**SCEC PROPOSAL 2021**

**Shared SCEC Research Computing and Cyberinfrastructure Resources**

**Investigators:** Ahmed Elbanna (UIUC) and Ricardo Taborda (EAFIT)

**Preparers:**

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**Science Objectives:**

P.4a, P.4b, P.4c, P.5a

**Total Funding Request**: **$75,000** (ESTIMATED)*

*Final funding request to be determined based on funded proposals with Research Computing and Software Developer requests.

**Motivation and Purpose**: SCEC researchers make extensive use of research computing resources and tools including high-performance and cloud computing, observational and simulated data, community earth models, open-source scientific community software, and complex research computing software stacks. A growing number of research projects also require improved information sharing, data access and data delivery tools. The purpose of the shared SCEC research computing (RC) and cyberinfrastructure (CI) is to identify and properly allocate the available SCEC capabilities and resources in terms of software developer time to support projects funded through the annual SCEC science collaboration process that have RC/CI needs.

Researchers may not precisely predict the amount of computing resources and/or developer time required at the outset of the project, or due to unforeseen conditions that develop as the project goes on the initial estimates may change. The proposed initiative asks for an estimate of needs from each research project, and then these needs are drawn from the infrastructure resources. This allows for balancing of efforts and efficient redistribution of resources where needed most. The leaders of the SCEC Computational Science (CS) disciplinary group, Ricardo Taborda and Ahmed Elbanna, together with Tran Huynh, Phil Maechling and Christine, will coordinate the research computing and cyberinfrastructure requests with the available SCEC software staff time.

**SCEC Software and Capabilities:** The RC/CI initiative provides critical support to SCEC researchers working on a variety of SCEC-related projects including SCEC community models, Ground motion simulation platforms, and seismic hazard modeling. Table 1 provides an overview for the SCEC software and related capabilities that will be accessible through the shared platform.

**Table 1: SCEC Software and Capabilities.**

| SCEC Software | Capabilities |
|---|---|
| SCEC Community Models | Data access, delivery and management for SCEC community models (e.g., CFM, CVM, CGM, CSM, CRM, CTM, UCVM) |
| Community Information System | Project websites; data access, delivery and management for SCEC research projects |
| Collaboratory for the Study of Earthquake Predictability (CSEP) | Delivery and maintenance of versioned, documented code for making and evaluating forecasts including intercomparisons to evaluate predictive skills; software support to allow individual researchers and groups to participate in prediction experiments |
| Broadband Platform | Provides a verified, validated, and user-friendly computational environment for generating broadband (0-100Hz) ground motions |
| CyberShake Platform | Provides physics-based probabilistic seismic hazard curves and maps using seismic reciprocity to generate large ensembles of ground motion simulations ($> 10^8$) |
| OpenSHA Platform | Used to analyze and evaluate CyberShake hazard model results; includes reference implementations the UCERF2 and UCERF3 |

**Process:** In the current SCEC science plan (or RFP), we asked Investigators whose projects might involve SCEC research computing and/or cyberinfrastructure to clearly state in their proposal an estimate of the level of effort (in terms of days, weeks or months of software developer time) required. Furthermore, we also asked that they specify the capabilities and SCEC software and developer(s) needed to achieve the proposed project plans, if known *a priori*. Prior to the proposal submission deadline, we received several requests for the developer level of effort needed, as well as the demanded resources and the initial estimate for the budget, for planned 2020 SCEC proposals. This provided initial guidance for the total funding requested here.

As a next step, the CS group leaders, Ricardo Taborda and Ahmed Elbanna, will scan all the proposals submitted and information submitted online to produce a summary of the SCEC capabilities and a more precise estimate for the total developer time requested on all 2020 SCEC proposals. The CS group leaders will then confer with a representative from the SCEC software group and Tran Huynh, Associate Director for Science Operations, to assemble a table of all requested RC/CI needs from all proposals submitted, translating the total request into a total dollar amount request from the annual science budget.

A CS group representative will provide guidance on the overall needs (in terms of total dollar amount) for the shared SCEC research computing and cyberinfrastructure, based on discussions of projects to be funded at the PC proposal review meeting.

For the SCEC projects selected for funding that requested RC/C resources:

1. The CS group leaders, in consultation with Phil Maechling, Christine Goulet, and Tran Huynh, will coordinate the allocable developer time on the funded projects to meet SCEC priorities. The allocable developer time will be based on available time the software developer may work on SCEC projects funded through the annual science collaboration process, taking into account commitments for other SCEC (special) projects.
2. The CS group leaders will work with the investigators to ensure proper SCEC data sharing, publication and crediting processes.
3. The CS group leaders will submit an annual report for the shared SCEC research computing and cyberinfrastructure through the SCEC reports system.

**Rationale for the estimated budget**: The initial estimate of $75,000 is based on the approximate man-hours requested from researchers who have directly contacted the CS group leaders and Tran Huynh prior to proposal submission. This budget request will need to be revisited after all proposals that need SCEC research computing and cyberinfrastructure support have been identified and evaluated by the Science Planning Committee. The final budget allocation will be based the sum total RC/CI requested from all proposals recommended for funding and available SCEC developer time. (No funding is requested for PIs Ahmed Elbanna and Ricardo Taborda.)

**Results from prior support:** The process for allocating shared SCEC RC/CI resources through the annual collaboration planning process was initiated in 2020. Ten proposals submitted explicitly requested research computing and software development support from SCEC developers, Scott

Callaghan, Kevin Milner, Mei-Hui Su, Edric Pauk, and Fabio Silva. In total, 33.5 weeks of developer time was requested. During the time allocation process, the Computational Science Group leaders identified an additional 17 proposals as potentially requiring SCEC developer support for the proposed plans. These PI's did not explicitly request developer time, but were also accounted for when estimating the available time from SCEC developers to support projects funded in 2020. All but one of these proposals were recommended for funding. The need for SCEC research computing and developer support might be greater than requested or reported. Our efforts in 2021 will be to further track and understand better needs of the funded SCEC projects, and to be able to allocate limited developer time more appropriately.

**Current and pending support:** No funding requested for PIs Elbanna and Taborda.