

**U.S. DEPARTMENT OF ENERGY  
NUCLEAR ENERGY RESEARCH INITIATIVE  
ABSTRACT**

---

**PI:** Daniel B. Fisher **Proposal No.: 99-0077**

**Institution:** Duke Engineering & Services

**Collaborators:** Sandia National Laboratory, ABB-Combustion Engineering, Massachusetts Institute of Technology, North Carolina State University

**Title:** The Development of Advanced Technologies to Reduce Design, Fabrication, and Construction Costs for Future Nuclear Plants

---

Duke Engineering & Services in collaboration with Sandia National Laboratory, ABB-Combustion Engineering, the Massachusetts Institute of Technology and the North Carolina State University propose to pursue the development of innovative technologies to reduce design, fabrication and construction costs for future nuclear plants. This proposal will focus on examining the Design, Procure, Construct, Install and Test (DPCIT) cycle as a means of applying new technologies since the capital cost of a new nuclear unit is substantially affected by the work practices of the cycle. With the future of new nuclear construction contingent upon having a schedule from first concrete to fuel load of 36 months, it is vital that innovative practices be produced for the entire process of designing and delivering a nuclear power plant. There are three sources of innovations to merge into a new DPCIT cycle: manufacturing technologies, improved reactor design and construction technologies, and information technologies.

The aerospace and automotive manufacturing organizations have pioneered a number of practices that have reduced their product cycle times by more than 50%. However, the translation of these innovative practices requires a structure for adopting these new practices as well as a mechanism for understanding the interrelationships. This project proposes to adopt a series of three models to capture the process, product, and productivity knowledge needed to carry off a shortened schedule.

A number of earlier research efforts such as modularization and simplification of structures were directed at product simplification within the constraints of already existing designs or work practices. These efforts have identified various techniques for achieving incremental improvements. However, these improvements remain unexamined in the United States due to a lack of current domestic orders. Therefore, the potential improvements that could illustrate a cost effective DPCIT cycle remain unassembled in their larger and more powerful configuration.

Information technology has transformed a number of industries by making new types of collaboration possible as well as mechanizing a number of design processes as well as information retrieval processes. The development of Internet technology has enabled substantial reductions in design-procure cycle time for a range of industries. In the recent years, there has been a merger of design and configuration

---

management software such that new designs can be built with much less time and reduced errors. The prior generation of nuclear technology was heavily influenced by the

high cost of computation relative to labor costs. That relationship is now reversed and deserves a reexamination. Therefore, the project team will merge process improvements that have been previously investigated with new information technologies and work practices that have been developed in manufacturing businesses into a series of models that serves as the basis for minimizing the entire design and construction schedule, and hence, the capital cost of a new reactor plant.