

Inter-agency Working Group: Motivation and Rationale

Our National economic and security strength is and will be largely dependent on our expertise in the fields of engineering and manufacturing. Though we have historically demonstrated strength in these areas, the decline of available resources, the increasing complexity of products and systems, and the often unanticipated environments in which they will be used, has forced our attention to the critical issues of affordability, efficiency and adaptability within current engineering practice.

Major increases in available computational power allow us to now explore solutions that address the inherent problems of large-scale complex engineered systems (LSCES) that are fundamental to national priority environments such as aerospace, nuclear, maritime, and major civil infrastructure systems. In parallel we need to investigate the core principles of engineering science that lay the foundation for significant, next generation advances in cross-discipline engineering practice and education in multi-scale environments.

National concerns go beyond the question of retaining dominance in the industrial world. We must develop and focus strategic efforts to effectively—and successfully—compete with developing nations where expertise in science and technology is now raised to the highest priority. To respond to these concerns, it is our position that the *leadership of multiple, cross-mission agencies must collaborate on addressing the following key issues:*

- 1) Engineering process and practice has been essentially stagnant for over 25 years in the face of rapidly changing missions, industrial needs, and global competition, particularly in the context of Large-scale Complex Engineered Systems.
- 2) To revolutionize paradigms in engineering, enabling technologies must be developed that leverage new scientific and technological advances in areas of digital data representation, systems and physics-based modeling, advanced collaboration and decision-making techniques, mathematical solutions to resolving design decisions, and other approaches based on modern information and physical sciences.
- 3) To achieve transformational advances in engineering practice, a comprehensive, multi-year basic and applied research strategy must be adopted and supported to nurture and sustain world-class advances in engineering, to accelerate the incorporation of novel concepts in engineering and manufacturing science, and to perpetuate innovation by training a new generation of engineering educators and professionals.
- 4) To *realize* paradigm change in engineering practice, effective methods for transformation of research to practice must be addressed. The exploration of effective transition models need not be restricted to novel ideas, but could leverage previous, successful methods that could be reinterpreted and applied effectively to engineering science studies and related communities.

We seek participation of those who share our interest in developing cross-agency, national consensus on a set of principles, goals and key S&T concepts to bring forward through a unified voice on issues of engineering practice in our Nation. Agencies need the independence required to interpret goals and execute their missions. A unified voice is important to invigorate, stimulate and share concerns and solutions related to this most critical issue. Equally important is developing a strategy to reshape the field of engineering as a scientific discipline worthy of significant investment towards strong, industrial and national security futures. We hope the outcome of this meeting will be a path forward and an initial plan toward furthering those goals.