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| ***Experimental Site:*** | **UC Davis** |
| NEES Site User Agreement: | No (Local Researcher)  Yes Execution Date |
| New ESUF: | Submission Date |
| Revised ESUF: | Revision No.  Date of Original ESUF  Submission Date |

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| ***Participant’s Institution Information*** | | | | | | |
| ***Primary Personnel*** | | ***Institution:*** | | | | |
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| ***Project Information*** | | | | | | | |
| ***Project Title*** | | | | ***Sponsor*** | | ***Award Number*** | ***Type*** |
|  | | | |  | |  | NEESR  Pre-NEESR  Other: |
| ***Description of Planned Experiments*** | | | | | | | |
| *\*\*\*Please provide a very brief description of the project, including the general research topic and highlights of major model details.*  Example:  In this project we plan to perform five experiments on the large centrifuge looking at structure-soil-structure interaction. Each experiment will include several instrumented structures. The first model will be in dry sand. Subsequent models will include clay and/or saturated sands, depending on findings along the way. | | | | | | | |
| ***Preliminary Schedule for Centrifuge Usage:***  *A typical project involves 1-3 test series per year. One test series every 6 months is a heavy load for one graduate student. A typical test series requires 8 weeks of effort on site, including 4-6 weeks of pre-test preparation, 1-2 weeks on the arm, and 1-2 weeks for disassembly and clean up.* | | | | | | | |
| Experiment | | | | | Fiscal year and quarter (Oct. – Sept.) | | |
| 1 | | | | | e.g. FY10 Qtr 1 | | |
| 2 | | | | | e.g. FY10 Qtr 3 | | |
| 3 | | | | | e.g. FY11 Qtr 1 | | |
| 4 | | | | | e.g. FY11 Qtr 3 | | |
| 5 | | | | | e.g. FY12 Qtr 1 | | |
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| ***Description and Scope of Special Experimental Site Services Needed (if applicable):*** | |
| *\*\*\*Please review the Site Services List and estimate any major research-supported tasks you may request to be performed by UC Davis personnel. Services may include drawings and fabrication of model structures, design and implementation of custom DAQ solutions, or other services that take advantage of our existing staff expertise. A detailed scope of work and budget will be negotiated later for each task as needed.*  Example:  Each model will include fabricated model structures with strain gauges. We may ask UC Davis staff to create design drawings and fabricate the model structures. We may ask UC Davis staff to install the strain gauges on the structures. | |
| ***Project-specific Risks & Safety Issues (if applicable):*** | ***Associated Mitigation Plans (if applicable):*** |
| Site access and safety are dictated by the UC Davis Site Safety Plan. Please include any project-specific risks that are not adequately captured in the overall safety plan. An example might be if your model includes a structure that you expect to collapse under shaking, or if you plan to request adding new DAQ subsystems to the centrifuge.  Any part added or removed from the centrifuge that is not contained in the model container and that weighs more than ½ lb must be documented in the mounted equipment inventory.  Stress calculations are required for:   1. Any part considered critical 2. Any part weighing more than ½ lb if there is any chance that is could fall outside the centrifuge model container or cause serious damage to an experiment or other equipment. | |
| 1) | 1) |
| 2) | 2) |
| 3) | 3) |

**ROLES & RESPONSIBILITIES**

## General Project Scheduling and Project Planning Milestones:

We encourage project teams to be in ongoing contact with our facility staff during the planning of your experiment. Continuous communication is critical during research where tasks fall outside of normal tasks, which occurs in nearly all research projects. Below we have listed several planning milestones to help guide the planning and scheduling of experiments. Official scheduling of projects is done through NEEScomm for NEES users. See <http://nees.org/site/resources/pdfs/Site%20Scheduling%20Protocol.pdf>

* Request to enter experiment queue – all information requested must be complete for each experiment before it can be assigned a target test date. We recommend submitting the request at least nine months before your request date.
* Complete model plan – three months prior to target test date.
* For planning, users should recognize that operating procedures allow for one spin per day and that spins may not begin after 2:30 pm except under exceptional circumstances.
* Sensor Inventory Request – submit with complete model plan three months prior to target test date.
* Experiment Presentation to Center Staff – at least two weeks prior to beginning work on site.
* All model structures in hand one month before target test date.
* All custom testing apparatus / new techniques / new routines should be executed on the centrifuge arm one month before target test date. Note that any new equipment / technique must be successfully executed on the arm before your model will be placed on the centrifuge bucket.

Note that the typical lead time for purchases can be expected to be 4-6 weeks ARO. Purchases over $5000 may take 2-4 weeks to get through campus purchasing. Sensor lead times can be significantly longer. Pore pressure transducer lead time is typically nine months. If you are planning anything outside of our standard procedures then you should be talking with us very early in the process to make sure purchases and custom fabrication can be complete before your team arrives in Davis to start building the model.

## Target Test Date / resource distribution:

Tests will be scheduled to avoid conflicts over time on the arm. However, projects may find their schedule slips as they build their model. If there are multiple teams preparing models then the first team ready to go on the arm will be placed on the arm. This means that once you are ready to go on the arm your team may be delayed up to two weeks while we complete the test on the arm.

You will be given access to approximately half of our available sensor inventory (more may be available depending on schedule). We will work with you to develop a test construction schedule. All tasks that can be completed will be completed before the model is moved onto the centrifuge arm. Any new equipment / technique must be successfully executed on the arm before your model will be placed on the centrifuge bucket.

## Operating Costs and Use Fees:

The UC Davis Center for Geotechnical Modeling is a self-supporting unit. We recover all of our operating expenses by charging fees to users according to University policy. The most recent facility use fees are posted at the Center’s website at <http://binders.cgm.ucdavis.edu/forms/research/rates.pdf>.

Our costs to operate and maintain the facility in support of NEES users are generally recovered through our NEES MO&M award rather than through use fees. Our costs to operate and maintain the facility in support of non-NEES experiments are recovered through use fees charged to non-NEES users. The posted rates indicate which fees do and which do not apply to NEES users.

Our posted rates reflect our effort in providing service, not for delivery of a product. We will give our best effort to ensure the research is successful, but there is no guarantee of performance. Rates are set to the minimum level possible to recover our actual costs in providing our best effort at supporting successful research experiments. Rates do not include contingency, consistent with our non-profit rate model. We use typical performance to set a level of average expectation on effort. In the event of hardship (e.g. equipment failure during an experiment) we will work with our clients within our rate structure to make sure that the fees charged reflect our real expenses as incurred.

Our facility will invoice your project directly for costs as they are incurred. We will strive to keep you up to date as costs are incurred by giving you regular estimates from of our work logs. We will strive to provide monthly invoices of costs.

Note that non University of California clients are charged a Non-University Differential. The NUD is added to our facility recharge rate when we invoice any non University of California clients.

## Research Support:

The work involved in performing a centrifuge test includes "research" tasks and "operations" tasks. The facility staff necessarily performs operations tasks. The user performs research tasks or the user may pay facility staff to perform tasks. When our Center staff performs research tasks for any research project, the costs must be recovered directly from the research project. In general researchers have the choice of performing tasks themselves or having technicians perform the tasks for them.

A “Basic Research Support” fee is charged to all users as a flat estimate of the time we will spend supporting a single researcher performing a typical experiment. All users can avoid this fee entirely by sending a skilled second research team member for the duration of the experiment. At Davis, a single researcher will continuously need a second set of hands, from running the crane during pluviation to connecting wires during troubleshooting. The Basic Researcher Support fee estimates a single researcher will typically consume about 80 hours of staff support over the typical eight weeks they are on site. It does not provide a full-time assistant for the duration of the experiment. This flat book rate is similar, for example, to taking your car to the shop to get the brakes done - the shop charges a certain number of hours as a standard rate, regardless of the actual number of hours to do the job. Some cars take a little more time, some a little less. The advantage is the customer can predict the cost and budget accordingly before getting the work done.

Beyond basic research support, our staff members support research projects through tasks such as fabricating model structures and custom testing devices. Our costs to execute these research tasks are generally recovered through University-approved hourly labor rates for each of our staff members as appropriate.

The tasks in the list below are examples of research-specific support that will incur an hourly fee. Procedure for recharge is that staff log hours spent and their time is billed according to campus approved recharge rates.

1. *Specimen* 
   1. *design, fabrication, and instrumentation of structures*
   2. *mixing clay or Hydroxypropyl Methylcellulose*
   3. *drying and crushing/sieving soil*
   4. *Cleaning general work area, sensors or model containers, and untangling wires without assistance of researcher who generates the mess.*
2. *Instrumentation*
   1. *calibrating instruments prior to each experiment*
   2. *installation of strain gauges*
   3. *custom wiring for instrumentation*
   4. *custom fabrication to expand/modify DAQ*
   5. *cleaning instruments post-test*
3. *in-flight testing tasks*
   1. *programming specialized loading sequences and control algorithms using loading actuators*
   2. *design and development of custom loading apparatus*
   3. *perform geophysical testing during a test*
4. *Custom testing capabilities*
   1. *design and development of new model preparation or test capabilities*
   2. *design and construction of test-specific transducer mounts and brackets*
   3. *design, development, and/or expansion of DAQ electronics or capabilities.*
   4. *special modifications to telecollaboration equipment*

**Operations Tasks.** The tasks in the list below are examples of tasks our staff will perform in the normal operation of the centrifuge facility. In general, researchers do not have the choice of performing these tasks – they must be performed by trained facility personnel. These costs are covered by either NEES MO&M or facility use fees as appropriate.

1. *Facility Maintenance*
   1. *For all major centrifuge hardware components (e.g., shaker, bucket, containers) and major laboratory equipment (e.g. forklift, large mixer, consolidation press )- periodic inspection, perform required maintenance, perform required repairs, and update as necessary*
   2. *maintain facility supplies*
2. *Instrumentation Maintenance*
   1. *troubleshoot and repair instruments and amplifiers*
   2. *maintain instrument and electronics supplies inventory*
   3. *maintain transducer performance logs*
   4. *update transducers and data acquisition systems*
   5. *periodic inspection, required maintenance, perform required repairs, update as necessary*
3. *Researcher training*
   1. *Soil preparation and model building equipment – pluviators, consolidation press, fluid mixer with HPMC, clay mixer, small forklift, vacuum saturation process*
   2. *model building techniques*
   3. *Instrumentation - proper care of transducers and signal conditioning systems, how to calibrate, how to place*
   4. *how to use Research DAQ software*
4. *Test Planning*
   1. *help plan model design, including instrumentation layout*
   2. *recommend model building techniques and methods*
   3. *help in selection and preconditioning of input motion*
   4. *help planning how to record all instruments and amplifiers*
   5. *help in planning use of telecollaboration and teleoperation during testing*
5. *Facility Preparation – performed before each experiment*
   1. *assist researchers in clean up of model prep room*
   2. *check model containers - check drainage line, check for vacuum leaks, place saturation tubes and drainage filter in model container, straighten shear-rods*
6. *Model building*
   1. *minor assistance with model preparation and instrumentation calibration*
   2. *minor updates and modifications to existing instrumentation racks and support equipment.*
   3. *Saturation - place vacuum lid and route water supply lines, move pore fluid supply tank and set up de-airing system, set up the CO2 supply and regulator, initialize the water supply, remove vacuum lid, etc.*
7. *Test (on arm tasks)*
   1. *mount container on the arm*
   2. *set up cameras*
   3. *make connections to data acquisition system as directed by researcher and route cables on the centrifuge*
   4. *assist in proof-testing instruments*
   5. *troubleshoot/repair/bypass non-functioning channels if practical*
   6. *safely operate centrifuge and shaker*
   7. *provide support for testing procedures during spinning*
      1. *assist with collection of test data – review data with researcher to help ensure data quality*
      2. *operate the shaking tables*
      3. *control centrifuge spinning and monitor safety monitoring systems*
8. *Post-test*
   1. *remove model to model prep room*
   2. *minor assistance with removing cabling from sample*
   3. *minor assistance with post-test measurements*
   4. *minor assistance in post-test excavation*

**TRAINING PROCEDURES & REQUIREMENTS**

## Technical Training: Our experience has been that new researchers should have a strong experimental background to be successful in leading a centrifuge research experiment.

Researchers that are new to centrifuge modeling or new to our facility are faced with learning a wide range of technologies and procedures necessary for successfully completing a centrifuge test. For example, a new researcher may need to learn many of the following items.

• Calibration of sensors for measuring pore pressures, displacements, accelerations, strains, and/or stresses.

• Operation of data acquisition systems and understand data processing techniques.

• Construction of soil models, including sand pluviation methods, clay mixing and consolidation methods, sensor placement techniques, saturation methods, and viscous pore fluids.

• Detailing of structural models, such as piles, building frames, and abutments.

• Hydraulic actuator controls for the loading of structures or penetrometers.

• Utilization of high-speed video systems.

• Shear wave velocity measurement systems.

• Data archiving procedures.

• Any range of tasks unique to their project, such as grout gel times, voice coil vibrators, biocementation processes, or admixtures for controlling sensitivity of reconstituted clays.

There are three primary ways that training is obtained: (1) on-site mentorship under an experienced researcher, (2) on-site training provided by our staff or researchers, and (3) off-site training at other facilities, workshops, and/or courses.

On-site mentorship is our recommended means for a new researcher to obtain training on a full spectrum of required research tasks. The new researcher arranges to spend from 4-6 weeks helping a more experienced researcher perform their test; most experiments require two active researchers, so the more experienced researcher gains valuable assistance while the new researcher gains hands-on training. In many cases, an agreement may be reached where the mentor reciprocates the assistance on the new researcher's experiment. Mentorship-based training has been most successful in our experience.

On-site training on research tasks is also provided by our facility staff at the approved recharge rates. The research tasks for which training is required depends on the specifics of the planned experiment.

Off-site training is an important component for new researchers in all situations. New researchers are encouraged to attend one of the joint UCD/RPI Centrifuge Training Workshops, to become familiar with centrifuge scaling laws and literature, and to have experience with experimental techniques. Researchers are also strongly encourages to take a machine shop safety / introduction course at their home campus before coming to Davis.

The recharge rates include a "new lead researcher" preparation fee that reflects the average costs of training and interaction with a new lead researcher. This fee can be greatly reduced by credits for appropriate training and for having an experienced team member on-site. This fee only applies to the first test run by a new lead researcher.

**Safety Training:**

Visiting researchers must obtain an "appointment without salary" at UC Davis prior to commencing work at our site. This "appointment without salary" will be facilitated by our Administrative Assistant and is critical because it provides visiting researchers will the applicable university insurance coverage.

Visiting researchers are also required, prior to commencing work at our site, to read the site safety manual (posted on our web site), attend a safety training meeting held by our on-site safety coordinator, and read and sign a laboratory use agreement that explains the safety policies of our center.

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| **Exceptions to NEES Data Sharing and Archiving Policies and Guidelines (nees.org)** | | | | |
| \*\*\* It is expected that the results of this project will be shared with the Equipment Site and NEES Community in accordance with the NEES Data Sharing and Archiving Policies and Guidelines found on the NEES website. In this section, please explain if you expect to request any exemptions from portions of this plan. | | | | |
| Expected Data Volumes: Typical data volumes produced in a research project are described in the data guide (nees.org). Indicate if you expect low, typical, or high data volumes resulting from your project. | | | | |
| Data type | Low | Typical | High | Comments |
| Photos |  |  |  |  |
| Videos |  |  |  |  |
| Sensor Data |  |  |  |  |
| Documents |  |  |  |  |

If more space is needed, please attach extra pages to this form.

**ACKNOWLEDGMENT OF ROLES AND RESONSIBILITIES**

***(For All Participants)***

Participant and Site have discussed and understand each party’s roles and responsibilities listed in the Roles & Responsibilities section above.

Participant understands and acknowledges that:

1. Equipment Site scheduling will be in accordance with the NEES Facilities User Guide and is subject to the approval of Purdue. In the event a change to the schedule is needed, Participant shall submit a request to modify the Equipment Site Utilization Form. Equipment Site shall evaluate the request and coordinate as required under the Site User Agreement. If a mutually acceptable compromise cannot be achieved, Participant or Equipment Site can petition Director of Site Operations at NEEScomm. NEEScomm will work with both parties to reach that acceptable compromise.
2. The NEES Site is supported under an NSF subaward from Purdue University. The Site shall be operated in accordance with said subaward, Purdue’s Cooperative Agreement (CMMI-0927178) and all NEES policies and guidelines, which can be found at nees.org.
3. Results of this project will be shared with the Equipment Site and NEES Community in accordance with the NEES Data Sharing and Archiving Policies and Guidelines found on the NEES website. Exceptions to following these policies and guidelines are listed earlier on this form.

***(For Participants external to Equipment Site’s institution)***

Participant understands and acknowledges that:

1. Participant’s institution has entered into a NEES Site User Agreement with the Equipment Site, and the project shall be conducted in accordance with that Site User Agreement and this Form.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Name and Title | Signature | Date |
| Participant PI |  |  |  |
| Equipment Site PI |  |  |  |
| NEEScomm | Director of Site Operations |  |  |