

# Workshop for Scientists and Engineers on Historic Site of Angkor, Cambodia

## Summary of Proposed Work

### **Preamble:**

At a workshop (NSF AWARD # 0350433) organized by the principal investigator, it was suggested that the World Heritage Site of Angkor, Cambodia, be examined to explore some unconventional challenges in civil engineering — *mechanics of materials, stochastic computation, computer graphics and animation for CAD* — relative to issues of sustainable development. Structural deformation, which can be readily observed on numerous historic monuments in the Angkor region, Cambodia, will provide a basis for formulation and validation of the engineering mechanics research. The computational tools that integrate two new methods viz., *LiveDesign* and use of combinatorics on words, were identified as appropriate tools in modeling socio-economic policies. Serendipitously, the stress analysis modeling philosophies are equally applicable to determining conservation methodologies and predictions of the built environment. Hence the extension into social sciences related to sustainable development to quantify economic policies.

### **Key foreign collaborators:**

Build Bright University, and Japanese Government Team for Safeguarding Angkor

Two important aspects are:

- (A) Developing a synthesized model of engineering and sustainable socio-economic development;
- (B) Field studies to implement the engineering mechanics aspects of NSF sponsored research.

### **Intellectual Merit:**

#### Overview

Structural deformations are intimately related to foundation behavior highlighted by ground water flow. Advanced engineering computational techniques, which were discussed at the NSF workshop (NSF AWARD # 0350433), are equally applicable for structural stress analysis and ground water flow calculations. Additionally, the architects in the workshop suggested focusing on visualization with GIS (Geographical Information System) tools that led to proposing Computer Mathematics/Graphics Applications that will be addressed as follows.

- i) The workshop will combine engineering with social sciences to address conservation, planning, and sustainable growth at cultural heritage sites in developing countries.

- ii) This grant will provide the opportunity for undergraduate, MS and PhD students in Engineering, Architecture, Anthropology and Sociology to work together.
- iii) This research will facilitate development of new research proposals for NSF, NEA and the US State Department to address issues in sustainable development of cultural heritage sites.
- iv) Designing a methodology that uses remote sensing, geographic information systems, and distributed computing technologies will be based on knowledge of the theories and principles underlying urban development, cultural dynamics, and environmental forces. The quantitative system will allow for better analysis and management of the evolving social and environmental systems.

### **Broader Impact:**

- a. The focus is to advance discovery and understanding in course work via field research for BS and MS-level teaching, training and learning.
- b. The proposed activity encompasses institutions from across the country (viz., Columbia University, NY, Harvey Mudd, CA).
- c. Five out-of-seven initially selected participants are women in engineering/architecture, medicine, human ecology and social development disciplines.
- d. Networks and partnerships between the NSF, NEA, the US State Department, UNESCO, and World Monuments Funds will be established.
- e. Subsequent proposals will focus on: field research with ground penetrating radar; and software engineering for Geographical Information Systems to initiate infrastructure development for research and education.
- f. All results will be disseminated via the internet without restrictions.
- g. The benefit to both national and international societal concerns is indeed a key point.