The goal of this project is to develop the Discontinuous Petrov-Galerkin (DPG) scheme for the compressible Navier-Stokes equations in three dimensions (3D) and to develop computer codes implementing the method. Thus far this technique was applied only to the twodimensional case and it was used for simulations with not very demanding values of the Reynolds number.

We wish to take advantage of the most important feature of the approach: its robustness being independent of the viscosity parameters, no matter how small they are. This will allow us to simulate the flow problems on large class of meshes, including the adaptive meshes with significant range of element sizes, their aspect ratios (flat elements in boundary layers), and to use the higher order approximations which is very rare in CFD computations. The adaptive meshes will be generated automatically by subdividing the elements with largest estimated errors. The error estimates for both the global error in the energy norm and for the viscous fluxes on the surface of the body placed into the fluid will be developed. Obtaining the reliable values of the viscous fluxes, the skin friction and the heat flux is the most challenging part of the viscous simulations.

The flow solver must be prepared for parallel computations as the great stability of the scheme takes its price, substantially larger amount of computations. We plan to simulate the threedimensional problems characterized by large Reynolds number approaching $Re = 10^6$. The results should be compared to the experimental measurements or to some other reliable simulations.