Web Enabled Disaster and Crisis Response: What Have We Learned from the September 11th

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Web Technology and the Attack on the World Trade Center

Abstract

The September 11, 2001 attack on the World Trade Center was an attack on corporate America, particularly the financial and investment sector that is heavily concentrated in lower Manhattan. The attack resulted in unprecedented corporate losses. Insured property losses exceeded $70 billion—greater than the insured losses resulting from Hurricanes Hugo and Andrew and the Loma Prieta and Northridge earthquakes combined (Murphy, 2001). In the month after the attack Wall Street lost $160M in commissions, 45,000 security workers were displaced by attacks, 108,500 jobs were lost, and 13.4 million square feet of office space were destroyed. Impacts on individual businesses were extreme. Merrill Lynch had 9,000 employees displaced. (Hagg, 2001). Morgan Stanley Dean Witter and Co, had 3,700 personnel displaced from the WTC, but sustained only 6 casaulties. (McPhee and O'Shaughnessy, 2001). Cantor Fitzgerald lost almost 75% of their employees when Tower One collapsed. The disaster recovery and contingency planning efforts made following the 1993 World Trade Center bombing and the system improvements made in anticipation of Y2K enabled businesses to survive catastrophic impacts. Web based technology was critical to the survival of the businesses impacted by the attack on the World Trade Center and was a key element in the corporate and public sector response.

Key Words: Disaster recovery, web technology, contingency planning, terrorism, September 11

Introduction

The September 11 attacks on the World Trade Center and the Pentagon inflicted on the United States its first civilian mass casualty disaster since the Texas City Explosions/Fires of 1947 (581 deaths, 3,500 injuries). The toll of the attacks, almost 3,000 lives lost, approaches the casualty toll of the Galveston Hurricane of 1900, the most catastrophic disaster in U.S. history. Estimates of insured losses are as high as $77 million, far exceeding the $ 19.6 billion loss caused by Hurricane Andrew in 1992, the nations prior worst economic loss. This paper briefly describes how this catastrophic attack impacted e-commerce, how the same technology enabled corporations to recover critical business processes, and how web technology assisted both businesses and emergency management organizations to respond to the attacks.

The corporate business continuity and disaster recovery capabilities of some of the world's largest financial institutions were tested and challenged when the World Trade Center collapsed on September 11, 2001. The impact on the U.S. financial

system seemed catastrophic. The New York Stock Exchange was closed by order of President Bush and did not reopen for trading until Sept 17, the second longest closure in NYSE history (Berenson, Sept 17, 2001). Key executives were missing, offices, computers and files destroyed. The infrastructure of lower Manhattan suffered devastating impact. Approximately 80% of the circuits used for voice and data communications were out of operation following the attack, over 3.5 million high capacity circuits and 300,000 telephone lines. (Mehta, 2001). The rapid corporate recovery from this event can be attributed to the attention given to contingency and disaster recovery planning following the 1993 bombing of the World Trade Center, the preparations for Y2K, and e-commerce technology that allows business to be independent of physical location. The next section describes the attacks and provides a timeline of the response to the attack in the first 48 hours. Given this context, the following section describes the business recovery, and the final section comments on implications for e commerce.

Timeline of the Response to the Attacks

(This section is adapted from Harrald, Renda-Tanali, and Coppola, 2002)

At 8:45am on September 11, 2001, American Airlines Flight 11 crashed into the north tower of the World Trade Center complex in New York City. Initially, this unbelievable event appeared to be isolated. Eighteen minutes later, as the media was televising video around the world of the smoking skyscraper, a second commercial airliner came into view and disappeared with an enormous explosion into the South tower. This plane, Flight 175 (also from Boston,) confirmed any initial fears that the United States was under attack by an unidentified terrorist group.

Within five minutes of the second event, the Federal Aviation Administration ordered all New York City airspace 'sterilized', (freed from air traffic). Seven minutes later, all New York City airports were closed, and at nine minutes after that (9:26am), all civil flights were prevented from taking off. Over 4000 planes had been over US land, and several hundred were en route from overseas - all were grounded or re-routed to Canada. This could do nothing, however, to stop American Airlines flight 77 from reaching its crash- course destination of the Pentagon at 9:43. Fearing yet another attack, the White House was evacuated at 9:45. Just after 10am, the South Tower of the World Trade Center complex collapsed, raising the estimated dead and injured exponentially. Secret service agents were positioned in Lafayette Park (10:08), the United Nations complex was evacuated in New York (10:13), and several federal departments and agencies are evacuated in Washington, DC (10:22). By 10:30, the U.S. Office of Personnel management had begun the evacuation of all DC federal buildings.

Also around 10:30am, the North Tower of the World Trade Center complex collapsed, adding to fears concerning the scale of casualties. At this point, Governor

Pataki closed all government offices in New York, and New York City Mayor Giuliani ordered the evacuation of all Manhattan areas south of Canal Street. It was reported that several airports around the country were evacuating, and rumors of car bombs and additional hijacked planes were making there way into the news. Reports that there was a fourth hijacked plane were confirmed when the plane crashed in Somerset County, Pennsylvania.

At noon, it was still not known if the attack was over. Washington, DC closed its city government buildings, and the GSA closed its buildings and courthouses throughout 5 states in the capitol region. DC mayor Anthony Williams declared a state of emergency for the city of Washington at 1:22pm. Soon after, the FAA announced that there would be no commercial air traffic until at least noon of September 12.

By mid afternoon, rescue crews from around the country began arriving at the three sites to assist to local police and fire departments that immediately responded. Mayor Giuliani announced at 2:49, in a press conference, that subway and bus services were restored in New York City. Estimates into the number of injured or killed range from several hundred to tens of thousands, though no official was willing to give specific numbers.

As the evening approached, it was reported that Building 7 or the World Trade Center complex which had been burning for much of the day has collapsed. In addition, other buildings in the area of the towers were reported to be on fire. Mayor Giuliani appeared at an evening press conference and urged New Yorkers to remain at home on September 12th if they could, though Defense Secretary Rumsfeld held a news conference in which he stated that Pentagon employees should expect to report to work.

Timeline of the First 48 Hours

September 11, 2001

8:45am American Airlines Flight 11 from Boston flown into World Trade Center North Tower (cnn.com)

8:50 EPA Headquarters EOC activated

8:50~ USCG NRC alerts FBI of WMD terrorist event.

9:00~ Airports Authority begins evacuation of Reagan, BWI and Dulles airports

9:01 EPA headquarters and EPA Region 2 begin coordination conference call (EPA Timeline)

9:03 United Airlines Flight 175 from Boston flown into World Trade Center South Tower (cnn.com)

9:08 FAA sends written notice to all NYC airports to 'Sterilize' the airspace

9:10   EPA Headquarters uses GETS conference call system with regions 1-4 (EPA Timeline)

9:17   FAA shuts down NYC Airports (cnn.com)

9:21   Port Authorities of NY and NJ close all bridges and tunnels in NY area (cnn.com)

9:26   FAA issues national "ground stop", preventing all civil flights from taking off

9:30   President Bush gives first press appearance in Florida (cnn.com)

9:32   HHS National Disaster Medical System (NDMS) and Commissioned Corps Readiness Force (CCRF) notified and placed on advisory (HHS Sitreps)

9:40   DC recalls off-duty police officers, begins closing roads and securing government buildings (Washington Post, 9/17, A1)

9:43   American Airlines Flight 77 hits Pentagon - immediate evacuation begins. (cnn.com)

9:45   FAA grounds all planes in the US

9:45   White House evacuation begins (cnn.com)

9:50~   Arlington County activates emergency response plan - County Mgr. Ron Carlee becomes director of the emergency response (Alexandria/Arlington Extra, 9/20, p12)

9:57   President Bush departs Florida for Barksdale, LA (cnn.com)

10:00   EPA begins coordination with NY and VA governments (26 initial staff to NYC and Pentagon) (EPA Timeline)

10:05   World Trade Center South Tower Collapses (cnn.com)

10:08   Secret Service begin patrol of Lafayette Park, across from the White House (cnn.com)

10:10   Partial collapse of the Pentagon (cnn.com)

        United Airlines Flight 93 from Newark crashes in Somerset County, PA (cnn.com)

10:13   United Nations evacuates NY headquarters (11,400 employees) (cnn.com)

10:16   DC Mayor COS sends email to 100's of workers 'Evacuate Building NOW' - retracts 4 min's later (Washington Post, 9/17, A1)

10:22   World Bank, State Department and Justice Department evacuate (cnn.com)

10:24   FAA reports all inbound transatlantic flights are being diverted to Canada (cnn.com)

10:25   Alarm sounds at OPM, PA system instructs employees of that building to evacuate

10:28   World Trade Center North Tower collapses (cnn.com)

10:30   OPM and White house begin evacuation of all Washington, DC federal buildings

10:39   FAA closes all operations at all US airports by NOTAM (Notice to Airmen)

10:46   Colin Powell begins his trip back to the United States (cnn.com)

11:50~ DC hospitals move into emergency response mode

10:54   Israel begins evacuation of all diplomatic missions (cnn.com)

10:57   NY Governor Pataki closes all NY government offices (cnn.com)

11:02   NYC Mayor Giuliani orders evacuation of area south of Canal Street (cnn.com)

11:16   CNN reports the Center for Disease Control and Prevention response teams preparing to respond (cnn.com)

12:00pm US closes border to Mexico

12:04   Los Angeles International airport evacuated (cnn.com)

12:15   San Francisco airport evacuated (cnn.com)

12:46   GSA orders federal courthouses and offices in VA, DE, MD, PA, WV closed until further notice

Trains in/out of DC Union Station stopped

DC closes all government buildings and all 19 buildings under Capital Police jurisdiction

1:04   President Bush gives second press appearance from Barksdale, LA (cnn.com)

1:27   Mayor Anthony Williams holds news conference, declares state of e mergency for DC (cnn.com)

1:44   Pentagon announces 5 warships and 2 aircraft carriers have been deployed for NY and East Coast (cnn.com)

1:48   President Bush begins flight from Barksdale, LA to Offutt Air Force Base, NE (cnn.com)

2:00   FBI announces they "are working under the assumption that the 4 planes are part of a terrorist attack" (cnn.com)

2:21   53 people reported injured at the Pentagon

2:30   FAA announces there will be no commercial air traffic until at least 12pm on September 12 (cnn.com)

2:49   Mayor Giuliani announces subway and bus service has been partially restored - no casualty info (cnn.com)

3:55   Mayor Giuliani announces that 200 people are critically injured, of 2100 total infuries reported (cnn.com)

4:06   CA Governor Gray Davis dispatches USAR teams to NYC (cnn.com)

4:25   Stock exchanges (ASE, NYSE, Nasdaq) announce that they will remain closed September 12 (cnn.com)

4:30   President Bush leaves Offutt Air Force Base, NE for Washington, DC (cnn.com)

5:20   World Trade Center building 7 collapses (cnn.com)

6:00   Incident Command Meeting at the Pentagon, led by Chief Schwartz

6:00   AMTRAK resumes rail service

6:10   Mayor Giuliani urges NYC residents to remain home September 12 if at all possible (cnn.com)

6:40   Donald Rumsfeld holds news conference in Pentagon to announce the building is operational except for corridors 2-6 (cnn.com)

6:54   President Bush arrives in Washington, DC (cnn.com)

7:02   CNN reports that some NYC bridges are open to outbound traffic

7:17   Attorney General Ashcroft announces FBI website for attack tips, and that friends/family can call 800.331.0075 to leave contact information (cnn.com)

7:30   President Bush issues major disaster declaration for NYC (FEMA-1391_DR)

7:45   NYPD announces that 78 officers are missing, and at least 200 firefighters are feared dead (cnn.com)

8:30   President Bush gives 3rd press appearance (cnn.com)

9:22   Pentagon fire still burning, but under control (cnn.com)

Unsp   DOD opens media operation center at Marine Corps Post Henderson Hall, Arlington, VA (703.697.9928) (defenselink.mil)

Unsp   HHS activates National Medical Emergency System, which put and puts 7000 volunteer doctors in 80 disaster teams on readiness alert. The PHS Commissioned Corps was also put on readiness alert (5700 personnel); waits for orders from FEMA (HHS Sitreps)

Unsp Federal Reserve assures that funds will be available if needed

Unsp   DC Emergency Management Agency holds meeting at Franklin D. Reeves Conference Center

Unsp   FEMA dispatches 4 USAR teams to Pentagon - claims to have coordinated Emergency Response

Unsp   Arlington Fire Chief Plaugher announces 100 - 800 feared dead at Pentagon

Unsp	HHS sends 3 DMATs to the Pentagon (46 medical personnel from the U.S. Commissioned Corps DMAT in Rockville, MD; 35 from Winston-Salem, NC; and 36 from Atlanta, GA.) (HHS Sitreps)
Unsp	HHS sends 3 DMORTs to the Pentagon, with 102 personnel (HHS Sitreps)
Unsp	HHS sends 5 DMATs to NYC (25 personnel from Lyons, NJ; 44 from White Plains, NY; 41 from Boston; 52 from Worcester, MA; and 49 from Providence, RI). (HHS Sitreps)
Unsp	HHS sends 4 DMORTs with a total of 169 personnel to NYC from throughout the East Coast. (HHS Sitreps)
Unsp	Navy prepares USS Comfort to ship to NYC if necessary
Unsp	US Customs goes on Code Red Security Alert
Unsp	USCG sends 4 helicopters, 270' Cutter, 3 110' coastal patrol boats and 7 small boats to NYC
Unsp	FEMA names Ted Monet as coordinating officer of the disaster
Unsp	HHS CDCdeploys 4 epidemiologists and 2 laboratory experts to NY to assist assessing medical needs and capacity planning for treating victims in the area's hospitals. (HHS.gov)
Unsp	HHS Centers for Medicare & Medicaid Services sends 5 staff to assist at the response center established by FEMA in Edison, NJ (HHS.gov)
Unsp	HHS authorized the 1st emergency use of the National Pharmaceutical Stockpile - the shipment arrived in NYat 9pm - 1 of 8 "12-Hour Push Packages" (HHS.gov)
Unsp	HHS CDC worked with tetanus vaccine manufacturers and the public health dept's of NY and DC to ensure adequate supplies of the vaccine were shipped to both locations (HHS.gov)
Unsp	HHS CDC activates Health Alert Network (provides rapid information to all health departments)(HHS.gov)
Unsp	EPA and OSHA both monitoring exposure to potentially contaminated dust and debris; Region 2 emergency response staff stationed at FBI Joint Operations Center in NYC, Trenton NJ EOC, and FEMA's office in Albany, NY; Region 2's Edison, NJ office is providing space for 100 FEMA staff; EPA HQ EOC operating on 24-hour basis; R3 has emergency responders deployed DC, Ft. Meade and at Willow Grove Naval Air Station, PA. (EPA Timeline)
Unsp	EPA - REGION II: Deployed 4 On-Scene coordinators to NYC, began 24-hour operations in
Edison, NJ,	Collected 4 dust samples in vicinity of WTC, initiated daily ambient air monitoring program downwind of WTC, coordinated with NYC and OSHA (EPA Timeline)

Unsp   EPA-REGION III: Deployed 4 OSCs (VA, EOC, DC EOC, FEMA ROC, Ft. Meade), Deployed 4 START with OSC to Ft. Meade (EPA Timeline)

Unsp   EPA-HEADQUARTERS: Began 24-hour operatoin at EOC, prepared for Continuity of Operations Plan (COOP) activation, removed EPA's website to protect against hackers & secure data (OEI), staffed FEMA EST, staffed FBI Strategic Information Operations Center (SIOC), Took precautions to ensure payroll for all EPA employees, Discussion of permitting issues for air and waste with Regions II and III. (EPA Timeline)

September 12, 2001

8:00am FEMA director Allbaugh announces phone number (800.462.9029) for emergency assistance

8:11   Mayor Giuliani announces the rescue of 6 firemen and 3 police officers from WTC (stratfor.com)

8:15   UN announces that all staff are ordered out of Afghanistan (stratfor.com)

9:05   Announcement made that Dulles Airport will open at 3pm for luggage/car retrieval (stratfor.com)

9:53   Pentagon announces that 80 bodies have been recovered (stratfor.com)

10:06   Congress reconvenes (stratfor.com)

10:30~ DOD opens family assistance center at Sheraton Hotel in Crystal City (info, counseling, support)(defenselink.mil)

11:20   FAA bans all air-travel in US indefinitely (stratfor.com)

11:58   Pentagon evacuates because of smoke; staff return shortly thereafter (stratfor.com)

1:00pm Pentagon alerts HHS that it will handle all med and mort needs on -site (

1:07pm FBI conducts search of Boston hotel room (stratfor.com)

1:10   American Airlines distributes passenger lists (stratfor.com)

1:48   United Airlines distributes passenger lists (stratfor.com)

2:20   Flights rerouted on September 11 given authority to resume - all others still grounded (stratfor.com)

2:40   Amtrak train from Boston to Providence boarded - 3 taken into custody (stratfor.com)

Unsp   Bush issues Emergency Declaration for Arlington County

Unsp   NY Union officials release that ~265 Firemen were killed

Unsp   FAA says that flights can resume, but airline executives decide not to do so for safety reasons

Unsp   Allbaugh and Bush meet to discuss the role FEMA will play in the disaster

Unsp   FEMA Acting Deputy Director Mike Brown holds press conference, gives NYC statistics - 40 bodies recovered, 1600 treated

Unsp   Bush requests $20 billion in emergency funding from congress; congress allocates $20 billion

Unsp   Army Corps of Engineers sends Structural Assessment Teams to assess debris removal and power

Unsp   FEMA Director Allbaugh flies to New York City

Unsp   IAFF President Harold Schaitberger says toll to NYC firefighters higher than originally estimated

Unsp   Metro opens Pentagon subway stop

Unsp   DOE's Energy Information Agency (EIA) releases oil market assessment showing overall U.S. and global oil supplies appeared to be minimally impacted, to quell rising fears of a shortage; DOE coordinates with ACOE to restore power to NYC, provide power generators and fuel; DOE personnel help evaluate the movement of critical oil resources into NY Harbor and review tug and barge availability for oil movement to upstate NY; DOE offers key equipment to assist in the NYMEX re-opening and is coordinates with USCG and local harbors to evaluate oil supplies up and down the East Coast; in conjunction with FEMA, DOE assists in search and rescue using Ground Penetrating Radar (GPR) equipment, adapted with motion detection applications and uses remotely-operated equipment, including infrared cameras, robotic equipment and fiber optic cameras, to aid the search for victims and evidence.

Unsp   EPA-REGION II: Received initial mission assignments from FEMA for $200,000, later increased to $500,000, established operations from Edison, NJ with help of 12 OSCs, took initial dust and air samples near WTC, provided 200 Tyvek suits to Monmouth County, NJ Health Department (EPA Timeline)

Unsp   EPA-REGION III: Received initial mission assignment from FEMA for $25,000, deployed 4 OSCs and 2 air inspectors to Pentagon and surrounding Arlington/DC area, deployed OSCs to FEMA A-ROC, ERT-A in Arlington, DC EMA; closed DC EMA, moved 4 START personnel from Ft. Meade to Pentagon (EPA Timeline)

Unsp   EPA - HEADQUARTERS: Began twice daily emergency response technical conference calls with regions 1-6, prepared morning and evening special reports, held conferene call with the National Response Team agencies, established communications support for Region II, including website and web access to email (EPA Timeline)

pm   Donald Rumsfeld announces Pentagon death toll lower than estimated 800 (defenselink.mil)

pm   HHS NMRT-E Weapons of Mass Destruction travels to NYC (HHS Sitreps)

September 13, 2001

7:30am Pentagon evacuated after a bomb threat is called in

8:15   Sec. Thompson authorizes first collaboration of DMORT team with FBI to PA crash site

12:00pm Vice President Cheney is taken to Camp David

6:00pm Congress evacuated after a bomb threat is called in

6:00   NYC Mayor's Office (Sam Benson) discusses establishment of treatment center with HHS, to begin at 7am on September 14th

Unsp   President Bush declares September 14 a day of remembrance

Unsp   President and Congress agree on $40 billion in emergency appropriations

Unsp   Airline operations resume

Unsp   Army search and rescue move ~60 bodies to Dover Air Force Base, DE from Pentagon

Unsp   President Bush announces the creation of Homeland Security cabinet position, names Tom Ridge

Unsp   President Bush issues Emergency Declaration for VA

Unsp   Tommy Thompson meets with Governor Pataki and Mayor Giuliani to discuss NYC needs (HHS.gov)

Unsp   HHS Substance Abuse and mental Health Administration team dispatched to NY to conduct longer-range planning for services to rescue workers, survivors and others. (HHS.gov)

Unsp   HHS sends National Medical Response Team (NMRT) to NY to help detect any possible industrial chemical-related problems that may result from the collapse of buildings (HHS.gov)

Unsp   HHS sends DMORT team with 35 personnel and a portable morgue with 8 personnel to Pennsylvania crash site at request of FBI. (HHS Sitreps)

Unsp   HHS Veterinary Medical Assistance Team (VMAT) activated and sent to NYC - 9 vets. (HHS Sitreps)

Unsp   HHS FDA continues to monitor pharmaceutical and blood availability and helped arrange deliveries of skin products for burn victims in New York and Washington, D.C.(HHS.gov)

Unsp   EPA-REGION II: Staffed Edison, NJ with 30 personnel, received 15 OSCs who were deployed to Edison, NJ, provided assistance to financial district companies to recover business assets in computers, coordinated with ACOE on WTC debris removal (EPA Timeline)

Unsp   EPA-REGION III: Deployed 6 OSCs to Arlington, VA, Initiated air monitoring at Pentagon, transitioned A-ROC activities back to ROC in Philadelphia (EPA Timeline)

Unsp EPA-HEADQUARTERS: Continued EOC operations, technical conference calls, and special reports, initiated procurement of laptops and wireless communications for Region II. (EPA Timeline)

The Business Recovery and Web Technology

The rapid recovery of key financial institutions was a direct result of Y2K preparations and disaster recovery systems established after the 1993 World Trade Center bombing. These systems relied on back up sites and web technology to allow recovery of business processes without loss of data or interruption of customer service. No organization, however, planned for the loss of key personnel experienced or for the extended loss of systems and facilities. The fact that corporations are a terrorist target will generate significant new interest in corporate crisis management. Table 1 provides examples of a few of the most severely impacted companies. The discussion that follows focuses on the impact on e commerce and the use of web technology in recovery and response.

Table 1: *Selected Impacts of World Trade Center Attacks*

Company/ Building/floor	Industry	# victims	# employees at ground zero	IT damage
Cantor Fitzgerald 1/101-105	Investments	730	1000	Resumed on line trading on 13 Sept with eSpeed and Tradespark
Marsh McLennon Tower 1/93-100 Tower 2 47-54	Consulting Financial	245	1,900	Lost most of IT staff, recovered all systems
AON Tower 2/92-99, 100	Insurance	165	1,100	No data loss, But high speed access down until Oct 14
Morgan Stanley Tower 2 5 WTC	Investments	6	3,700	$150M No data lost, email restored in 72 hours
Merrill Lynch	Investment Services	3	9,000	Relocated 8,000 employees, Restored sytems same day
American Express Tower 1, 3WFC, /WTC	Financial Services	11	3,200	$140 M no interuption in customer service

Approximately 2,700 Morgan Stanley employees were evacuated from Tower 2 when Tower 1 was hit. Security Chief Richard Rescorla, head of corporate security, was responsible for the successful evacuation and he was one of the only 6 Morgan Stanley employees killed (McPhee and O'Shaughnessy, 2001). Morgan Stanley was able to successfully protect shareholder value and remain profitable in spite of the losses of 9/11. Investments in redundant computing and communication technology made after the 1993 WTC bombing played a significant role in this successful recovery (Morgan Stanley 2001 *Annual Report*).

Cantor Fitzgerald, a private corporation, is a major financial trading firm that conducts over $50 trillion in transactions annually. Cantor Fitzgerald owns the electronic trading systems e–Speed and Tradespark. These systems survived the loss of the physical headquarters and l' of the Cantor Fitzgerald employees for two reasons. First, the company had redundant capabilities in London and New Jersey and since e-traders typically worked later shifts than did voice traders, many of the technical e-trading staff survived the collapse of Tower 1. Cantor Fitzgerald resumed trading within 48 hours of the attack using these e commerce systems. CEO Howard Lutnick elected to concentrate his business recovery trade on the electronic trading systems and not recover the voice brokerage service. (Cantor Morning News, Nov 15). The company also used its electronic commerce capability to distribute financial assistance to surviving employees and to families of missing employees (Cantor Morning News, Oct 15).

Marsh McLennan Companies, Inc. reported a 4% increase in net revenue, and a 3% increase in earnings per share in 2001, in spite of the losses of September 11 (MMC Annual Report). On September 16, 2001, J.W. Greenberg, the Chairman of Marsh and McLennan Companies was able to report that, "all areas of our businesses are operating effectively", including the subsidiaries of Marsh, Putnam, Mercer Consulting, and Guy Carpenter . Disaster recovery plans that were key to this survival included (MMC News, Sept 16).

- Mercer Consulting recovery of all files and computer processing applications
- Guy Carpenter's documentation imaging system and redundant data storage prevent the loss of over 25 million documents
- Marsh was able to recover all computer systems in spite of its loss most of both its information technology and financial support services staffs.

Merrill Lynch had over 9,000 employees impacted by the attack, but was able to successfully evacuate its headquarters in the World Financial Center and resume business within minutes using backup computer sites and a crisis command center in New Jersey (Ballman, 2001). Although its offices were not destroyed by the attacks, they were within the "ground zero" recovery area and Merrill Lynch was denied access to its own facilities. Merrill Lynch had successfully relocated over 8,000 employees by the time the New York Stock Exchange opened on the 17th . According to Paul Honey, Merrill Lynch's director of global contingency planning,

the successful recovery of data was primarily a function of the company's preparation for Y2K. Merrill lynch handled 8% of the NYSE trading volume on the first day it opened. (Hagg, 2001). Merrill Lynch was able to accomplish this by transferring trading operations to London, Tokyo and Hong Kong. The company used its web site to communicate relocation and emergency transportation information to employees, and to communicate with displaced workers (Rynecki, 2001).

Businesses were faced with the horrendous task of accounting for their employees and determining who was dead, injured, or missing. No organizations had established systems to do this on the scale required. Corporations used dedicated websites or internet pages:

- To establish memorials or relief funds,

- To distribute funds to employees

- To communicate with employees, providing information on situation and on how to access assistance

- To communication with shareholders, investors and/or other stakeholders

Conclusions and Unresolved Problems

The September 11 attack on the World Trade Center was a turning point for corporate America. The strategic importance of disaster recovery contingency planning and corporate crisis management preparedness were dramatically demonstrated. The ability to restore e-commerce operations, even with catastrophic loss of physical facilities was key to the survival of major financial and investment businesses. Web based technologies were also used in innovative ways by corporations and emergency managers. Corporations accounted for and communicated with employees. FEMA, the American Red Cross, The US Army Corps of Engineers, and the Environmental Protection agency all used web communication to inform the public and to provide status reports internally and externally. NY City Emergency Management Agency managed the extensive logistics of the recovery operation using an web based resource management system (E-team). The FBI established a website to receive information and tips from citizens that might aid the law enforcement investigation. There is, however, evidence that the terrorists also used the internet to plan the attacks showing that the web provides communication and coordination capability for all potential users.

In spite of its success, however, corporate America learned some difficult lessons. They learned that, although they were prepared to lose systems, they were not prepared to lose people. They learned that contingency plans and crisis management were critical strategic functions. They know that plans must be tested through drills and exercises. Finally, the threat of terrorist attacks has led to the reconsideration of

the practice of concentrating critical resources in a physical location and to rethinking possible worst case scenarios.

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