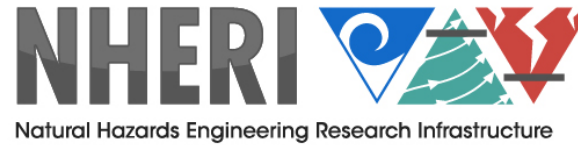




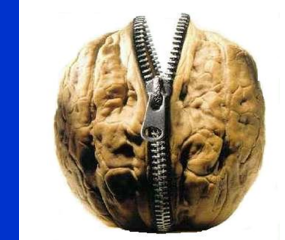
National
Science
Foundation

University of California at San Diego



UC San Diego
JACOBS SCHOOL OF ENGINEERING
Structural Engineering

Research Planning in a



*Tara Hutchinson, Professor
University of California, San Diego*

*Joint Researcher Workshop
UC San Diego, Lehigh & SimCenter*

*December 16-17, 2019
University of California, San Diego*



LEHIGH **NHERI**
Real-Time Multi-Directional Testing Facility

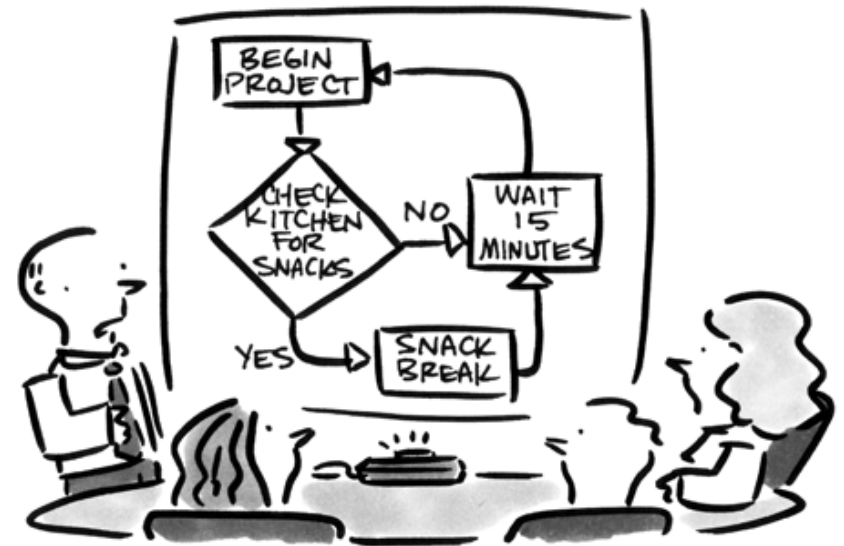
University of California at San Diego



SimCenter **NHERI**
Center for Computational Modeling and Simulation

Key Steps

- 1) Project vision, test purpose, impact
- 2) Selecting your team
- 3) Developing your schedule
- 4) Estimating your budget



"I think I found what's slowing us down..."

1) Vision, Test Purpose, Impact

➤ Outline the **Project Vision**

- These tests are LARGE, COSTLY, and LARGE
- They will take immense time and resources
- By their nature, they are landmark and completely unique & support broad *visions to solve grand challenge research problems*

➤ Clearly define the **Tests Program Purpose**

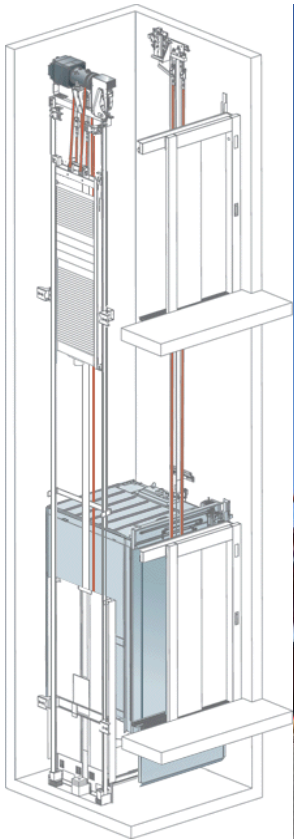
- Identify the purpose of the test program
- Focus on clarifying the mechanisms that will dominate the response; this will help you sell your vision, and know what to measure
- What are the key gaps in knowledge?
 - ✓ Past related research
 - ✓ Limitations in design codes/methods/standards of practice

➤ Incorporate **modeling/simulation/design standards**, for:

- Validation of existing, advancement of new, extending test scenario conditions, etc.

Test Program Overview (NEESR-BNCS)

- Three-phased full-scale test program conducted on a 5-story building-NCS system
- **Vision (short): understand total building system seismic response**



Summary of Major NCSs:

- ▶ Egress systems:
 - ▶ Operable Elevator
 - ▶ Stairs
- ▶ Facades:
 - ▶ Concrete cladding
 - ▶ Balloon framing
- ▶ Hospital equipment
- ▶ Roof mounted equipment
- ▶ Sprinkler and riser systems
- ▶ Ceilings
- ▶ Interior partition walls



Project Vision (verbose)

- ❑ To make breakthrough advances in the understanding of total building systems performance (structural *and* nonstructural systems) under moderate and extreme seismic conditions through full-scale testing.
- ❑ Obtain data, which are sorely needed to characterize the earthquake performance of structural and nonstructural building systems, including nonstructural systems with protective measures.
- ❑ Use this data to validate nonlinear simulation tools, which in turn can be used for higher-performance code design and performance-based seismic design of nonstructural and building systems.
- ❑ Infuse findings into seismic design guidelines and codes
 - Validate current code assumptions
 - Advance current code guidelines

Identify your hopeful impact!

➤ State your impact in the context of NSF Merit Review Criteria

- Identify the transformative impacts
- Identify the broader impacts

2) Choose your project team

➤ Complex, large test programs can require input and support from large teams:

- Academics (PIs, graduate students, undergraduate students)
- Industry partners (design engineers, manufacturers, code experts)
- Staff (your home University, NHERI@UCSD, DesignSafe-CI)



15 members of the “CFS-Midrise Building” test program (Summer 2016), three PIs (UCSD, WPI), two grad students, eight industry partners (four companies), two staff

Project leaders

- **Researcher(s) on-site = project leaders**
- **Manage project resources to achieve deliverable (timeline)**
 - Supplies, contractors, equipment
 - Work closely with NHERI staff
- **Before coming to UCSD**
 - Scheduling
 - CAD drawings (construction, instrumentation)
 - Pre-test analysis
 - ✓ Motion selection
 - ✓ Instrumentation layout
 - Prepare mathcad/matlab sheets
- **At UCSD**
 - Instrumentation, cameras
 - Tooling, labeling, oversight/participate in construction



Industry Partners (BNCS)



Also on your team: on-site technical staff@UCSD



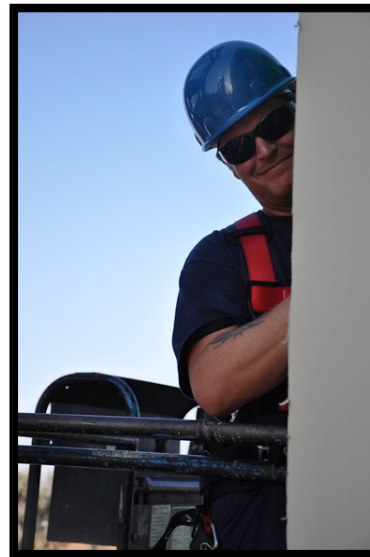
Darren McKay
Development Engineer
Shake table operation,
instrumentation/planning



Alex Sherman
Development Technician
Construction/de-erection,
instrumentation



Roxy & friends
(construction supervisor)



Jeremy Fitcher
Development Technician
Construction/de-erection,
instrumentation

Robert Beckley
IT Manager and Network
Administrator
Cameras, data storage



Acting Site
Operations Manager

3) Develop your schedule (major items)

➤ @Proposal level

- *Test planning*
 - ✓ Construction drawings, pre-test modeling, instrumentation planning, material & construction procurement
- *On-site test efforts*
 - ✓ Construction: duration varies significantly based on test scope (BNCS > 1yr, CFS ~ 5 weeks)
 - ✓ Instrumentation: can vary, 2-4 weeks is common, some can occur during construction
 - ✓ Test Execution: can vary, 2-4 weeks is common, but depends on how many motions, how much in between (different phases/model configurations, retrofit/repair, inspection down-time, etc)
 - ✓ Demolition: don't forget this in your schedule & budget! Can take 2-4 weeks depending on the complexity of specimen!
- *Post-test data processing*
- *Post-test modeling*
- *Technology transfer – outcomes of your research project*

3) Develop your schedule (on-site efforts)

➤ @Start of project

- Notification of award, rough planning (approximate YrQrt)
- Prior year (narrow in on the quarter)
- ~3 months before (*when is highly dependent on complexity*)
 - ✓ Specimen drawings
 - ✓ Test protocol
 - ✓ Motion selection, iteration (bare table)
 - ✓ Instrumentation plans
- Present to NHERI staff (*when is highly dependent on complexity*)
 - ✓ Solicit input on planning
 - ✓ Assure safety protocols are in place
 - ✓ Discuss ideas regarding motions, instrumentation, maximizing test outcomes

Schedule e.g. (on-site efforts, CFS)

- **Start of construction: (layout, tie-downs); major construction items [4-5weeks]:**
 - Structural framing erector (4/18-4/28); mass installation with floors
 - Doors (framing, finish) (5/8-5/13)
 - Interior work (sheetrock, mud/tape) (5/2-5/13)
- **Instrumentation (5/9-5/27) [3weeks]**
- **Seismic tests (hopeful...5/30-6/3) [1week]**
- **Remove seismic sensors (6/6-6/10) [1week]**
- **Fire tests (6/13-7/1) [2weeks]**
- **[12 weeks total on-site]**



Schedule e.g. (on-site efforts, superstructure construction, BNCS)



ROOF SLAB:
September 21st, 2011

FIFTH FLOOR SLAB:
September 6th, 2011

FOURTH FLOOR SLAB:
August 19th, 2011

THIRD FLOOR SLAB:
August 3rd, 2011

SECOND FLOOR SLAB:
July 15th, 2011

FOUNDATION:
June 27th, 2011



Research Activities (during construction)

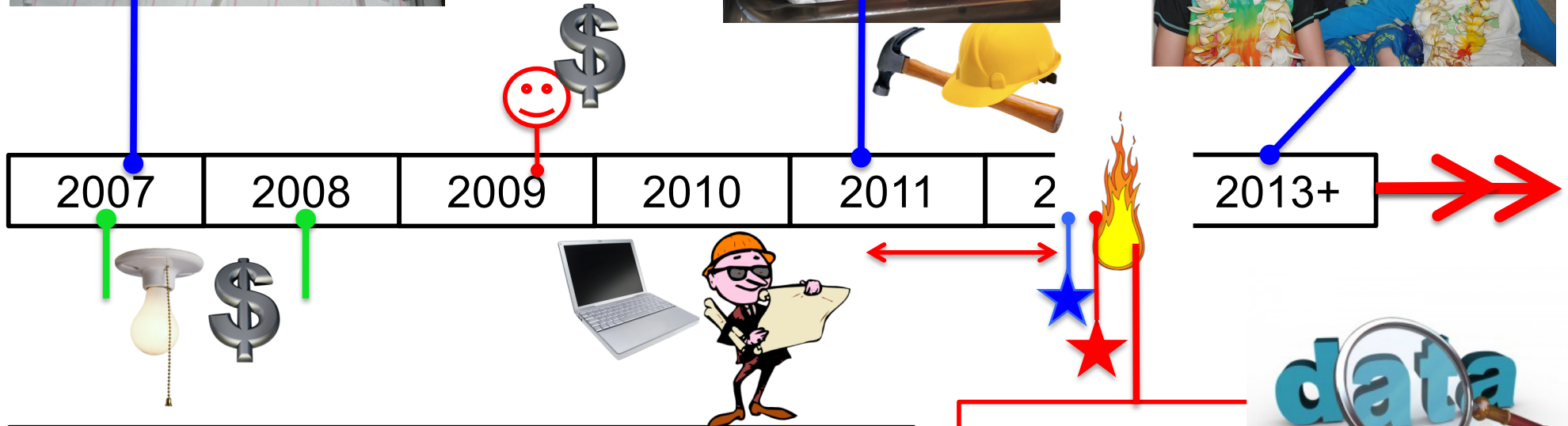
- **During construction, research team needed to multi-task**
 - Conduct pre-test simulations (guide motion selection, instrumentation layout)
 - Watch, document, & take part in (as feasible) construction
 - Create instrumentation drawings
 - Watch, document, & take part in (as feasible) construction
 - ✓ We created a weekly construction log documenting all key construction activities digitally & disseminating them during a weekly team meeting










chedule

Temus: March 31, 2011



-  Pre-proposal workshop
-  NEESR Funding & Kick-off meeting
-  Construction (~9m)
-  Seismic Testing Phases (~1m)
-  Live Fire Testing (~0.5m)



4) Estimating your budget (*Big Picture*)

➤ **Research staff (PI, students)**

- Carrying out tests, modeling, project, etc.
- How many and for how long (designate PI/students to major items)

➤ **Tests**

- Physical test costs
- Can vary dramatically, some ideas next slide....

➤ **Travel, workshops**

- Supporting your research planning and dissemination
- How much, how many, purpose, etc.

Overall budget heavily linked to duration, scope of tests, and additional support (outside of NSF resources)

4) Estimating your budget (*Physical Test Costs*)

- **Site will support operations during construction and de-erection**
 - Guidance on test planning
 - Over-sight of construction and de-erection; execution of tests
- **Site will not support construction and de-erection costs – you will need a separate budget for these costs**
 - Select several contractors, request estimates; understand their heavy equipment needs (during construction they will need to either rent the sites equipment or obtain rental outside of site)
 - Useful list of UCSD-vendor contractors (used in the past with success by various research teams): <https://ucsd.designsafe-ci.org/resources/>
- **Site will provide and support placement of all major sensors**
 - Analog sensors, camera system – check our inventory against your needs, if there are specialty sensors you will need to budget for them
- **Site will not support cost of expendables associated with sensors – you will need a separate budget for these costs**
 - Strain gages, cabling, labels, unique support brackets for sensors or cameras, damaged sensors and cables (include SOME allowance)

4) Budget: Expect the Unexpected!



Testing Scope & Project Resources (BNCS)

➤ Three Test Phases

1. Base isolated building-nonstructural system
2. Fixed base building-nonstructural system
3. Controlled live fire tests

➤ ~5M US\$, multi-organizational 4 year project (2010-2014)

- NSF-NEES core research project - \$1.2M
- Englekirk Advisory Board - \$1.5M (est)
- Charles Pankow Foundation - \$250k
- California Seismic Safety Commission (hospitals) - \$360k
- Industry consortium - remainder \$ resources, materials, equipment, technical expertise, etc.



Other considerations when planning your NSF research program: *ECO*

- **Education & community outreach (ECO) is a key element in NSF merit review (broader impacts)**
- **Experience of NHERI@UCSD Team:**
 - **Technology transfer** (webinars, project videos, laboratory tours, etc)
 - **Media relations** [Jacobs School of Engineering Media Team (available to help)]: <http://jacobsschool.ucsd.edu/shaketable/index.sfe>
 - **Educating future engineers**
 - ✓ Seismic outreach ambassador program (eg. NHERI4kids)
 - ✓ NSF NHERI REU
 - ✓ Graduate student training



Please contact Prof Lelli van den Einde @UCSD for these and many more ideas

NHERI 4 Kids



Kids arriving, checking in, safety meeting.



Lunch!!!



Being interviewed about their designs



Engaged students

NHERI4kids

- Testing their kNex structures on table



Additional Resources (via DesignSafe)

➤ <https://ucsd.designsafe-ci.org/resources/>

UC SAN DIEGO
EXPERIMENTAL FACILITY



🏠 Facility Overview Equipment Portfolio Experimental Protocol Payload Projects Workshops ▾ **Resources** Contact

RESOURCES

- [Recharge Rates](#)
- [UCSD Safety Manual](#)
- [UCSD Data Management Plan](#)
- [Useful Local Contractor Contacts](#)
- [Site Location](#)
- [List of Instrumentation](#)
- [Hybrid Simulation Capabilities](#)

Last Remarks

- **NHERI@UC San Diego staff and PI/Co-PIs/SP are available resources to help with your proposal planning and project execution**
- **We recommend discussions during proposal preparation to help develop scope & budget**
- **All conversations are kept confidential**
 - We want to help you succeed!
 - The actual level of early interactions during project planning with NHERI@UC San Diego is up to you - but again, we want you to succeed!

Thank you for coming!