# FINAL REPORT

Contract Number: NAS9-16810
Lower Body Graduated Negative Pressure System

Following is the final report of the Lower Body Graduated Negative Pressure System.

The first task concerning the Lower Body Negative Pressure Suit was to determine the best type construction for a leg section with these goals in mind:

- good mobility
- minimum amount of bulk
- ease of storage
- lightweight
- rigid enough to withstand atmospheric pressure
- minimum amount of preparation before donning and donning time.

After a study of three systems we chose to use the wire hoops (rings) separated one inch apart in an airtight material furnished by NASA.

Using the system we developed we fabricated a leg section, using a nylon ripstock material and support rings fabricated using 3/32" piano wire. These rings were cemented in place approximately one inch apart making a flexible tapered collapsible cylinder shaped leg section. The leg section was fitted with six pressure seals approximately every fifth or sixth ring making six separate compartments that incased one leg including the foot up to the groin area. The pressure seals were constructed from closed-cell neoprene foam. A rigid fiberglass boot was

fabricated using polyester resin and fiberglass cloth and mat. The boot was attached to the leg section using cement and reinforcement bands. The boot was fitted with an insole and a neoprene sole and heel.

A hip-waist harness was fabricated and attached to the leg section by two adjustable straps. This system was more than adequate to support the leg suit section while withstanding more than 120 mm Hg in the boot section.

A set of six negative pressure regulators was fabricated, tested and installed. The regulators were identical, each holding a 20 mm Hg pressure differential. The top regulator controls the pressure to 20 mm Hg below atmospheric, the next regulator lowers the pressure 20 mm Hg below the first stage with the bottom stage being the boot maintaining a -120 mm Hg.

This system was equipped with a vacuum source that consisted of a mini-diaphragm compressor/vacuum pump. This pump has the capability of maintaining .-5 in. Hg with .31 CFM, -10 in. Hg with .21 CFM, -.15 in. Hg with .14 CFM -20 in. Hg with .07 CFM.

This pump was more than adequate to maintain the leg section at a maximum pressure of -120 in. Hg in the boot section.

We found this unit provided good mobility and was not too bulky to store. We also found this type of suit would be what we would consider to be in an acceptable comfort range depending on the fit and duration of wear.

We recommend fabricating a flight prototype using what we have learned to develop a suit that would include both legs plus the lower abdomen up to the waist. This will give some seal problem over the soft

tissue of the abdomen but we feel if the pressure in this area is maintained at no more than -20 mm Hg these proglems could be overcome. We would not recommend going any higher than the waist because this would cover the diaphragm causing difficulty in breathing.