PRELIMINARY

PROJECT DOCUMENT COVER SHEET

M018

VECTORCARDIOGRAM

Principal Investigator(s):

Dr. Raphael F. Smith
Dr. Newton W. Allebach

REPORT NUMBER	DATE
DB-50-67-M018	3-31-67

PREPARED BY:	Robert L. Johnson Robert L. Johnson, M.D., Space Physiology Branch
APPROVED:	(BRANCH AND/OR SUPPORT OFFICE) George G. Armstrong, Jr., M.D., Chief, Space Physiology Branch
APPROVED:	(DIVISION) Lawrence F. Dietlein, M.D., Chief, Biomedical Research Office
APPROVED:	(PROGRAM OFFICE)

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REVISIONS					CHG. LETTER
DATE	PREPARED BY	APPROVALS			
		BRANCH	DIVISION	PROGRAM OFFICE	

PRELIMINARY

REPORT NUMBER DB-50-67-M018

MSC FORM 151A (JUL 66)

(Exp. No.) (Title)

M018 VECTORCARDIOGRAM

EXPERIMENT IMPLEMENTATION PLAN

for

MANNED SPACE FLIGHT EXPERIMENTS

(Date)

(Draft Format
Approval Pending)

(1)

EXPERIMENT IMPLEMENTATION PLAN
FOR
MANNED SPACE FLIGHT EXPERIMENT

1. Title of Experiment — Experiment No.

Vectorcardiogram — M018

2. Sponsorship

Sponsoring Program Office (SPO)	OMSF, Space Medicine
Principal Investigator (PI)	Dr. Raphael F. Smith and Dr. Newton W. Allebach
PI Institutional Affiliation	Naval Aerospace Medical Institute
SPO Manager	S. P. Vinograd, M. D.

3. Development

Experiment Development Center	MSC, Medical Research & Operations Directorate
Center Experiment Manager	Dr. R. Johnson

4. Integration

OMSF Flight Program Office	ML
Payload Integration Center	MSFC

5. Approval (Headquarters use only)

Sponsoring Program Office Approval _____ Date: _____

Flight Program Office Approval _____ Date: _____

Approved for Flight Assignment _____ Date: _____

Program Office
Associate Administrator

Date: _____

Section I - Experiments Summary

1. Technical Information - The purpose of the M018 experiment is to measure electrocardiographic potentials during weightlessness and the immediate post-flight period by methods that allow precise quantitation of the changes that occur. These measurements will be compared to control data obtained on earth.

The primary aspects of this investigation are as follows:

a. To utilize the vectorcardiogram to detect the changes in the electrical activity of the heart that are associated with weightlessness and other stress conditions encountered in space flight.

b. To correlate the vectorcardiographic changes observed during and immediately after prolonged space flight with anatomical shifts in heart position and of body fluids, changes in heart size, altered myocardial perfusion and other alterations in cardiac function resulting from the conditions of space flight.

c. To apply computer techniques to analysis of the data. Vectorcardiograms (VCG) will be taken at regular intervals during space flight in order to determine serially the changes in cardiac electrical activity. Records will be taken at rest before, during, and after a three minute period of exercise. Similar tracings will be made daily after return to earth. The findings will be compared with BCG's taken prior to flight. Changes in the VCG patterns will be correlated, using computer techniques for data reduction and analysis, with anatomical and functional changes in the heart. The cumulative effect of the stresses of extended periods of space flight and particularly of weightlessness, upon the VCG and the return to preflight patterns following flight will be furnished. The changes observed in ground-based studies previously accomplished will be utilized in the analysis of data.

The three orthogonal components of the VCG, utilizing the Frank lead system, will be obtained prior to, during, and after flight on each astronaut, both while at rest and during and after a standardized exercise.

The stresses of space flight will produce changes in cardiac function which are reflected in electrical potential measured at the body's surface. The vectorcardiogram, using a standard orthogonal lead

system, furnishes data which can be reduced and analyzed by computer techniques. By utilizing the vectorcardiogram at intervals during space flight, both under resting conditions and a standard exercise, and after return to earth, it is hoped to identify and to some degree quantitate the changes in cardiac function that result from weightlessness and other stresses of space flight. Correlation of these changes with alterations in anatomical position of the heart and body fluid shifts should furnish fundamental knowledge of the cardiac response to space flight.

2. Engineering Information - The major experiment hardware components required are:

a. Vectorcardiograph System - One per each astronaut participating in the experiment, consisting of:

(1) A Frank lead network

(2) Calibration and timing circuits

(3) Three electrocardiogram signal conditioners

The Frank lead network serves to normalize six electrocardiogram signals taken on the body into the three orthogonal electrocardiogram signals required for vectorcardiograph analysis. The calibration and timing network applies calibration signals to the inputs of the three electrocardiogram amplifiers on remote command. The vectorcardiograph system then presents three normalized, amplified electrocardiogram signals from low impedance sources for telemetry or magnetic recording.

(4) Harness and vest - One body worn vest per astronaut will be provided with built-in harnesses to properly connect the five electronics modules and the body worn electrodes to the power source and data acquisition equipment. This vest may be the standard unit being proposed for use with experiments M050 and M051 and will be capable of accommodating the electrodes for the sternal and axillary bipolar leads as well as the Frank lead VCG.

(5) Electrodes - Standard Apollo body worn electrodes may be utilized with this equipment. However, studies are presently underway to develop quick-don type electrodes for use with this experiment equipment.

(6) A bicycle ergometer, being utilized on experiment M050, will be utilized with this experiment.

There are no modifications or changes to the spacecraft systems other than those required for mounting of the ergometer in the Workshop.

Spacecraft subsystems support will be supplied by the Experiment Data System presently being used to support M050 and M051.

The bicycle ergometer hardware, which is a part of the M050 (Metabolic Cost) experiment, will also be utilized in conducting this experiment. Provisions are required for mounting the bicycle ergometer inside the Workshop prior to conducting the experiment.

The weight of the experiment equipment is estimated at 4.7 pounds with a volume of .27 cubic feet.

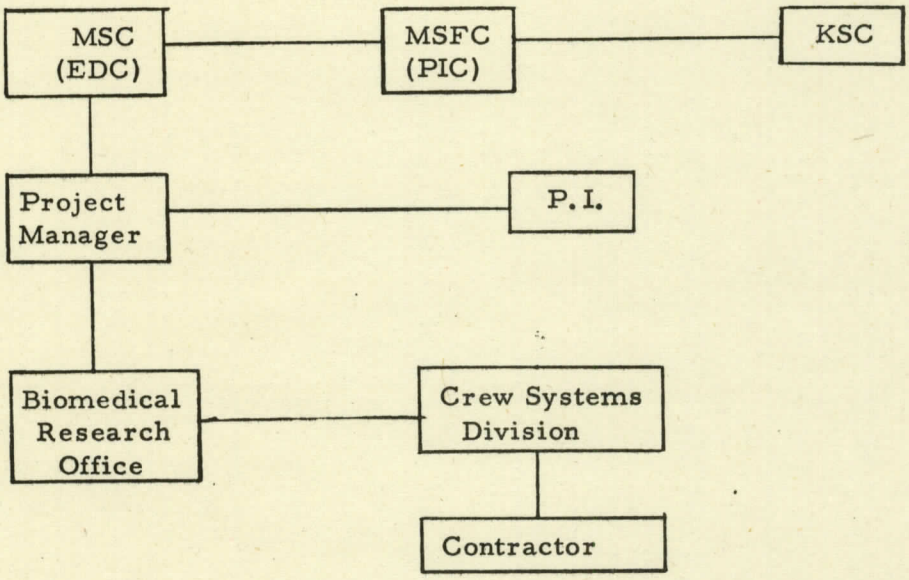
The estimated power requirement is 1 watt during the experiment operation. Total power is estimated at 15.0 KWH. Power required for operation of the Experiment Data System is not included in the above estimate.

3. Operations Support - This experiment is to be conducted within the Workshop environment. Each of the astronauts will be a subject in the experiment with one of the other astronaut participating as an observer. Approximately 15 hours of in-flight experiment time for each astronaut will be required. The astronaut activities will include the application removal and storage of the electrodes; and the obtaining of VCG data with the subjects at rest and with standard exercise on a bicycle ergometer.

This experiment requires no special preflight facilities, ground tracking, vehicle attitudes or recovery facilities.

The data to be recovered will consist of magnetic tapes which weigh 2.5 pounds with a volume of .25 cubic feet.

4. Management Arrangements - The major organizational elements involved in implementation of the experiment and their relationship with the Principal Investigator, the equipment contractor, and the space vehicle contractor are as follows:



5. Schedule and Resource Requirements

		FY 67				FY 68				FY 69			
a. Schedule of Major Milestones:													
Approved for Flight				Δ									
Hardware Contract		Δ											
ICD Complete					Δ								
Design Complete				Δ									
Complete Qualification Testing					Δ								
Flight Units Fabricated					Δ								
DEP Complete						Δ							
Flight Hardware Delivered						Δ							
Installation and Checkout Complete							Δ						
b. Funding Requirements	Funding Source	(Dollars in Thousands)											
Design, development, fabrication & testing (mock-up, prototype & support equipment)					27								
Supporting study effort						20							
Fabricate, test & deliver (flight hardware)					50		50						
Space vehicle installation & check-out													
Data analysis & publication										20			

SECTION II - (TECHNICAL INFORMATION)

1. OBJECTIVES:

The purpose of the M018 experiment is to measure electrocardiographic potentials during weightlessness and the immediate post-flight period by methods that allow precise quantitation of the changes that occur. These measurements will be compared to control data obtained on earth.

The primary aspects of this investigation are as follows:

a. To utilize the vectorcardiogram to detect the changes in the electrical activity of the heart that are associated with weightlessness and other stress conditions encountered in space flight.

b. To correlate the vectorcardiographic changes observed during and immediately after prolonged space flight with anatomical shifts in heart position and of body fluids, changes in heart size, altered myocardial perfusion and other alterations in cardiac function resulting from the conditions of space flight.

c. To apply computer techniques to analysis of the data.

2. JUSTIFICATION:

The stresses of space flight will produce changes in cardiac function which are reflected in electrical potential measured at the body's surface. The vectorcardiogram, using a standard orthogonal lead system, furnishes data which can be reduced and analyzed by computer techniques. By utilizing the vestorcardiogram at intervals during space flight, both under resting conditions and after standardized exercise, and after return to earth, it is hoped to identify and to some degree quantitate the changes in cardiac function that result from weightlessness and other stresses of space flight. Correlation of these changes with alterations in anatomical position of the heart and body fluid shifts should furnish fundamental knowledge of the cardiac response to space flight.

3. EXPERIMENT APPROACH:

a. Vectorcardiograms (VCG) will be taken at regular intervals during space flight in order to determine serially the changes in cardiac electrical activity. Records will be taken at rest before, during, and after a three minute period of exercise. Similar tracings will

be made daily after return to earth. The findings will be compared with BCG's taken prior to flight. Changes in the VCG patterns would be correlated, using computer techniques for data reduction and analysis, with anatomical and functional changes in the heart. The cumulative effect of the stresses of extended periods of space flight and particularly of weightlessness, upon the VCG and the return to preflight patterns following flight will be furnished. The changes observed in ground-based studies previously accomplished will be utilized in the analysis of data.

b. The three orthogonal components of the VCG, utilizing the Frank lead system, will be obtained prior to, during, and after flight on each astronaut, both while at rest and during and after a standardized exercise.

c. From three voltages recorded simultaneously from body surface sensors placed in the three major axes of the chest the following VCG items will be computed:

(1) Spatial mean vectors of QRS, T, ST, ventricular gradient, angle between the spatial QRS vector and T vector

(2) Instantaneous P, QRS, T vectors

(3) Heart rate, rhythm

(4) PR interval, QRS duration, QT interval

(5) First derivitive of ECG wave form

(6) Special parameters that will be used in the statistical analysis

An example of this is the d' which is a measure of the relative distance from the terminus of a group of vectors to the terminus of a vector occurring after stress.

d. Data reduction and analysis will consist of comparing in-flight with pre and post flight records. In addition to rate and rhythm changes, the standard VCG items will be computed and statistical programs created to express this data in a form that will test the significance of any changes observed. The VCG data recorded on magnetic tape in analog form will be converted to digital form enabling the investigator to carry out a variety of mathematical operations that are not possible with the conventional electrocardiogram or even with the usual vectorcardiogram.

e. The body surface potentials will range from .0005 volts to ± .002 volts. Frequency to be recorded will range from 0-2 cps to 100 cps with 10 db per octave roll of the upper cutoff frequency. A 1 mv calibration signal will be required. Each of the three components from the Frank lead system will be amplified by signal conditioners of the type used on Gemini flights and recorded, along with a voice channel to indicate the event, on an on-board recorder.

f. The astronaut on whom the VCG is being recorded will perform a three minute ergometer exercise test at each recording period. The observer astronaut will apply the electrodes and operate the recording system. He will also be responsible for timing the exercise period and the post-exercise recordings. Both will be involved in removing the sensors and stowing equipment.

4. DISCIPLINARY RELATIONSHIP:

The electrode system and sensor configuration have been thoroughly tested in conventional aircraft under high "g" stress, transient null gravity, thermal stress, and with the USN full pressure suit.

Computer programs for data reduction, spatial trigonometric calculations, and statistical analysis have been developed and published in Naval Aerospace Medical Institute reports.

Members of the Staff at Naval Aerospace Medical Institute have accumulated VCG records using the proposed VCG system on greater than 1000 normal subjects and have carried out VCG stress studies with computer analysis in over 200 normal subjects.

5. BASELINE OR CONTROL DATA:

A number of support studies have been conducted or are planned to augment the flight investigation. Specifically, the work consists of the following:

a. VCG stress studies of subjects during KC-135 zero "g" flights.

b. VCG studies of subjects in full pressure suits during aircraft flights under high "g" stress.

c. VCG studies of subjects during centrifuge tests.

d. VCG studies of subjects in simulated altitude chamber tests.

e. When the profile of the mission is determined and the astronauts for the mission have been designated, VCG recordings will be made on each subject on at least three occasions. Control data will be obtained with the subject resting and for standardized stress on a bicycle ergometer.

The above support studies, a through d, have been completed and computer programs developed utilizing the test data obtained.

SECTION III - ENGINEERING INFORMATION

1. EQUIPMENT DESCRIPTION:

Experimental Hardware - This experiment requires the following equipment:

a. Vectorcardiograph System - One per each astronaut participating in the experiment, consisting of:

(1) A Frank lead network

(2) Calibration and timing circuits

(3) Three electrocardiogram signal conditioners

The Frank lead network serves to normalize six electrocardiogram signals taken on the body into the three orthogonal electrocardiogram signals required for vectorcardiograph analysis. Three electrocardiogram amplifiers of the type chosen for Apollo in-flight biomedical monitoring amplify the outputs of the Frank lead network. The calibration and timing network applies calibration signals to the inputs of the three electrocardiogram amplifiers on remote command. The vectorcardiograph system then presents three normalized, amplified electrocardiogram signals from low impedance sources for telemetry or magnetic recording.

(4) Harness and vest - A body worn vest will be provided with build-in harnesses to properly connect the five electronics modules and the body worn electrodes to the power source and data acquisition equipment. This vest may be the standard unit being proposed for use with experiments M050 and M051. In any case, proper power for the electronic equipment will be provided within the vest. Pockets for the electronics modules and appropriate interconnections will be provided in the vest. The vest and equipment associated with the M018 experiment will weigh less than 2.2 pounds.

(5) Electrodes - Standard Apollo body worn electrodes may be utilized with this equipment. However, studies are presently underway to develop quick-don type electrodes for use with this experiment equipment.

(6) A bicycle ergometer, being utilized on experiment M050, will be utilized with this experiment.

b. Pertinent system specifications are as follows:

Common mode rejection ratio at electrodes	- 80 db
Output Impedance	- 200 ohms or less
Output Characteristics	- 0 - 5 V. with respect to ground-biased at 2.5 V.
Frequency response	- ± 3 db from 0.2 to 100 cps

Noise - Less than 10 uv referred to input

Size - 5 modules - 1.5 x 2.3 x .410 inches each

Weight - Less than 300 gm., excluding harness and electrodes

c. The following types and quantities of hardware will be required for the development and conducting of the experiment:

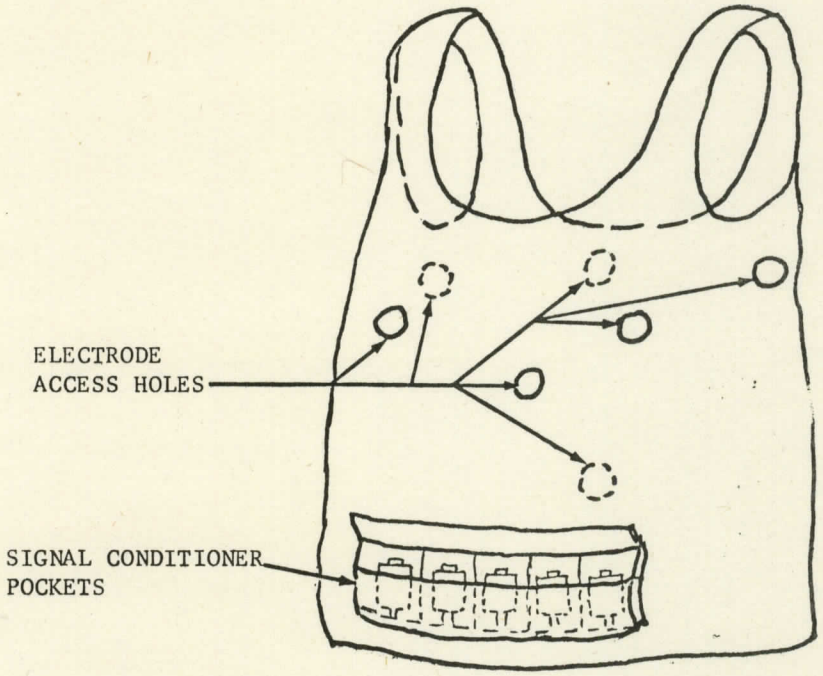
(1) Soft Mockup
(2) Mass Mockup
(3) Prototype
(4) Flight Unit
(5) Flight Unit Spare

] quantities being reviewed.

d. The experiment equipment circuits have been developed and are presently being packaged in flight configured modules. All components have been developed except for the vest.

2. WEIGHT AND VOLUME:

The total estimated weight of the experiment hardware is 4.7 pounds. The total estimated volume is .52 cubic feet.



PROPOSED VCG VEST CONFIGURATION

Fig. 1

Equipment Item	Weight (lbs)	Volume FT^3 Stored	Volume FT^3 Operation	Dimensions (Inches) Stored	Dimensions (Inches) Operation	Shape Stored	Shape Operation
Vest - including signal conditioners and harnesses	1.7	.25	4.0*	12 x 12 x 3	12 x 24 x 36	Square Box	Fitting over body
Electrode Application Kit	0.5	.02	Same	4 x 4 x 2	same	Square Box	Same
Data Tapes	2.5	.25	Same			Roll	Same

* When applied to astronaut's thorox

The attached Figure 1 conceptually depicts the anticipated envelope requirements.

4. SPACECRAFT INTERFACE REQUIREMENTS:

a. There are no required or desired locations for the storage of the experiment equipment.

b. The bicycle ergometer hardware, which is a part of the M050 (Metabolic Cost) experiment, will also be utilized in conducting this experiment. Provisions are required for mounting the bicycle ergometer inside the Workshop prior to conducting the experiment.

c. There are no modifications or changes to the spacecraft systems other than those required for mounting of the ergometer in the Workshop.

d. Spacecraft subsystems support will be supplied by the Experiment Data System presently being used to support M050 and M051.

5. POWER:

The experiment equipment requires 1 watt during operation and 15.0 KWH total power, including power required by the Experiment Data System.

6. ENVIRONMENT CONSTRAINTS:

Environment	Operating
Temperature	$0^{o}F$ to + $160^{o}F$ (+ $200^{o}F$ at re-entry)
Pressure	15.5 psia to minimum of 10^{-12} psia. Test to 1.47×10^{-5} psia.
Humidity	15% to 95% (non-operate)
Oxygen	100% at 5.5 psia
Shock	40 "g", 11 ms longitudinal 15 "g", 11 ms lateral 20 "g", 11 ms vertical
Acceleration	$\pm$ 15 "g" longitudinal $\pm$ 7.25 "g" remain axis
Vibration	12.6 "g" rms, random vibration, 3 axis
Acoustic Noise	135 db overall sound pressure level
Radio Interference	MIL-I-26600
Endurance	100,000 hours continuous operation

6. DATA MEASUREMENT REQUIREMENTS:

parameter measured		Electrocardiogram (3 Channels)
Equipment Item Used		Vectorcardiograph System
Expected Values	Unit Average Range Tolerance	0 - 2.5 volt EKG signal biased at 2.5 volts. ± 0.25 volts
Measurement	Frequency Time Unit Duration	EKG signals from 0.2 Hz - 100 Hz passband amplifier
	No. of Channels	Three
	Transmit or Record	Both
Signal	Type Frequency Amplitude Sampling rate Accuracy Resolution	EKG signals, 0.2 Hz - 100 Hz (3 db down) 0 - 2.5 volts biased at 2.5 volts ± 0.25 volts
Time	Pulse Synchronous Reset	None

SECTION IV - RELIABILITY AND QUALIFICATION REQUIREMENTS

The experiment equipment and associated hardware will be controlled and measured against acceptable standards of workmanship and design to assure system operational integrity and minimum degradation of experiment objectives. Such standards and measurements will be verified by implementing in-process inspection techniques and Government monitoring of qualification tests, including certification histories, as required.

Preparation of the final R&QA Program will be closely coordinated with the payload integration center to insure adequate provisions for flight safety and experiment success.

SECTION V - OPERATIONS SUPPORT

1. SPACECRAFT ORIENTATION REQUIREMENTS:

Describe maneuvers: N/A

Nature and characteristics of object being measured or observed:

Astronaut physiological parameters

Number of measurements required: 15 VCG's per astronaut

Type of orbit: Workshop Orbit

Orbit attitude, perigee N/A Orbit Period N/A

apogee N/A Orbit Inclination N/A

Lighting Constraints: Normal Workshop lighting

Spacecraft pointing accuracy:

Pitch N/A Roll N/A Yaw N/A

Allowable spacecraft rate:

Pitch N/A Roll N/A Yaw N/A

Time per measurement: 1 hour

Orbital location during measurements: N/A

2. ASTRONAUT TRAINING:

There are no special skills required of the astronauts. The astronauts will be trained during baseline testing at which time training tasks including application, removal and storage of the electrodes will be accomplished. Control data will be obtained with the subject resting and for standardized stress on a bicycle ergometer. Each astronaut will have VCG recordings made on at least three occasions. The procedures for obtaining the VCG recording are identical to those called out during flight. Reference the "Astronaut Support Synopsis". The training time required would be one hour per occasion (three hours total) for each astronaut.

3. ASTRONAUT SUPPORT SYNOPSIS:

During the preflight testing, 3 VCG's will be obtained on each astronaut. At these times, each astronaut will receive instructions which will enable him to act as observer during the inflight VCG experiment. The procedures to be learned and which will be followed in the flight consist of:

a. Application of electrodes and harness.

b. Activation of the amplifiers and recording equipment by on - off switches.

c. Calibration of the system.

d. Recording of the VCG while subject is at rest (recumbent during pre- and post-flight).

e. Indication by voice of the time exercise begins and when it ends three minutes later.

f. Recording of the VCG during exercise and for 15 seconds at one minute intervals after exercise through a 10 minute period.

g. Calibration of system prior to completion.

h. Turning off the VCG amplifiers and recording systems.

i. Removal of harness and electrodes.

j. Stowage of equipment.

The subject will assist in the harness and electrode application. The level of exercise to be performed on the ergometer will be learned during the pre-flight recordings. The proper position of each electrode will be marked so that these sites can be identified during flight. With the exception of the procedures for obtaining and stowing the equipment, the procedures to be followed in-flight will be identical to those of the pre-flight testing.

The time required to apply the equipment, conduct the experiment, and then stow the equipment is estimated at 60 minutes per astronaut for each occasion.

Preflight Time	In-Flight Time	Post-Flight Time
Baseline study approximately 3 hours	approximately 15 hours *	10 hours

The above time estimates are for each astronaut. All three astronauts are to be subjects in the experiments.

* Based on daily VCG on each astronaut during the days available for medical experiments. Minimum acceptable number would be 5 with each being taken at 3 day intervals.

4. PRE-LAUNCH SUPPORT:

There are no special pre-launch support requirements.

5. FLIGHT OPERATIONAL REQUIREMENTS:

There are no special flight operational requirements.

6. RECOVERY REQUIREMENTS:

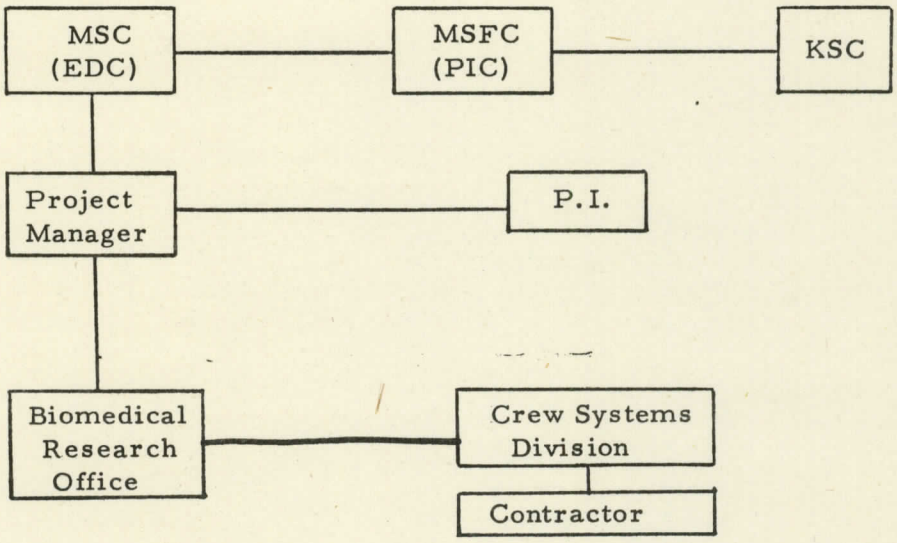
It will not be necessary to return the experiment equipment. The data to be returned will be on the magnetic tapes. The tapes weigh 2.5 pounds and have a volume of 1/4 cubic feet.

7. DATA SUPPORT REQUIREMENTS:

There are no data support requirements. The magnetic tapes are to be removed from the spacecraft and sent to MSC. Data reduction will be performed by the PI at NAMI, Pensacola, Florida, from copies of original tape supplied by MSC.

SECTION VI - MANAGEMENT ARRANGEMENTS

The following diagram depicts the elements of the Experiment Development Center (EDC) and other organizations that interface with it.



1. RESPONSIBILITY ASSIGNMENT:

Responsibility for hardware development will be assigned to Crew Systems Division of KSC. The principal investigator will assume responsibility for acceptability testing of prototype units from the standpoint of data quality and reliability estimates. Monitoring of activities will be performed at MSC by the Biomedical Research Office. Computer analyses of the flight and baseline data will be performed by the P.I. The integration of findings into a final report will be performed by the principal investigator.

2. ORGANIZATION DESCRIPTIONS:

The sponsoring program office is NASA Headquarters, Space Medicine, with Dr. S. P. Vinograd as the supporting office sponsor. Marshall Space Flight Center is the experiment integration center. This group will direct the Kennedy Space Center in installation and spacecraft modifications for the experimental hardware, as well as in retrieval of the tape recordings.

At the Manned Spacecraft Center, supervision of experiment development will be divided into two aspects: (a) hardware development, to be performed by the Crew Systems Division, Directorate of Engineering and Development; and (b) experiment coordination, to be performed by the Biomedical Research Office of the Medical Research and Operations Directorate. The experiment manager at MSC is Dr. R. Johnson. The Principal Investigator is Dr. Raphael Smith of the Naval Aerospace Medical Institute, Pensacola, Florida. Dr. Smith will provide for the experiment plan or any changes thereof and for data reduction and analysis.

SECTION VII - MANAGEMENT REPORTING

Financial, schedule, and technical information will be furnished to the appropriate Headquarters Program Office as required.

Reporting documentation to be used for managing the program are as follows:

a. Monthly Progress Report

b. Monthly Financial Reports (in-house and contractors)

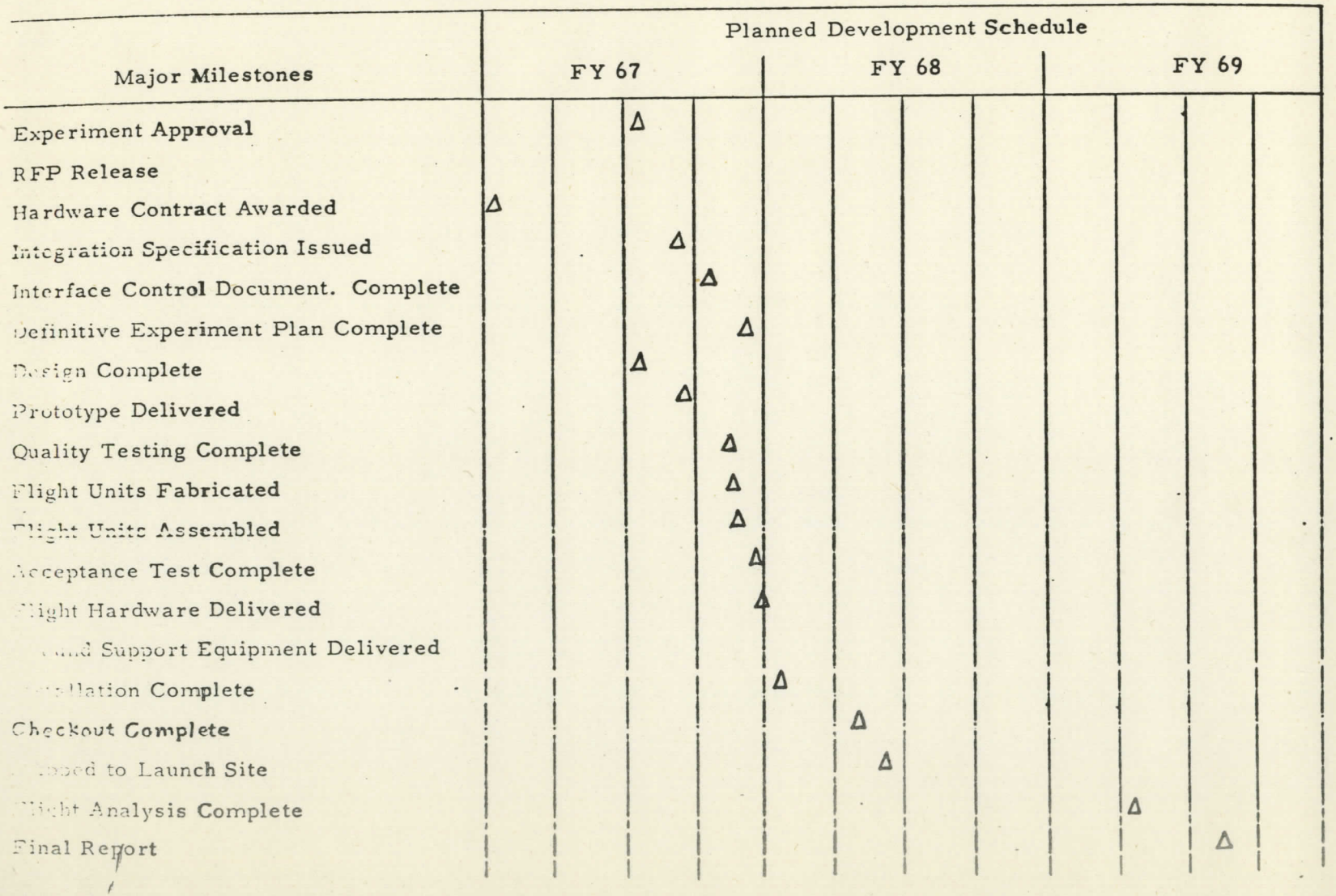
c. Final Report

SECTION VIII - PROCUREMENT ARRANGEMENTS

The EDC has let a contract with Spacelabs, Inc., of Van Nuys, California, to design, develop, and manufacture this hardware exclusive of the Experiment Data System and the body worn vest for flight use. The equipment presently exists in circuit breadboard form, and the flight configured modules are presently being designed and fabricated. The EDC will design the body worn vest in-house and let a contract for manufacture of flight hardware as soon as hardware interfaces are defined. Procurement to design and fabricate the Experiment Data System is presently pending.

SECTION IX - SCHEDULE AND RESOURCE REQUIREMENTS
1. DEVELOPMENT SCHEDULE

Indicate the planned development schedule for the major milestones outlined below:



2. QUARTERLY FUNDING REQUIREMENTS (Dollars in Thousands)

	Source of Funding	FY 67				FY 68				FY 69				TOTALS
DESIGN Exp. Hardware Training Equip. Checkout Equip.														
SUPPORT STUDIES						20								
SUPPORT FACILITIES AND SERVICES														
SUPPORT EQUIPMENT Mock-up														
Engineering test units Fabrication Assembly Test														
Prototype Fabrication Assembly Test														
Training Units Fabrication Assembly Test					25									25
Checkout Equipment Fabrication Assembly Test														

QUARTERLY FUNDING REQUIREMENTS (Dollars in Thousands) (cont'd)

	Source of Funding	FY 67				FY 68				FY 69				TOTALS
FLIGHT EQUIPMENT Flight Unit Fabrication Assembly Testing Spares Fabrication Assembly Testing					50		50							100
DOCUMENTATION Major Documentation Def. Exp. Plan Rel. Predictions Qual. Test Rept. Failure Analysis etc. Periodic Reports Briefings & Reviews														
TRAVEL	OMSF	.100	.200	.200	.200	.300	.500	.500	-	-	-	-	-	2
VEHICLE INTEGRATION Vehicle Modif. Installation Checkout														

QUARTERLY FUNDING REQUIREMENTS (Dollars in Thousands) (cont'd)

	Source of Funding	FY 67				FY 68				FY 69				TOTALS
PUBLICATION														
Data reduction	OMSF	-	-	-	-	-	-	4	-	10	-	-	-	
Analysis		-	-	-	-	-	-	5	-	5	-	-	-	20
Reporting		-	-	-	-	-	-	5	-	5	-	-	-	
GRAND TOTAL														167

3. MANPOWER:

a. In-House (Man - Months)

	FY-67	FY-68	FY-69	TOTAL
R&D	6	4	0	10
Experiment Management	1/2	1	1	2 1/2

b. Contractor (Man - Months)

FY-67	FY-68	FY-69	TOTAL
30			30

4. FACILITIES:

No major facilities will be utilized or required for experiment.

SECTION X - EXPERIMENTAL RESULTS

EXPERIMENTAL RESULTS:

1. Data Handling

   Biomedical recorder tapes to be handcarried or mailed to Crew Systems Division, MSC, after retrieval from spacecraft. Re-recordings to be made by IESD, MSC. Copies to be mailed to principal investigator.

2. Technical Reports

   a. One "Quick Look" report to be made by principal investigator within one month of flight termination.

      Preliminary analyses to be made by principal investigator.

   b. Copies of preliminary and final reports to be distributed to MSC, Headquarters sponsoring office, and to MSFC.

3. Public Information (as applicable)