CIFE

Center for Integrated Facility Engineering

http: //cife.stanford.edu

CIFE, Stanford University
Jerry Yang & Akiko Yamazaki
Environment & Energy Building
473 Via Ortega, #292B
Stanford, CA 94305-4020

Tel 650-723-4945
Fax 650-723-4806
e-mail: *cife-email@stanford.edu*

CALL FOR CIFE SEED RESEARCH PROPOSALS

SUBMISSION DEADLINE: April 1, 2014, 9:00 AM PDT

Brief Summary

This Call for Proposals invites Stanford faculty to propose seed research projects focused on innovative applications of technologies and methods for integrated use by the Architecture, Engineering and Construction (AEC) industry to build and operate capital facility projects that are believably sustainable themselves and that provide lessons for how to scale to communities, regions, nations and the world Here at Stanford and in practice, there is new recognition of the crucial issue of sustainability in new building, retrofit and operation of facilities. The experience of both researchers and practitioners now recognizes that sustainable impact requires a complementary approach to technology, methods, organizational processes, and facility design, construction and operations. Thus, *we specifically solicit multi-disciplinary innovative proposals that have the potential to significantly improve facility sustainability and that include methods to measure their impacts in practice.*

Traditionally, we have supported projects that use or leverage Information technology, but that focus is not necessary. We solicit innovative multi-disciplinary research that improves any or many of the products, organizations and processes of the AEC industry to design, construct and operate sustainable facilities, which the industry provides for capital facilities such as buildings, civil works and mechanical, chemical and biotechnical process plants. This call for proposals provides background on the CIFE (Center for Integrated Facility Engineering) mission and research goals and guidelines for how to submit proposals. CIFE normally funds projects for one year, with an option for a competitive second year renewal. The goal is for successful "seed" projects to produce external proposals for substantial further funding. See http://cife.stanford.edu/ for a summary of the CIFE mission and activities.

Timetable for projects for funding during AY 2014-15:

February 24	Call for proposals
March 24	Budget Request due at Engineering Research Administration for departments in the School of Engineering or your local research administration staff, for other Stanford departments.
April 1, 9 AM PDT	Proposals and budget due. Submit .doc, docx or .pdf document in electronic format to cife-email@stanford.edu.

April 3, 9 AM PDT	Presentation materials due to CIFE for Technical Advisory Committee Meeting. Submit PowerPoint document in electronic format to cife-email@stanford.edu.
April 10	CIFE Technical Advisory Committee (TAC) meeting - review of proposals *(all PIs will have an opportunity to present their proposals)*
April 15	CIFE Award decisions

Areas of CIFE Research Focus

CIFE defines *breakthrough business objectives* for AEC organization performance (http://cife.stanford.edu/mission):

- **Schedule performance**: CIFE member companies will have designed three major AEC projects within a year and constructed them within "six months".
- **Cost conformance**: CIFE member companies deliver 98% of their AEC projects within 2% of their budgets. Most CIFE companies see that excellent VDC models are crucial for dramatically improved cost conformance.

  These objectives include Function (quality) during design and construction that exceeds >= 99% conformance with explicitly stated project development objectives, which will include a combination of quantitative measurements of the performance of physical components and systems as well as assessment by relevant stakeholders that intended process "checklists" of steps have been followed successfully. We recognize that, for highly reliable and ultimately highly resilient facilities, process quality will need to exceed six-sigma reliability for process steps that significantly affect human or facility life safety.

  Sustainability: CIFE member companies develop their new AEC projects with lifecycle improvements that exceed 75% in energy, water and materials use than 2002, profitably. This objective includes operational energy use and water and construction material waste. Many companies now demonstrate significant commitment and achievement in this area.

- **Globalization**: CIFE member companies will acquire 50% of their materials and services from global providers and will make at least 50% of their sales in global markets. These related objectives are important for many companies already, and inevitably global companies will find new opportunities for market growth, cost management and, perhaps most important, sources of innovation.

Guidance for proposal teams

CIFE welcomes research on theory and use of innovative methods at all phases of the facility life cycle. Research of interest includes methods by which companies can measure performance during the design and construction phases; benchmark values for outcome performance and process conformance to objectives; and new methods to improve the variance and the mean performance.

All proposed projects must have two Principal Investigators. One PI must be a Stanford University faculty member from any department.

We focus on research that has *actionable* impact. We solicit research that leads to knowledge and methods that real project teams and real communities will (ultimately) be able to use for real development of real projects. That is, while we recognize that facility development goes on within broader contexts, we focus our solicitation on research that enables action by AEC teams at the expense of research that elucidates or even improves social, economic, political and historical contexts. We recognize that our successful research needs significant product development before it can have broad impact on AEC practices.

Based on recommendations of the CIFE Industrial Advisory Board, we solicit projects that involve multiple intellectual disciplines and that involve expertise of multi-disciplinary faculty and graduate student teams, such as:

- **Building Information Modeling and VDC for Facility Management (FM):** this topic includes efforts to clarify capabilities of the current generation of software tools including BIM authoring and review technologies, Industry Foundation Class (IFC) data standards and FM standards such as Construction Operations Building Information Exchange (COBie). Issues of interest include methods to design for aesthetics and function, such as effective occupancy, safety, climate control, and energy management. One possible function to support is development, use and maintenance of different kinds of asset schedules both in design and FM phases. Another function is to optimize asset use, both in the design and in FM phases.
- **Integrated VDC modeling, analysis, production planning and management:** e.g., innovative modeling, data collection and analysis methods to do model-based description and prediction of the performance of the physical facility, organization or process models or measurement of their performance.
- **Collection, interpretation and use of large volumes of data in the design, construction and FM phases of the facility life cycle**: Potential data sources include mobile technologies and building management systems (BMSs). There is value in automated methods that infer intended or desirable performance values from general knowledge of good facility design and specific statement of facility project intent. In addition, there is value in automated methods to track performance over time, classify different types of patterns of change and suggest patterns that indicate current or future potential risks.

We also solicit proposals that support of the CIFE breakthrough performance objectives, such as in the areas of:

- **Metrics:** definition of metrics that enable better management and better and value-based outcomes; processes to collect, report and use them in management; a searchable global benchmark database that solicits and shows measures of process and project outcome performance across the global AEC community;

- **Reliability:** approved designs now are widely available in BIM format. However, designers of record normally actually inspect a small percentage of the high-risk elements as they are installed. We solicit creative work to develop and demonstrate the value proposition of improving risk management of physical elements that have life or, in event of a suit, corporate safety risk. Investigators can explore use of BIM, field photographs of critical elements and a checklist-enabled designer review and approval of field installation while it still easy to fix any problems.
- **Strategy and methods to dramatically increase project and organization performance,** e.g., business strategy to sell projects and services with breakthrough performance objectives and to enable multiple teams to achieve breakthrough, and professional development methods that enable many practitioners to use the best of VDC methods in the best ways possible.
- **Methods to support operations and facility management,** e.g., commissioning, energy, space and security management. We expect that these innovative methods will be based on methods that use suitable Building Information Models (BIM), but the BIM basis is not a prerequisite.
- **Pre-fabrication** methods to support of dramatic improvement in one or more of schedule, safety, cost, quality, sustainability or reliability using innovative methods to pre-fabricate components and systems;
- **Innovative methods that dramatically increase facility asset utilization,** e.g., automated and robotic methods to reconfigure a space or system during a working year, season, week or day.

Please review and propose research that directly supports the CIFE breakthrough and intermediate CIFE goals and challenges for members**.** Proposals that do not address the identified challenges will still be considered for funding if, in the judgment of the reviewing TAC committee members, they are more innovative and promising than others that directly address the CIFE goals. Proposed projects often support more than one VDC goal.

	Want to collaborate with CIFE research in this area		
	Will add $ and time	will add time	no
Regarding management methods			
With the goal to minimize management cost, we informally assess process performance by asking a few key managers of their assessments when it is convenient to do so	0	2	4
With the goal to maximize production reliability, we formally measure process performance frequently and communicate it continuously to all staff using a range of methods	0	3	2
With the goal to minimize BIM modeling effort, we build BIMs and review as needed using the preferred methods of the BIM authors	0	3	2
With the goal to maximize BIM value for design, fabrication and FM, we formally specify facility design functional goals, create BIMs using formal BIM guidelines and review BIM and design quality formally and often with respect to explicit goals	0	5	1
Regarding sustainability			
With the goal to minimize project delivery effort, we address the sustainability goals of clients using the our past best practices	2	1	2
With the goal to deliver world-leading project sustainability, we design and apply energy-efficient systems, continuous monitoring and lifecycle sustainability prediction during design-construction, then have ongoing programs to compare measured and predicted performance and learn from any	2	3	1
With the goal to deliver world-leading project sustainability, we select teams and team members carefully and early, manage and operate using integrated agreements, set explicit and aggressive design and operating performance targets and manage using continual performance assessment for	1	2	2
Regarding the construction process			
With the goal to minimize project risk for ourselves and clients, we use well-established methods to design facilities and rely on experienced field construction methods and workers to do their best	1	5	0
With the goals to achieve dramatic construction schedule compression and far higher finished quality, we design and coordinate the fabrication-level detail of most major subassemblies and do extensive pre-fabrication	2	2	2
Regarding professional education of our staff and crucial value chain partners			
With the goal to maximize value-adding billable hours, we provide 20 or fewer hours per year of training for at least some of our staff	3	1	2
With the goal to dramatically improve the depth and breadth of our use of emerging VDC methods, within the next 24 months, all staff including senior and project executives, project leaders and almost all field staff will receive >= 40 hours VDC professional development activities and we will work with partners to provide complementary development for their staff.	3	2	1

Figure 1: Investigators can focus their proposals informed by these results of a survey of CIFE Advisory Board members of their level of interest in working with CIFE on particular areas of research. Higher numbers represent a higher level of interest.

Selection Criteria

The CIFE Technical Advisory Committee will evaluate seed proposals according to the criteria shown on the Proposal Review Form available at http://cife.stanford.edu/SeedResearch2014.

Funding Levels

There are no fixed funding limits for project proposals. Typical projects have budgets in the range of $30 - $80K. This year, we again request multi-PI proposals (from any departments) and solicit proposals that include specific plans for mutually engaging collaboration with CIFE member companies. We also encourage innovative

arrangements among PIs, for example multiple PIs collaborating to focus on the same test case(s) in complementary ways. An ideal is that multiple investigators propose a large enough integrated proposal that it became a "flagship" project to advance the CIFE mission.

The total amount of funds available for seed projects this year will be around $200,000. Because of budgetary constraints, successful proposals may not be awarded all of the funds requested.

Intellectual Property Rights

Any inventions that may be developed with CIFE Seed Research funding are in the public domain. Stanford University will not assert any intellectual property rights for inventions developed with CIFE Seed Research funding.

Policies and Guidelines for CIFE Seed Research Projects

Proposal Details

- The Maximum proposal length is 4,000 words (about eight pages, excluding cover and budget detail pages). Be concise; this is not a NSF proposal. Please include a short bibliography of relevant publications.
- Use the Proposal Template provided on the website at http://cife.stanford.edu/SeedResearch2014
- Please request a proposal number from Teddie Guenzer (Teddie.Guenzer@stanford.edu).
- The proposal submission must include the proposal using the template provided and the budget prepared by your research administrative staff. Late or incomplete proposals will not be accepted.

Requirements for Awarded Seed Projects

Project website: The PIs of awarded projects must create a website about their CIFE research project *by the end of the first quarter* and maintain it throughout the remainder of the life of the project. Initial release of the first half of awarded funds will be contingent on creation of the project web site that describes the proposed project. Release of the second half of awarded funds will be contingent on updating the project web site to describe the then-current project status. The website should provide access to at least the following information:

- A practical scenario illustrating the engineering/business problem addressed by the research and highlighting the potential impact of the research on practice,
- The original proposal (except the budget),
- Explanations of test cases used for the project, and
- PowerPoint presentations developed for this project

RA participation in CIFE Seminar: The research assistant(s) supported by the CIFE award will participate in the CEE320 "Seminar on Integrated Facility Engineering" or CIFE Ph.D. student seminar starting in the fall of each academic year.

Final project report: Submit a final project report (.pdf format) by the last day of the final project quarter (September 30). CIFE will put this report on its web site. Find details at "Instructions to Authors" on the CIFE web page.