Study of Space Cabin Atmospheres

NASA Research Grant NGR-22-007-053

Semi-Annual Status Report

For the Period

July 1, 1965 to December 31, 1965

Submitted by

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I. Summary of Activities

A. Particulate Sampling Device

During the period covered by this report Dr. Silverman and the writer met with representatives of the NASA Electronics Research Center and Block Engineering, Inc., to provide consultation on the design of an in-flight space cabin aerosol sampling instrument (later identified as the Aerosol Particle Analyzer) to be prototyped by Block Engineering, Inc. under Contract No. NAS 12-39. The consultation dates and the major topics covered are briefly described below. On most of these dates a number of different items were discussed.

July 1, 1965	Miniature air sampling pumps.
August 9, 1965	Tape samples for in-flight collection of particulates.
	Physiologically significant particle sizes.
September 3, 1965	Anticipated aerosol concentrations in flight situations.
	Presentation of counting data; integrated versus differential count.
September 13, 1965	Significance of particle shape and index of refraction.
October 18, 1965	Filter media for tape sampler
	Internal calibrator.
October 26, 1965	Review of Aerosol Particle Analyzer design.
	Sampling pump.
	Air entry on Aerosol Particle Analyzer

B. Field Aerosol Generator

In order to optimize design and calibrate any particulate sampling device it is necessary that a model aerosol be used which is representative of the aerosol for which the device is

designed. A technique which has been proposed as a tentative ASTM standard aerosol for the calibration of optical particle counters has been described by Whitby and Vonda. In this technique a water solution of monodisperse polystyrene latex is used to form a primary droplet aerosol containing one polystyrene latex particle per droplet. The droplet water is then evaporated, resulting in a discrete aerosol of polystyrene latex. This method of generating a homogeneous aerosol has been previously used in our laboratories. We have started the design of a portable generator of this type which could be used for field calibration of the Aerosol Particle Analyzer and for evaluation of other types of particle counters to be developed in this laboratory.

C. Survey of Particle Counter Designs

Optical methods are presently the basis for most successful automatic particle counting devices. Optical particle counters have been described in detail in the literature and a significant amount of technical information is available on their performance. (1) The optical particle counter evolved under Contract No. NAS 12-39 represents an optimum design of such a system and should perform adequately under in-flight space conditions. It is the purpose of this grant, however, to study other methods of contaminant sampling including particulate sampling, and we therefore have initiated a review of other methods of determining size distribution and concentration of aerosols. At this date we have not identified one sampling method which warrants major attention, although the simplicity of an acoustical system seems attractive for an initial feasibility study.

II. Future Activities

During the next report period the following activities will be given major attention:

A. A model aerosol generator will be designed and evaluated for calibration of the Aerosol Particle Analyzer and other devices to be developed under the present grant. It is our intent to design a portable unit which can be used outside of the laboratory, for example, pre-launch calibration of the Aerosol Particle Analyzer. At the present time such a device is not available.

B. Proceed with a feasibility study of an acoustical type particle sampling device to meet the needs for a space cabin monitoring device.

C. Study the deposition of particulates on life system filters from manned space flights to determine the nature, origin, size and morphology of particulates removed from the cabin environment. As a part of this study we will determine the efficiency of this filter media for given particle sizes.

III. Personnel

Due to the death of Dr. Leslie Silverman shortly after the end of this report period it has been requested that William A. Burgess be named Director for the completion of the grant.

Wm. A. Burgess