To: Professor Neil A. Armstrong
    Henry J. Heimlich, M.D.
    George Rieveschl, Ph.D., Sc.D.

From: Edward A. Patrick, M.D., Ph.D.

Reference: AAMI presentation

Mr. Miller of AAMI requested an abstract of our paper being presented on March 20th in Boston at AAMI. They select abstracts of interest and place them in the press room established for the meeting. Enclosed is a copy of an abstract I have prepared from the paper and am sending it to Mr. Miller.

Sincerely,

Edward A. Patrick, M.D., Ph.D.
Professor of Electrical Engineering, Purdue University, School of Medicine, Indiana University

EAP/gb
Enclosure
APOLLO DOUBLE DIAPHRAGM PUMP FOR USE IN ARTIFICIAL HEART-LUNG SYSTEMS

by

Neil A. Armstrong

Henry J. Heimlich, M.D.

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George Rieveschl, Ph.D., Sc.D.

The pump used to circulate fluid for thermal control in the astronaut's space suits for the moon landing program is being investigated for adaptation to extra-corporal heart-lung systems as well as in implantable artificial heart-lung systems. The pump was made available through the courtesy of NASA (National Aeronautics and Space Administration). The results from our study are reported in this presentation and a forthcoming publication.

A limitation of existing heart-lung machines is that they can be used safely only for several hours. This time limit is due in part to the fact that continuous use of the pump destroys red blood cells which are filtered by organs such as the kidney causing injury to the organ and a fatal result. For this reason, one of the major developments sought is a pump which causes minimal destruction of the blood elements. With such a pump it is conceivable that the heart can be bypassed for an indefinite number of days or weeks to get a patient over an acute coronary, post operative pneumonia,
cardiac failure, pulmonary insufficiency, and some other acute and chronic problems.

This paper reports findings indicating that the Apollo Double Diaphragm Pump is less destructive to red blood cells by many times than any existing pump now used in heart-lung machines. These findings are based on studies performed on the pump in the form it existed in the astronaut's backpack. When modified to conform to the specific purpose for use in a heart-lung machine or cardiac bypass, it can be expected to function even better.

This research is being conducted by a multidisciplinary team working through two Universities and a major hospital. The team, called HARP (the surname initials of its members), consists of Henry J. Heimlich, M.D., Director of Surgery, the Jewish Hospital, Cincinnati, Ohio; Neil A. Armstrong, Professor of Aerospace Engineering, University of Cincinnati; George Rieveschl, Ph.D., Sc.D., Vice President of Special Projects and Department of Environmental Engineering, University of Cincinnati; and Edward A. Patrick, M.D., Ph.D., Professor of Electrical Engineering, Purdue University.