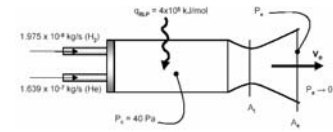


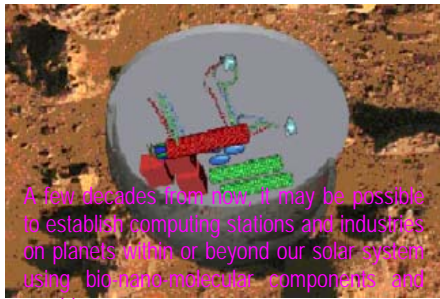
CONSTANTINOS MAVROIDIS

Rutgers University

Protein Based Nano-Machines for Space Applications

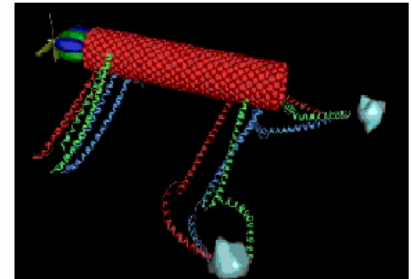


A multidisciplinary team from Rutgers University, State University of New Jersey and Shriners Hospital for Children (a Harvard Medical School affiliated hospital), has been assembled to respond to NIAC CP 01-02 research opportunity. We propose to develop novel and revolutionary biomolecular machine components that can be assembled and form multi-degree of freedom nano-devices that will be able to apply forces and manipulate objects in the nano world, transfer information from the nano to the macro world and also be able to travel in the nano environment. These machines are expected to be highly efficient, economical in mass production, work under little supervision and be controllable. The vision is that such ultra-miniature robotic systems and nano mechanical devices will be the biomolecular electromechanical hardware of future outer space and planetary



exploration missions.

such ultra-miniature robotic systems and nano mechanical devices will be the biomolecular electromechanical hardware of future outer space and planetary



A vision of a nano-organism: Carbon nano-tubes form the main body; peptide limbs can be used for locomotion and object manipulation, a biomolecular motor located at the head can propel the device in various environments.

Some proteins, due to their structural characteristics and physicochemical properties, constitute potential candidates for this role. During Phase I, we will (a) identify such proteins that can be used as actuators, sensors, gears, joints and other machine elements in nano/micro machines and mechanisms. (For example, based on our preliminary studies, a sub-unit of the Human Immunodeficiency Virus type 1 (HIV 1) a protein known as gp41 [glycoprotein 41] can be used to produce an actuated linear joint); (b) study the protein interface to carbon-nanotubes that can be used as rigid links; (c) develop dynamic models, virtual assemblies of the proteins into mobile linkages and realistic simulations to accurately predict the performance of such nanomachines; (d) perform a series of biomolecular experiments to demonstrate the validity of the proposed concept.

