Project 5: Reconstruction of the Thermal Environment

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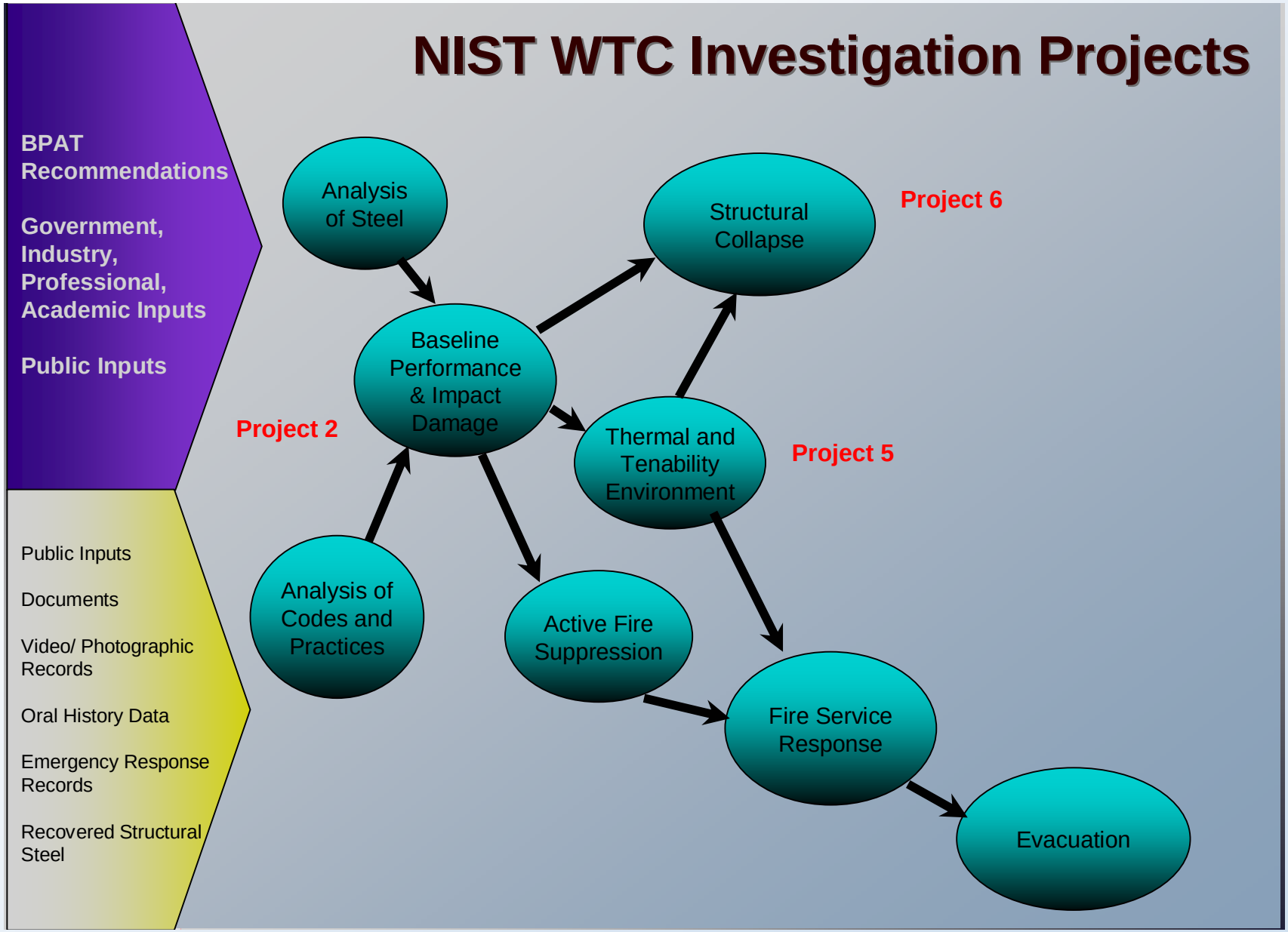
Project 5 Purpose

Reconstruct the time-evolving temperature, thermal environment, and smoke movement in WTC 1, 2, and 7 for use in evaluating the structural performance of the buildings and behavior and fate of occupants and responders.

Today's discussion is limited to WTC 1 and WTC 2

NIST WTC Investigation Projects

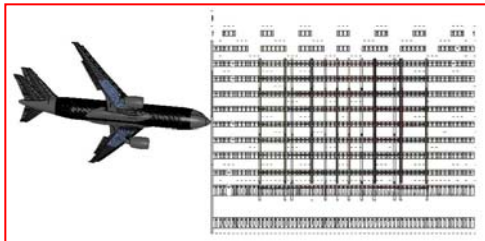


Principal Project 5 Output

Provide maps of steel and concrete temperatures as a function of time for the affected floors in WTC 1 and WTC 2 for use in Project 6 (Structural Fire Response and Probable Collapse Sequence)

Numerical Modeling was used to provide estimates for:

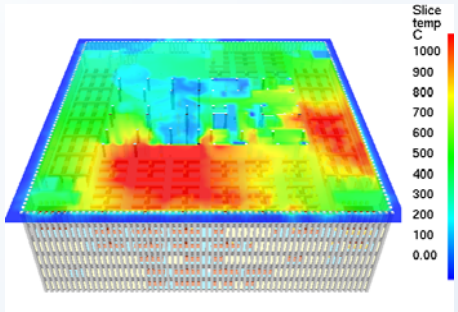
- Initial damage (e.g., structural steel, floors, fire proofing; primarily provided by Projects 2 and 6)
- Fire locations and gas temperatures (Project 5)
- Heat transfer to and resulting heating of structural steel and concrete (Project 5)
- Structural Fire Response and Most Probable Collapse Sequence (Project 6)



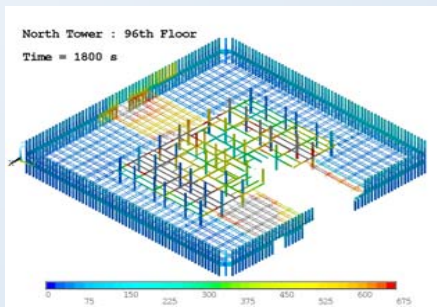
Aircraft Impact and Initial Damage

Projects 2 and 6

Project 5



Fire Growth and Estimated
Gas Temperature Distributions



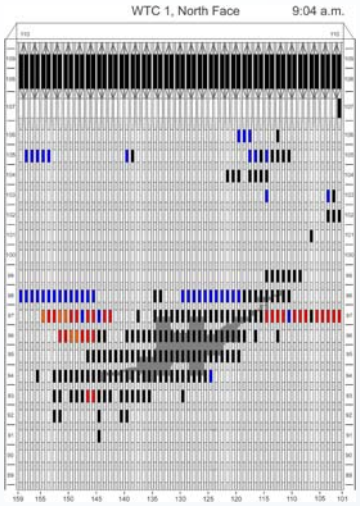
Heat Transfer and Structural
Element Temperatures

Project 6

Probable Collapse Sequence

NIST

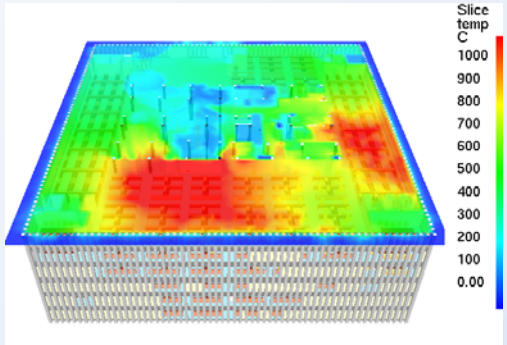
Project 5



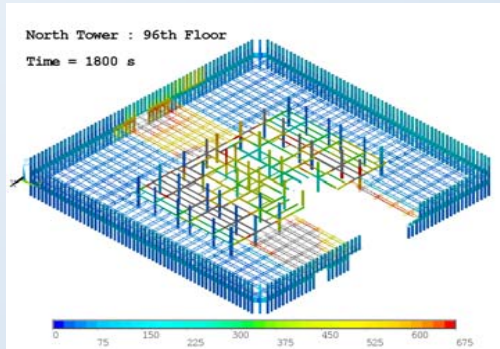
Visual Analysis (Pitts)

Fire Tests (Hamins)

Fire Growth and Estimated Gas Temperature Distributions (McGrattan)



Heat Transfer and Structural Element Temperatures (Prasad)



Project 6

Project 5 Tasks

- Task 1: Visual Evidence, Damage Estimates, and Timeline Analysis (Pitts, Butler, Junker)
- Task 2: Experiments and Modeling of Structural Steel Elements Exposed to Fire (Hamins, Maranghides, McGrattan,Johnsson, Ohlemiller,Donnelly, Yang, Mulholland, Prasad, Kukuck, Anleiter, McAllister)
- Task 3: Fire Tests of Single Office Workstations (Ohlemiller, Mulholland, Maranghides, Filliben, Gann) (Reported by Hamins)
- Task 4: Reaction of Ceiling Tile Systems to Shocks (Gann, Riley, Repp, Whittaker, Reinhorn, Hough)
- Task 5: Experiments and Modeling of Multiple Workstations Burning in a Compartment (Hamins, Maranghides, McGrattan, Ohlemiller, Anleitner)
- Task 6: Computer Simulation of the Fires in the World Trade Center Towers (McGrattan, Bouldin, Forney)
- Task 7: Fire Structure Interface and Thermal Response of the World Trade Center Towers (Prasad, Baum)

TO BE EMPHASIZED IN PRESENTATIONS

- Integration of various modeling approaches
- Enhancements and extensions to existing numerical models
- Temporal and spatial variations
- Task results