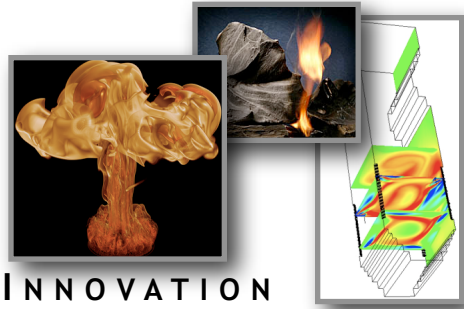


COMBUSTION SIMULATION VERIFICATION, VALIDATION AND INNOVATION



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Abstract

The demand for more and cleaner energy is one of the world's greatest challenges, and hydrocarbon combustion will remain at the heart of the global energy portfolio for the foreseeable future. The ability to use high-performance computing to produce high-fidelity simulations of combustion processes is a powerful enabling technology for the advancement of scientific discovery for energy applications. At the same time, the explosive growth in the number and resolution of combustion diagnostic and measurement techniques has produced unprecedented volumes of combustion-related data that allow validation of computer models to unprecedented levels. This presentation will draw on the experience of the DOE Advanced Simulation and Computing (ASC) program to identify the need to create a computational environment that tightly integrates data assimilation with computational simulation science, tuned for the discipline of combustion sciences, for the purpose of simulation verification and validation.

The presentation will advocate the development of tools necessary to produce a dynamic integrated environment that will automate the currently tedious process of performing the thousands upon thousands of simulations and comparisons to data to extract quantifiable model uncertainty and to perform rigorous sensitivity analysis of combustion simulations. This vast computational need will require utilizing grid computing at the peta-scale.

Predictive simulation science of combustion processes with quantified uncertainty is the enabling technology for rapid analysis and deployment of new technologies for the increasing global demand for energy.