CLEANER WORKSHOP 2:
Defining the Concept of Environmental Field Facilities (EFFs)

October 20-22, 2002
University of Minnesota

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http://www.eng.nsf.gov/nees
http://www.nees.org
http://www.neesgrid.org
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Remote Users
(Faculty,
Students,
Practitioners)

Instrumented
Structures
and Sites

High-
Performance
Network(s)

NEES Resources

Simulation
Tools
Repository

Field Equipment

Curated Data
Repository

Global
Connections
(FY 2005 – FY 2014)

Laboratory Equipment

Leading Edge
Computation

Remote Users:
(K-12 Faculty and
Students)
NEES Authorized Budget and Program
FY 2000 - FY 2004  (in millions)

<table>
<thead>
<tr>
<th></th>
<th>FY 00</th>
<th>FY 01</th>
<th>FY 02</th>
<th>FY 03</th>
<th>FY 04</th>
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<td>$7.70</td>
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NSF 00-6  NEES: Earthquake Engineering Research Equipment, Phase 1 (11 awards to 10 universities) $45 M + LAN supplements
NSF 01-164 NEES: Earthquake Engineering Research Equipment, Phase 2 (5 awards at end of FY 2002) $15 M + LAN supplements
NSF 00-7  NEES: System Integration (SI) - University of Illinois at Urbana-Champaign $10.3 M (including a scoping study)
NSF 01-56 NEES: Consortium Development (CD) - Consortium of Universities for Research in Earthquake Engineering $2 M

All Awards to be completed by September 30, 2004
NEES Equipment Awards
Phase 1 and 2

- Shake tables (3)
- Geotechnical centrifuges (2)
- Tsunami wave basin (1)
- Large-scale laboratory experimentation systems (7)
- Field equipment and monitoring installations (3)
University of California, San Diego
National Science Foundation NEES Award CMS-0217293
Large High Performance Outdoor Uniaxial Shake Table Facility
National Science Foundation NEES Award CMS-0217421
Brigham Young University, with University of California, Santa Barbara and University of Southern California
Two Permanently Instrumented Field Sites in Southern California for Site Characterization and Soil-Foundation-Structure Interaction Studies (GVDA and WLF)
NEES Experimental Capabilities
FY 2005 – FY 2014

• Large/full-scale testing
  – Full scale structures and subassemblages
  – Nonstructural components
  – Lifeline/pipeline/utility/buried systems
  – Long-span, multi-span and extended-in-plan structures
• Soil-foundation-structure interaction
• Site characterization, liquefaction, lateral spreading
• Near source high velocity input excitation
• High density 3D strong motion arrays
• Tsunami modeling/effects on the natural and built environments
• Fast hybrid simulation – substructuring
• Geographically distributed hybrid simulation
• Remote observation of experiments (public clients)
• Remote observation/operation of experiments (private clients)
NEES Equipment Awards
Expectations

Different from research awards
Substantially larger award amounts

Cooperative Agreements
- Four-year duration
- Reporting and annual reviews
- Design, procurement, construction, commissioning
- Outreach and training to the EE community through 2014
- Cooperation with other awardees
- NSF approval of subawards over $100K
- External advisory board
- Commitment through 2014 for shared use
Goals of NEESgrid architecture:
• Create shared infrastructure
• Facilitate interoperability between facilities
• Facilitate exchange of information among community members (including practitioners)
• Provide platform for application development
• Define common tools for different sectors of the earthquake engineering community
• Permit use of distributed system as an integrated whole instead of as a collection of distributed sites
Where is the Grid in NEESgrid?

Site A: Experimental Data Producer
- NEESpop A
  - Experimental Equipment
  - Video I/O
  - Audio I/O

Hub A

Site B: Remote Lead Investigator
- NEESpop B
  - Telepresence Equipment
  - Active PI
  - Data Cache

Hub B

Site C: Passive Collaborator
- NEESpop C
  - Teleobservation Equipment
  - Passive coPI
  - Data Cache

Hub C

Internet Fabric and Operations

Experimental Component
- Grid Ops Center
- Grid Data Repository

Campus Net Component
- Internet Fabric and Operations

NEESgrid Component

NEESgrid A
- Experimental Equipment
- Video I/O
- Audio I/O

NEESgrid B
- Telepresence Equipment
- Active PI
- Data Cache

NEESgrid C
- Teleobservation Equipment
- Passive coPI
- Data Cache
Working Together on the Grid

• Telepresence
  – Teleobservation: remote observation of experiments
  – Teleoperation: remote control of NEES resources

• Collaboration Support
  – Collaborative tools to support distributed R&D teams
    • Community codes to provide software tools for engineers
    • Collaborative frameworks (e.g., CHEF, OpenSEES)

• Repositories of NEESgrid resources
  – Includes experimental data, numeric simulation results, digital content (e.g., movies, video), software tools
Typical NEESgrid Resources

- Experimental Sites funded by NSF and by others (including EPSCoR, DOT’s, DOE, HUD)
- Archives of Experimental Results
  - Grid facilitates replication of results remotely or locally
- Archives of Computational Simulation Results
  - Digital content for use in R&D, practice, education, outreach
- Archives of Computational Tools
  - Browsable and searchable library of community codes
- Capabilities (e.g., HPC sites for numeric simulation)
  - Grid facilitates ubiquitous access to computing resources, including high-performance parallel supercomputers
Key near-term NEESgrid milestones

- Consolidate Project Plan for Reorganization
- Assemble Draft PEP, UR, and SA Content
- Prototype Telepresence Capability
- Deploy/Demonstrate Collab Tools Prototype
- First Prototype NEESpop Demos
- Deploy NEESpop to EA Sites
- Conduct Integration Workshops
- Initial Deployment of Simulation Archive
- Publish Phase II Survey Results
- Publish Updated UR Content

Jan 1, 2002
Apr 1, 2002
July 1, 2002
Oct 1, 2002
Jan 1, 2003
Apr 1, 2003
July 1, 2003

- Early Adopters Selection
- Implement SI Reorg
- Publish Phase I Practice Survey Results
- Publish all SI Content
- Deploy EA Telepresence Capability
- Initial Technology Risk Mitigation
- Broaden NEESpop Deployment
- Deploy Acceptance Metrics
- Complete Visits for Phase II Sites
NEES Consortium Development

Robert Reitherman, PI
Consortium of Universities for Research in Earthquake Engineering (CUREE)

• Act to engage earthquake community in establishing a broad consensus for the organizational structure and governance of a single community-based and community-led NEES Consortium – Articles of Confederation
  – 20 Regional Workshops and 1 National Workshop
  – NEES Consortium established early in 2003
  – Support development of Consortium proposal to NSF by October 1, 2003
• Facilitate community-generated input for the NEES system integration awardee
• Coordinate outreach and training activities
• Maintain an interactive web-site
NEES Consortium Concept

• Focal point for NEES
• Operate NEES
• Operate under ten-year plans (strategic, business,...)
• Establish and administer policies and procedures for NEES equipment sites and network
• Lead culture change to promote development of integrated experimentation, computation, theory, databases, and model-based simulation
• Conduct and coordinate outreach and training for NEES equipment sites
• Develop connectivity and interactions with other U.S. and international equipment sites, programs, and networks
• Pursue technology development for NEES
• Interface with NSF and other federal agencies
Anticipated Schedule for NEES Consortium Review

Proposal submitted to NSF (By October 1, 2003)

Ad hoc Mail Reviews (October – November 2003)

Panel Review(s) (January-February 2004)

CMS/ENG/DRB/NSB Reviews (March-June 2004)

NEES Consortium Award (October 1, 2004)
NEES Status

- 11 equipment sites underway, 5 new starting
- 3 early adopter equipment sites (Oregon State, RPI, U Nevada-Reno)
- SI team developing underlying system architecture, data repository, simulation tools repository, telepresence/collaborative capabilities
- ~20 Regional Workshops and 1 National Workshop completed by CD team
- CD team to form Consortium in early 2003
- Annual grantees conference (next in Reno in 11/02)
- Summer FY 2003: NSF will assess budget, schedule, and plan distribution of remaining contingency funds

We promised NEES by September 30, 2004!
NEES Grand Challenge Research (GCR) Plan

Establish the NEES/Earthquake Engineering Research Agenda

- Developing a Long-Term Research Agenda for the Network for Earthquake Engineering Simulation
  - Richard Little, PI, National Academy of Sciences, CMS-0135915

- The Earthquake Research Plan: Research Needs and Opportunities for Earthquake Engineering
  - Susan K. Tubbesing, PI, Earthquake Engineering Research Institute, CMS-0130009

Multi-year solicitation for multi-year awards (e.g., 5 year duration)

- Multi-institutional (both PIs and NEES equipment sites)
- Estimate at $1.5 million/year
- >2 GCR starts per year (pending budget)
- Must align w/known earthquake loss exposures
- Piggyback awards for HBCU, PUI participation
- Comprehensive: analysis, simulation, testing, database, education, outreach, technology transfer
- Ramp-up in FY2003-FY2004 in a modest way
What NEES Will Be

• An unprecedented, world-class shared infrastructure in earthquake engineering research and education
• Interconnectivity of resources that is the heart of NEES
• A new *modus operandi* for research/development/tech transfer/deployment
• New and unencumbered pathways for all to engage in earthquake engineering research and education
  – Educators, students, practitioners, general public...
  – Telepresence, curated data repository, simulation tools...
  – Information exchanges/collaborations
• Platform for application and technology development

The earthquake engineering community must maintain/renew vision for NEES.
NEES Operation
FY 2005 – FY 2014

- Maintenance and Operation of NEES resources
  *Consortium responsibility*
  *Ten-year proposal to NSF*

- Research Program Defined and Implemented
  *NSF responsibility, Community follow-through*

- Education, Outreach, & Human Resource Development
  *Community responsibility*
  - Wide impact of NEES resources
  - Many opportunities for participation by academe, industry, and general public
George E. Brown, Jr. Network for Earthquake Engineering Simulation

NEES Oversight during Construction Period:
FY 2000 - FY 2004

NSF Directorate for Engineering (ENG)
Assistant Director, ENG
Director, Division of Civil and Mechanical Systems (CMS)

NEES Program Director (J. Pauschke)

NSF Internal Project Advisory Team (PAT)

NEES System Integration Award
NEES Program Director (J. Pauschke)
w/CISE Program Directors

NEES Consortium Development Award
NEES Program Director (J. Pauschke)

NEES Equipment Awards
NEES Equipment Project Coordinator (T.L. Anderson through December, 2002)
w/ENG Program Directors
George E. Brown, Jr. Network for Earthquake Engineering Simulation

NEES Oversight during Operational Period:
FY 2005 - FY 2014

NSF Directorate for Engineering (ENG)
Assistant Director, ENG
Director, Division of Civil and Mechanical Systems (CMS)

NEES Program Director

NEES Consortium Awardee
- Provide leadership for NEES
- Build inclusive environment and opportunities
- Coordinate, maintain, and operate NEES, with shared-use access to equipment sites
- Maintain, update, and operate the NEES system network, including curated data repository
- Coordinate outreach and training activities for NEES resources, including equipment sites
- Pursue development of new technology and applications, and national and international participation and partnerships

NEES U.S. Linkages
- Other equipment sites as part of NEES (university and federal/national labs)
- Distributed experimentation
- Data curation
- Simulation software

NEES Equipment Awardees
- Participate in NEES Consortium
- Operate equipment as shared-use equipment site
- Provide outreach and training activities
- Incorporate NEES into research and academic programs

NEES International Linkages
- Other equipment sites as part of NEES (university and federal/national labs)
- Distributed experimentation
- Data curation
- Simulation software
NEES Contacts & Information
http://www.eng.nsf.gov/nees
E-mail: nees@nsf.gov

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Dr. Thomas L. Anderson, CMS Expert for NEES Equipment Project Coordination
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Ms. Maria Valerio, Grants Specialist, DGA <mvalerio@nsf.gov>

Ms. YeVonda McIlwaine, NEES Program Assistant, CMS/ENG, <ymcilwai@nsf.gov>