear of a 747 to serve as the “killing” beam against theater ballistic missiles. A test of the COIL conducted by TRW in August 1996 produced a beam with power in the range of hundreds of kilowatts that lasted several seconds.[58]

Optics

No matter how powerful a laser is, it will never reach its target without optical components. The optical components not only “direct” the beam through the laser to its target, but they also relay the laser energy and, when required, correct for any atmospheric turbulence that will distort the beam. The tremendous advances in optics have played a key role in convincing the Air Force that laser weapon systems can be produced. Without these successes by government laboratories and industry, high-energy laser weapons would be impossible.

Adaptive Optics. The reason stars twinkle in the night sky is due to atmospheric turbulence, which also will distort and degrade any laser. This effect has especially severe effects for the shorter wavelength lasers, such as COIL.[59] These systems require sophisticated optics in order to “pre-compensate” the laser beam for atmospheric turbulence.[60] To pre-shape the laser beam, an adaptive optics technique is used. Over the past several years, the Air Force Research Laboratory, Phillips Research Site, and the Massachusetts Institute of Technology's Lincoln Laboratory have made significant strides in adaptive optics.[61]

The principle behind adaptive optics is to use a deformable mirror to compensate for the distortion caused by the atmosphere. The system first sends out an artificial “star” created by a low power laser. When that laser beam is scattered by the atmosphere, the scattering radiation is reflected back and measured so that the system knows just how much the atmosphere is distorting the laser. By feeding this information into a complex control system, the deformable mirror, with its hundreds of small actuators positioned behind the mirror, alters the surface of the mirror to compensate for atmospheric distortion. Thus, a high-energy laser can be “pre-distorted” so it will regain its coherence as it passes through the atmosphere.[62]

The Starfire Optical Range at the Phillips Research Site has successfully demonstrated the adaptive optics technique. It has a telescope with the primary mirror made of a lightweight honeycomb sandwich, which is polished to a precision of 21 nanometers, or approximately 3,000 times thinner than a human hair. To compensate for the distortion caused by gravity, the primary mirror has 56 computer-controlled actuators behind its front surface to maintain the surface figure. The 3.5-meter telescope adaptive optics system has a 941-actuator deformable mirror that is controlled by a complex computer system.[63] What has been accomplished at the Starfire Optical Range represents possibly the most significant revolution in optical technology in the past ten years.[64]

Large Optical Systems. In addition to adaptive optics, large mirrors, either on the ground or in space, are needed to expand and project the laser energy onto the missile. Several significant large optics programs were conducted in the late 1980s and early 1990s. The Large Optics Demonstration Experiment (LODE) established the ability to measure and correct the outgoing wavefront of high-energy lasers.[65] The Large Advanced Mirror Program (LAMP) designed and fabricated a four-meter diameter lightweight, segmented mirror.[66] This mirror consists of seven separate segments that are connected to a common bulkhead. The advantages of building a mirror in segments are to reduce the overall weight and fabricate larger mirrors. In addition, each segment can be repositioned with small actuator motors to slightly adjust the surface of the mirror. The program's finished mirror successfully achieved the required optical figure and surface quality for a space-based laser application.[67]

Acquisition, Tracking, Pointing, and Fire Control

Directing the laser energy from the optics to the target requires a highly accurate acquisition, tracking, pointing, and fire control system. A laser weapon system, either space-based or ground-based, needs to locate the missile (acquisition), track its motion (tracking), determine the laser aim point and maintain the laser energy on the target (pointing), and finally swing to a new target (fire control). The accuracy for each component is stringent because of the great distances between the weapon and the targets.[68]

The United States put considerable time and resources into both space and ground programs in acquisition, tracking, and pointing technologies. Space experiments are critical to any high-energy laser weapon system because they demonstrate the high-risk technologies and do so in the actual operational environment. However, the space programs in the 1980s suffered from high costs and the space shuttle *Challenger* accident.[69] While many programs were terminated or had their scope reduced due to insufficient funding, two highly successful space experiments were completed in 1990. The Relay Mirror Experiment demonstrated the ability to engage in high accuracy pointing, laser beam stability, and long duration beam relays. This is a critical technology for any weapon architecture that requires relay mirrors in space. Another successful test was the Low Power Atmospheric Compensation Experiment that was conducted by the MIT Lincoln Laboratory, which demonstrated the feasibility of technologies that are designed to compensate for the atmospheric turbulence that distorts laser beams.

A number of the space experiments were canceled or redesigned as ground experiments. Ground experiments can be successfully conducted as long as the tests are not limited or degraded by the earth's gravity. Two ground experiments demonstrated the key technologies that are essential for the space weapon platform to maintain the laser beam on the target despite the large vibrations induced by the mechanical pumps of a high-energy chemical laser.[70] The Rapid Retargeting/Precision Pointing simulator was designed to replicate the dynamic environment of large space structures. Using this technology, which is especially critical for a space-based laser, scientists tested methods to stabilize the laser beam, maintain its accuracy, and rapidly retarget. Within the constraints of a ground environment, the techniques developed should be applicable to space systems.[71]

Another successful experiment was the Space Active Vibration Isolation project, which established a pointing stability of less than 100 nanoradians. This equates to four inches from a distance of 1000 kilometers. The Space Integrated Controls Experiment followed that program and further improved the pointing stability.[72] To understand the technology necessary to control large structures, such as space mirrors, the Structure and Pointing Integrated Control Experiment (SPICE) was developed to demonstrate the value of active, adaptive control of large optical structures.[73] These tests, experiments, and demonstrations represent the current state-of-the-art in laser technology, which leads to the question of how to fit these technologies into an architecture and how much further to push the technology.

V. Space-Based Laser Architecture

A space-based weapon system possesses unique capabilities against ballistic missiles. It has the distinct advantage over ground systems of being able to cover a large theater of operations that is limited only by the platform's orbital altitude. As the platform's altitude increases, the size of the area it “sees” increases. Ultimately, if the platform is orbiting in a geosynchronous orbit, it can provide coverage of nearly half the earth's surface. Alternatively, if a laser is deployed in low-earth orbit, it decreases the distance from the laser to the missile, and yet increases the number of weapon platforms that are required to provide global coverage. Each alternative presents a range of strengths and weaknesses as those pertain to effectiveness, technological feasibility, and cost.

The concept of space-based laser (SBL) weapons has been contemplated since the 1970s. SBLs have been considered for offensive and defensive satellite weapons as well as ICBM defense.[74] The original Strategic Defense Initiative (SDI) architecture was designed to destroy the Soviet Union's ICBMs in the boost phase before the deployment of independently-targeted re-entry vehicles or warheads. As an example of a Strategic Defense Initiative-type scenario, a study suggested that if the Soviets attacked with 2,000 ICBMs, all launched simultaneously, the system would be required to kill 40 missiles per second. This threat drove the space-based laser platform's requirements to a 30 megawatt laser and a ten-meter diameter primary mirror.[75]

Following the collapse of the USSR and the reduced risk of nuclear war, space-based laser concepts have been redirected to defend against theater ballistic missiles. Rather than concentrating on a large number of long-range missiles launched from the Soviet Union, the focus for laser systems is to destroy short-range missiles launched from anywhere in the world. This change in the threat significantly reduces the requirements for laser weapons below that which was outlined in the SDI scenarios in the 1980s.[76]

Operational Concept

The BMDO has completed several space-based laser architecture studies of the orbital altitude, power, optics requirements, and the number of platforms for laser weapons. It has determined that the best concept is a system of twenty space-based laser platforms that operate at an inclination of 40 degrees, 1,300 kilometers above the surface of the earth. In this orbit, the space-based laser can destroy a missile in approximately two to five seconds, depending on the range of the missile. Each laser can retarget another missile in as little as one-half second if the angle between the new target and the laser platform is small. The space-based laser will be capable of destroying a missile within a radius of 4,000 kilometers of the platform. The initial deployment will consist of twelve platforms for partial coverage of the earth, and move eventually toward a constellation of twenty satellites that will provide nearly full protection from theater ballistic missile attacks.[77]

Each space-based laser platform will consist of four major subsystems: a laser device, optics and beam control system, acquisition, tracking, pointing and fire control (ATP/FC) system, and associated space systems. The laser device will be a hydrogen fluoride laser that operates at 2.7 microns. A primary mirror, with a diameter of eight meters, will utilize super-reflective coatings that will allow it to operate without active cooling, despite the tremendous heat load from the laser energy.[78] One estimate for the laser power is eight megawatts.[79] The fire control system includes a surveillance capability and a stabilized platform to maintain the beam on the target despite the jitter produced by the mechanical pumps of the high-energy laser. The associated space systems provide the necessary electrical power, command and control, laser reactants, and on-board data processing. The estimated weight of each space-based laser is 35,000 kilograms.[80] For comparison, the Hubble Space Telescope is 11,000 kilograms and Skylab was 93,000 kilograms.[81]

Architecture Evaluation

The space-based laser concept has to overcome several significant technological and operational challenges, many of which will be addressed with an on-orbit demonstration system. The operational concerns are related to its on-orbit logistics. Since the laser is chemically fueled, the space-based laser is only capable of a limited number of shots before its fuel is depleted. The current concept calls for 200 seconds of total firing time. With this much fuel, the space-based laser is capable of at least 75 shots against typical theater ballistic missiles. When the fuel is expended, the space-based laser must be either refueled in space or replaced.[82] Another potential hurdle is getting these platforms into space.

Technology Assessment. While individual pieces of technology have been developed, to date no such system has been integrated and demonstrated. The Alpha program demonstrated a hydrogen fluoride high-energy laser, which could be scaled up to the power levels required for an operational laser. In the case of optical components, the Large Optics Demonstration Experiment and Large Advance Mirror Program verified critical design concepts for large optics and beam control, but at only half the size of the operational laser. Several other programs described earlier proved the ability to accurately acquire, track, and point large structures.

One significant remaining question is whether all of these systems can be effectively integrated into a space platform. An on-orbit demonstration of an integrated system addresses those issues. The Space-Based Laser Readiness Demonstrator (SBLRD) is a proposed half-scale version of the operational laser platform. This demonstrator offers the potential to reduce the risks associated with fielding such a complex entity by integrating the various subsystems into a space-qualified package.[83] The system will consist of a high-energy hydrogen fluoride laser operating at one-third the output power of the operational laser. The acquisition, tracking, and pointing subsystem and the laser beam will not operate concurrently since this may violate the ABM treaty. At an estimated weight of 16,600 kilograms, which is slightly more than half the operational weight, the laser demonstrator will be launched on the Titan IV booster or the new Evolved Expendable Launch Vehicle. On-orbit tests will consist of deploying large target balloons to test the accuracy of the laser tracking and pointing subsystem. In addition, rockets with sensors will be launched as test vehicles. The test program, if we optimistically assume a launch date of 2005, will span three years. [84]

If the laser demonstrator comes to fruition, the maturity and feasibility of the space-based laser program will be significantly enhanced. The previous technology programs have demonstrated that most of the basic engineering obstacles can be overcome. The remaining concerns for the platforms are system engineering, integrating the subsystems, and demonstrating that they can work together in a space environment. The engineering that is required for the laser demonstrator would address most aspects of the laser platform. All of these steps are essential before the US can commit to develop a space-based laser system.

Another significant challenge facing the program is the launch vehicle for the full-scale platforms. The next generation launch booster, the follow-on to the Titan IV, will have the same capacity to place a payload of 22,000 kilograms into low earth orbit.[85] If the dimensions of the laser platform cannot be reduced, this limit on payload size will require that each laser platform is launched on two rockets and assembled in space, or for the development and fielding of a new class of launch vehicles. However, a new launch vehicle developed specifically for the space-based laser is not a likely option in view of how long the DOD has been trying to replace the Titan IV.[86] Assembling a large system such as a space-based laser in space has never been tested. Further studies are required to consider alternatives to reduce the weight or demonstrate the feasibility of assembling the system in space. For this reason, the assessment for the launch received a lower rating than the other subsystems. Furthermore, the maturity ratings for integration were based on a laser demonstrator launch in 2005 with final results by 2008.

Table 7. Space-Based Laser Architecture Technological Assessment

Systems	Feasibility	Maturity
High-Energy Laser	4 (no breakthroughs required)	4 (less than five years to field)
Optical Components	4 (no breakthroughs required	(less than five years to field)

ATP/FC	4 (no breakthroughs required)	(less than five years to field)
Integration	3 (major challenges remain)	(ten to fifteen years to field)
Launch	3 (major challenges remain)	(ten to fifteen years to field)

Note: This assessment assumes the successful development of a space-based laser readiness demonstrator.

Cost Estimate. Numerous government agencies and contractors have analyzed the program costs for the past 15 years. Recently, three independent cost estimates were conducted: a space-based laser contractor in response to an inquiry from the Chairman of the Senate Armed Services Committee (Senator Thurmond); a BMDO internal program office estimate; and the BMDO Capstone Cost and Operational Effectiveness Analysis (COEA) cost estimate. These estimates predicted that the cost could range from $17 billion to $29 billion for 20 platforms, including the work required for the remaining development efforts.[87]

In comparison with other advanced space programs, these cost estimates for the space-based laser are exceptionally low and probably unrealistic. Based on the experience with previous programs, the average cost of military satellites ranged from $50,000 to $150,000 per kilogram. In the case of the proposed space-based laser architecture, the entire constellation's estimated weight is 700,000 kilograms (twenty platforms at 35,000 kilograms each). Using this historical "average" cost of $100,000 per kilogram for the development of a space system, the costs for the platforms are likely to be in the range of $70 billion. Assuming that the laser demonstrator has been successfully tested in space, the technological readiness level, described in an earlier section, is rated as a 7, which effectively increases the cost estimate by ten percent. When launch costs are included, based on the new launch vehicle's proposed costs of $5,650 per kilogram, the total cost rises to $81 billion.* Using this rough estimate, we now have a means for comparing the space-based laser architecture with the following two competing architectures.

Technology Development Programs

Although the space-based laser components are relatively mature, several new technologies offer significant opportunities to reduce the size, cost, and weight of the laser platform. The objective in the near term must be to focus resources on the laser demonstrator because it is extremely risky to deploy

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* The following methodology was used to calculate the cost estimate for the SBL architecture:

1. SBL development cost = SBL total weight x cost per kilogram

= 700.000kg x $100,000/kg

= $70.0 x10^9

2. Added cost for level of technical readiness = development cost x 10%

= (\$70.0 x 10^{10}) x 0.10

= \$7.0 x 10^{9}

3. Launch cost = SBL total weight x cost per kilogram to orbit

= 700.000 kg x \$5650/kg

= \$3,955 x 10^{9}

4. Total cost = development cost + added cost for technological readiness = launch cost

= (\$70.00 x 10^{9}) + (\$70.0 x 10^{9}) + \$3,955 x 10^{9})

= \$80.955 x 109 or about \$81 billion

this weapon system without a successful demonstration of a high-energy laser weapon system in space. The various technologies in a space-based laser have been studied and tested since the 1970s, which implies that any remaining uncertainties exist in the system engineering aspects of building a space-worthy platform.

Investments in several key technologies could improve the performance and reduce the cost of the space-based laser, most notably in the areas of shorter wavelength lasers, larger optics, and improved pointing and tracking. Shorter wavelengths would allow for smaller and lighter optics. Various other laser candidates are possible to replace the hydrogen fluoride laser and produce a shorter wavelength, which includes a derivative of the hydrogen fluoride laser that operates at a wavelength of 1.3 microns.[88] A second alternative is the Chemical Oxygen Iodine Laser that also operates at 1.3 microns and is being pursued by the Airborne Laser program office. New diode lasers are being studied that would combine numerous beams to produce high power outputs at a wavelength as low as 0.8 microns.[89]

In addition to improving lasers, advancing the state of the art in optics is another area of potentially high payoffs. If the laser beam director had a larger primary mirror, the amount of fluence delivered on the target would increase. A larger mirror could focus the laser beam down to a smaller spot size and increase the laser intensity. In return, the laser power output could be reduced, which would save weight and potentially reduce costs.[90] Large optical systems are described in depth in the following section.

The final area for additional investment is in the pointing and tracking technology. Improvements in pointing accuracy would decrease the amount of “smearing” caused by beam jitter, which has the same effect as larger optics or more powerful lasers. Improved pointing could be accomplished by a variety of means. In any case, detailed analyses will identify where to focus efforts for improving pointing accuracy.

VI. Ground-Based Laser Architecture

A second major alternative to destroying theater ballistic missiles with laser weapons is to place the laser on the ground and relay the beam to the missile with large mirrors in space. The distinct advantage of this architecture is that the high-energy laser is kept on the ground, which eliminates the need to fit a laser platform onto an existing launch vehicle and the need to refuel the laser weapon's chemicals in space. In addition, the complex and maintenance-intensive equipment, i.e. the laser, fuels, and pumping systems, are left on the ground. If problems develop with the ground laser systems, the equipment is readily accessible without the need for planning, funding, and recovering satellites from orbit. A further benefit is that the ground laser and beam director are not as constrained by diameter, weight, or volume as is the case for a space platform that must fit within a launch vehicle.

Unlike the space-based laser architecture, the ground-based laser system concept utilizes large optical systems in space to pass the laser beam from a ground laser to the ballistic missile. However, as with the space-based laser, the ground-based laser concept evolved during the Strategic Defense Initiative era, but received far less emphasis than the space-based laser system given the technological challenges involved with this architecture.[91] The earlier-cited Strategic Defense Initiative-type scenario for the ground-based laser system suggested that the system would be required to kill 40 missiles per second, if the Soviets attacked with 2,000 simultaneously launched ICBMs. This scenario drove the architecture requirements for at least 150 ground telescopes and 50 powerful ground lasers.[92] Since then the threat has changed dramatically and so have the technologies. This section presents an architecture that is based on this reduced threat and an evaluation of the technological feasibility, maturity, and cost of this operational concept.

Operational Concept

The ground-based laser architecture consists of multiple ground stations with high-energy lasers placed in different regions of the country. This system includes the laser and two types of space-based optical components: the relay mirror and the mission mirror. For the laser beam to be transmitted through the atmosphere without significant power losses due to absorption, the ground laser most likely would be either a deuterium fluoride or COIL type device. For reference, the problem with a hydrogen fluoride laser is that at its wavelength the laser beam is largely absorbed by the atmosphere.

Since poor weather, such as clouds, wind, and pollution, can distort the laser beam, the ground-based lasers must be located in regions that have good weather year round. A study on laser communications determined that to achieve 99.5 percent availability due to weather conditions, five sites are required, which translates into fifty minutes of poor weather per week at all five sites simultaneously. Typical sites are in the southwest United States, such as California, Arizona, and New Mexico.[93]

Each of the five ground systems would include a high-energy laser, beam director, adaptive optics, acquisition and tracking systems, and related support systems. Of the two possible options in the near-term for the high-energy laser, deuterium fluoride or Chemical Oxygen Iodine Laser (COIL), the COIL is the preferred laser given the advantages associated with its shorter wavelength. But the key question is whether the laser can achieve the necessary energy level. For the ground-based laser concept, the required energy of the laser would need to be substantially greater than the space-based laser, principally because of greater losses due to atmospheric transmission, thermal blooming, and the longer ranges that the beam must travel.

The ground laser would be integrated with a beam director in a fashion that resembles the previously-discussed SEALITE system. Similar to the new large astronomical telescopes, the beam director would have an “active” primary mirror formed by independent mirror segments mounted on mechanical actuators to maintain the optical figure.[94] It would also include a multiple-actuator deformable mirror that operates at high bandwidth to compensate for atmospheric distortion, which is analogous to the adaptive optics system at the Starfire Optical Range. It is worth noting that the technology demonstrated at Starfire overcame one of the fundamental problems with a ground-based laser system.

From the beam director, the laser beam is transmitted through the atmosphere to a constellation of mirrors in space. Changes in the altitude of the space mirrors will affect the diameter required for the beam director's primary mirror, relay mirrors, and mission mirrors, and as well as the number of space mirrors. As an example of just one of many technical and operational tradeoffs, the relay mirror could be positioned in geosynchronous, highly elliptical, or medium earth orbits, where it would “catch” the laser beam and then relay it to the mission mirror. While a geosynchronous or highly elliptical orbit would require a larger diameter relay mirror than the medium earth orbit, at geosynchronous orbit the number of mirrors required to “cover” the world is so much less than medium earth orbit that it effectively reduces the complexity of the laser system. For this architecture, a total of four relay mirrors in geosynchronous orbit would provide the necessary worldwide coverage. One of these mirrors would be positioned as close as possible to the zenith of the ground lasers to minimize atmospheric effects.[95]

Since the mission mirror must receive the incoming laser beam from the relay mirror and then focus the beam onto the target, the mission mirrors would be in low earth orbit. This option reduces the diameter of the mission mirror and produces a correspondingly smaller laser spot on the intended target. As with the relay mirrors, the parameters of the mission mirror depend on a number of factors, including the laser wavelength, relay mirror diameter, mission mirror diameter, and altitude of each mirror.[96]

One particularly intriguing concept for the mission mirror is known as a bifocal mirror. Consisting of two connected telescopes, this system is coupled by smaller mirrors that transfer the beam from the receiving telescope to the transmitting telescope. The first telescope, the incoming receiver, is pointed directly at the relay mirror so that the laser beam is received directly into the primary mirror. This design reduces the loss of laser power from incidence angles that are less than 90 degrees, which essentially ensures that most of the laser light is “caught.” From there the beam is transferred to the second telescope, the outgoing transmitter, which sends it to the target.[97] To achieve the same robustness as the space-based laser architecture for theater ballistic missile defense, twenty mission mirrors would be required.[98] The assumptions that were used to estimate the size and power of the laser and diameter and weight of the space-based mirrors are outlined in Table 8.

Table 8. Ground-Based Laser System Parameters[99]

System Parameters	Comments
Beam Director	8 meter primary
Relay Mirrors	4 mirrors in geosynchronous earth orbit, 20 meter diameter, 40,000 kilometers from ground laser
Mission Mirrors	20 mirrors in low earth orbit, 8 meter diameter for each telescope, 35,000 kilometers from relay mirrors and 4,000 kilometers from target
Laser Power Losses	25 percent due to all effects: atmospheric turbulence, absorption, and cumulative laser jitter
Ground Laser Output Power	25 megawatts based on ranges between laser and space mirrors and power loss values

In addition to the large primary mirrors, each mirror satellite also includes an active control system for the mirror surface, laser beam aberration reduction, and optics to focus the beam, as well as satellite “housekeeping” subsystems (power, communication, attitude control, and thermal control).[100] The use of lightweight mirror technology, similar to NASA's Next Generation Space Telescope (NGST), would keep the weight of the mirror quite low.[101] Based on this technology, the relay mirror spacecraft would weigh an estimated 34,000 kilograms, and the mission mirror satellites, with their dual telescope design, would weigh 8,500 kilograms. [102]

Architecture Evaluation

The ground laser and large space mirrors must overcome some significant obstacles that are not encountered with the space-based laser architecture. For instance, the greater distance between the lasers and the targets dramatically increases the laser power requirement. Also, atmospheric losses will be larger than the space-based laser system, which in turn not only increases the power requirement for the laser but also increases the demands on the adaptive optics for controlling the quality of the laser beam.[103] Furthermore, the large space mirrors must be built to high optical quality standards, but these will also be susceptible to damage from space debris and high-energy space particles.[104]

Technology Assessment. The technological challenges associated with the ground-based laser system primarily involve the optics (fabricating large mirrors, deploying large mirror systems in space, and applying optical coatings to mirrors) and achieving sufficient output power for the ground laser. Since the 1980s, the SDIO and the BMDO have studied large space mirrors, which was described earlier in the discussion of the Large Optics Demonstration Experiment and Large Advanced Mirror Program. Currently, NASA is investigating new concepts for the NGST, with a primary mirror for this telescope that is eight meters in diameter and can be either deployable or inflatable.[105] To reduce launch costs, NASA plans to keep the maximum weight to only 2,700 kilograms for the entire system (telescope and spacecraft) and launch it on an Atlas rocket.[106]

To achieve this demanding requirement, the telescope design incorporates low density, thin mirrors that are unfolded in space much like the opening of flower petals. Both TRW and the Harris Corporation have preliminary design concepts based on radio antenna applications. This large mirror will have its "figure," i.e. shape, corrected by a deformable mirror concept that was developed by the SDIO. NASA has implemented an aggressive risk reduction program to demonstrate these technologies.[107] Much of the NASA mirror technology is applicable to the ground-based laser's space mirrors, but because the ground-based laser relay mirrors require diameters of 20 meters, it significantly increases the technological difficulty. Even with the NASA technology, the relay mirror weight is far beyond the current capacity of launch vehicles, particularly if it is put in geosynchronous orbit. The implication of these constraints is that the United States would require a new launch vehicle that is even larger than that needed for the space-based laser architecture. Another alternative is a technological leap that significantly reduces the weight of the relay mirror.

In addition to the tremendous size of the mirrors, the mirror coatings for space and ground are unique to the ground-based laser problem because they must be capable of withstanding significant heat from the laser beam. Optical coatings on all the mirrors which "see" the high-energy laser must reflect over 99 percent of the beam or be capable of absorbing the remaining heat from the laser and remain intact. The high-energy laser programs such as MIRACL and Alpha have considerable experience with this type of high reflectivity coating. The conclusion of studies cited earlier was that the optical coating processes would meet the performance requirements of the ground-based laser system.[108]

It should be noted, however, that the power required for each ground-based laser is at least twenty-five times greater than that which has been demonstrated to date. To achieve this increase in power, multiple lasers must be optically coupled together to produce one powerful beam, and while this is physically possible, it will take years to overcome the engineering challenges.

Table 9. SBL, GBL Technological Feasibility Comparisons

Systems	SBL Feasibility	GBL Feasibility
High-Energy Laser	4 (no breakthroughs required)	2 (requires multiple breakthroughs)
Optical Components	4 (no breakthroughs required)	2 (requires multiple breakthroughs)
ATP/FC	4 (no breakthroughs required)	3 (major challenges remain)
Integration	3 (major challenges remain)	3 (major challenges remain)
Launch	3 (major challenges remain)	3 (major challenges remain)
Totals	18	13

The technological feasibility and maturity of the ground-based laser system falls short of the space-based laser system.[109] Placing twenty-meter diameter relay mirrors at geosynchronous earth orbit will require major technological breakthroughs to reduce the weight and volume sufficiently to allow the platforms to fit on an existing launch vehicle. While the COIL system is not as constrained by weight or volume as is the case with the space-based laser, it must be capable of much more power than has been demonstrated so far.

Table 10. SBL, GBL Technological Maturity Comparisons

Systems	SBL Maturity	GBL Maturity
High-Energy Laser	4 (less than five years to field)	2 (ten to fifteen years to field)
Optical Components	4 (less than five years to field)	2 (ten to fifteen years to field)
ATP/FC	4 (less than five years to field)	4 (less than five years to field)
Integration	2 (ten to fifteen years to field)	3 (five to ten years to field)
Launch	2 (ten to fifteen years to field)	2 (ten to fifteen years to field)
Totals	16	13

Cost Estimate. For this architecture to be a viable alternative to the space-based laser concept, the cost must be at least the same and preferably less than the space-based option. In order to compare architectures fairly, the cost estimates in this study for the ground-based laser architecture are divided into two components: the on-orbit segment and the ground segment. These estimates are based only on DOD's experience with previous space programs and high-energy laser systems.

Recently, NASA published a paper which suggested that the new telescope, with an aperture of eight meters, will cost only about twenty-five percent of the Hubble space telescope, which has an aperture of 2.4 meters. That study cites several ways to reduce program costs, including improvements in mirror fabrication facilities, computer processing, and streamlined bureaucracy. NASA's goal is for the entire program to cost $500 million including research, development, test, and launch.[110] Since some of the research and development efforts for the one-of-a-kind NGST may benefit the space mirror systems for this architecture, it is conceivable that the costs of ground-based laser system will be reduced. Despite this potential cost improvement, the space components will be estimated at $100,000 per kilogram if this is to be consistent with the space-based laser system estimates.

In the case of the space mirrors, the constellation's estimated weight is 306,000 kilograms (four relay mirror platforms at 34,000 kilograms each and twenty bifocal mirror platforms at 8,500 kilograms each). Based on the historical cost estimate of $100,000 per kilogram, the costs for the platforms should be $30.6 billion. Using the technological readiness level described in a previous section, the rating for the ground-based laser architecture means that the conceptual design has been formulated. This rating requires another twenty-five percent factor added on to the estimate for a total of $38.25 billion. When launch expenses are included, based on the Evolved Expendable Launch Vehicle's proposed costs of $5,650 per kilogram, the total space segment cost rises to $40 billion.*

In the case of the estimated cost for the ground portion of the ground-based laser architecture, there are strong arguments that this architecture will decrease on-orbit weight and therefore reduce the overall cost of the system. There are, however, problems with such analyses of the cost of the ground segment.

In the past, high-energy lasers were built for experimental purposes rather than for operational weapon systems. Estimating the cost of a laser system from an experimental system is inherently risky because it does not take into consideration the additional specifications that are required by operational systems. Unfortunately, the only "operational" system on which this estimate can be based is the Airborne Laser (ABL) program, which is currently

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* The following methodology was used to calculate the cost estimate for the on-orbit segment of the GBL architecture:

1. GBL on-orbit development cost = GBL on-orbit weight x cost per kilogram

= 306,000 kg x $100,000/kg

= $30.6 x 10^9

2. Added cost for level of technological readiness =development cost x 25%

= ($30.6 x 10^9) x 0.25

= $7.65 x 10^9

3. Launch cost = GBL on-orbit weight x cost per kilogram to orbit

= 306,000 kg x $5650/kg

= $1,729 x 10^9

4. Total on-orbit cost = development cost + added cost for technological readiness + launch cost

= ($30.6 x 10^9) + (7.65 x 10^9) + ($1.729 x 10^9)

= $39.979 x 10^9 or about $40 billion

under development. As discussed earlier, this program also uses a Chemical Oxygen Iodine Laser device as its laser, but it is deployed on an aircraft. This is a significant difference because there is a requirement for an airborne system to be lower in weight, which reflects the fact that weight is constrained by the volume of the aircraft. Considering that the projected cost for each ABL aircraft is $1 billion, the cost per watt of output power is $330.[111] Using an optimistic estimate in which fifty percent of the cost was to fit the system within the aircraft (a constraint which is not required for a ground-based laser), the cost per watt is reduced to $165. With this cost estimate, each ground laser site would cost roughly $4.13 billion, and five sites would cost $20.6 billion. This places the entire ground-based laser architecture, including space and ground segments, at $61 billion.*

* The following methodology was used to calculate the cost estimate for the total cost of GBL architecture using the “ABL” model

1. GBL ground segment cost/site = GBL power (in watts) x cost/watt

= 25 x 10^6 W x $165/watt

= $4.125 x 10^9

2. Cost for five sites = cost/site x number of sites

= ($4.125 x 10^9) x 5

= $220,625 x 10^9

3. Total cost = on-orbit segment cost + ground segment cost

= ($39.979 x 10^9) + ($20.625 x 10^9)

= $60.631 x 10^9 or about $61 billion

Another source for a cost comparison can be derived from an estimate of developing a ground-based laser anti-satellite system.[112] If we use a linear extrapolation of the laser power required for missile defense, each site would cost roughly $26 billion, and therefore, five sites would cost roughly $130 billion. Based on this number, the ground system plus the $40 billion for the space segment would put the total system cost in the range of $170 billion.* The large variation in cost estimates for the ground-based system makes it difficult to recommend this architecture as a more cost effective approach in comparison with the space-based laser approach.

Table 11. SBL, GBL Cost Comparisons

Cost Range	**SBL**	GBL
Low Estimate	$17 billion[1]	$61 billion [2]
High Estimate	$81 billion [3]	$170 billion [4]

Notes: 1) BMDO estimate, 2) Author's estimate based on “ABL” model, 3) Author's estimate, 4) Author's estimate based on the “ASAT” development model.

Clearly, the great technological challenges associated with achieving the laser output power as well as building and placing the twenty-meter diameter relay mirrors into geosynchronous orbit, reduces the attractiveness of the ground-based laser system.

*** the following methodology was used to calculate the cost estimate for the total cost of GBL architecture using the "ASAT" model:

1. GBL cost/site = GBL brightness (in watts/steradian) x ASAT cost/watt/steradian

$= 20 \times 10^{18}$ W/steradian x ($\$1.3 \times 10^{9}/1 \times 10^{18}$ W/steradian)

$= \$26.0 \times 10^{9}$

2. Cost for five sites = Cost/site x number of sites

$= (\$26.0 \times 10^{9}) \times 5$

$= \$130.0 \times 10^{9}$

3. Total cost = on-orbit segment cost + ground segment cost

$= (\$39.979 \times 10^{9}) + (\$130.0 \times 10^{9})$

$= \$169.979 \times 10^{9}$ or about $170 billion

Technology Development Programs

Despite this assessment, a few promising technologies merit long-term investment. The two significant challenges facing this architecture are achieving the high power from the laser and reducing the cost of the ground laser. Revolutionary concepts for different laser options or optically coupling multiple lasers together need to be investigated for further development. Theoretically, multiple lasers could be optically coupled together and projected as one intense beam from the ground to the relay mirror. Other approaches include the use of adaptive optics to combine the beams from multiple apertures.[113] These techniques are still at their infancy and clearly require more laboratory analysis and demonstrations.

One of the more promising areas for technological investment is real-time holography to correct for wavefront errors in large mirrors. Currently, the surfaces of large mirrors are manufactured to stringent standards through grinding and polishing. The surface must maintain the same optical qualities during launch, deployment, and operation. Yet, when mirrors are constructed of thin, lightweight materials, the optical quality cannot be maintained except through complex mechanical systems. To alleviate this problem, Phillips Research Site is conducting research in a real-time holographic compensation system, which would allow the mirror to be far less than perfect by using an all-optical process to compensate for imperfections in the surface quality. The outcome of the research could have far reaching implications not only for a ground-based laser system, but also for reconnaissance, remote sensing, and astronomical satellites.[114]

Although NASA is aggressively pursuing large deployable mirror technology, active involvement by the Air Force with NASA could be extremely fruitful. Since the National Reconnaissance Office (NRO) is interested in large, deployable optical systems for imaging satellites, it may be interested in combining efforts and resources into the program. For a relatively small investment, the Air Force could integrate its research and development efforts in large mirrors with similar efforts underway at NASA.

VII. Space-Based Laser "Plus" Architecture

The most intriguing of these concepts is space-based laser weapons that are deployed in conjunction with large orbiting mirrors. This "space-based laser plus" (SBL Plus) option potentially could reduce the number of space-based laser platforms, reduce on-orbit weight, and overall costs, and do so while providing a more robust constellation. The concept behind this architecture is to decrease the number of platforms and insert bifocal mirrors into the same orbit as the laser weapons.

As with the first concept, placing the weapon in orbit takes advantage of the unique aspects of space. But unlike ground-based laser systems, the space-based laser is able to cover a large theater of operations directly, and is limited only by the platform's orbital altitude and the range to the missile. As the laser platform's altitude increases, the size of the area it sees increases, and the number of platforms that are required for global coverage decreases. Yet, the farther the laser weapon is from the missile, the more energy is required to destroy it, since the laser beam's spot size increases with the distance between the laser and the target. In addition, the platform's mechanical pumps and cooling systems create vibrations that cause the beam to jitter, and in turn, spread the laser's energy. To maintain the same intensity on a missile, a higher-altitude orbit would require a more powerful laser or a primary mirror with a larger aperture.

A more attractive alternative to compensate for this loss in intensity from a higher orbit and beam jitter is to fire the laser platform at space mirrors. This concept, which was explored briefly in the 1980s, combines the strengths of both previously described architectures to produce an effective and technologically achievable system at lower cost.[115]

Operational Concept

One of the more significant costs of the space-based laser-only architecture is the laser platform. If the number of these large platforms could be reduced and if the architecture could still maintain its operational effectiveness, then the overall cost would decrease. In the space-based laser "plus" architecture, mirrors are placed in orbit between the laser platforms and positioned so that they are always in view of a laser. These mirrors allow the laser platform to fire directly at the missile or relay the laser beam through the mirror depending on the location from which the missile is launched.

For example, if a missile is launched directly in the laser platform's field-of-view, then the laser fires directly at the missile. If, instead, the missile is fired in the mirror's field-of-view, then the laser platform closest to the mirror would direct the laser beam towards that mirror. The mirror would "catch" the laser beam, refocus, and direct it against the missile. This concept requires fewer laser platforms because the space-based mirrors provide the global coverage, while the laser's intensity remains sufficient because the mirrors attenuate the jitter and refocus the beam. One concept for these mirrors is the bifocal design discussed in the previous section. With this dual telescope design, one telescope would always be pointed in the direction of a laser platform, while the other telescope would be aimed at the earth's surface.[116]

The exact number of laser platforms, the size of the laser platforms and mission mirrors, and orbits for each system requires a detailed architecture analysis. One possible configuration consists of ten bifocal mission mirrors and ten space-based laser platforms. The space-based laser platforms would have a hydrogen fluoride laser with a power of eight megawatts and a primary mirror aperture of eight meters. The mission mirrors would consist of an eight-meter aperture for each telescope.

Architecture Evaluation

An analysis in the mid-1980s considered a large ICBM threat environment against two different space-based laser constellations. One constellation included space-based laser platforms only, while the other was a mix of space-based laser platforms and orbiting mirrors. The report concluded that the space-based laser with orbiting mirrors had several advantages: a lower overall weight of the payloads that must be placed in orbit, a reduced aperture, a less stringent constraint on laser beam jitter, and a reduction in the overall vulnerability of the system.[117] Although this study assumed the earlier-cited SDI-type missile scenario, the results for today's theater ballistic missile threat will be similar. In comparison with the previous two concepts, the technological requirements for this architecture are far less demanding.

Technology Assessment. One distinct advantage of this architecture is the possibility of reducing the weight and expense of the system. Instead of twenty laser platforms, the concept requires roughly ten platforms and ten orbiting mission mirrors. The combined weight of the space-based lasers and mission mirrors is approximately forty percent less than that of the space-based laser-only architecture. Lightweight mirror technology, which is being developed independently by NASA and the Air Force Phillips Research Site, would reduce the weight of the mission mirror and permit this technology to fit on existing launch vehicles. With this improved technology, the eight-meter bifocal mirror systems would weigh 8,500 kilograms each.[118]

Another benefit of the SBL "Plus" architecture is that it decreases the size of the space-based laser so that the system would not require the development of a new launch vehicle for placing these systems into orbit. The addition of space-based mirrors in the architecture creates a wide range of options for reducing the weight of the laser platforms. One approach is to make the laser platform's aperture smaller and increase the number of mission mirrors in orbit. This system maintains the same effectiveness because the range between the laser and the mirror is less and the mission mirrors refocus the laser beam while attenuating the jitter of the laser platform.

A particularly intriguing option is to build the laser platform without the large beam director. The laser device, with its chemical fuels, is positioned close enough to a mission mirror to perform the function of the beam expander. One drawback of this concept is that the laser cannot fire directly at a missile, but must always be fired at a space-based mirror before striking the target. Yet, the advantage is that the laser platform's weight is significantly less than the SBL-only design, and offers the benefit of fitting on an existing launch vehicle.

A third alternative is to reduce the output power of the laser and increase the transmitting aperture of the bifocal mirror. The larger aperture of the mission mirror compensates for the lower laser power, but provides the same laser intensity on the target. These three examples illustrate the increased flexibility that is derived from adding mission mirrors to the architecture. The broad observation is that any tradeoffs must balance the size and cost of laser platforms and mission mirrors with increasing the technological feasibility of the weapon system and allowing each platform to fit on an Evolved Expendable Launch Vehicle.

Table 12. SBL, GBL, and SBL "Plus" Technological Feasibility Comparisons

Systems	SBL Feasibility	GBL Feasibility	SBL Plus Feasibility
High-Energy Laser	4 (no breakthroughs required)	2 (requires multiple breakthroughs)	4 (no breakthroughs required)
Optical Components	4 (no breakthroughs required)	2 (requires multiple breakthroughs)	4 (no breakthroughs required)
ATP/FC	4 (no breakthroughs required)	3 (major challenges remain)	4 (no breakthroughs required)
Integration	3 (major challenges remain)	3 (major challenges remain)	3 (major challenges remain)

Launch	3 (major challenges remain)	3 (major challenges remain)	4 (no breakthroughs required)
Total	18	13	19

Note: This assessment assumes the development of a successful space-based laser readiness demonstrator and an overall reduction of the size of the space-based laser platform.

Table 13. SBL, GBL, and SBL "Plus" Technological Maturity Comparisons

Systems	SBL Maturity	GBL Maturity	SBL "Plus" Maturity
High-Energy Laser	4 (less than five years to field)	2 (ten to fifteen years to field)	4 (less than five years to field)
Optical Components	4 (less than five years to field)	2 (ten to fifteen years to field)	4 (less than five years to field)
ATP/FC	4 (less than five years to field)	4 (less than five years to field)	5 (possible today)
Integration	2 (ten to fifteen years to field)	3 (five to ten years to field)	4 (less than five years to field)
Launch	2 (ten to fifteen years to field)	2 (ten to fifteen years to field)	5 (possible today)
Total	16	13	22

Note: This assessment assumes the development of a successful space-based laser readiness demonstrator and an overall reduction of the size of the space-based laser platform.

The space-based laser "plus" architecture draws on components from both the space-based laser and the ground-based laser concepts. As with the space-based laser-only architecture, the SBL Readiness Demonstrator (SBLRD) is essential. This technical assessment is based on the assumption that the demonstrator is successfully funded, built, and tested. In addition, this architecture also relies on using the concept of bifocal mission mirrors. It consists of two connected telescopes that are coupled by smaller mirrors to transfer the beam from the receiving telescope to the transmitting telescope. The receiver telescope is pointed directly at the space-based laser platform so that it receives the laser beam directly into its primary mirror, transfers the beam to the second telescope, the outgoing transmitter, and then sends it to the missile.[119]

Cost Estimate. While the SBL "Plus" has technological benefits over both the space-based laser-only and ground-based laser concepts, a thorough study of this concept is required before a meaningful cost estimate is possible. However, the following analysis provides a rough estimate of the overall cost of this system in comparison with other architectures. The twenty platform space-based laser-only constellation will cost between $17 billion to $29 billion, based on the estimates by the DOD. But an analysis based on weight on-orbit yields the more realistic cost estimate of $81 billion. As described in the previous section, the ground-based laser architecture is estimated to cost as much as $170 billion.

The cost estimate for the SBL "Plus" architecture is based on the weight of the space platforms. Each of the space-based laser platforms weighs an estimated 35,000 kilograms. If each mission mirror were the same aperture size and weight as the bifocal mirrors for the ground-based laser architecture, they would each weigh 8,500 kilograms. For a space-based laser with orbiting mission mirrors, the number of laser platforms could be reduced by fifty percent from the space-based laser-only architecture. With ten mission mirrors placed in low earth orbit, the overall system weight would be 435,000 kilograms (ten laser platforms at 35,000 kilograms each and ten mission mirrors at 8,500 kilograms each). Using the historical cost of $100,000 per kilogram, the cost for the systems would be $43.5 billion.

Since the laser demonstrator will test the critical laser hardware in space but not the bifocal mirrors, the space-based laser "plus" architecture merits a technology readiness level of 5, which adds another ten percent to the estimate based on experience from previous space programs. When launch costs are included (based on the Evolved Expendable Launch Vehicle's proposed costs of $5,650 per kilogram), the total cost rises to $50 billion.*

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* The following methodology was used to calculate the cost estimate for the SBL Plus architecture:

1. SBL Plus development cost = SBL Plus total weight x cost per kilogram

= 435,000 kg x $100,000/kg

= $\$43.5 \times 10^9$

2. Added cost for level of technological readiness = development cost x 10%

= ($\$43.5 \times 10^9 \times 0.10$

= $\$4.35 \times 10^9$

3. Launch cost = SBL Plus total weight x cost per kilogram to orbit

= 435,000 kg x $5650/kg

= $\$2,458 \times 10^9$

4. Total cost = development cost = added cost for technological readiness + launch cost

= $(\$43.5 \times 10^9) + (4.35 \times 10^9) + (\$2.458 \times 10^9)$

= $\$50.308 \times 10^9$ or about $50 billion

These costs are about forty percent less than the cost of the space-based laser-only option and seventy percent less than the cost of the ground-based laser system.

Table 14. SBL, GBL, and SBL "Plus" Cost Comparisons

SBL	GBL	SBL "Plus"
$81 billion	$170 billion	$50 billion

Technology Development Programs

For this concept, the appropriate programs for developing this technology are a combination of the previous two architectures. Clearly, the Readiness Demonstrator is essential because without an on-orbit test of a subscale system, numerous and challenging system engineering issues remain unresolved. Including a subscale bifocal mirror in space with the laser demonstrator program offers several unique opportunities. Furthermore, the research being conducted by the Phillips Research Site on holographic wavefront correction may allow large bifocal mirrors to have a less than perfect shape because it uses an all-optical process to compensate for imperfections in the surface of the mirror.

A combined Air Force, NASA, and NRO program that demonstrates the technology for bifocal mirrors could help share the cost, and build strong bureaucratic support for these programs. From past experiences, consolidating DOD and NASA programs is not always popular with DOD acquisition policy makers but can be cost effective if planned carefully.[120] The optimum demonstration would include a bifocal mirror that is launched into space concurrently with the laser demonstrator. If there was funding for building a bifocal mirror satellite and launching it at the same time as the launch of the demonstrator, then the on-orbit tests of the high-energy laser could be coordinated with the mirror. The Air Force could demonstrate the space-based laser with the orbiting mirrors architecture, NASA would be able to demonstrate a space-qualified deployable mirror for the NGST, and the NRO could use this "space-qualified" technology for future imaging satellites.

VIII. Conclusions

The main purpose of this study is to explain three alternative architectures for high-energy laser space systems. Lasers such as MIRACL and Alpha have demonstrated that the technology for achieving the necessary power levels for the lasers is within the reach of the U.S. defense establishment. Other programs, including the Large Optics Demonstration Experiment and the Large Advanced Mirror Program, validated the design and manufacturing concepts for large optical systems. Programs such as the Rapid Retargeting/Precision Pointing Simulator and Structure and Pointing Integrated Control Experiment confirmed the feasibility of technologies for controlling and stabilizing large space structures. Finally, the Space-Based Laser Readiness Demonstrator will bring the individually tested systems into an integrated package in order to demonstrate that the system works in space.

While the second alternative, the ground-based laser system architecture, is attractive in some aspects, it is far less mature and potentially far more expensive than the space-based laser concept. The ground-based high-energy laser is the most technically challenging and costly system to develop. The first reason is that this system must be capable of producing laser power up to twenty-five times greater than that which has been demonstrated to date. Although it is technologically feasible to develop this system, the costs are likely to be significantly greater than the space-based laser system. Furthermore, the 20-meter diameter relay mirrors for this concept push the envelope of technology significantly further than competing concepts, which increases the technical risk and cost of this laser system.

Table 15. Strengths and Weaknesses of Competing Architectures

System	Space-Based Laser	Ground-Based Laser	Spaced-Based Laser “Plus”
Strengths	Readiness Demo will address most major issues	Eliminates need to size laser to existing launch vehicle	Reduces total weight on-orbit and cost of system
Weaknesses	Requires two launches per laser platform or new launch vehicle	Laser and space-based mirror requirements drive system cost	Bifocal mirror technology has not been demonstrated

The principal recommendation of this study is that the Air Force, in conjunction with the Ballistic Missile Defense Organization, should give serious consideration to the SBL Plus option, which is a combination of space-based lasers with orbiting mirrors. When bifocal mirrors are positioned in orbit between the laser platforms, it will reduce the number of the heavy space-based lasers that must be put into space, and hence it will reduce the overall weight and cost of the weapon system. In this concept the space-based lasers would either fire directly at the missile or relay the laser energy to a mission mirror, and the bifocal mission mirrors would “catch” the laser beam from the laser platform, refocus, and direct it against the target. In addition to reducing the number of laser platforms, this configuration of mission mirrors would attenuate some of the laser jitter. In comparison with the space- and ground-based laser concepts, this is a far less technologically demanding approach, for several reasons.

The first is that size of the mission mirror is approximately the same as NASA's NGST, which is already under development. Second, the size of the primary mirror or the output power of the laser could be reduced from that envisioned in the original concept for the space-based laser. Finally, with a smaller laser platform, the system could fit on the proposed Evolved Expendable Launch Vehicle and therefore not require a new launch vehicle. If the SBL Plus architecture were selected, the best demonstration of its feasibility would be a jointly funded (AF, NASA, and NRO) bifocal space mirror that is conducted concurrently with the space-based laser demonstrator.

Recommendations. The Department of Defense should incorporate space mirrors into the space-based laser architecture and pursue a number of other steps.

First, it is necessary to conduct a detailed architecture study for a space-based laser system with mission mirrors. This study must examine the tradeoffs between laser power, laser jitter, aperture size, mission mirror size, orbits, weight, and total life-cycle cost.

Second, the Department of Defense, in conjunction with the Air Force, should fund a bifocal mirror program that could be launched before, or concurrently with, the Space-Based Laser Readiness Demonstrator. This effort should focus on the development of a sub-scale, rather than full-size, mirror, and address the key acquisition, tracking, and pointing issues. The BMDO and Air Force should encourage a combined program with NASA and the NRO to test the mirror technology in space, and these organizations should invest along with NASA and the NRO in the mirror technology that is under development for the NGST.

Third, it is essential to investigate the ancillary missions that could be conducted with bifocal space mirrors, including high-resolution ground imaging, high-resolution space imaging, and remote sensing. It is equally important to continue the development of real-time holography at the Phillips Research Site as a way to improve the ability to correct the wavefront errors that will distort lasers and hence reduce their operational effectiveness.

In a time of declining defense budgets, American policy makers must select the laser weapon architecture that is the most technologically achievable and cost-effective. Despite the fact that ground-based lasers have some advantages, the optimum path for the United States at the beginning of the twenty-first century is to develop a space-based laser with orbiting mirrors as part of a long-range strategy for using high-energy laser weapons to enhance the capability of the United States to defend itself against ballistic missiles.

Glossary

ABL Airborne Laser

ABM Anti-Ballistic Missile

ALI Alpha/LAMP Integration

AO Adaptive Optics

ASAT Antisatellite

ATP/FC Acquisition, Tracking, Pointing, and Fire Control

BMD Ballistic Missile Defense

BMDO Ballistic Missile Defense Organization

COEA Cost and Operational Effectiveness Analysis

COIL Chemical Oxygen Iodine Laser

CW Continuous Wave

DARPA Defense Advanced Research Projects Agency

DEW Directed Energy Weapon

DF Deuterium Fluoride

DOD Department of Defense

EELV Evolved Expendable Launch Vehicle

GBL Ground-based Laser

GEO Geosynchronous Earth Orbit

HEL High-Energy Laser

HF Hydrogen Fluoride

ICBM Intercontinental Ballistic Missile

IRBM Intermediate Range Ballistic Missile

J joule (unit of energy)

LAMP Large Advanced Mirror Program

Laser Light Amplification through Stimulated Emission of Radiation

LEO Low Earth Orbit

LODE Large Optics Demonstration Program

MEO Medium Earth Orbit

MIRACL Mid-Infrared Advanced Chemical Laser

MRBM Medium Range Ballistic Missile

MTCR Missile Technology Control Regime

MW Megawatt (1,000,000 watts)

NGST Next Generation Space Telescope

NRO National Reconnaissance Office

SBL Space-based Laser

SBLRD Space-based Laser Readiness Demonstrator

SDI Strategic Defense Initiative

SDIO Strategic Defense Initiative Organization

SLBM Submarine Launched Ballistic Missile

SOR Starfire Optical Range, Kirtland AFB, NM

SRBM Short Range Ballistic Missile

TBM Theater Ballistic Missile

TMD Theater Missile Defense

USAF United States Air Force

Notes

1. These are not the only possible architectures for theater missile defense. Another architecture is using an Airborne Laser (ABL) system in conjunction with relay mirrors. Because the ABL operates above the clouds (and hence most of the atmospheric turbulence), performance reductions from weather and atmospheric turbulence are reduced. While another option is a broader mix of forces that includes Space-based Lasers (SBL), Ground-based Lasers (GBL), ABL, and relay mirrors, these concepts are beyond the scope of this paper.

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14. *Ibid.*

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21. Robert Wong, "Cost Modeling," in *Space Mission Analysis and Design,* ed. James R. Wertz and Wiley J. Larson (Torrance, CA: Microcosm Press, 1992), 718. Also, the Secretary of the Air Force/AQ has a homepage for space system cost models called "Space Boosters," n.p.; on-line, Internet, 10 November 1997, available from http://www.saffm.hq.af.mil/SAFFM/afcaa/space/space.html.

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27. Steven Erlanger, "U.S. Telling Russia to Bar Aide to Iran By Arms Experts," *New York Times,* 22 August 1997, A1. Also, "Russia-Israel Strain Over Iran Missile Aid," *New York Times,* 25 August 1997, A3.

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45. Pedrotti, 427.

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60. An equally important use of adaptive optics, particularly for SBLs, is in compensating for wavefront errors that are internal to the laser system. This wavefront error is often due to less-than perfect beam quality from the laser device, but also can include error from the distortion caused by optical components and beam-path conditioning (for reference, this involves mechanisms for reducing beam distortion). In the case of the Airborne Laser, two adaptive optics systems are used, one for correcting internal wavefront error and the other for correcting distortions due to atmospheric turbulence.

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62. *Ibid.*

63. "3.5-Meter Telescope Fact Sheet," Phillips Laboratory Public Affairs home page, n.p.; on-line, Internet, 28 October 1997, available from http://www.plk.af.mil/ORG_CHART/DS/PA/FACTSHEETS/metertel.html. Also, author interviews at the Phillips Research Site.

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66. US General Accounting Office Report, 21.

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70. Another important test was the High Altitude Balloon Experiment (HABE) that was funded by the Ballistic Missile Defense Organization.

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74. The original notions for the Alpha laser, LODE optics and Talon Gold ATP/FC were technology development programs that were conducted in the early 2980's for an antisatellite SBL concept.

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88. USAF Scientific Advisory Board, *New World Vistas: Air and Space Power for the 21st Century*, Directed Energy Volume. (Washington, DC: USAF Scientific Advisory Board, September 1996), 25.

89. *Ibid.*

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91. Numerous architecture studies have been performed for a ground-based laser system, the most recent and definitive of which was conducted in 1990. Two very detailed discussions are in: Lockheed Missile and Space Company, "Ground-based Laser Concept Formulation and Technology Development Planning" (U), Report Number: LMSC-L081927, 15 May 1990, (Secret) and TRW, "Ground-based Laser Concept Formulation and Technology Development Planning" (U), Report Number: 54579-6007-SX-00, 17 May 1990. A more general discussion of the physics of the system is provided in "Science and Technology of Directed Energy Weapons," American Physical Society Study, *Reviews of Modern Physics*, vol. 59, Part II, July 1987.

92. "Science and Technology of Directed Energy Weapons," 210.

93. R.D. Stark, RF - *Laser Comparison and Considerations,* Aerospace Corporation Report ATR-94 (6486)-8 (El Segundo, CA: Aerospace Corporation, July 1993), 52-53. Also see Peter B. Ulrich and R. James Morgan, *SDIO Ground-based Laser Support - Laser and Power Technology, Volume VIB, Special Tasks in Ground-Based Laser Beam Control,* DNA-TR-90-103-V6B (Alexandria, VA: Defense Nuclear Agency) June 1991, B-45.

94. V. Krabbendam and T. Sebring, *Ground-based Laser System Optical Component Producibility Study - Executive Summary,* RADC-TR-90-355 (Griffiss AFB, NY: Rome Air Development Center, 1990), 3.

95. Relay mirror systems are also very interesting for a number of missions other than missile defense, including remote sensing, target designation, global wind measurements, and active imaging.

96. Dr. Marc Hallada and Dr. Dustin Johnston, Schafer Corporation, author interview, 1 November 1997.

97. Phillips Laboratory, Kirtland AFB, NM, author interview, 31 October 1997.

98. Estimate based on 2,000 km altitude and 4,000 km range from mission mirror to target. Verified by U.S. Air Force Academy Department of Physics, interviewed 26 November 1997. Also, another option for this architecture is to use all bifocal mirrors at LEO and count on multiple relay bounces to reach the target.

99. Estimates were derived by author and confirmed with Phillips Laboratory, Kirtland AFB, NM on 1 December 1997. If the ground telescope has an 8-meter diameter and a tracking/pointing accuracy of 100 nrad, the jittered spot diameter of the beam at 40,000 km is just under 20 meters.

100. Krabbendam and Sebring, 3.

101. The Next Generation Space Telescope (NGST) is intended to be a deployable optical system that offers the potential for lighter weight and easier packaging on a launch vehicle. This technology also may reduce the weight and volume of the SBL.

102. The mirror weight estimates for deployable mirrors vary greatly. One estimate provided by Phillips Laboratory, Kirtland AFB, NM is the mirror weight scales with D$^{1.3}$, where D is the mirror diameter. Another estimate is mirror weight scales with $D^{2.3}$ to $D^{2.7}$. This information was from Richard Dyer, Schafer Corporation, who was on NASA's NGST independent review team. To be conservative, this study used $D^{2.7}$ as the scale factor, included the mirror supporting mass in addition to the mirror, and added 2,000 kg for the spacecraft. The bifocal included another 20% to account for the transfer optics. Using the NGST weight of 2,700 kg:

For Relay Mirror:

(Mass of mirror / 2700 kg) = $(20\text{ m} / 8\text{ m})^{2.7}$; Mass of mirror = 32,000 kg

+ 2,000 kg (for spacecraft)

= 34,000 kg

For Mission Mirror:

(Mass of mirror / 2700 kg) = $(8\text{ m} / 8\text{ m})^{2.7}$; Mass of mirror = 2,700 kg

2,700 x 2 = 5,400 kg (for two mirrors with bifocal design)

+ 20% of 5,400 (for transfer optics)

+ 2,000 kg (for spacecraft)

=8,500 kg

103. Ulrich and Morgan, C-105.

104. “Science and Technology of Directed Energy Weapons,” 8.

105. Ron Cowen, “After Hubble: The Next Generation,” *Science News*, 26 April 1997, 262.

106. NASA, “NGST Costs,” 1 May 1997, n.p.; on-line, Internet, 5 November 1997, available from http://ngst.gsfc.nasa.gov/project/text/Execsum.html. For the detailed study report: H.S. Stockman, ed., “The Next Generation Space Telescope - Visiting a Time When Galaxies Were Young,” June 1997, on-line, Internet, 14 November 1997, available from http://oposite.stsci.edu/ngst/initial-study/.

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108. Robert R Kappesser, et al., *SDIO Ground—based Laser Support - Laser and Power Technology, Volume I - Optics,* DNA-TR-90-103-V1 (Alexandria, VA: Defense Nuclear Agency, May 1991), 4. Also, V. Krabbendam and T. Sebring, *Ground-based Laser System Optical Component Producibility Study - Executive Summary,* RADC-TR-90-355 (Griffiss AFB, NY: Rome Air Development Center, 1990), 4.

109. This assessment would be closer to the SBL architecture if the development programs involving deployable optics come to fruition. If large mirrors could be deployed in space from existing launch vehicles, the rating for this concept would likely improve.

110. NASA, “NGST Costs,” 1 May 1997, n.p.; on-line, Internet, 5 November 1997, available from http://ngst.gsfc.nasa.gov/project/text/Execsum.html.

111. Forden, 47. Dr. Forden states that each aircraft costs about $1 B and estimates the output power to be 3 MW.

112. Phillips Laboratory, Kirtland AFB, NM, author interview 1 December 1997. The estimate was based on a GBL ASAT system with a brightness of 1.0×10^{18} watts/steradian. This estimate included COIL design, fabrication, assembly, and check-out; beam control design, fabrication, assembly, and check-out; atmospheric compensation design, fabrication, assembly, and check-out; facility design, construction; system integration; system development testing; and operational testing. The total cost was $1.3 B over seven years. This extrapolation, which is based on a worst-case analysis, assumes a brightness factor approximately 20 times greater and therefore a cost 20 times higher.

113. “Science and Technology of Directed Energy Weapons,” 7.

114. Christopher M. Clayton, “Lethal/Sublethal DEW (Large Lightweight Optics Wavefront Compensation) - Real-Time Holography for Lightweight Space Optics,” *Laboratory Research Initiative Request, Executive Summary*, (Kirtland AFB, NM: Phillips Laboratory, 1997).

115. Lawrence Sher and Capt Stephan McNamara, “Relay Mirrors for Space Based Lasers,” Research Report, *Laser Digest*, AFWL-TR-88-68, Volume VI (Kirtland AFB, NM: Air Force Weapons Lab, May 1989).

116. Phillips Laboratory, Kirtland AFB, NM, author interview, 31 October 1997.

117. Sher and McNamara. A more detailed analysis of the physics is provided in Lawrence Sher,“Optical Concepts for Space Relay Mirrors,” Research Report, *Laser Digest*, AFWL-TR-88-68, Volume II. (Kirtland AFB, NM: Air Force Weapons Lab, May 1989).

118. Again, the following approach is used to calculate the weight of the mission mirror;

(Mass of mirror / 2700 kg) = $(8 \text{ m} / 8 \text{ m})^{2.7}$; Mass of mirror = 2,700 kg

2,700 x 2 = 5,400 kg (for two mirrors with bifocal design)

+ 20% of 5,400 (for transfer optics)

+ 2,000 kg (for spacecraft)

=8,500 kg

119. Phillips Laboratory, Kirtland AFB, NM, author interview, 31 October 1997.

120. Wiley J. Larson, "Process Changes to Reduce Cost," in *Reducing Space Mission Cost*, ed. James R. Wertz and Wiley J. Larson (Torrance, CA: Microcosm Press, 1996), 22.

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- ***Appendix C***
-

- ***Appendix D***

- ***Appendix E***

The Star Wars Beam Weapons

and

Star Wars Directed-Energy Weapons (DEW)

(A focus of the Star Wars Program)

by

Dr. Judy Wood and Dr. Morgan Reynolds

(originally posted: October 17, 2006)

Page 5a: More Toasted Cars

At the time this article was being developed, many people expressed disbelief that energy weapons existed outside of science fiction until they were reminded of the Star Wars Program, also known as the Strategic Defense Initiative (SDI)*. The name of this article was chosen as a reminder that energy weapons do exist and have been developed over 100 years. Most of this technology is classified information. It can also be assumed that such technology exists in multiple countries. The purpose of this article was to begin to identify the evidence of what happened on 9/11/01 that must be accounted for. In doing so, the evidence ruled out a Kinetic Energy Device (bombs, missiles, etc.) as the method of destruction as well as a gravity-driven "collapse."

*SDI was created by U.S. President Ronald Reagan on March 23, 1983.[1] It is thought that SDI may have been first dubbed "Star Wars" by opponent Dr. Carol Rosin, a consultant and former spokeswoman for Wernher von Braun. However, Missile Defense Agency (MDA) historians attribute the term to a Washington Post article published March 24, 1983, the day after the Star Wars speech, which quoted Democratic Senator Ted Kennedy describing the proposal as "reckless Star Wars schemes."[2] Before it was named the "Star Wars Program (SDI) in 1983, it was the Advanced Space Programs Development.[3]

12/12/10 -- Dr. Judy Wood

[1]Strategic Defense Initiative, Wikipedia,
[2]Sharon Watkins Lang. SMDC/ASTRAT Historical Office. "Where Do We Get Star Wars?", *The Eagle*. March 2007.
[3] Robert M. Bowman, former Director of Advanced Space Programs Development for the U.S. Air Force in the Ford and Carter administrations.

[Note: References and Sources will be posted and figure numbers will be corrected (in sequential order) when this paper is finished .]

This page last updated, January 30, 2007
(Click on pictures to enlarge.)

Jump to bus (Figure 5(a)) Jump to van (Figure 6(a)) Jump to policecar (Figure 7(a)) Jump to leg (Figure 8(a)) Jump to swamp (Figure 9(a))	**Audio:** **29 November 2006**, Judy Wood narrates these pages web pages on "The Dynamic Duo" with Jim Fetzer, Genesis Communications Network, gcnlive.com, archive (mp3-1)(mp3-2)(mp3). **6 December 2006**, Morgan Reynolds discusses these pages on "The Dynamic Duo" with Jim Fetzer, Genesis Communications Network, gcnlive.com, archive, (mp3)(mp3) Return to the Toasted Cars page of the BeamWeapon series. Link to Even More Toasted Cars

These pictures are taken along the street that goes between the postal building and WTC7, and are about a block north of WTC7, before WTC7 "faints."

From album WTC Pictures by member cuoffrd

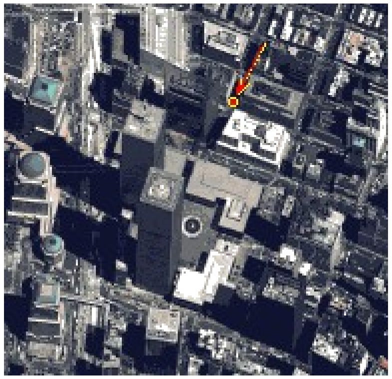
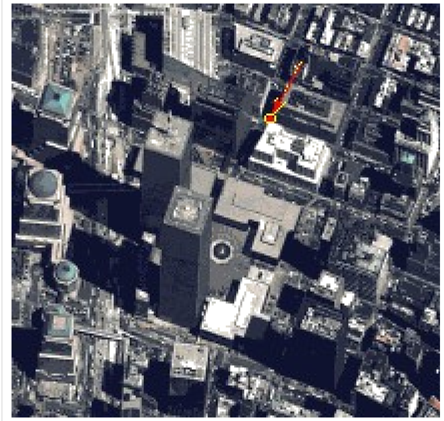


Figure 1(a). Looking up at the smoke	**Figure 1(b).**
Source website	

	
Figure 2(a). rubble w FDNY bkgrnd Why is there a hole in the street, here? Referring to Figure 3(a), below, it appears they were doing work here. However, that is a rather large hole to leave unattended with nearly no attempt to keep vehicles and pedestrians from falling in. The few boards that are there would provide very little protection. So, it is likely that this hole was being worked on the morning of 9/11/01, otherwise it would have had more protection. There appears to be very little debris on top of the boards while there the "dust" is rather deep in that area. So, perhaps they were knocked down after the majority of the debris had fallen.	**Figure 2(b).**
Source, website	

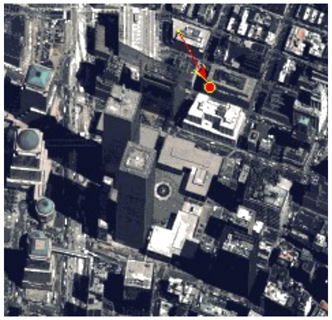


Figure 3(a). small fire

Figure 3(b).

[Source]

Figure 4(a). Barclay St fire

Figure 4(b).

[Source]

Bus [Top]

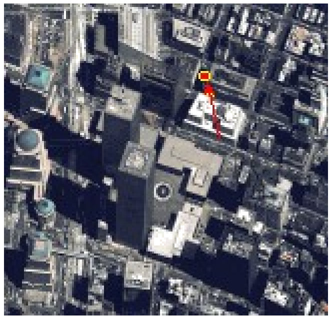


Figure 5(a). burned out cars and bus Consistently, they seem to have missing door handles. And the gas tanks don't appear to explode.	**Figure 5(b).**
Source	

Van Top

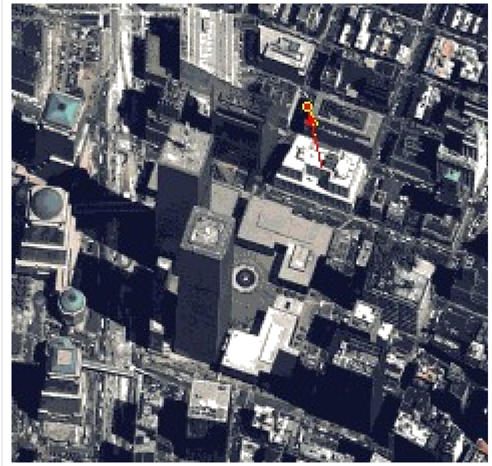


Figure 6(a). burned suv and mail truck	**Figure 6(b).**
Source	

Police Car Top

	
Figure 7(a). burned NYPD car Police car I've not seen before. Why the back end and not the front?	**Figure 7(b).**
Source	

Leg? Top

Figure 8(a). burned cars bus trucks and fire
WTC7 looks REALLY good here! (It's the building on the right, a block away from where the camera person is standing.) It looks like those could be body parts on the sidewalk (arm or leg?). I believe this is after WTC1 goes poof, but am not sure. I have pictures from the next block up, next to WTC7, and it didn't look nearly as bad as this! So, I'm thinking that this part of the street got toasted when they did WTC1 and the other one (posted on http://janedoe0911.tripod.com/StarWarsBeam5.html) was after WTC2 and before WTC1.

Figure 8(b).

Source

Swamp Top

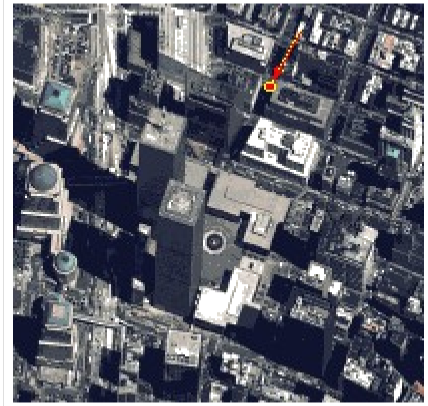
	
Figure 9(a). block with fire at end I think this is just before they did WTC7. Notice how empty the streets are, while they are flooded with water and lots of fire hoses. Obviously the water lines weren't busted! The traffic light in the distance appears to still have power. *(9/11/01)*	**Figure 9(b).**
Source	

Figure 9(c). WTC7, looking south, down W. Broadway.
Source, 080.JPG, (entered 9/18/01)
(picture probably taken 9/12/01 or the morning of 9/13/01, but no later than 9/13/01)

Figure 9(d). WTC7, looking south, down W. Broadway.
Source, 081.JPG, (entered 9/18/01)
(picture probably taken 9/12/01 or the morning of 9/13/01, but no later than 9/13/01)

Figure 9(d). "This is an interview by Diane Sawyer of a Fireman who witnessed these Melted cars, and he states that where these cars were, there were no Fires around!!!"
I believe his is talking about W. Broadway.
URL, (9/11/01)

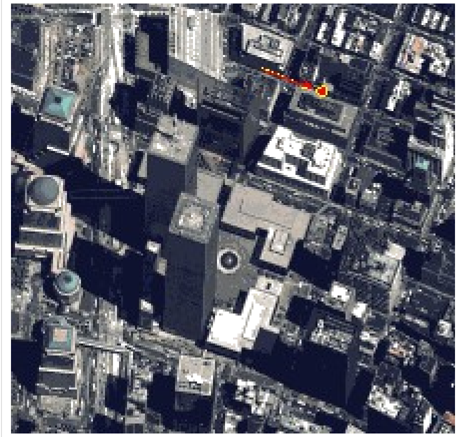


Figure 10(a). paper on street
This is a look east down Park Place.

Figure 10(b). Location of Burlington Coat Factory, 45 Park Pl, New York, NY

Source

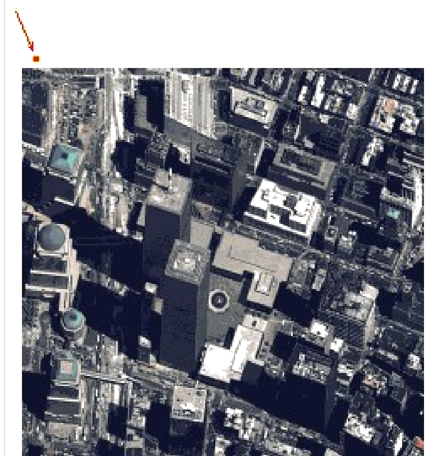
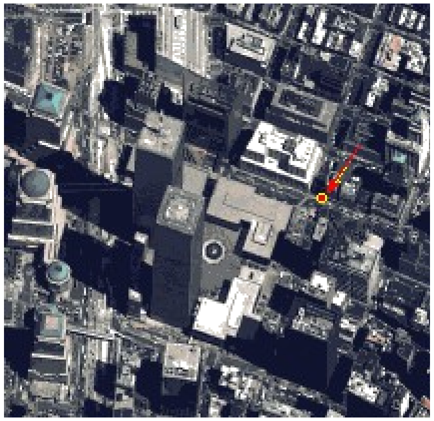
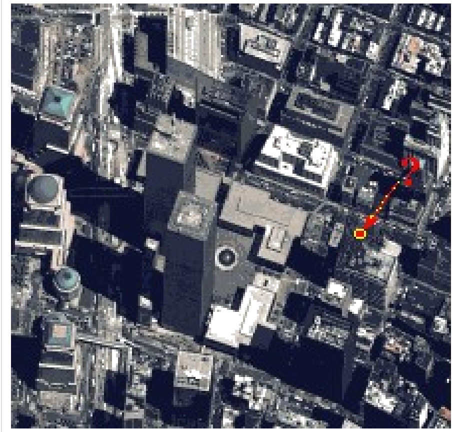


Figure 11(a). fire from afar	**Figure 11(b).**
Source	

Figure 12(a). building ablaze After 2 went poof. Standing on Church street, looking south, with the postal building on hte right and the WTC4 remaining "stub" in the distance.	**Figure 12(b).**

Source	

	
Figure 13(a). close up building ablaze Maybe they set WTC5 on fire for a "smokescreen" after the fact? Why would this building be on fire so viscously and so FAST?	**Figure 13(b).**
Source	

	
Figure 14(a). look at bronze statue of man Is that a statue or is that a human?	**Figure 14(b).**
Source	*Source*
www.prisonplanet.com The figure was a bronze statue named "Double Check," created by sculptor J. Seward Johnson, that sat on a park bench near the towers. The discovery of the statue shown below two days after 9/11 was subject of a CNN piece in December 2001. The statue became a shrine to victims of 9/11.	

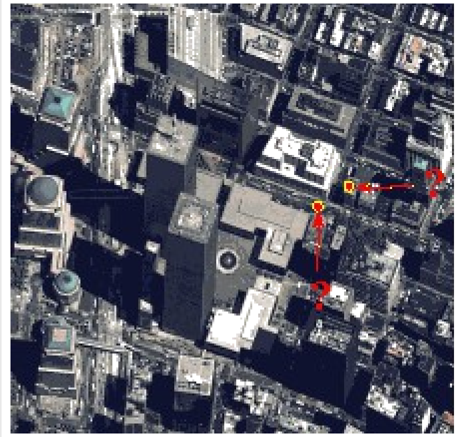


Figure 15(a). flag

Figure 15(b).

Source

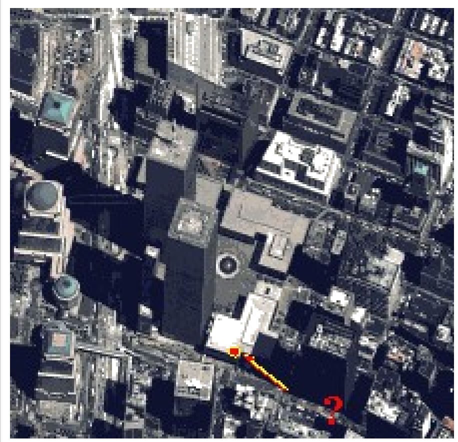


Figure 16(a). rubble close up

Figure 16(b).

Source

Figure 17(a). rescue workers

[Source]

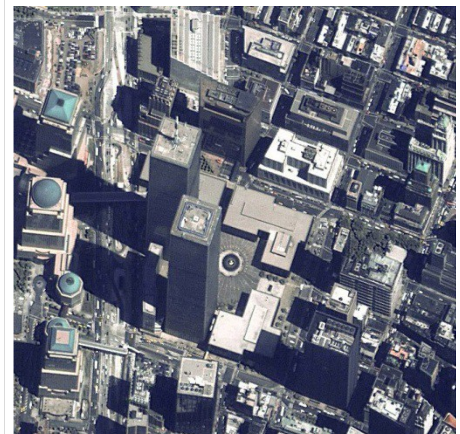


Figure 17(b).

Figure 18(a). rescue workers at work

[Source]

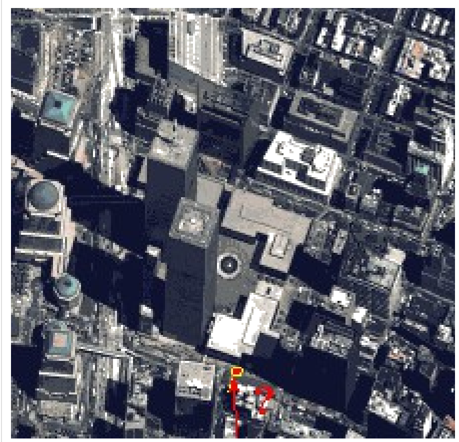


Figure 18(b).

Figure 19(a). FDNY working

Source

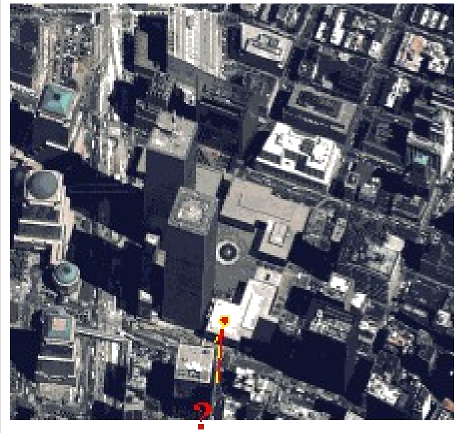


Figure 19(b).

Figure firetruck. A badly damaged firetruck. Where did its engine go? The bottom of the tire has turned to goo below a distict horizontal line in the tire.
Source:

Figure hazmat. A FDMY Hazmat truck in front of WTC6 on West Street. The remaining upper part of the truck has been peeled and evaporated in areas. The upper part of the cab is gone and the engine block seems to have disappeared. The photo was taken on 9/11 after WTC1 disappeared but before WTC7 collapsed. *(9/11/01) Source:*

Figure 66(e). Why would the front of this fire truck wilt?
Source:

Figure 66(h). Is there something attractive about engine blocks? Why not gasoline fuel tanks?
Source:

Figure 77. The mail truck parked on the left side of the street looks burnt. Why?

Figure flip. Why is this car upside down? A burned out SUV with missing windows

(Click on photo for enlarged view.) The building on the left is the USPS Federal Building and on the right is WTC7. WTC5 is on fire at the end of the street. Why? If this area is hot enough for spontaneous combustion, why isn't the paper on fire? The cars on the right side of the street are also toasted.
Source:

and toasted front end is parked in front of WFC2 on West Street but will not be moving under its own power.
(9/12/01) Source:

Figure 66(g). This fire seems to be very selective.
Source:

Figure 66(i). A minivan is consumed by flames. The fire rages inside the vehicle, contained by the remaining windows. The fire appears more intense at the front where the engine is.
Source:

Figure onfire1. The tires and even the pavement under the car are on fire. The windows appear to be intact with no visible interior fire. There is line of fire along the trunk lid. The right front fender is deformed and has turned white.
Source

Figure onfire2. A fire rages, apparently on Vesey Street, sending up thick black smoke. These may be the vehicles that eyewitness Rebecca O. described as she ran past WTC6 during the destruction of WTC2.
Source

Figure 66(o). Why doesn't the paper burn?
Source:

Figure 66(z). Why is this fire truck burnt? It is missing its front grill, headlights, and related fron end brightwork. Where are the tires?
Source:

Figure yy. The cars parked in the back suffered extensive damage. The car on the left and on the far right look like they have had their engines eaten. The cars in the foreground experienced less damage, but many windows are missing, however partial and whole windows also remain.
(9/12/01) Source:

Figure 78. Why is this windshield crumpled up? Curiously, the interior of the car does not appear to contain anything that crashed through the windshield.
Source:

Figure 64. Peculiar wilting of car doors and deformed window surrounds on FDR Drive.
Source:

Figure 65. Map of lower Manhattan shows the WTC and FDR Drive a half mile or more apart.

	
Figure 66. Toasted cars in a lot near the WTC. *Source*:	**Figure 70.** What was this thing across the street? Was it a car? Was it a van? What caused that line of burn marks on the hood of the car in the foreground on the right? In the left foreground, the remains of a vehicle sit atop a white sedan. Are we looking at the front or the back end? It looks like the front end and if it is, its engine is missing. We can see daylight through the wheelwell. *Source*:

From album WTC Terrorist Attack Sep.11, 2001- Album #1 by member magicfan33 *Top*

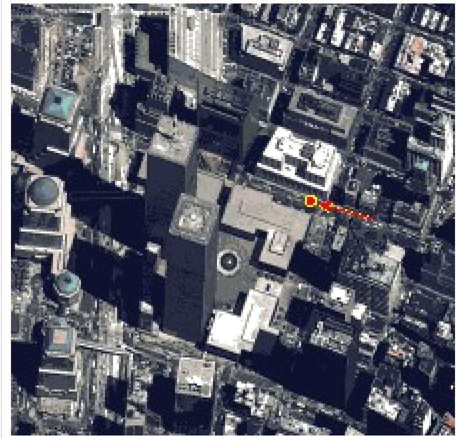
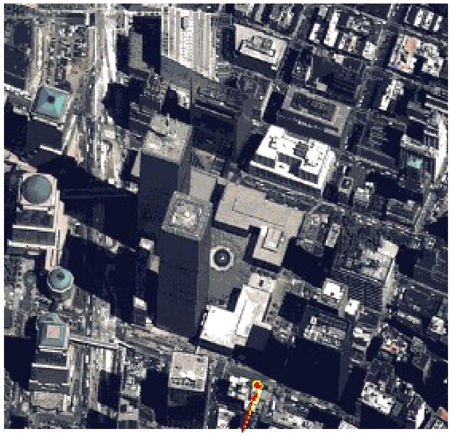


Figure 20(a). Burned cars outside the WTC after both towers were destroyed.

Figure 20(b).

Source

	
Figure 21(a). Burning Wreck of WTC Towers Sep.11, 2001 Isn't it interesting that the traffic light is green (not red)? There is a weird irony with that. So, why wasn't the power knocked out? Do the traffic lights run on backup batteries? There is eyewitness testimony saying the power to WTC2 went off a second or two before WTC2 began to come apart. I believe this is true and that it was done to isolate the WTC Towers from the power grid. Otherwise, they may have knocked out the power grid over a very large (multi-state) area. We can remember when a power surge knocked out the power grid for NYC and much of the northeast. So, I can't imagine that a total destruction of a WTC tower in 10 seconds would not cause a problem.	**Figure 21(b).**
Source	

	
Figure 22(a).	**Figure 22(b).**
Source	

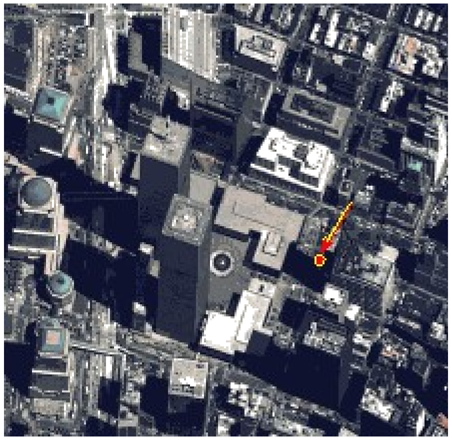


Figure 23(a). | **Figure 23(b).**

[Source]

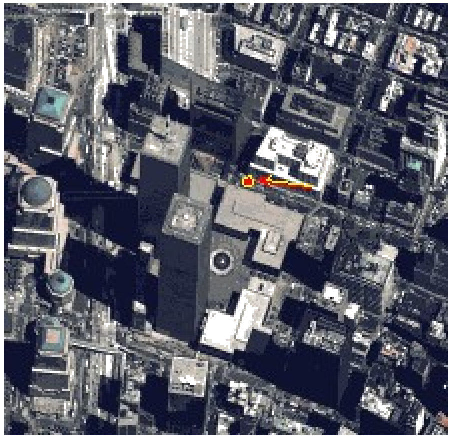


Figure 24(a). | **Figure 24(b).**

[Source]

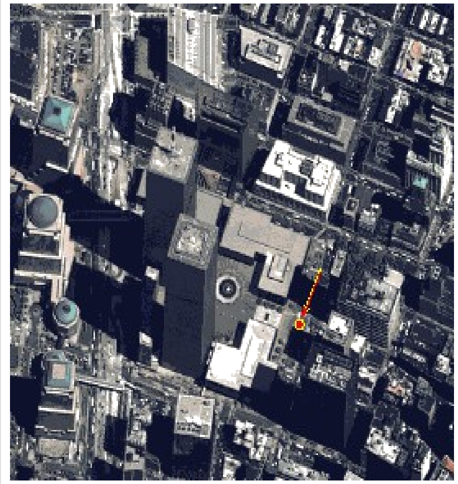


Figure 25(a).	Figure 25(b).
Source	

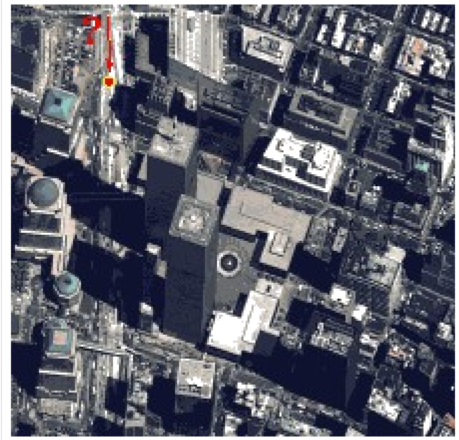
	
Figure 26(a). The building material is turning to dust as it falls!	**Figure 26(b).**
Source	

Figure 27(a). These appear to be survivors moving to safety, so it is likely this picture was taken shortly after the two towers were "poofed" and before WTC7 dropped. What is the "fog" around their feet? If it were fine dust, it wouldn’t have settled out of the air this quickly. If it were fine dust, it would have gradually settled out of the air, leaving the air clearer and clearer, gradually. Find dust would not move as a well-defined "cloud" and sink together. If it were kicked up by the feet, it would be more localized around the feet — especially on the right.

Figure 27(b).

Source

Figure 28(a). That was not simple dust that hit this guy's shirt. Whatever it was had direction and didn't hit the white part of his shirt. It looks like he was sprayed with brown paint while his tie was tucked in. But, why didn't it seep under the tie and wick across the fabric? It seems like it had to be a dry blast (unlike

the familiar mud-puddle splash).	
Source	

Link to PrisonPlanetCollection

This page is currently UNDER CONSTRUCTION

30 January 2007

(Click on pictures to enlarge.)

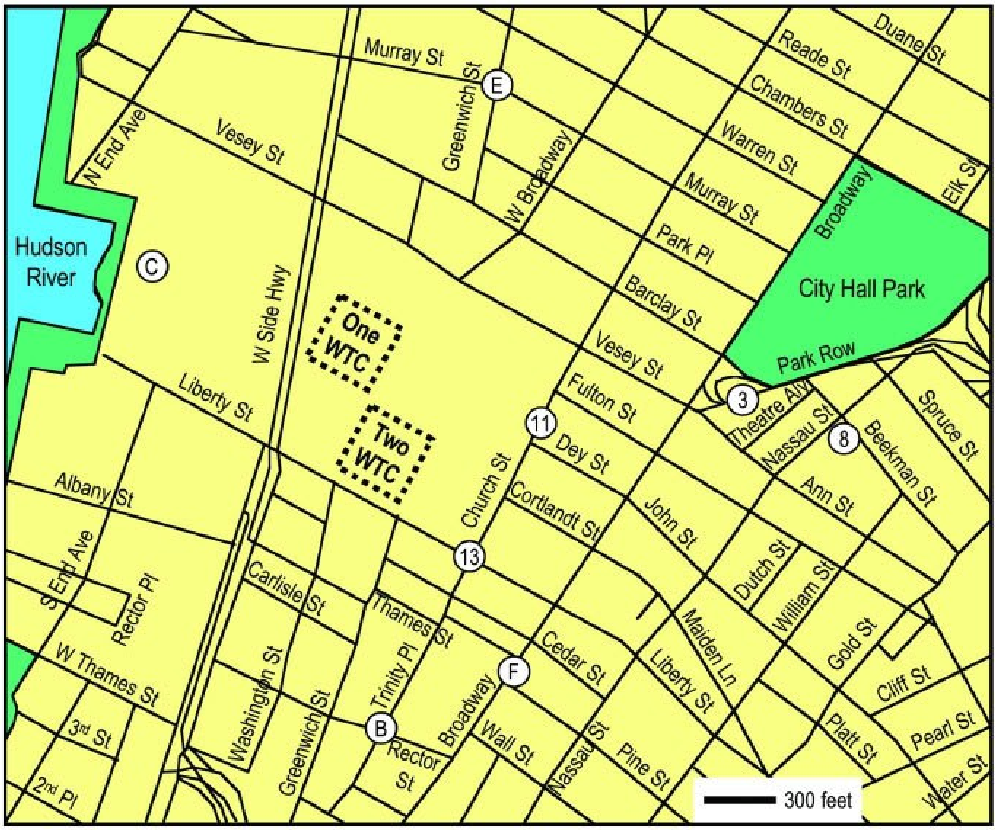
Jump to Church Street dust

Jump to Clean Street

Jump to Clean Street too

From Prison Planet

The dates are when they were entered into the system. Perhaps different sources on different days?



http://www.ehponline.org/members/2003/5930/fig1.jpg

Figure 1. Map with street names
[Source]()

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 70.JPG, 9/13/01

Figure 2. The label of "Air Craft Parts" is a good indication that the cleanup crew maintained their sanity with a good sense of humor.
Source, 70.JPG, 9/13/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, Mvc-013s.JPG, 9/14/01

Figure 3. A NYPD worker watches the WTC5 fireworks.
Source, Mvc-013s.JPG, 9/14/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, Mvc-014s.JPG, 9/14/01

Figure 4. We understand this is "Double Check," a bronze statue.
Source, Mvc-014s.JPG, 9/14/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 001.JPG, 9/18/01

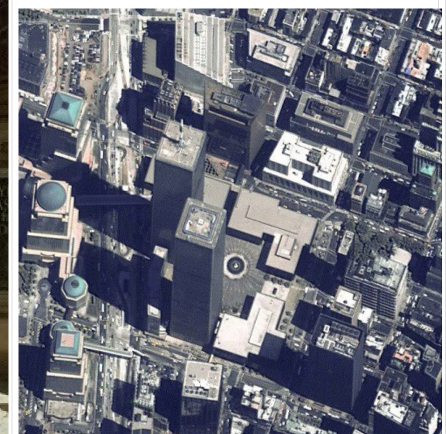
Figure 5. This USPostal truck is clearly located in front of 100 Church Street. :-) This location is one block north of the post office and is between Barlclay and Park, directly on the other side of the building from the "body part" picture. Source, 001.JPG, 9/18/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 007.JPG, 9/18/01

Figure 6. Looking south from the Vesey-Church intersection.
Source, 007.JPG, 9/18/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 009.JPG, 9/18/01

Figure 7. Looking south from the Vesey-Church intersection.
Source, 009.JPG, 9/18/01



http://www.infowarsmedia.com/images/sept11/sept_11.zip, 024.JPG, 9/18/01

Figure 8. We should be able to figure this one out. Does anyone have any suggestions? What is striking is that the street has no vehicles on it. Also, there is only powder on the streets.
Source, 024.JPG, 9/18/01

• Motown Gift Shop
148 Church Street
(212) 966-3923

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 029.JPG, 9/18/01

Figure 9. WTC7, looking south, down Greenwich Street.
Source, 029.JPG, 9/18/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 031.JPG, 9/18/01

Figure 10. WTC7, looking south, down W. Broadway.
Source, 031.JPG, 9/18/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 049.JPG, 9/18/01

Figure 11. Looking west on Vesey, between WTC5 and the Post Office.
Source, 049.JPG, 9/18/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 052.JPG, 9/18/01

Figure 12. Caption
Source, 052.JPG, 9/18/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 053.JPG, 9/18/01

Figure 13. Caption
Source, 053.JPG, 9/18/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 059_1.JPG, 9/18/01

Figure 14. Subway entrance at Vesey and W. Broadway, which was at the southeast corner of WTC7.
Source, 059_1.JPG, 9/18/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 080.JPG, 9/18/01

Figure 15. WTC7, looking south, down W. Broadway.
Source, 080.JPG, 9/18/01
(picture probably taken 9/1201, but no later than 9/13/01)

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 081.JPG, 9/18/01

Figure 16. WTC7, looking south, down W. Broadway.
Source, 081.JPG, 9/18/01
(picture probably taken 9/1201, but no later than 9/13/01)

http://www.infowarsmedia.com/images/sept11/sept_11.zip, DSC00024_2.JPG, 9/18/01

Figure 17. The Verizon Building with remains of WTC6 in the foreground. Source, DSC00024_2.JPG, 9/18/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, DX-2.JPG, 9/18/01

Figure 18. WTC7, looking south, down Greenwich Street.
Source, DX-2.JPG, 9/18/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, DX-3.JPG, 9/18/01

Figure 19. WTC7, looking south, down Greenwich Street.
Source, DX-3.JPG, 9/18/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 002_1.JPG, 9/19/01

Figure 20. Caption
Source, 002_1.JPG, 9/19/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 010_1.JPG, 9/19/01

Figure 21. The remains of WTC7, as viewed down West Broadway, with the Post Office on the near left and WTC5 in the distance on the left. It is amazing how fast they toted off the toasted cars.
Source, 010_1.JPG, 9/19/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 068.JPG, 9/19/01

Figure 22. A view south down West Broadway with WTC7 on the right and the Post Office on the left.
Source, 068.JPG, 9/19/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 069.JPG, 9/19/01

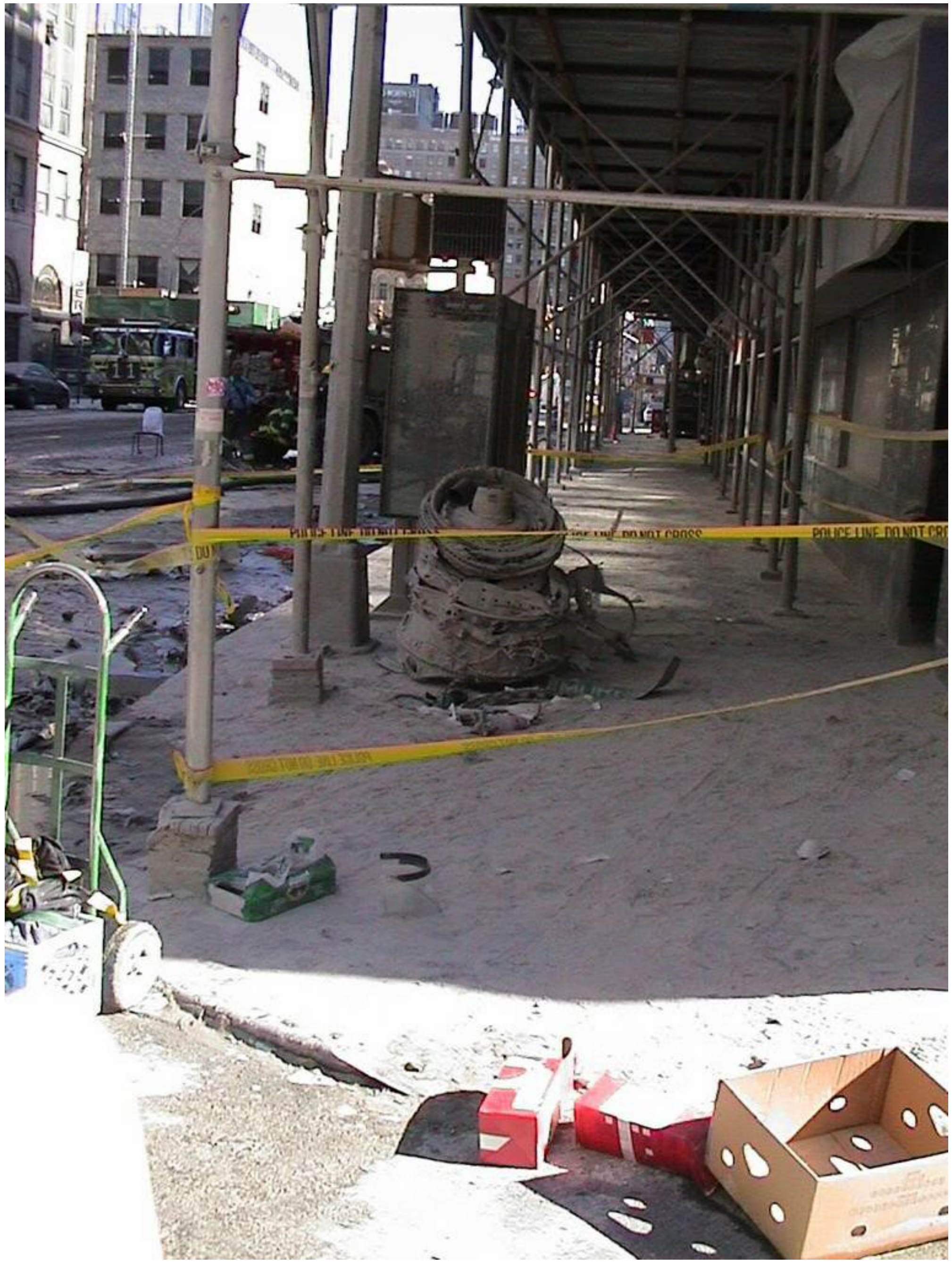
Figure 23. A view south down West Broadway with WTC7 on the right and the Post Office on the left.
Source, 069.JPG, 9/19/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 070.JPG, 9/19/01

Figure 24. A vew south down West Broadway, with WTC7 on the right and the Post Office on the left.
[Source](http://www.infowarsmedia.com/images/sept11/sept_11.zip), 070.JPG, 9/19/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, 0002.JPG, 9/20/01

Figure 25. Viewing the remaining north "stub" of WTC4, looking west. WTC4 was a 9-story building. Why is there no visible debris of the 110-story WTC2 above the third or forth floor?
Source, 0002.JPG, 9/20/01



http://www.infowarsmedia.com/images/sept11/sept_11.zip, DSC00004.JPG,

9/20/01
Figure 26. This is supposedly at the corner of Church and Murray (a.k.a. Spook Corner). This piece is not oriented at its position of maximum stability and lowest potential energy. It is probably not impossible for this piece to have landed in this unstable position, but it is highly improbable. In addition, there is no evidence for how this object arrived in this location and in that orientation. How could this item "bounce" over the curb (while leaving no marks) jumping 10-20 feet on the last bounce, or travel horizontally and land without bouncing (with a completely inelastic impact), and/or fall through the canopy onto the sidewalk without bouncing... Source, DSC00004.JPG, 9/20/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, DSC00015.JPG,

9/20/01

Figure 27. A view from Vesey Street looking northwest. The Verizon building is on the left. It is curious how a building could collapse and leave some windows intact. In any case, this building was not pulverized! A portion of the walkway over the street can be seen.
Source, DSC00015.JPG, 9/20/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, DSC00021.JPG,

9/20/01

Figure 28. Caption
Source, DSC00021.JPG, 9/20/01

http://www.infowarsmedia.com/images/sept11/sept_11.zip, sp21_003.JPG, 9/21/01

Figure 29. Caption
Source, sp21_003.JPG,

http://drjudywood.com/articles/DEW/StarWarsBeam1.html