SUMMARY FOR REPORT ON "MULTISTAGE ELECTROPHORETIC PURIFICATION OF CELLS, PARTICLES, AND PROTEINS", SUBMITTED 3/6/2000 NASA CONTRACT NUMBER: NAS 9-98088

Electrophoresis is a process that separates particles and solutes suspended in a fluid medium by application of an electric field. The primary purpose of this project is to develop a multistage means of studying the electrophoretic properties of substances in microgravity. The secondary purpose is to develop a lab unit that is commercially marketable for ground based applications of its unique multistage feature.

The deliverable item for this contract is a "flight prototype", shown in Figure S-1a. This unit has been designed to serve as a ground based lab unit. This unit is unique in that it has a circulation system for maintaining isothermal conditions and removing gases created by electrolysis that are detrimental to the outcome of a separation. Additionally, the flight prototype uses a feedback system to maintain a constant, or programmed user-specified electric field, even when the conductivity of the fluid medium changes over time. The flight prototype is controlled via a Graphical User Interface (GUI), shown in Figure S-1b, which runs on a personal computer running a Windows™ operating environment.

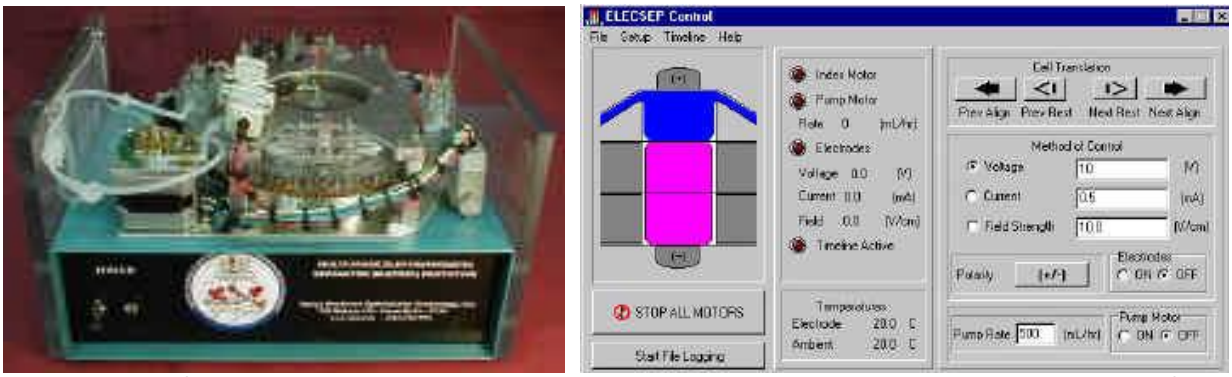

Figure S-1a (left) The ELECSEP Flight Prototype. Figure S-1b (right) The ELECSEP Graphical User Interface.

Research performed at SHOT's facility and at the University of Colorado, Boulder included mathematical modeling of the electrophoresis process, testing and refining of theoretical predictions, validation of low-current and high-current lab units and the flight prototype, and performance verification. Thermal, hydrodynamic and electrochemical pitfalls were identified and minimized or eliminated. Successful experimental results were obtained in aqueous two-particle separations and the verification of ELECSEP's ability to quantify the electrophoretic mobility of red blood cells and other particles.

Some of the potential applications for which ELECSEP may be used include:

- Isolation of productive subpopulations of cells
- Separating cells at high particle concentrations
- Creating and controlling saturation zones during crystal growth
- Studying electro-kinetic demixing
- Studying the effects of surface forces in electro-aggregation