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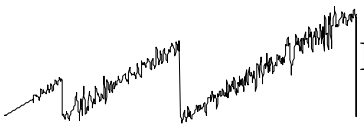

NEES at CU Boulder

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The George E Brown, Jr. Network for Earthquake Engineering Simulation

CU-NEES
Guidelines and Policies for Facility Use

By

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Sept. 06

Center for Fast Hybrid Testing

Department of Civil Environmental and Architectural Engineering

University of Colorado

UCB 428

1. Introduction

CU-NEES is one of the fifteen shared-use NEES centers. It specializes in so-called "Fast Hybrid Testing". The principal disciplines involved with the NEES Center of Fast Hybrid Testing are structural engineering and structural mechanics in the Department of Civil, Environmental, and Architectural Engineering. Shared-use implies that 50% of the facility resources are to be exclusively reserved for NEES, and the remaining 50% could be used for other non-NEES projects.

Fast Hybrid Simulation is a revolutionary testing paradigm in which a complex structure is decomposed into two substructures. One is numerically simulated on the computer through finite element analysis, and the other is physically tested in the laboratory. Both tests are conducted simultaneously and in (near) real time. Whereas the hardware is set in three high-performance servo-hydraulic actuators, the software remains a challenge as we seek to continuously upgrade it to account for recent computational advances.

Through the support of the National Science Foundation CU-NEES maintains the facility in state-of-the-art condition so as to enable any NEES/NSF researcher to come and use our facility for their research. Following NEESinc policy, a Research Participation Agreement (RPA) will be developed and signed by the Researcher, Equipment Site and NEESinc. This RPA would then govern the conduct of the research and establish the responsibilities of all parties to it.

The NEES facility at the University of Colorado is managed and operated by a team of permanent staff members. The team consists of the PI/Director, Operations Manager, System Administrators, EOT Coordinator, IT Assistant, Instrumentation Engineer, System/Software Engineer, Laboratory Technician, and part-time laboratory assistants. The organization chart is shown in Figure 1.

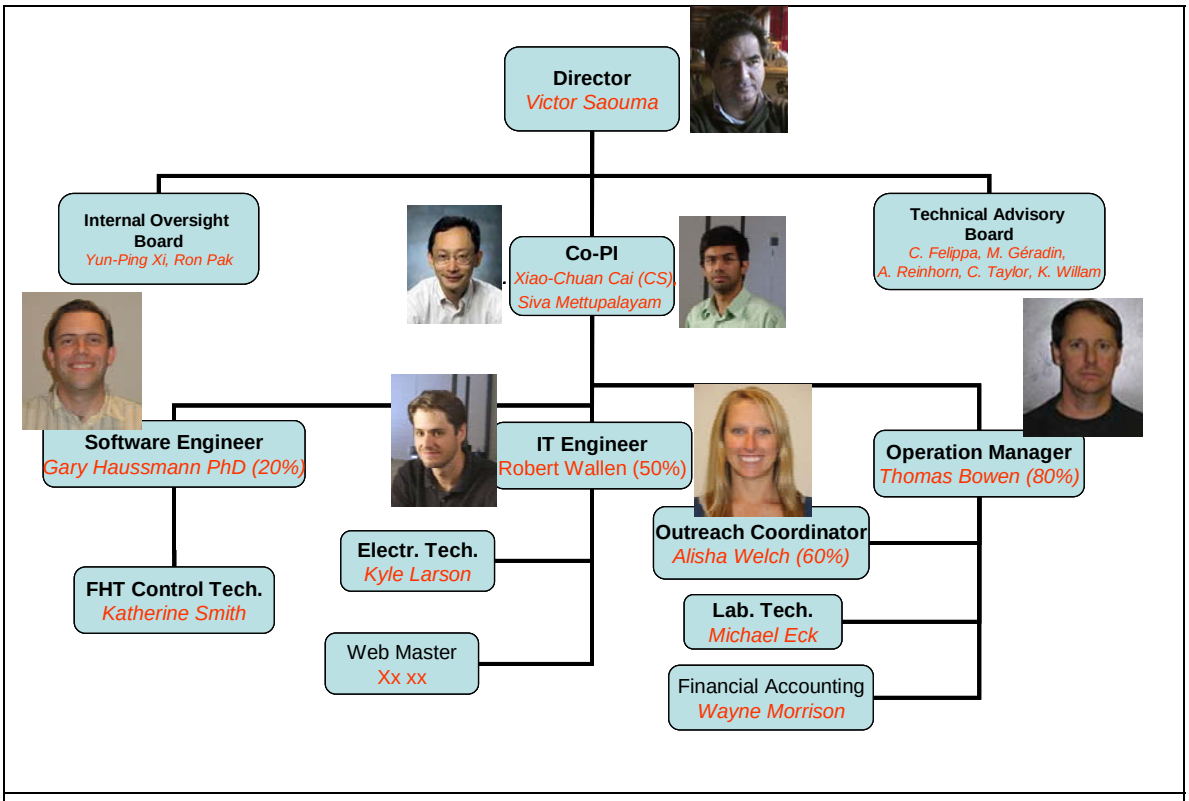

Fig. 1 – Organization Chart

1.1 P.I.: Victor Saouma

Responsibilities: Oversee the facility personnel and operations; primary liaison between the equipment site and NEES Consortium on administrative, budgetary, and policy issues; direct training activities for current and potential NEES users; Assist NEES researchers in proposal development; assist NEES researchers in post-award planning and design of experiments.

Appointment: 18.3% FTE

Qualifications: Ph.D. and professor of Structural Engineering; over 20 years of experience in large scale testing, finite element software development and earthquake engineering

1.2 Co P.I.'s Xiao-Chuan Cai and Siva Mettupulayam

Responsibilities: The site CO-P.I. presently provides crucial technical support to the site. Prof. Cai's expertise lies in parallel computations, while the one of Prof. Mettupulayam is on the fundamental underpinnings of hybrid simulation.

Appointment: 0% FTE

1.3 Operation Manager: Thomas Bowen

Responsibilities: Manage site operations and equipment maintenance; execute laboratory policies; primary contact between the site, NEES Consortium, and NEES users on the day-to-day operation of the facility; supervision of the laboratory technician; scheduling and coordination of staff activities; safety and risk management; facilitate access for NEES researchers and their students; coordinate training needs with the Consortium staff; coordinate educational services with the Consortium staff; coordinate outreach activities with the NEES Consortium; assist NEES researchers with proposal development and cost estimation; assist NEES researchers with post-award planning and design of experiments; assist NEES researchers with experiment execution..

Appointment: 1 FTE

Qualifications: M.S. in Civil Engineering; many years of experience in construction and construction project management; currently the manager of the Structures and Materials Lab. and Safety Officer of the Department.

1.3.1 Laboratory technician

Responsibilities: Maintain the laboratory infrastructure in good operational condition; maintain test fixtures/tools; maintain and operate ancillary facility, equipment, and services; maintain hydraulic actuators and power system; conduct on-site training for new laboratory users on tools and mechanical equipment; assist NEES researchers in setting up experiments; assist NEES researchers with sensor/instrument installation.

Appointment: None

1.3.2 Outreach Coordinator: Alisha Welch

Responsibilities: Develop an outreach program specific to NSF/NEES requirements as they relate to the CU FHT facility. Develop and integrate a knowledge-based and practical illustration and demonstration platform to reach a diverse and varied demographic of participants. Identify and seek out minority and underrepresented groups for inclusion in all outreach related activities. Assume the point-of-contact role for all outreach related activities. In this particular capacity it is expected that you will act as a knowledgeable spokesperson regarding operational and general technical aspects of the FHT system. You should be sufficiently familiar with FHT protocol to participate directly in media level promotion of our site. Develop and distribute, as necessary, literature and promotional information about the CU NEES center. Seek and respond to Outreach related RFP. This will include budget development and explicit characterization of CUNEES FHT capabilities appropriate for each individual RFP and associated target audience.

Appointment: 30% FTE (and additional 30% through institutional support)

Qualifications: BS in Recreation Management, emphasis on Event Planning. Many years in industry of event planning, experience as administrative assistant, two years experience in middle/high school education.

1.4 Software Engineer: Gary Haussmann

Responsibilities: Operation and maintenance of MTS controller/data-acquisition system; operation of FHT system; post-experiment data quality assurance; maintenance of OpenSees and Simulink programs for fast hybrid tests; training on software usage/user support; develop training materials; conduct training workshops; assist in pretest analysis.

Appointment: 20 %FTE (and 60% through institutional support)

Qualifications: Ph.D. in Electrical Engineering, three years of work experience in electronics design, seven years of work experience working on simulation and visualization of structures. Currently provides model and software development.

1.4.1 FHT Control Technician: Katherine Smith

Responsibilities: Operation and maintenance of MTS controller/data-acquisition system; operation of FHT system; assist with experiment execution; post-experiment data quality assurance; transfer of data to the NEES data repository.

Appointments: 40%

Qualifications: Concurrent Bachelor/Masters student in Structural Engineering at CU Boulder; currently FHT Control Technician in the Colorado NEES Project.

1.5 IT Engineer: Robert Wallen

Responsibilities: Electronic instrument preparation; calibration of instruments; maintenance of electronic instruments; reconfigure instrumentation for special research needs; coordinate with Consortium NEESpop specialists; management of local NEESpop/data storage; software deployment and integration; coordinate with Consortium telepresence specialists; coordinate with campus networking specialists.

Appointment: 30% FTE Instrumentation; 20% FTE System Administration

Qualifications: B.S. in Electrical Engineering; work for many years in lab. Instrumentation and data acquisition systems in Civil Engineering labs.; work in industry as a software engineer for a year; currently the IT engineer in the Colorado NEES project.

1.5.1 IT Assistant

Responsibilities: Basic monitoring of the IT system; local account management; management of local computers; local user support; updating and enhancement of site's webpages; on-site monitoring and maintenance of local telepresence services; on-site monitoring & maintenance of LAN and WAN; support for video conferencing; transfer of data to the NEES data repository.

Appointment: Student (hourly)

1.5.2 System Administrator

Responsibilities: Coordinate with Consortium web specialists; periodic upgrades; maintain and evolve a web site suitable for outreach activities; regression testing; coordinate with campus security specialists; security maintenance.

Appointment: Student (hourly)

2. Policies

It is the policy of the Structures and Materials Testing Laboratory (SMTL) at the University of Colorado (CU) that houses the NEES facility to make the facility and its staff available for laboratory research and industrial testing to all qualified users. Every attempt will be made to accommodate concurrent use of the Laboratory when practical. The Laboratory has NEES and non-NEES equipment. Where conflicts arise, priority use of NEES equipment will be given to NEES projects and subsequently to the faculty of the Civil, Environmental & Architectural Engineering (CEAE) at CU. For non-NEES equipment, priority will be with the CEAE faculty and then to NEES projects. This priority structure is summarized in Table 2.

Table 2 – Priority Policy on Equipment Use

	NEES Projects	**Non-NEES Project**	
		CU CEAE Faculty	**External to CU CEAE Dept.**
NEES Equipment	First	Second	Third
Non-NEES Equipment	Second	First	Third

For the purposes of this policy statement, NEES projects are defined as projects receiving funding through the NSF for use of the NEES equipment, which is the definition currently adopted by the NEES Consortium.

A fee structure has been developed for NEES and non-NEES projects to cover laboratory costs that are not included in the annual operations and maintenance budget provided by the NSF through the NEES Consortium. Fees will be charged for the use of non-NEES equipment by all projects, NEES or non-NEES, and for the use of NEES equipment by non-NEES projects. The fees will be based on hourly, daily or monthly usage. For this purpose, usage of the equipment is defined as the time during which the equipment is dedicated to a project, thereby, precluding that resource from being available to another project. For example, an actuator being configured into an experimental setup is being "used" since it is unavailable to another project, and charges for use of that actuator will accrue to the particular project until the equipment is returned to the available equipment pool. Faculty of the CEAE Department at CU will pay a reduced rate for services and equipment fees that reflect the indirect costs paid to the University from their grants.

NEES projects do not pay for use of NEES equipment or NEES-funded personnel for qualified activities listed below.

3. Scope of Services Covered by the NEES O&M Budget

A basic scope of services is available to NEES projects through the O&M budget provided by the NSF through the NEES Consortium. The following list outlines these services at the Colorado NEES Equipment Site:

- Assistance in proposal development with regard to the laboratory equipment and infrastructure
- Assistance in experiment planning and design with regard to the laboratory equipment and infrastructure
- Laboratory cost estimation
- Equipment and safety training
- Materials and test specimens receiving
- Equipment and test setup (each project will be allocated a fixed amount of personnel time depending on the scope of the project)
- FHT system operation
- Video conferencing support
- Instrument calibration, data acquisition, and data quality assurance
- Data transfer to NEES data repository
- Office space, PC, and ethernet access
- Equipment and specimen storage for duration of experiment
- Space for specimen assembly
- Use of the concrete mixing and curing rooms
- Liaison services with local contractors

Additional services are available at additional costs. These are considered as research costs that should be covered by research projects. The recharge rates for the additional equipment and labor are being developed. Examples of some of these services are given below:

- Miscellaneous materials and supplies specific to the project and their acquisition, including consumables, special tools, strain gages, and special instrument mounting devices
- Use of laboratory tools by visiting researchers
- Special test fixtures – labor and materials
- Development of special instrumentation and data-acquisition capabilities that are not available in the existing NEES facility

- Labor for strain gage application
- Specimen construction and assembly
- Project specific machining and welding
- Special software development and integration
- Modification of existing electronic system and network
- Materials testing
- Use of non-NEES equipment in the laboratory, such as the existing static actuators and universal testing machines.
- Demolition and disposal of specimens

4. Safety and Risk Management

Training is provided to all laboratory users. Emphasis in this training is placed on safe operating procedures; hazards related to specific equipment usage and general laboratory safety. Personal Protective Equipment (PPE) is issued to each laboratory user while working in the facility. This PPE includes, but is not limited to, hardhats, safety glasses and goggles, hearing protection, and masks and respirators as needed. Numerous first aid kits and fire extinguishers are mounted throughout the Laboratory. Eye wash stations and showers are easily accessible to all laboratory users. A medical facility on campus is available to treat most injuries and Boulder Community Hospital Emergency Room is within 1.5 miles of the Laboratory.

Personnel employed by the University of Colorado (CU) are covered for on-the-job accidents through Worker's Compensation coverage provided internally through the Office of Risk Management. CU employees are covered through this insurance while traveling off-campus and performing job-related tasks. This coverage is limited to employees of the University, however. Therefore, it is expected that visitors to the Laboratory have similar worker’s compensation coverage from their own institutions. It is required that visitors to the Laboratory not on the University of Colorado payroll sign a waiver indemnifying the University and NEES Consortium of liability for accidents or injuries as a result of NEES activities in the Laboratory, and provide evidence of the aforementioned insurance coverage.

Neither the University of Colorado, nor its agents intend to provide or imply any insurance coverage for any individuals not directly employed by the University. It is also understood and hereby acknowledged that the NEES Consortium, Inc does not carry accident/injury insurance for visitors to the NEES facility at the University of Colorado site.

5. Site Access Policies

The Director and staff at the Colorado NEES site recognize the importance of opening the facility to all members of the earthquake engineering community for their research needs. Modifications have been completed on expanding the accessibility to the testing

areas within the Laboratory while maintaining a safe, secure working environment for participants and visitors. There are, however, some areas within the Laboratory that remain open to employees of the facility alone. In general, these are consistent with standard safe industry practice and reflect a cautious approach in the interest of safety. As an example of such, our hydraulic pumps and electrical service equipment will remain closed to all visitors, including those working on NEES projects. Additionally, the hydraulic actuators and control system will be operated exclusively by the facility staff. These systems require extensive training and experience to operate properly and are integral to the FHT test platform. Improper operation poses significant risk to the system and persons in the Laboratory.

The Structures and Materials Testing Laboratory (SMTL) that houses the NEES research facility is a ground floor laboratory fully compliant with ADA requirements. Offices within and adjacent to the SMTL are also handicap accessible. Special accommodations may be arranged with advance notice.

The Colorado equipment site offers office spaces with Ethernet access for visiting NEES researchers and students. These offices are located either within the SMTL or are directly adjacent to the Laboratory. While the Laboratory does not operate on a 24-hour basis, the facility and its offices are accessible at all hours. The control room for the Fast Hybrid Test System has a full window wall facing the test equipment and is designed to accommodate up to 4 researchers with computer access available. During testing, researchers will be asked to refrain from entering the test area for safety reasons. The control room affords an ideal viewing platform during testing of both the test area and test object.

The larger SMTL facility has numerous load frames and testing apparatus available for use by the NEES community. A formal training session must be completed satisfactorily prior to any unassisted use. The same is true for use of the Laboratory's general machinery such as drill presses, mills, band saws, etc. The staff of the SMTL is available to assist and/or perform most common jobs requiring use of these tools. Trained members of the SMTL staff will operate the Laboratory's forklift and overhead crane. Operation of this equipment poses a safety and potential liability risk to the University and possibly the NEES Consortium.

Chemical safety within the SMTL is of great importance and receives corresponding attention. No chemicals are to be brought or shipped to the SMTL without the prior written consent of the Operations Manager. These chemicals include, but are not limited to, concrete additives and curing agents, degreasers, strain gage application chemicals, and household cleaning products. Generation of hazardous waste from experimental procedures will be closely monitored and projects will be held accountable in traditional "cradle to grave" policy for any waste generated and may incur charges related to proper waste disposal. In general, the University's Environmental Health and Safety Department will remove hazardous wastes generated (and handled properly) at the SMTL at no charge. The SMTL stores hazardous waste in a secured area for no longer than one week. This area is off-limits to visiting persons for obvious reasons.

Other site-specific hazards within the Laboratory will be identified in an official orientation walkthrough provided at the earliest opportunity to all visitors. The staff of

the SMTL is committed to providing the safest and most accessible environment to all visitors to the facility. A wide range of personal protective equipment (PPE) is available on a loan basis through the laboratory office. All visitors are encouraged to bring their own PPE where possible. Outside of the specific limitations identified here, the Laboratory is an open facility frequently bustling with the activities of graduate and undergraduate students, faculty, and researchers, with numerous projects occurring simultaneously throughout the Laboratory. It is an atmosphere of cooperative discovery that the NEES community will become a part of, and the SMTL staff will work toward a smooth incorporation of new participants into the facility. Though some access limitations are necessary, it is unlikely and unintentional that visitors should find the facility restrictive. Every effort will be made to address and remedy specific concerns should they arise and special circumstances may require special accommodations.

6. Appendix

Memorandum of Understanding

Between

CU-NEES

And

SESM Group

Regarding

Structural Laboratory

Nov. 9, 2005

As part of the contract between CU/CEAE and NSF/NEESInc.:

1. The Department (represented by SESM) is committed to providing adequate laboratory space to the NEES project.
2. CU-NEES must
    a. Develop a Usage policy regarding NEES equipment/space.
    b. Develop a recharge structure for NEES equipment and personnel and non-NEES equipment.
    c. Establish an Internal Oversight Board (IOB), consisting of Structures/Geotechnical faculty and the NEES Facility Director, to resolve possible conflicts between NEES and SESM.
    d. Hire a full time (100%) Operation Manager.

In light of the above, it is mutually agreed that:

1. CU-NEES is responsible for the oversight of the Structural Laboratory (Strong floor; 1B and 2B).
2. SESM is responsible for the oversight of the Materials and Concrete Laboratory (Non-NEES Laboratory Space, NNLS).
3. In accordance with the contractual agreement with NSF, NEES has access to the NNLS, and SESM has access to the NEES space.
4. The Internal Oversight Board is composed of Prof. Saouma (Chair), Xi, and Pak representing the Structures and Geotechnical groups respectively.
5. A separate Structural Laboratory Committee (SLC) composed of Prof. Xi. (Chair), Prof. Mettupalayam, Saouma, and other faculty involved in experimental work, and Bowen will supervise usage of the NNLS.
6. SESM is delegating the Operation Manager of CU-NEES with the responsibility to:

a. Manage the Departmental yearly contribution of $15,000, supervise the students maintaining the NNLS, and submit an annual report to SESM in July.
b. Provide adequate assistance in the Laboratory component of CVEN3161 and CVEN4161
c. Provide support for NNLS when appropriate.

_____	_____
Victor Saouma	Yun-Ping Xi
Director, CU-NEES	SESM