Research Planning in a

“I think I found what’s slowing us down…”

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University of California, San Diego
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Key Steps

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

HVAC
Facades
Hospital Floor
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)
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 \textit{(when is highly dependent on complexity)}
  - Specimen drawings
  - Test protocol
  - Motion selection, iteration (bare table)
  - Instrumentation plans
- Present to NHERI staff \textit{(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 [4-5 weeks]:
  - 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) [3 weeks]

- Seismic tests (hopeful…5/30-6/3) [1 week]

- Remove seismic sensors (6/6-6/10) [1 week]

- Fire tests (6/13-7/1) [2 weeks]

- [11-12 weeks total on-site]
Schedule e.g. (on-site efforts, superstructure construction, BNCS)

- **FOUNDATION:**
  - June 27th, 2011

- **SECOND FLOOR SLAB:**
  - July 15th, 2011

- **THIRD FLOOR SLAB:**
  - August 3rd, 2011

- **FOURTH FLOOR SLAB:**
  - August 19th, 2011

- **FIFTH FLOOR SLAB:**
  - September 6th, 2011

- **ROOF SLAB:**
  - September 21st, 2011

- **ROOF SLAB:**
  - September 21st, 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
### Schedule

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Pre-proposal workshop</td>
</tr>
<tr>
<td>2008</td>
<td>NEESR Funding &amp; Kick-off meeting</td>
</tr>
<tr>
<td>2009</td>
<td>Construction (~9m)</td>
</tr>
<tr>
<td>2010</td>
<td>Seismic Testing Phases (~1m)</td>
</tr>
<tr>
<td>2011</td>
<td>Live Fire Testing (~0.5m)</td>
</tr>
<tr>
<td>2013+</td>
<td></td>
</tr>
</tbody>
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**Notes:**
- Elan: Aug 8, 2007
- Temus: March 31, 2011
- “I knew this would be easy. We built it last year.”

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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

- **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 site 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.
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!