



NIST Response to the World Trade Center Disaster

**Federal Building and Fire Safety Investigation
of
the World Trade Center Disaster**

Part I - Introduction

April 5, 2005

**National Institute of Standards and Technology
Technology Administration
U.S. Department of Commerce**

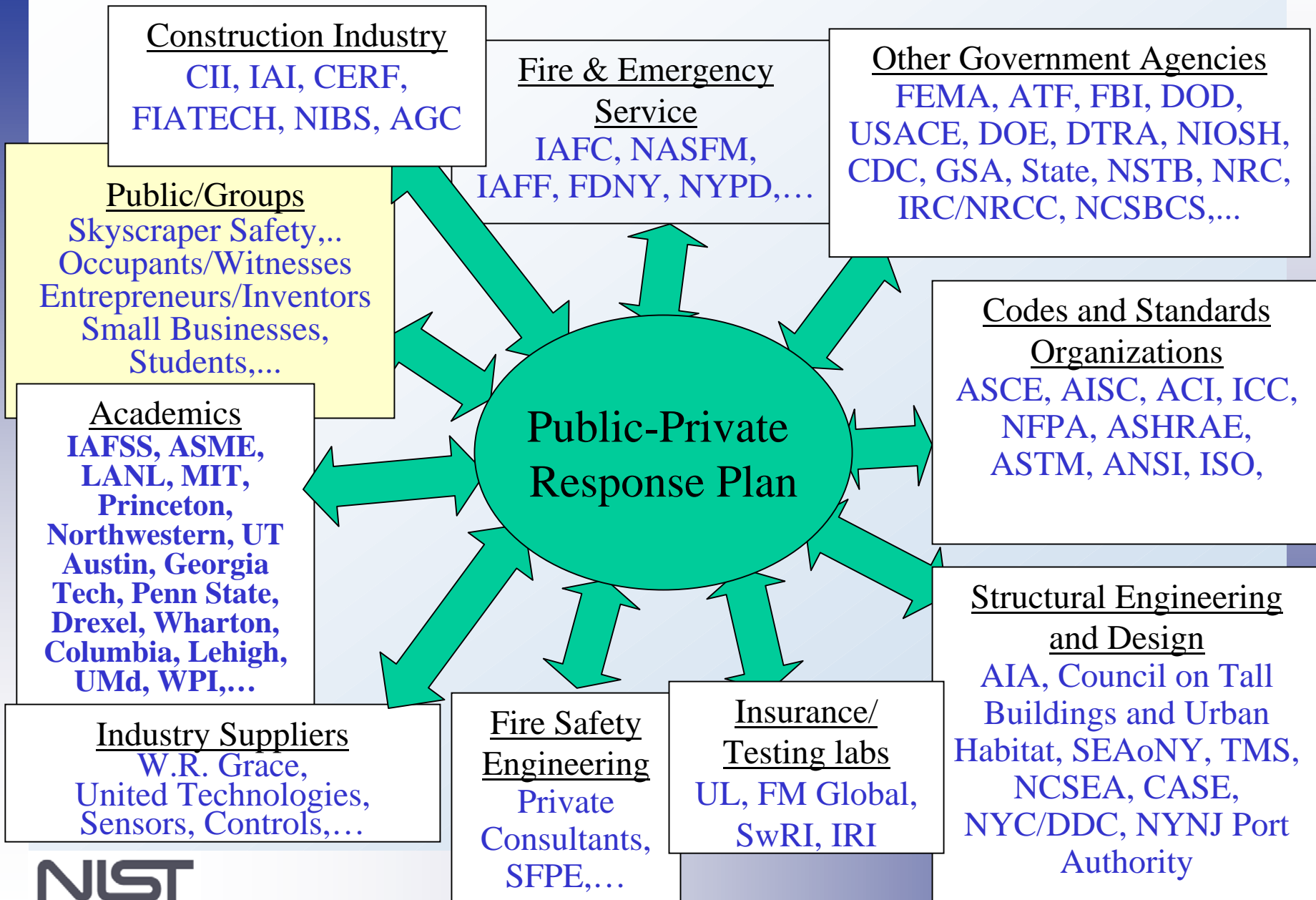
Outline

- Part I — Introduction
- Part IIA — WTC Towers Collapse Analysis
- Part IIB — WTC Towers Collapse Sequence
- Part IIC — WTC 7 Collapse
- Part III — Baseline Performance Analysis
- Part IV — Life Safety (Evacuation, Emergency Response, Active Systems)
- Part V — Procedures and Practices
- Part VI — Issues and Recommendations

National Context

- The collapse of the World Trade Center structures following the terrorist attacks of September 11, 2001 was one of the worst-ever building disasters in recorded history – killing 2749 people.
- More than 400 emergency responders were among those killed, the largest loss of life for this group in a single incident.
- Strong private sector, public, and Congressional demand for a comprehensive response to the World Trade Center disaster.
- Congress passed and the President signed into law on October 1, 2002, the National Construction Safety Team (NCST) Act.
 - Gives NIST authorities to investigate building failures.
 - Modeled after the NTSB, with some differences.

Stakeholders and Partners



**BPAT
Recommendations**

**Govt.
Industry
Professional
Academic
Inputs/Actions**

**Public Inputs/
Efforts**

**WTC
Investigation**

**WTC
Response Plan**

**Research &
Development**

**Dissemination
and Technical
Assistance Program**

**Guidance and Tools for
Improved Practices**

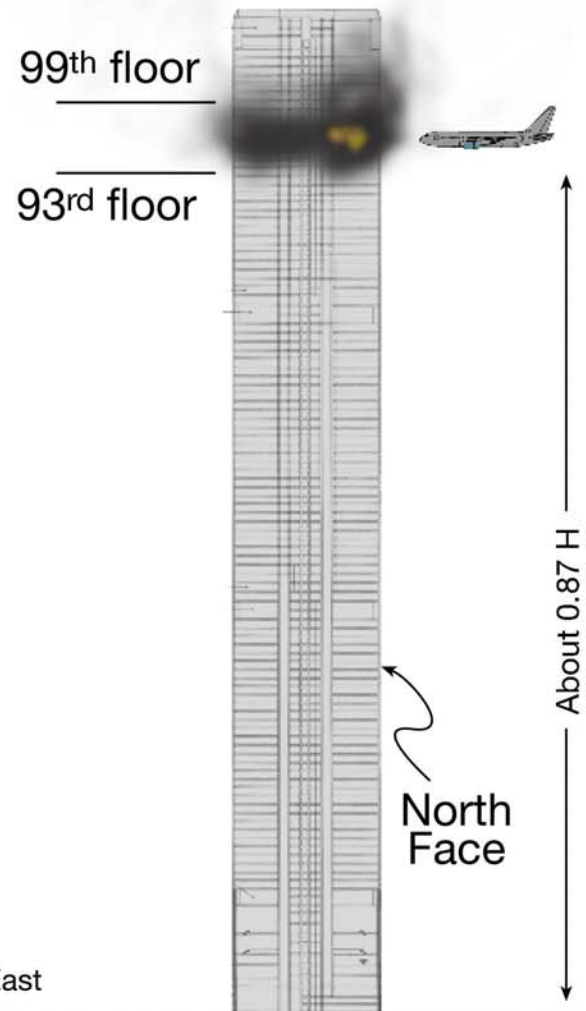
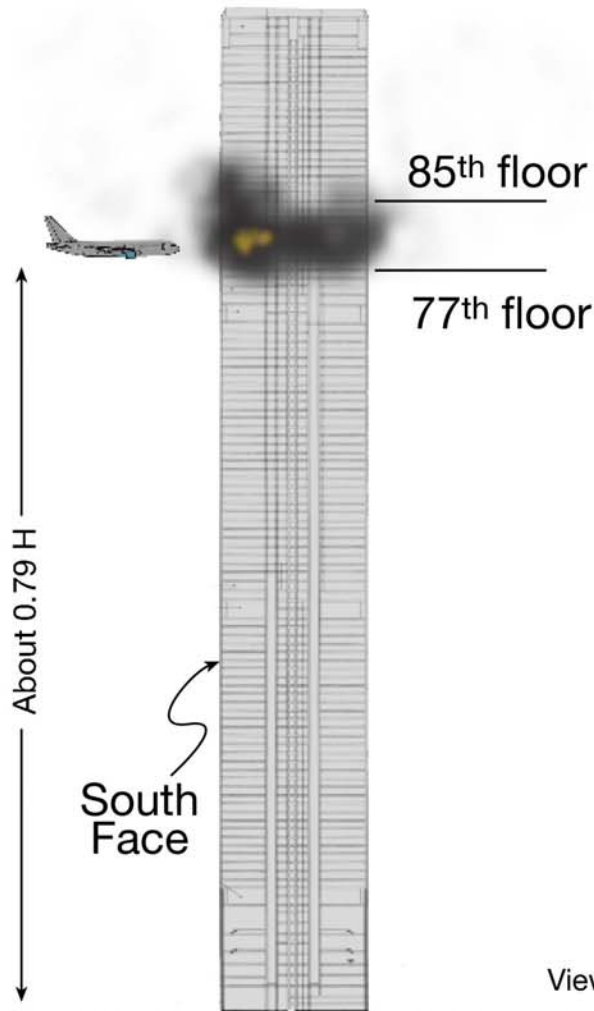
**Technical Basis for Improved
Building and Fire Codes
and Standards**

**Owners, Contractors, Designers,
Emergency Responders and
Regulatory Authorities**

**Standards and Code Development
Organizations**

NIST WTC Investigation Objectives

- Determine:
 - why and how the WTC Towers collapsed following the initial impact of the aircraft, and
 - why and how the 47-story WTC 7 collapsed
- Determine why the numbers of injuries and fatalities were so low or high depending on location, including technical aspects of fire protection, occupant behavior, evacuation, and emergency response
- Determine the procedures and practices that were used in the design, construction, operation, and maintenance of the WTC buildings
- **Identify, as specifically as possible, areas in current national building and fire model codes, standards, and practices that warrant revision**

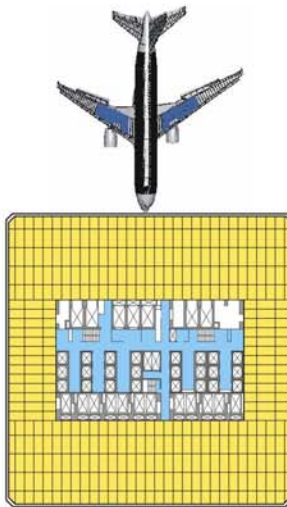


View from the East

WTC 2: Hit at 9:02:59 a.m.
Collapsed after 56 minutes

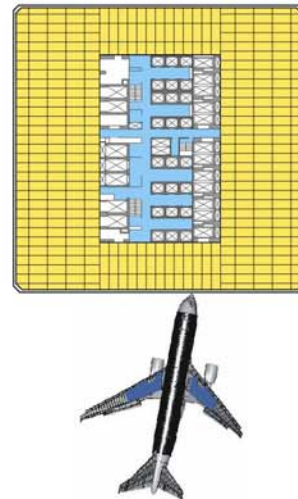
WTC 1: Hit at 8:46:30 a.m.
Collapsed after 102 minutes

Point of impact:
Close to the center
and nearly normal
to the building



WTC 1

Point of impact:
Close to the corner
and with an angle



WTC 2



Verizon Building

7 WTC
(47 Stories)

Barclay St.
Old Post Office Building

Washington St.

West Broadway St.

Vesey St.

6 WTC
(9 Stories)

5 WTC
(9 Stories)

American Express Building

Fulton St.

Millenium Hotel

West St.

1 WTC
(110 Stories)

Austin J. Tobin Plaza

Church St.

Day St.

Merrill Lynch Building

3 WTC
(22 Stories)

2 WTC
(110 Stories)

4 WTC
(9 Stories)

Cortlandt St.

1 Liberty Plaza Building

Liberty St.

Credit: NOAA
September 23, 2001

90 West Building

Washington St.

Bankers Trust Building

Greenwich St.

Some Specific Questions

- ❑ How and why did WTC 1 stand nearly **twice** as long as WTC 2 before collapsing (102 min. vs. 56 min.) though they were hit by virtually identical aircraft?
- ❑ What factors related to **normal** building and fire safety considerations not unique to the terrorist attacks of September 11, 2001, if any, could have delayed or prevented the collapse of the WTC towers?
- ❑ Would the undamaged WTC towers have remained standing in a **conventional** large building fire scenario?
- ❑ What factors related to **normal** building and fire safety considerations, if any, could have saved additional WTC occupant lives or could have minimized the loss of life among the ranks of first responders?
- ❑ How well did the procedures and practices used in the design, construction, operation, and maintenance of the WTC buildings **conform** to accepted national practices, standards, and codes?

WTC Investigation Projects

**BPAT
Recommendations**

**Government,
Industry,
Professional,
Academic Inputs**

Public Inputs

Public Inputs

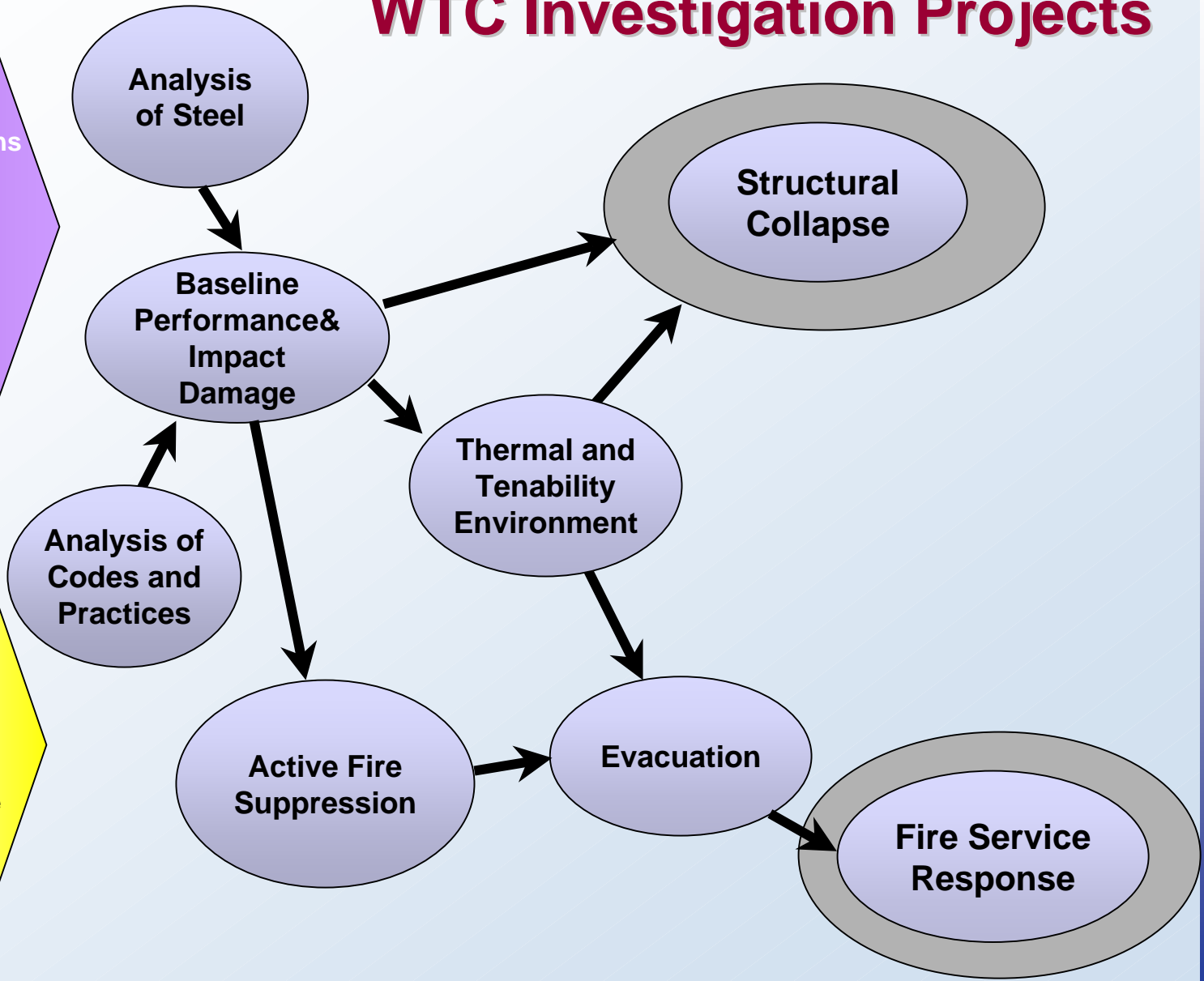
Documents

Video/ Photographic
Records

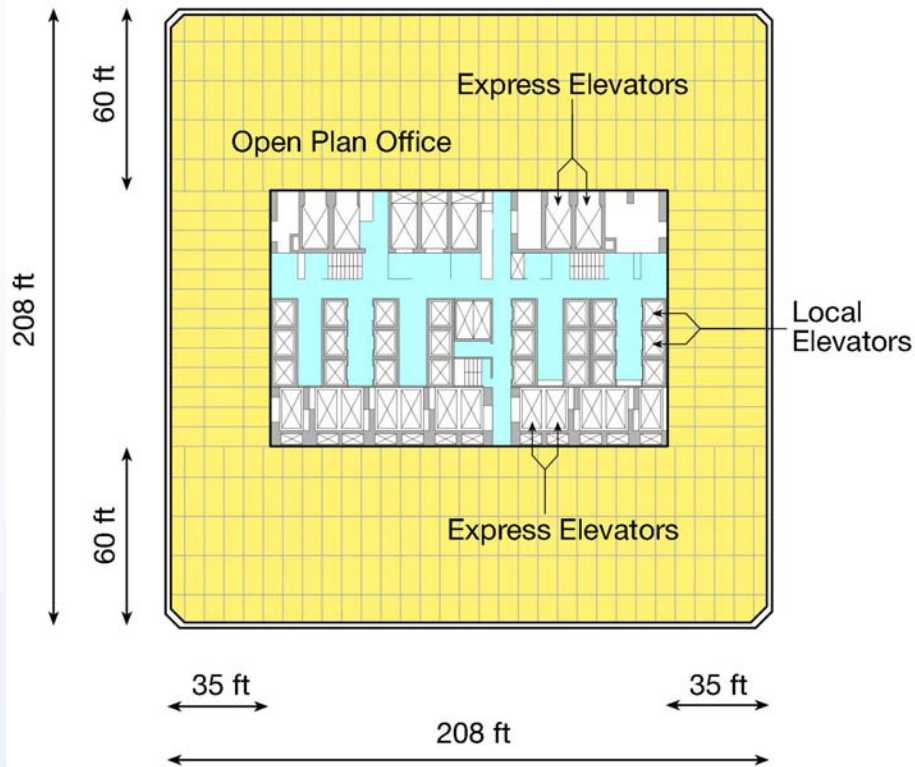
Oral History Data

Emergency Response
Records

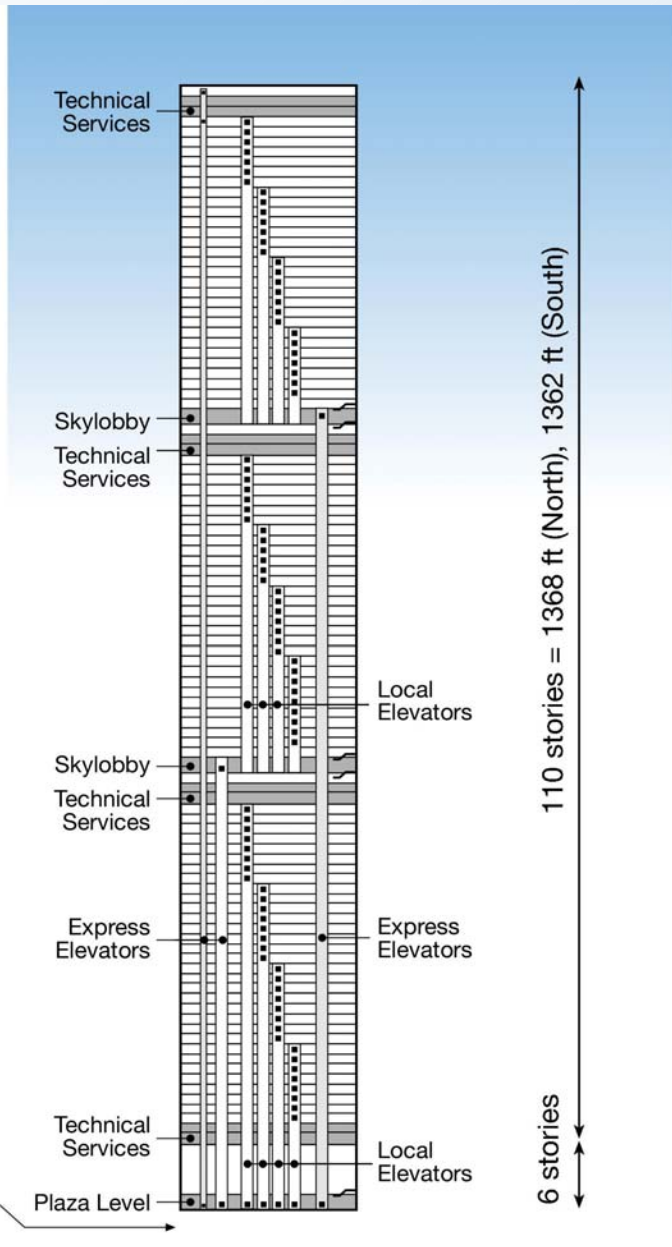
Recovered Structural
Steel

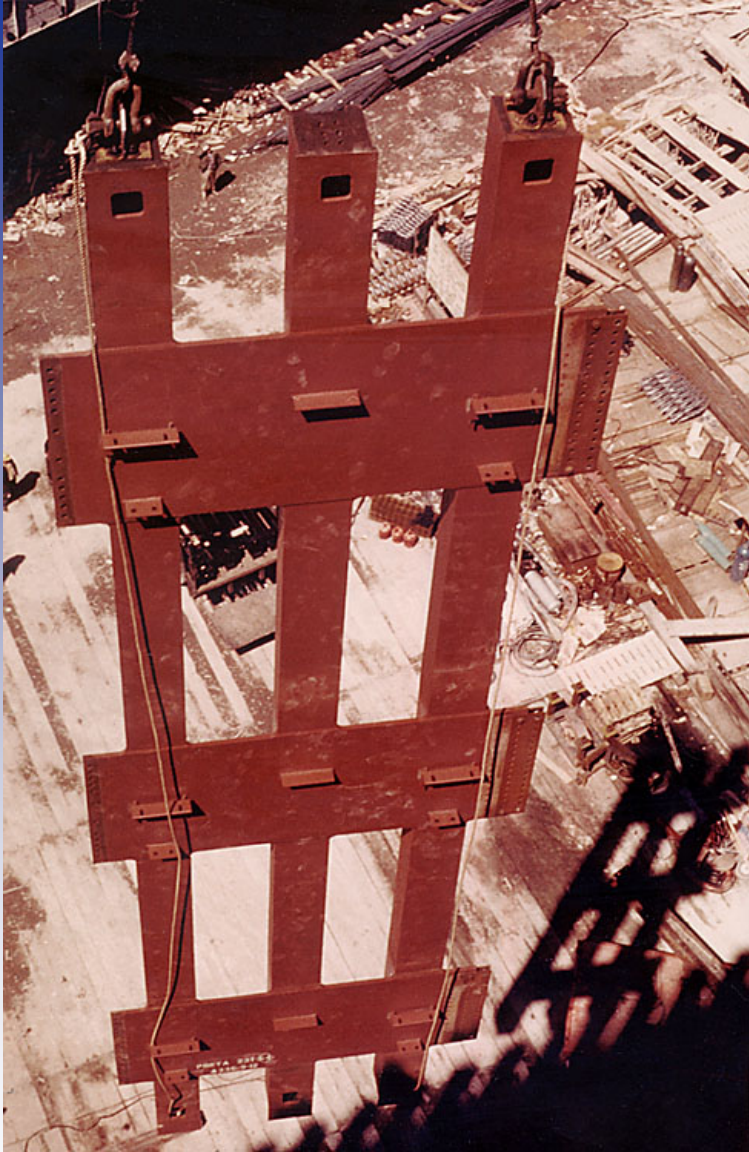


System Design Concept



Underground Car Park
(total capacity 2000)





Source Unknown



Safety of WTC Towers in Aircraft Collision

- Buildings are not normally designed to withstand the impacts of fuel-laden commercial airliners.
- Safety of the WTC towers and their occupants in an aircraft collision was a consideration in the original design.

Available Sources of Information:

- Port Authority (February 1964), three-page white paper, “Salient points with regard to the structural design of The World Trade Center towers,” dated 2-3-64.
- Port Authority (March 1964), three-page document, “period of vibration due to plane crash at 80th floor.”
- Alternative Insurance Works (2001), World Trade Center Property Risk Report, Prepared for Silverstein Properties, Inc.
- *The New Yorker* (11/19/2001), “The Tower Builder” by John Seabrook, Interview with Leslie Robertson.
- FEMA 403 (2002), *World Trade Center Building Performance Study: Data Collection, Preliminary Observations, and Recommendations*.
- Glanz and Lipton (2003), *City in the Sky – The Rise and the Fall of The – World Trade Center*, Times Books, 2003.

Available Information on Safety of WTC Towers in Aircraft Collision (1)

- Type of Aircraft: Boeing 707 (largest jet aircraft in the air at that time)
DC-8
- Speed of Aircraft: 600 mph (Port Authority, February 1964)
180 mph (FEMA 403, 2002)
- Location of Impact: 80th floor (Port Authority, March 1964)
- Structural design: It appears that the design of the WTC towers considered the impact of 707 aircraft and **analysis** indicated that such collision would result in only local damage which could not cause collapse or substantial damage to the building

NIST found no documentary evidence of any analysis supporting this conclusion.

Available Information on Safety of WTC Towers in Aircraft Collision (2)

Fire safety: There are two views on whether the effect of jet fuel and aircraft contents was a consideration in the original building design:

- One view suggests that an analysis was done indicating the biggest problem would be the fact that all the fuel would dump into the building and there would be a horrendous fire.
- Another view suggests that the fuel load, and the fire damage that it would cause, may not have been considered.

Life safety: There are two views on the potential effect of aircraft impact on occupant life safety.

- One view, which did not consider the fires, suggests that the aircraft impact would not have endangered the lives and safety of occupants not in the immediate area of impact
- Another view, which considered the fires, recognized that many people would not survive even though the building structure would remain.

Context of Findings

- ❑ Buildings are not specifically designed to withstand the impact of fuel-laden commercial airliners. While documents from The Port Authority of New York and New Jersey (PANYNJ) indicate that the impact of a Boeing 707 flying at 600 mph, possibly crashing into the 80th floor, was analyzed during the design of the WTC towers in February/March 1964, the effect of the subsequent fires was not considered. Building codes do not require building designs to consider aircraft impact.
- ❑ Buildings are not designed for fire protection and evacuation under the magnitude and scale of conditions similar to those caused by the terrorist attacks of September 11, 2001.
- ❑ The load conditions induced by aircraft impacts and the extensive fires on September 11, 2001, which triggered the collapse of the WTC towers, fall outside the norm of design loads considered in building codes.
- ❑ Prior evacuation and emergency response experience in major events did not include the total collapse of tall buildings such as the WTC Towers and WTC 7 that were occupied and in everyday use; instead, that experience suggests that major tall building fires result in burnout conditions, not overall building collapse.
- ❑ The PANYNJ was created as an interstate entity, under a clause of the U.S. Constitution permitting compacts between states, and is not bound by the building and fire codes of any local, state, or federal jurisdiction. The PANYNJ's longstanding stated policy is to meet and, where appropriate, exceed requirements of local building and fire codes.

Data Collection and Sources

- **NIST based its review, analysis, modeling, and testing work for the WTC Investigation on a solid foundation of technical evidence.** This required access to critical data such as building documents, videographic and photographic records, emergency response records, and oral histories, in addition to samples of recovered WTC steel.
- **NIST received considerable cooperation and large volumes of information from a variety of organizations and agencies, including the building designers, owners, leaseholders, suppliers, tenants, first responders, contractors, insurers, news media, photographers, survivors, and families of victims.** The documents and other information relate to the design, construction, operation, inspection, maintenance, repair, alterations, emergency response, and evacuation of the WTC complex.
- NIST received cooperation from The National Commission on Terrorist Attacks Upon the United States (9-11 Commission).
- Local authorities providing information included The Port Authority of New York and New Jersey (PANYNJ) and its consultants and contractors and several New York City agencies, including The Fire Department of the City of New York (FDNY); The New York City Police Department (NYPD); The New York City (NYC) Law Department; The NYC Department of Design and Construction (DDC); The NYC Department of Buildings (DoB); and The NYC Office of Emergency Management (OEM).

Data Collection and Sources (2)

- The Occupational Safety and Health Administration provided correspondence sent to it regarding the evacuation experience of WTC occupants on September 11, 2001.
- NIST received information from Silverstein Properties and its consultants and contractors; the group of companies that insured the WTC towers and its technical experts; Nippon Steel; Laclede Steel; U.S. Mineral Products Co. and Isolatek International; Morse Zehntner Associates; W.R. Grace & Co.; Citigroup, formerly Salomon Smith Barney; United Airlines; American Airlines; and Boeing.
- The information from Silverstein and the insurance companies included the large body of technical work completed by both parties as part of the insurance litigation involving the WTC towers, such as reports on the structural collapse, fire spread and severity, and wind tunnel test results for the WTC towers. In addition, technical experts for both parties independently provided extensive briefings to the WTC investigation team and discussed the tenability environment and the evacuation procedures in the buildings.
- NIST received information on floor plans, furnishings, and contents from tenants of all three buildings.
- NIST was unable to gather a small portion of information since that evidence was lost when the WTC buildings collapsed. However, the available information was adequate for purposes of the investigation.

Role of WTC Investigation

- Bring clarity to important technical issues related to the building collapses and loss of life based on objective and impartial analysis of the facts in the following areas:
 - Building performance (e.g., BPAT Recommendations)
 - Occupant behavior and evacuation
 - Emergency response procedures
- Develop findings and recommendations to address technical issues affecting the safety of buildings, occupants, first responders, and communities that face the risk of terrorist threats.
- Develop findings and recommendations to address technical issues affecting the general safety of buildings, occupants, first responders, and communities.

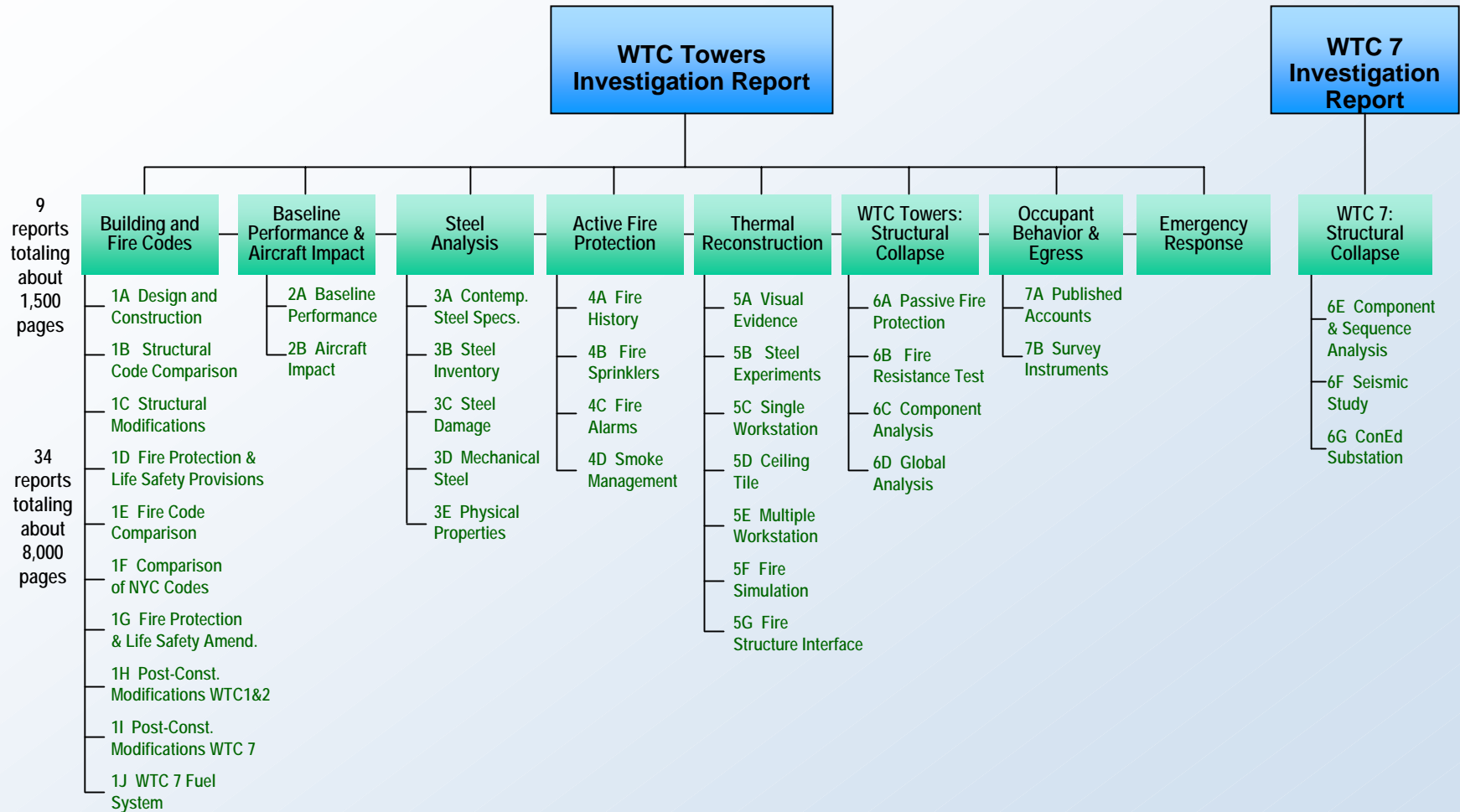
WTC Investigation Status

- Investigation nearing completion; drew talent from NIST, outside experts, and contractors; \$16 million investigation; \$5.5 million awarded in contracts.
- Two public updates issued (December 2002, December 2003); two technical progress reports issued (May 2003, June 2004). Full text available on Web site <http://wtc.nist.gov>.
- Three public meetings held:
 - June 24, 2002 (NYC) to present draft WTC investigation plan and solicit comments on the plan.
 - February 12, 2004 (NYC) to solicit comments on (1) technical aspects of investigation, (2) additional information that NIST might consider, (3) areas to be considered for recommendations.
 - August 24, 2004 (Chicago) to observe fire resistance test of WTC floor system at Underwriters Laboratories
- Six media/public briefings on investigation progress, extensive briefings at six meetings of the National Construction Safety Team Advisory Committee, and one meeting (April 2003) to solicit public input for first-person interviews of occupants and first responders.
- Current findings may be revised and additional findings may be presented in final report.
- **NIST is not making any recommendations at this time; all recommendations will be made in the final report.**

Schedule for Completion of Investigation

- Major focus is on writing the Investigation reports; technical work is complete.
- The time required to write and review the comprehensive set of draft documents that constitute final WTC investigation findings and recommendations is driving the release date of the report.
- The NIST reports include the overall investigation report for the WTC towers, 8 separate project reports, and 34 supporting technical reports, totaling some 10,000 pages. This enormous task has taken NIST longer to accomplish than originally anticipated.
- NIST is committed to putting accuracy, quality, and completeness ahead of schedule, taking whatever time is required to do the job right.
- NIST plans to release a draft of the final report for public comment in June 2005; public comment period of about 6 weeks after release of the draft report; NIST plans to release the final Investigation report in September 2005.
- WTC 7 report will be issued as a supplement to the main report: draft planned for October 2005; final for December 2005.
 - Decoupling of WTC 7 report necessary to accommodate overlapping staffing demands for work on WTC towers.
 - This change affects mainly the collapse analysis; other WTC 7 work will be reported with the other Investigation reports.
- WTC Conference: Putting Recommendations into Practice, September 13-15, 2005.

WTC Investigation Reports



43 reports for WTC Towers; 5 reports for WTC 7

Disclaimer No. 1

Certain commercial entities, equipment, products, or materials are identified in this document in order to describe a procedure or concept adequately or to trace the history of the procedures and practices used. Such identification is not intended to imply recommendation, endorsement, or implication that the entities, products, materials, or equipment are necessarily the best available for the purpose. Nor does such identification imply a finding of fault or negligence by the National Institute of Standards and Technology.

Disclaimer No. 2

The policy of NIST is to use the International System of Units (metric units) in all publications. In this document, however, units are presented in metric units or the inch-pound system, whichever is prevalent in the discipline.

Disclaimer No. 3:

Pursuant to section 7 of the National Construction Safety Team Act, the NIST Director has determined that certain evidence received by NIST in the course of this Investigation is “voluntarily provided safety-related information” that is “not directly related to the building failure being investigated” and that “disclosure of that information would inhibit the voluntary provision of that type of information” [15 USC 7306(c)].

In addition, a substantial portion of the evidence collected by NIST in the course of the Investigation has been provided to NIST under nondisclosure agreements.

Disclaimer No. 4:

NIST takes no position as to whether the design or construction of a WTC building was compliant with any code since, due to the destruction of the WTC buildings, NIST could not verify the actual (or as-built) construction, the properties and condition of the materials used, or changes to the original construction made over the life of the buildings. In addition, NIST could not verify the interpretations of codes used by applicable authorities in determining compliance when implementing building codes. Where an Investigation report states whether a system was designed or installed as required by a code *provision*, NIST has documentary or anecdotal evidence indicating whether the requirement was met, or NIST has independently conducted tests or analyses indicating whether the requirement was met.

Use in Legal Proceedings

No part of any report resulting from a NIST investigation into a structural failure or from an investigation under the National Construction Safety Team Act may be used in any suit or action for damages arising out of any matter mentioned in such report (15 USC 281a, as amended by P.L. 107-231).

**BPAT
Recommendations**

**Govt.
Industry
Professional
Academic
Inputs/Actions**

**Public Inputs/
Efforts**

**WTC
Investigation**

**Research &
Development**

**Dissemination
and Technical
Assistance Program**

WTC Response Plan

**Guidance and Tools for
Improved Practices**

**Technical Basis for Improved
Building and Fire Codes
and Standards**

**Owners, Contractors, Designers,
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**Standards and Code Development
Organizations**

Safety of Threatened Buildings R&D Program

Increased Structural Integrity Enhanced Fire Resistance



Fire Protective Coatings for Structural Steel - Predictive criteria for selection of fire protective coatings to accelerate development of materials with reduced vulnerability to extreme events.

Prevention of Progressive Collapse

To develop and implement performance criteria for codes and standards, tools, and practical guidance for prevention of progressive structural collapse.



Fire Resistance of Structural Steel -

Develop efficient test method for evaluating fire resistance of steel; Benefits of FR steel not adequately tested under ASTM E119



Fire Safe Building Structures

To develop and implement verified and improved standards, tools, methodology and guidance for the fire safety design and retrofit of concrete and steel structures.

Fire Resistance of Building Partitions

Technical basis for accurate measurement & prediction methodologies for inclusion of fire resistance properties of walls, floors & ceilings in performance-based fire safety design

Safety of Threatened Buildings R&D Program

Improved Emergency Egress & Access

Building & Emergency Equipment Stds & Guidelines

Occupant Behavior and Egress

Reliable predictions of time to egress

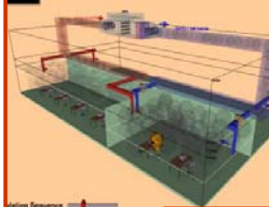


Equipment Standards for First Responders

Technologies that enhance building information transfer to support informed fire fighting decisions

Emergency Use of Elevators

Technical and procedural means to allow use of elevators during emergencies for evacuation of occupants with disabilities from, and for first responder access to, high rise buildings



Standard Information Models

Standard building information models that facilitate simulation of building system behavior during adverse events

Technologies for Building Operations in CBR Attacks

Analysis tools and guidance for assessment and subsequent reductions in vulnerability of buildings to CBR attacks



Cost-effective Risk Management Tools

User-friendly tool for building owners/managers to aid in selection of cost-effective strategies for management of terrorist and environmental risks



Dissemination and Technical Assistance Program



- **Concept:**

Engage leaders of the construction and building community in assuring timely implementation of needed changes to practices, standards, and codes.

- **Functions:**

Provide inputs and participate in developing best practices, guidance and tools for vulnerability assessment and reduction, guidance on standards and codes needs.

Represent public interest.

Timely adoption, dissemination, and use of investigation recommendations and R&D outputs.

- **Partners:**

Codes and standards developers, e.g., ICC, NFPA, ASME, ASTM...

Professional, engineering organizations, e.g., IAFC, ASCE, SFPE, AIA, AGC...

Industrial/trade bodies, e.g. CII, FIATECH, CERF, NIBS,...

Web site <http://wtc.nist.gov>

Email to wtc@nist.gov

Facsimile to (301) 975-6122

Regular mail:

**WTC Technical Information Repository, Stop 8610,
100 Bureau Drive, Gaithersburg, MD 20899-8610.**

Background Slides

National Construction Safety Team Act

PL 107-231

- ***Congress directs NIST to investigate building failures that have resulted in “substantial loss of life or that posed significant potential for substantial loss of life.”***
 - **NIST investigations are to assess building performance and emergency response and evacuation procedures.**
 - **Building failures include those caused by extreme natural events (earthquakes, hurricanes, tornadoes, floods, etc.), building or community-scale fires, failures during construction or in active use, acts of terrorism, Presidential disaster declarations, activations of National Response Plan.**
- ***Modeled by Congress after the National Transportation Safety Board; provides NIST with similar authorities.***
- ***NIST is carrying out the World Trade Center investigation and the Rhode Island Nightclub Fire investigation under the authority of the Act.***
- ***NIST is required to establish and deploy an investigation team within 48 hours of building failures to the maximum extent possible.***

Earthquakes

San Fernando, CA (1971)
Mexico City, Mexico (1985)
Loma Prieta, CA (1989)
Northridge, CA (1994)
Kobe, Japan (1995)
Kocaeli, Turkey (1999)

Hurricanes

Camille, MS/LA (1969)
Alicia, Galveston, TX (1983)
Hugo, SC (1989)
Andrew, FL (1992)
Hurricane Mitch and Georges, LAC (1998)

Construction/Building

Skyline Plaza Apartments, Bailey's Crossroads, VA (1973)
Willow Island Cooling Tower, WV (1978)
Kansas City Hyatt Regency, Kansas City, MO (1981)
Riley Road Interchange, East Chicago, IN (1982)
Harbor Cay Condominium, Cocoa Beach, FL (1981)
L'Ambiance Plaza, Hartford, CT (1987)
Ashland Oil Tank Collapse, Floreffe, PA (1988)
U.S. Embassy, Moscow, USSR (1987)
Murrah Federal Building, Oklahoma City, OK (1995)

Tornadoes

Jarrell, TX (1997)
Spencer, SD (1998)
Oklahoma City, OK (1999)

Fires

DuPont Plaza Hotel, San Juan, PR (1986)
First Interstate Bank Building, Los Angeles, CA (1988)
Loma Prieta Earthquake, CA (1989)
Hillhaven Nursing Home (1989)
Pulaski Building, Washington, D.C. (1990)
Happyland Social Club, Bronx, NY (1990)
Oakland Hills, CA (1991)
Hokkaido, Japan (1993)
Watts St, New York City (1994)
Northridge Earthquake, CA (1994)
Kobe, Japan (1995)
Vandaila St, New York City (1998)
Cherry Road, Washington, DC (1999)
Keokuk, IA (1999)
Houston, TX (2000)
Phoenix, AZ (2001)

Prior NIST Investigations...

Results:

- Probable technical cause
- Lessons learned: successes and failures
- Improvements to standards, codes, and practices, technologies
- Establish future research priorities

Existing Authorities:

- *NCST Act (2002)*: building failures, evacuation and emergency response procedures
- *NIST Act (1986)*: structural investigations
- *NEHRP Reauthorization Act (1990)*: earthquakes
- *National Post-Storm Data Acquisition Plan*: wind, storms and floods
- *National Response Plan*: structural and fire safety; disaster operations and situation assessment; urban and industrial hazard analysis; mitigation
- *Fire Prevention and Control Act (1974)*: fire investigations

Some of WTC Response Plan's Advocates

- American Concrete Institute, Strategic Development Council
- American Society of Civil Engineers, and Civil Engineering Research Foundation
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers
- American Society of Mechanical Engineers
- Associated General Contractors
- Building Owners and Managers Association
- Construction Industry Institute, and the Fully Integrated and Automated Technology (FIATECH)
- Construction Industry Round Table
- International Association of Fire Chiefs
- International Code Council
- National Association of State Fire Marshals
- National Conference of States on Building Codes and Standards
- National Fire Protection Association
- National Institute of Building Sciences and International Alliance for Interoperability--North America
- Skyscraper Safety Campaign
- The Infrastructure Security Partnership

Challenges Addressed

- Strong, conflicting public perspectives
- Competing collapse hypotheses
- Need for significant advances in state-of-the-art
- Need for developing NCST rules, human subjects protocols
- Coordination with 9/11 Commission and local authorities
- Blending “investigation” needs with “research” culture
- Leading and managing an extended investigation team of 236 people (85 staff from 3 NIST Laboratories; 124 contractors and technical experts; 27 secretariat/institutional support staff)

The Extended WTC Investigation Team

• WTC Investigation Team	14
• Other NIST Technical Staff	71
• Secretariat/Institutional Support	27
• Contractor Staff	112
• Experts (Contract/Employee)	12
	=====
Total	236

Enabling Actions

- **NIST Actions:**

- NIST Director established a World Trade Center study secretariat early in 2002—six months prior to formal announcement of the investigation—to ensure that relevant offices throughout NIST—public affairs, legal, contracts, congressional, budget, safety, program office—would all work to effectively support the investigation.
- NIST Director selected a new 5-year project on “Failure Analysis of Complex Systems” for funding from proposals submitted to the highly competitive NIST-wide competence program.

- **Administration Actions:**

- Requested \$16 million funding for the WTC investigation.
- Requested funding increases for the WTC R&D and DTAP programs (\$ 3 million in FY 2003, \$4 million in FY 2004 and FY 2005, \$2 million in FY 2006).

- **Congressional Actions:**

- House Science Committee held two standing-room only hearings in Spring 2002.
- Appropriated funds for the WTC investigation (\$16 million) and for the WTC R&D and DTAP programs (\$3 million increase in FY 2003).
- Passed the National Construction Safety Team Act (P.L. 107-231), which was signed into law on October 1, 2002.

NCST Advisory Committee

- Appointed by the NIST Director.
- Functions...
 - Review procedures and reports
 - Evaluate activities of teams
 - Assess implementation of recommendations
 - Annual report to Congress
- Reviewed WTC Investigation plan, progress, findings, and draft recommendations at 6 meetings.
- Reviewed all WTC progress reports and final reports
- Membership balances broad scope of disciplines and interests

Members

Dr. Charles Thornton, Co-Chairman,
Thornton-Tomasetti.

Dr. Robert Hanson, Professor Emeritus,
University of Michigan.

Mr. Philip DiNenno, President, Hughes
Associates.

Professor Glenn Corbett, John-Jay
College, NYC.

Dr. Kathleen Tierney, University of
Colorado, Boulder.

Mr. Paul Fitzgerald, FM Global,
(retired).

Mr. David Collins, The Preview Group.

Professor Forman Williams, University
of California at San Diego.

Dr. John Barsom, President, Barsom
Consulting.

Examples of Extensive Media Coverage...

- **Newspapers**

- *The New York Times*
- *The Washington Post*
- *The Wall Street Journal*
- *The International Herald Tribune*
- *The Guardian (UK)*
- New York City newspapers
- Major U.S. newspapers
- International newspapers

- **Magazines and Books**

- *The 9/11 Commission Report*
- *City in the Sky* (Glanz & Lipton)
- *102 Minutes* (Dwyer & Flynn)
- *Engineering News-Record*
- *Popular Mechanics*

- **Wire Services**

- *Associated Press*
- *Reuters*
- *United Press International*

- **TV and Radio Networks**

- *CBS Evening News*
- *CNN International*
- *WABC*
- *WNBC*
- *Fox News*
- *NY1*
- *C-Span*
- *NPR*
- *WNYC* (NY Public Radio)
- *Metro Radio Network*