Dr. John Jaeger

Executing the Army Corps of Engineers Post Katrina Actions for Change Initiative
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by

John Jaeger, PhD., P.E.
Chief, Engineering and Construction
Huntington District USACE
17th St. Canal Breach
facing south toward Waveland – 5 miles from the beach.

08/29/2005
New Orleans
Central Business District
## Katrina Precipitation

<table>
<thead>
<tr>
<th>Storm</th>
<th>Year</th>
<th>Total Storm Rainfall Range (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hurricane Katrina</td>
<td>2005</td>
<td>8.0 - 14.0</td>
</tr>
<tr>
<td>Tropical Storm Isidore</td>
<td>2002</td>
<td>4.5 - 7.5</td>
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<tr>
<td>Hurricane Lili</td>
<td>2002</td>
<td>2.5 - 8.5</td>
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<tr>
<td>Tropical Strom Allison</td>
<td>2001</td>
<td>14.5 - 21.5</td>
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<tr>
<td>Hurricane Danny</td>
<td>1997</td>
<td>1.0 - 9.5</td>
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<tr>
<td>Hurricane Andrew</td>
<td>1992</td>
<td>5.6 - 6.0</td>
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<tr>
<td>Hurricane Betsy</td>
<td>1965</td>
<td>4.0 - 7.0</td>
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</tbody>
</table>
New Orleans
Maximum Flooding Depth

- 8 to 15 feet
- 10 to 13 feet
- 12 to 15 feet
- 9 to 11 feet
“Katrina”

- One of America’s largest natural disasters
- Cat 5 strength less than 12 hours before landfall
- 127 MPH wind at Louisiana landfall
- Maximum surge of 28 to 30 feet along Mississippi coast
- 75 percent of New Orleans flooded
- More than 1,600 overall fatalities
- 400 Year event based on surge
- Largest surge and equaled largest wave height in North America
Interagency Performance Evaluation Task Force (IPET)

...“to provide credible and objective scientific and engineering answers to fundamental questions about the performance of the hurricane protection and flood damage reduction system in the New Orleans metropolitan area.”

Chief of Engineers
IPET Mission - The 5 Questions?

1. **The Flood Protection System**: What were the design criteria for the pre-Katrina hurricane protection system, and did the design, as-built construction, and maintained condition meet these criteria?

2. **The Storm**: What were the storm surges and waves used as the basis of design, and how do these compare to the storm surges and waves generated by Hurricane Katrina?

3. **The Performance**: How did the floodwalls, levees, pumping stations, and drainage canals, individually and acting as an integrated system, perform in response to Hurricane Katrina, and why?

4. **The Consequences**: What have been the societal-related consequences of the Katrina-related damage?

5. **The Risk**: Following the immediate repairs, what will be the quantifiable risk to New Orleans and vicinity from future hurricanes and tropical storms?
The Hurricane Protection System in S.E. Louisiana

Legend
- **Yellow** Federal
- **Orange** Federal Non-COE
- **Red** Non-Federal
New Orleans Area

Hurricane Protection System

- 350 Miles Levee/Floodwall
- 71 Pumping Stations (Fed & Non-Fed)
- Closure gates, interior canals
<table>
<thead>
<tr>
<th>Task Force</th>
<th>Leader</th>
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<tbody>
<tr>
<td>Project Director</td>
<td>Dr. Ed Link – U of Maryland</td>
</tr>
<tr>
<td>Technical Director</td>
<td>Dr. John Jaeger - CELRH</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Jeremy Stevenson - CELRH</td>
</tr>
<tr>
<td>Team</td>
<td></td>
</tr>
<tr>
<td>1. Data Collection and Management – Perishable, systems data, info management</td>
<td>Dr. Reed Mosher – ERDC- GSL</td>
</tr>
<tr>
<td></td>
<td>Denise Martin – ERDC - ITL</td>
</tr>
<tr>
<td>2, 3. Interior Drainage Numerical Models</td>
<td>Jeff Harris – IWR – HEC</td>
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<tr>
<td></td>
<td>Steve Fitzgerald, Harris County FCD</td>
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<tr>
<td>4. Numerical Model of Hurricane Katrina surge and wave environment</td>
<td>Dr. Bruce Ebersole – ERDC - CHL</td>
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<tr>
<td></td>
<td>Dr. Joannes Westerkink, U of Notre Dame</td>
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<tr>
<td>5a. Storm Surge &amp; Wave Physical Model – Hydrodynamic Forces</td>
<td>Dr. Don Resio – ERDC – CHL</td>
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<tr>
<td></td>
<td>Dr. Bob Dean, U of Florida</td>
</tr>
<tr>
<td>5b. Storm Surge &amp; Wave Physical Model – Centrifuge Breaching</td>
<td>Dr. Mike Sharp – ERDC – CHL</td>
</tr>
<tr>
<td></td>
<td>Dr. Scott Steedman – Cambridge University</td>
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<tr>
<td></td>
<td>Dave Zikoski – NOAA/NGS</td>
</tr>
<tr>
<td>7. Analysis of Floodwall and Levee Performance</td>
<td>Dr. Reed Mosher – ERDC – GSL</td>
</tr>
<tr>
<td></td>
<td>Dr. Mike Duncan – Virginia Tech University</td>
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<tr>
<td>8. Pumping Station Performance</td>
<td>Brian Moentenich – CENWP-HDC</td>
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<tr>
<td></td>
<td>Bob Howard – South Florida WMD</td>
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<tr>
<td>9. Consequence Analysis of Hurricane Katrina</td>
<td>Dave Moser – IWR</td>
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<td></td>
<td>Pat Canning - USDA</td>
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<tr>
<td>10. Engineering and Operation Risk and Reliability Analysis</td>
<td>Jerry Foster – HQUSACE</td>
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<td></td>
<td>Bruce Muller – USBR</td>
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IPET Participants:
Corps + over 50 Organizations

- **Federal Agencies**
  - Corps of Engineers (Lead agency)
    - MVD/MVN/MVK/MVS
    - Task Force Guardian
    - Huntington District (Task Force Co-Lead)
    - Louisville District
    - Tulsa District
    - Jacksonville District
    - Portland District, Hydropower Design Center
    - Engineer Research and Development Center
    - Institute for Water Resources / HEC
  - FEMA (Team member)
  - NOAA
    - NGS (Team Co-lead)
    - CO-OP (Team Co-Lead)
    - NWS
    - HRD
  - USBR (Team co-lead)
  - USDA Economic Research Service (Team Co-lead)
  - USGS (Team member)
  - NIST

- **State and Local Agencies**
  - Louisiana DOT
  - New Orleans Levee and Drainage Districts
  - South Florida Water Management District (Team Co-Lead)
  - Harris County Flood Control District, TX (Team Co-Lead)

- **International**
  - Japan
  - Netherlands

- **Academia**
  - University of Maryland (Task Force Lead)
  - Louisiana State University
  - Jackson State University
  - Utah State University
  - Penn State University
  - University of Florida (Team co-lead)
  - University of Delaware
  - University of North Carolina
  - University of South Carolina
  - University of Norte Dame (Team Co-Lead)
  - University of Texas
  - Stanford University
  - Texas A&M U
  - University of Wyoming
  - Georgia Institute of Technology
  - MIT
  - Oklahoma State University
  - Virginia Tech University (Team Co-lead)
  - Villanova University
  - Geo-Delft

- **Industry**
  - Steedman, Ltd., UK (Team co-lead)
  - Ocean Weather, Inc
  - ARA, INC
  - CH2M Hill
  - URS
  - RAC Engineering

Tremendous spectrum of talent and experience
Organization

SYNTHESIZE THE FACTS

National Research Council Independent Review Panel

Public Forums

Interagency Performance Evaluation Task Force

ASCE External Review Panel

GET THE FACTS

VERIFY THE FACTS

https://ipet.wes.army.mil
Effective Communication

1. Weekly IPET conference calls
2. Monthly IPET progress meetings
3. Use of Groove software and Internet web site
4. Progress meetings with the ERP and NRC
5. Establishment of public web site
6. Department of Justice coordination
7. Media events
8. Internal to USACE and external briefings
10. Coordination with N.O. reconstruction efforts
11. Risk Communication
Performance Evaluation
Plan and Interim Status,
Report 1 of a Series
10 Jan 2006
Vetted by ASCE ERP,
Reviewed by NRC Committee

Performance Evaluation
Status and Interim Results,
Report 2 of a Series
Performance Evaluation of the
New Orleans and Southeast
Louisiana Hurricane Protection
System
by Interagency Performance Evaluation Task Force
10 March 2006
Final Draft
(Revised in 2006)

Performance Evaluation
of the Hurricane Protection
System, Report 3 of a Series
Structural Performance
Component Provided to NRC
May 2006
Draft IPET Final Report

Volume 1: Executive Summary and Introduction

Volume 2: Geodetic Vertical and Water Level Datum

Volume 3: The Hurricane Protection System

Volume 4: The Storm

Volume 5: The Performance – Levees and Floodwalls

Volume 6: The Performance – Interior Drainage and Pumping

Volume 7: The Consequences

Volume 8: Engineering and Operational Risk and Reliability Analysis

Volume 9: General Appendices
Overall Risk Methodology

- Finalize Project Objectives
- Identify Hurricane Protection System Components
- Failure Modes & Effects Analysis
- Vulnerability Analysis
  - Probability Distribution of Load
  - Risk Quantification & Uncertainty Analysis
  - Consequence Analysis
- Systems Analysis
- Inundation Mapping
  - Probability Distribution of Loss
**Performance**

*17th Street Canal Breach Analysis*

**17th Street Canal Breach Mechanism**

- Deflection of I–Wall by surge/waves
- Full hydrostatic pressure along wall splits levee into two blocks
- Weaker clay at levee toe causes failure in subsurface clay layer
- Soil block from wall back displaced

**Confirmation in Centrifuge**

**Displacement of wall and part of levee**
June 02, 2006
Army Builders Accept Blame Over Flooding
By JOHN SCHWARTZ

Los Angeles Times
Army Corps Admits Design Flaws in New Orleans Levees
By Ralph Vartabedian
June 02, 2006
<table>
<thead>
<tr>
<th></th>
<th>USACE Actions for Change</th>
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<tbody>
<tr>
<td>1</td>
<td>Employ an Integrated Comprehensive Systems-Based Approach</td>
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<td>2</td>
<td>Employ Risk-Based Concepts in Planning, Design, Construction, and Major Maintenance</td>
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<tr>
<td>3</td>
<td>Continuously Reassess and Update Policy for Program Development, Planning Guidance, Design and Construction Standards</td>
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<td>4</td>
<td>Dynamic Independent Review</td>
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<tr>
<td>5</td>
<td>Employ Adaptive Planning and Engineering Systems</td>
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<td>6</td>
<td>Focus on Sustainability</td>
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<tr>
<td>7</td>
<td>Review and Inspect Completed Works</td>
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<tr>
<td>8</td>
<td>Assess and Modify Organizational Behavior</td>
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<tr>
<td>9</td>
<td>Effectively Communicate Risk</td>
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<tr>
<td>10</td>
<td>Establish Public Involvement Risk Reduction Strategies</td>
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<tr>
<td>11</td>
<td>Manage and Enhance Technical Expertise and Professionalism</td>
</tr>
<tr>
<td>12</td>
<td>Invest in Research and Development</td>
</tr>
</tbody>
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USACE Campaign Plan

Actions for Change

1 Comprehensive Systems Approach
   Actions 1,5,6

2 Risk Informed Decision Making
   Actions 2,7

3 Communication of Risk to the Public
   Actions 9,10

4 Professional and Technical Expertise
   Actions 3,4,8,11,12

Other External Reports

Other Internal Reports

US Army Corps of Engineers
Actions for Change Team Structure

Chief of Engineers

Board of Directors
MG Riley
MG Temple
Dr. Houston
Ms. Allaman

HQ SES Leaders
Mr. Dalton / Ms. Rivers

Senior Program Manager (Mr. House)

Comprehensive Systems Approach
Dr. White
Actions 1,5,6

Risk Informed Decision Making
Dr. Moser
Actions 2,7

Communication of Risk to the Public
William Peoples
Actions 9,10

Professional and Technical Expertise
Dr. John Jaeger
Actions 3,4,8,11,12

Senior Advisory Team
HQUSACE Senior Leaders
Advisory Boards
HQ Business Lines
CERD/IWR
NGO Reps
Interagency Reps
Ways USACE is Changing

1. Policy and guidance
2. Risk informed decisions used to manage risk
3. Training
4. System based approaches
5. Risk communication
6. Establish and resource a National Technical Competency Team (NTCT)
## Risk Communication

<table>
<thead>
<tr>
<th>Risk</th>
<th>Risk Management</th>
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<tbody>
<tr>
<td>Pure Risk</td>
<td>Risk Communication</td>
</tr>
<tr>
<td>Speculative Risk</td>
<td>Risk Characterization</td>
</tr>
<tr>
<td>Residual Risk</td>
<td>Variability</td>
</tr>
<tr>
<td>Transformed Risk</td>
<td>Uncertainty</td>
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<tr>
<td>Acceptable Risk</td>
<td>Safety</td>
</tr>
<tr>
<td>Tolerable Risk</td>
<td>Redundancy</td>
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<tr>
<td>Unacceptable Risk</td>
<td>Resiliency</td>
</tr>
<tr>
<td>Risk Analysis</td>
<td>Robustness</td>
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</tbody>
</table>
National Technical Competency Strategy (NTCS) – 6 Steps

1. Establish and resource a National Technical Competency Team (NTCT)
2. Identify future USACE missions, roles and methods of delivery
3. Determine competencies and level of technical capabilities to support these future roles.
4. Identify gaps between current and future competency and capability requirements
5. Develop short-term strategy and transition plan.
6. Develop USACE recruitment, hiring, development, and retention strategy.
Chief’s Priorities
Shape the Future of the Corps of Engineers

1. Deliver superior performance every time.
2. Set the standard for your profession.
3. Make a positive contribution to our nation and other nations.
4. Building Strong.
Questions?

To learn more about Actions for Change visit us on the web at
https://maps.crrel.usace.army.mil/AFC/