COLLECTION AND PRESERVATION OF BIOLOGICAL SPECIMEN DURING SPACE FLIGHT FOR POST-FLIGHT ANALYSIS

(STATEMENT OF WORK)

I. Background and Objectives

NASA's present space program is centered on the ability of landing an astronaut on the moon and returning him safely to earth. The Apollo Applications Program will utilize this ability to increase scientific knowledge, a significant aspect of which is knowledge of the effects of space flight on man. It is to this aspect that the program of in-flight medical and behavioral investigation is addressed. In order to accomplish with minimal constraint the experiments and measurements which make up the program, it will be necessary to provide for the preservation of specimens collected in-flight for clinical laboratory evaluation in ground based laboratories post-flight.

This statement of work is the initiation of an effort to identify and construct the sample preservation technique(s) and equipment best suited for space flight within the AAP configuration, and which will allow the clinical laboratory evaluations contemplated to be accomplished with acceptable accuracy. This program is to be achieved in three steps:

1. Study phase
2. Construction and testing of a laboratory prototype model
3. Construction and test of flight equipment

II. Scope of Study

The present request covers phase one only.

III. Contractor Tasks:

Critical comparative evaluation of the feasibility of utilizing the following methods of preservation of in-flight collected biological samples for post-flight analysis.

1. Chemical
2. Refrigeration
3. Freezing (various temperatures)
4. Vacuum Distillation

5. Lyophilization

6. Combination of chemical and other methods

7. Any additional method which may appear worthy of feasibility evaluation.

Appendix A is a list of the Laboratory Studies under consideration for the Apollo Applications Program. The contractor will determine the suitability of the various preservation methods listed for these laboratory tests. The study should include the following considerations:

1. Time for which a sample can be stored without jeopardizing the reliability of the subsequent analysis (within standard laboratory accuracy)

2. Effect of weightlessness on collection and preservation technique

3. Sample size required

4. Complexity of sample preparation for preservation

5. Weight volume and power requirements (to operate preservation system)

6. Special biological problems such as:

   use of anticoagulants
   hemolysis
   protein precipitation
   contaminant microbial growth

7. Necessity for return of preserved samples via command module through reentry profile, recovery and shipment to clinical laboratories.

IV. Program Management

The present contract is estimated to require a total of twelve professional man-months plus appropriate supporting personnel. This study should be completed within two (if necessary three) months. It is anticipated that two parallel contracts will be awarded.

The contractor is required to conduct a mid-term review at NASA Headquarters and to present four copies of a letter report. At the end of the contract period an oral report should be conducted at NASA Headquarters and ten copies of a written draft report should be provided. Following NASA review, contractor should supply 25 copies of the report in final form.

The technical part of the proposal, exclusive of the resumes of the bidder's experience, capabilities, and personnel, should be limited to a maximum of twenty pages double spaced. The bidder may, at his own discretion, include material indicating his qualifications for phases two and three on this project. However, NASA's decision on the awarding of contracts for these phases will be made only at the end of phases one and two respectively.

V. Future Plans

On the basis of the information provided in the first phase NASA will make a decision relative to initiation and specific coverage of a Design and Construction Phase (4 months). During this phase the contractor will prepare detailed designs for the sample preservation technique as specified by NASA. When the design has been approved, the contractor will construct a laboratory prototype model of approximately flight dimensions. The model will be subjected to a carefully planned series of laboratory tests.

NASA's decision on initiation of a third phase - construction and test of flight equipment - will be based on the results of the second phase tests.

The work described in Section V is not the responsibility of the contractor. It is included to assist him in performance of the tasks described in Section III If NASA should decide to continue this program into phases two and three the contractors for phase one will receive prime consideration.

CLINICAL LABORATORY EVALUATIONS

Parameters	Serum or Plasma	Urine	Whole Blood	Feces	Sweat	Micro-biology
Creatine	X	X				
Creatinine	X	X				
Serum Proteins (electropharesis)	X					
Mucoproteins & related Biocolloids	X	X				
Sodium	X	X		X	X	
Potassium	X	X		X	X	
Chlorides	X	X		X	X	
Phosphates	X					
Alkaline Phosphatase	X					
Calcium	X	X		X	X	
Magnesium	X	X				
Manganese	X	X				
Bicarbonate	X					
Zinc	X	X				
Sulfates	X	X				
Pyrophosphates		X				
NPN	X					
BUN	X					
Uric acid	X					
Glucose tolerance			X			
Fat tolerance		X				
Amino nitrogen	X					
Total nitrogen		X				
Blood lactic acid			X			
Bilirubin	X					
Standard Clinical analysis		X				
Protein Bound Iodine (PBI)	X					
17-hydroxy corticosteroids		X				
Catecholamines	X					
Thyroxine	X					
Thyroxine Binding Prealbumin (TBPA)	X					
Aldosterone		X				
Antidiuretic Hormone (ADH)	X	X				
Adreno-corticotrophic Hormone (ACTH)	X					
Serotonin		X				
Specific Gravity		X				
Proteins		X				
pH		X				
Hematocrit			X			
Reticulocyte count			X			
RBC (total)			X			
WBC(total)			X			
WBC differential			X			
RBC cell mass (isotopes)			X			
RBC survival			X			
Hemoglobin			X			
Platlet count			X			
Plasma Volume ($RISA^{125}$)	X					

Parameters	Serum or Plasma	Urine	Whole Blood	Feces	Sweat	Micro-biology
WBC Differential			X			
WBC Motility and Phagocytic Activity			X			
Platelet Estimate			X			
Platelet Adehensiveness			X			
Fibrinogen	X					
Fibrinolytic Activity	X					
Prothrombin Activity	X					
Plasma Thromboplastic Component (PTC)	X					
Antihemophylic Globulin (AHG)	X					
Immunoglobulins (compliment and antibodies)			X			
Cytogenic Studies of Lymphoeytes (caryotyping)			X			
Clotting time			X			
Clot Retraction			X			
Sampling and Culturing of Flora of Body						X
Colony Counts						X
Microbiological Identifications						X

No Storage of Samples

- Bone Density
- Metabolic Rate
- Respiratory Quotient
- Food Balance
- Water Balance
- Gastric Motility, Pressure, pH
- Bleeding Time
- pO_2 of Blood
- pCO_2 of Blood