HIGH PERFORMANCE COMPUTING ON MASSIVELY PARALLEL ARCHITECTURES

The Laboratory for Computational Physics and Fluid Dynamics of the Naval Research Laboratory (NRL) conducts research and development supporting the national initiative in high performance computing. Advanced algorithms, codes and licensable software are developed for commodity systems and for the newest massively parallel architectures. Research is pursued in the fields of compressible and incompressible fluid dynamics, reactive flows, fluid/structure interaction including submarine and aerospace applications, atmospheric and solar geophysics, magnetoplasma dynamics, fire modeling, engine modeling and molecular dynamics. We are interested in receiving proposals for research, development and related support that address our program in the following topics:

(1) Novel modeling and simulation of complex combustion systems involving multi-phase fuel injection such as droplets, sprays and particulate matter in a gaseous background.

(2) Innovative characterization of sound generation and investigation of methods to increase fuel-air mixing, reduce noise and pollution from jet engine exhausts using direct and large eddy simulation techniques and supporting data for validation.

(3) Innovative development, integration and maintenance of an environment for efficient approaches to the massively parallel processing of detailed chemical kinetics mechanisms and the development of simplified chemistry models for inclusion in multidimensional simulations of flames, fire and detonations.

(4) Novel finite difference modeling for large scale studies with general boundary conditions and modeling of local phenomena in multidimensional magnetofluids.

(5) Innovative many-body simulation models for plasma phenomena.

(6) New radiation transport and equation of state models for inclusion in highly parallelized and vectorized hydrodynamic simulation codes which address stellar processes such as coronal heating and solar flares, and laboratory plasmas, in which the effects of radiation transport and non-ideal equations of state are relevant.
(7) Novel techniques for structured and unstructured grid-based unsteady flow solvers for complex, three-dimensional flows. This research would also address parallel load balancing and adaptive refinement and remeshing for unsteady flows. CAD interfaces with grid generators and unsteady flow solvers for multiple moving surfaces and bodies in relative motion, bodies in and near a free surface, and bodies in turbulent separating flows are also sought.

(8) Innovative simulations of high-Knudsen-number flows using direct simulation Monte Carlo Methods, applied to microdynamics and materials processing.

(9) Development, validation and application of techniques for complex multi-phase flows.

(10) Development of innovative techniques for the simulation of low Reynolds number flows through complex geometries.

(11) Innovative modeling of elastic-plastic flows and flow interactions with solid deformable boundaries. This work would include shock loading in sand and/or explosive effects on deformable bodies.

(12) Development of innovative and efficient numerical techniques for the simulation of fluid flow and chemical phenomena relevant to fires and explosions in enclosures.

(13) Development, application, validation, and accreditation of numerical simulation models needed to support decisions in protection of buildings, facilities, and/or military platforms from the threat of chemical/biological incidents.

(14) Development and application of numerical simulation models, including visualization techniques, to investigate complex unsteady viscous flows associated with biofluidic systems and devices as well as artificial biomimetic vehicles and systems.

Address White Papers (WP) to Code 6410, or e-mail, telephone (202) 767-2402. Allow one month before requesting confirmation of receipt of WP, if confirmation is desired. Substantive contact should not take place prior to evaluation of a WP by NRL. If necessary, NRL will initiate substantive contact.