SOUTHWEST RESEARCH INSTITUTE ASSISTANCE TO NASA IN BIOMEDICAL AREAS OF THE TECHNOLOGY UTILIZATION PROGRAM

QUARTERLY PROGRESS REPORT NO. 4
1 June 1967 - 31 August 1967

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SwRI Project No. 14-1963

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SOUTHWEST RESEARCH INSTITUTE
SAN ANTONIO HOUSTON

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William E. Cory, Director
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PREFACE

This report documents project activities during the months of June, July, and August, 1967, on NASA Contract NAS4-94(09), designated as Southwest Research Institute Project 14-1963. Project team members include personnel from Southwest Research Institute, Baylor University School of Medicine, the University of Texas Medical Branch at Galveston, Rice University, Texas Institute for Rehabilitation and Research, and Tufts University. Additionally, problems were submitted from the Veterans Administration Southern Research Support Center, Wilford Hall USAF Hospital, and the University of Texas Medical School at San Antonio.

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A. INTRODUCTION

1. General

This project has as its goal in support of NASA's Biomedical Applications Program, the development of methods for effectively transferring the maximum amount of applicable aerospace technology to the fields of medicine and biology, of applying such methods to the accomplishment of as many such transfers as possible and of documenting the results of the project. The basic steps being utilized to accomplish these goals are:

(1) Selection of key consultants at specified medical schools and other biomedical research centers.

(2) Identification of need and problems, pertinent to the biological and medical research community, and likely to be amenable to solution by aerospace developed technology.

(3) Reduction of identified problems to writing, posing them in terms which are meaningful to physical scientists, engineers, and information retrieval specialists.

(4) Identification and evaluation of those items of aerospace technology which may be useful answers to submitted medical and biological problems.

(5) Communication of aerospace derived information to those investigators who originally submitted the problems.

(6) Rendition of assistance as needed to biomedical scientists in order to aid them in applying new aerospace technology effectively in the course of their investigations, thus achieving technology transfers.

(7) Documentation of all stages of development of technology transfers.

(8) Rendition of assistance to NASA in disseminating information about technology transfers.

Information pertaining to each biomedical problem submitted is organized and maintained in the form of a "case history" of that problem.

The biomedical case problem case history file constitutes the major source of information for this and future documentation of the project.

2. Participating Personnel

Southwest Research Institute Biomedical Applications Team:
SwRI Personnel
Ray W. Ware, M.D., Director
Louis S. Berger
Raul San Martin, M.D.
Charles J. Laenger, Sr.
Felix St. Claire
Robert J. Crosby

C.W. Hall, M.D., Asst. Professor, Department of Experimental Surgery, Baylor University School of Medicine, Houston, Texas.
F. Hermann Rudenberg, Ph.D., Associate Professor, Department of Physiology, The University of Texas Medican Branch, Galveston, Texas
W.W. Akers, Ph.D., Biomedical Engineering Laboratory, Rice University, Houston, Texas
Jack B. Johnson, Ass't. Chief, Biomedical Instrumentation Section, Southern Research Support Center, Veterans Administration, Little Rock, Arkansas

Joseph Canzoneri III, (VRA), Director, Biomedical Engineering, Texas Institute for Rehabilitation and Research, Houston, Texas
Sanford J. Freedman, Ph.D., (VRA), Neuropsychology Laboratory, Institute for Psychological Research, Tufts University, Medford, Massachusetts

Other Southwest Research Institute Staff Consulted:

Wallace L. Anderson, Ph.D., Senior Research Engineer
Gerald Gardner, Ph.D., Senior Research Physicist
Stephen Juhasz, Ph.D., Editor, Applied Mechanics Review
Richard T. Mannheimer, Senior Research Engineer
Paul D. May, Ph.D., Senior Research Chemist
Frank C. Milstead, Senior Research Engineer

B. BIOMEDICAL PROBLEMS

1. List of Submitted Problem Statements

Texas Institute for Rehabilitation and Research (VRA Sponsored)

No.	Title
HUV-1	Reduced Workload Environment for Physically Handicapped Patients
HUV-2	Advanced Computer Display & Interface Technology
HUV-3	Computer Scheduling Techniques
HUV-4	Heart Sounds, Interval Analysis
HUV-5	End Tidal Air Sampler
HUV-6	Ambulation Aid
HUV-7	Scheduling for Ward Patients
HUV-8	Mechanisms of Onset of Orthostatic Hypotension
HUV-9	Prosthetic Materials for Urinary Tract
HUV-10	Instrumented Prosthetic Leg
HUV-11	Improved Gas Sample Flow Control and Measurement
HUV-12	Special Automobile Modifications for Disabled Persons
HUV-13	Human Transfer Function Measurements
HUV-14	Physical Space Utilization
* HUV-15	Advanced Computer Terminal and Display Technology
	Rice University
RCU-1	"Artificial Heart" Control System Technology

*Identified during the fourth-quarter reporting period.

No.	Title
	Veterans Administration Southern Research Support Center
SRS-1	Indirect Measurement of Blood Pressure During Rest and Exercise on Arms and Legs
SRS-2	Catheter Tip Transducer for Blood Pressure and Flow Measurement
SRS-3	Locating Tip of Stomach Tube
SRS-4	Materials Suitable for Dry Electrode Fabrication
SRS-5	Temperature Regulatory Mechanisms of the Body
SRS-6	Investigations of Cutaneous Stimuli
	Baylor University Medical School
BLM-1	Noiseless Gas Valves for "Artificial Heart" Use
BLM-2	Support Slings for Postoperative Care of Large Animals
BLM-3	Triggering on R Wave of ECG
BLM-4	Valve for Proportional Gas Flow Control
BLM-5	Transthoracic Energy Coupling Devices
BLM-6	Biocompatible Spray-On Plastics, Impermeable to Bacteria
BLM-7	Telemetry of Cardiovascular Data from Free-Ranging Animals
BLM-8	Miniature Tape Recorder for Biological Data
*BLM-9	Cyclic Variation of Body Temperature in Mammals

*Identified during the fourth-quarter reporting period.

No.	Title
	The University of Texas Medical Branch, Galveston
GLM-1	Analysis of Transitional Flow-Convection/Diffusion
GLM-2	Monitoring of Blood Pressure by Extra-Vascular Sensor, Using Wireless Telemetry of Information
GLM-3	Determination of Local Blood Flow, Blood Gas Concentration, and Blood pH in Small Portion of an Organ
GLM-4	Implanted Blood Pressure Transducer
GLM-5	Chronic Intracranial Pressure Measurement in Man
GLM-6	A Model Vascular System
+GLM-7	Viscosity Measurement of Minute Samples of Blood
+GLM-8	Computer Program for Electroencephalograph: Period Analysis
+GLM-9	Measurement of Local Tissue Oxygen Consumption *In Vivo*
+GLM-10	Computer Program for Flame Spectrophotometry
+GLM-11	Elimination of Electrostatic Charge in Experimental Animals
+GLM-12	Computer Selection and Elimination of Artifacts
+GLM-13	Multiple Co-Spectral Density Analysis of Time-Series Data
*+GLM-14	Repetitive Measurement of Kidney Mass in Intact Animal
*+GLM-15	Respiration Volume and Rate Measurements in Unencumbered (Free) Child

* Identified during the fourth-quarter reporting period.
\+ First processed during the fourth-quarter reporting period.

No.	Title
	Wilford Hall Hospital
WLH-1	Blood Recirculation Technology
	The University of Texas Medical School at San Antonio
SNM-1	Enhancement of X-Ray Contrast Study Films

2. Problem Case Histories

Individual Summaries of Fourth-Quarter Activity

Note: A detailed listing of references disseminated, including those provided to problem originators in conjunction with the submitted problems, is presented in Section B4.

HUV-2

TITLE: Advanced Computer Display and Interface Technology

DATE SUBMITTED: 28 December 1966

SOURCE: Dr. C. Vallbona, Associate Professor, Texas Institute for Rehabilitation and Research

PROBLEM ABSTRACT DISSEMINATED: 11 August 1967

COMMUNICATIONS WITH NASA CENTERS:

12 June 1967 Site visit by Dr. R. W. Ware, L. Berger, and 3 TIRR staff members: Dr. C. Vallbona, J. Canzoneri, D. Liss, to Manned Spacecraft Center, Houston, Texas. Visitors were briefed on advanced computer technology by members of Mr. J. Overton's staff (Mr. J. Burr, Mr. R. Hodgkins).

OTHER COMMUNICATIONS:

Requested references sent to consultant 20 June, 5 July, and 24 August 1967.

HUV-3

TITLE: Computer Scheduling Techniques

DATE SUBMITTED: 28 December 1966

SOURCE: Dr. C. Vallbona, Associate Professor, Texas Institute of Rehabilitation and Research

COMMUNICATIONS WITH NASA CENTERS:

12 June 1967 Applicable information received during the site visit to Manned Spacecraft Center described in conjunction with Problem HUV-2 (see above).

OTHER COMMUNICATIONS:

References sent to consultant 13 July, 24 August 1967.

HUV-4

TITLE: Heart Sounds, Interval Analysis

DATE SUBMITTED: 28 December 1966

SOURCE: Dr. C. Vallbona, Associate Professor, Texas Institute of Rehabilitation and Research

SEARCH HISTORY:

28 August 1967 Following a conference at KAS Center, it was decided to re-submit this problem for a second round of searching.

HUV-6

TITLE: Ambulation Aid

DATE SUBMITTED: 28 December 1966

SOURCE: Dr. C. Vallbona, Associate Professor, Texas Institute of Rehabilitation and Research

PROBLEM ABSTRACT DISSEMINATED: 23 June 1967

HUV-7

TITLE: Scheduling for Ward Patients

DATE SUBMITTED: 30 January 1967

SOURCE: Miss Frances Brush, Director of Nursing, Texas Institute of Rehabilitation and Research

COMMUNICATIONS WITH RESEARCHER:

A reference sent 13 July 1967.

HUV-8

TITLE: Mechanisms of Onset of Orthostatic Hypotension

DATE SUBMITTED: 18 January 1967

SOURCE: J.C. Walker, Ph.D., Directress, Biochemistry Laboratory, Texas Institute for Rehabilitation and Research

1 June 1967 Mr. D. Bendersky, project leader of the Biomedical Applications Team at Midwest Research Institute, was sent a copy of the computer search returns as per Dr. Hartwig's request of 23 May.

HUV-9

TITLE: Prosthetic Material for Urinary Tract

DATE SUBMITTED: 10 February 1967

SOURCE: F. Brantley Scott, M.D., Assistant Professor, Baylor University Medical School, Houston, Texas

PROBLEM ABSTRACT DISSEMINATED: 12 June 1967

CENTER RESPONSE:

28 July 1967 Response received from Lewis Research Center from Mr. H. Allen.

HUV-10

TITLE: Instrumented Prosthetic Leg

DATE SUBMITTED: 21 February 1967

SOURCE: Lewis A. Leavitt, M.D., Chairman, Department of Physical Medicine, Texas Institute for Rehabilitation and Research

COMMUNICATIONS WITH RESEARCHER:

26 July References to related projects were given to the problem originator. These were received from the Biological Sciences Communications Project. The researcher expressed great interest, and found, on first reading, several useful items.

HUV-12

TITLE: Special Automobile Modifications for Disabled Persons

DATE SUBMITTED: 22 February 1967

SOURCE: Miss Mary Joyce Newsom

COMMUNICATIONS WITH NASA CENTERS:

12 June 1967 Site visit by Dr. Ware, L. Berger and three TIRR staff members: Dr. C. Vallbona, J. Canzoneri and D. Liss to Manned Spacecraft Center, Houston, Texas. Visitors were briefed on simulation research by Members of Mr. J. VanArtsdalen's staff: Mr. T. Lee and Mr. W. Miller. The existence of a crew training facility with Mr. Fader as Group Chief was disclosed.

OTHER COMMUNICATIONS:

A research protocol has been prepared by members of TIRR and NASA technology transfer aid will be coordinated with this program if and when approval is received for the program implementation.

References were sent to problem originator 26 July 1967.

HUV-14

TITLE: Physical Space Utilization

DATE SUBMITTED: 7 May 1967

SOURCE: Dr. C. Vallbona, Associate Professor, Texas Institute of Rehabilitation and Research

COMMUNICATIONS:

12 July 1967 The problem originator has found the search to be valuable, but he still has the need to know if anyone has written about using a computer to simulate usefulness of a given architectural design. It is planned to present this question as a problem abstract, after further consultation with the problem originator. Various requested references were sent to the problem originator 12 June and 3 July.

HUV-15

TITLE: Computer Terminal and Display

DATE SUBMITTED: 14 June 1967

PROBLEM ORIGINATOR: Mr. Donald Liss, Head, Computer Development

INITIAL DISPOSITION:

This problem will be coordinated with Problem HUV-2, since there is extensive overlap.

RCU-1

TITLE: "Artificial Heart" Control System Technology

DATE SUBMITTED: 9 December 1966

SOURCE: Dr. William Akers, Director, Biomedical Engineering Laborator, Rice University and C. W. Hall, M.D., Assistant Professor, Department of Surgery, Baylor University Medical School, Houston, Texas

PROBLEM ABSTRACT DISSEMINATED: 11 August 1967.

COMMUNICATIONS WITH RESEARCH CENTERS:

29 June 1967 Information stemming from an earlier site visit (19 May 1967) was received from Lewis Research Center on a fluid pneumatic valve and its associated fluid control circuit, developed by Mr. Vernon E. Gebben. This material was forwarded to the problem originator.

SRS-1

TITLE: Indirect Measurement of Blood Pressure During Rest and Exercise on Arms and Legs

DATE SUBMITTED: 3 February 1967

SOURCE: George W. Molnar, Ph. D., Coordinator for Professional Services, Southern Research Center, VA Hospital, Little Rock, Arkansas

OTHER COMMUNICATIONS:

28 August 1967 Following a conference at KAS Center, it was decided to re-submit this problem for a second round of searching.

SRS-2

TITLE: Catheter Tip Transducer for Blood Pressure and Flow Measurement

DATE SUBMITTED: 7 March 1967

SOURCE: J. B. Johnson, Assistant Chief, Biomedical Instrumentation Section, VA Hospital, Arkansas

PROBLEM ABSTRACT DISSEMINATED: 3 July 1967

(This problem abstract also covers Problems GLM-4 and GLM-5.)

COMMUNICATIONS WITH NASA CENTERS:

15 June 1967 Mr. Laenger, SwRI staff member, visited Ames Research Center where he met with Mr. George Edwards, Technology Utilization Officer; Mr. Horace Emerson, Staff member of the Technology Utilization Office; Mr. John Dimeff, Chief Instrumentation Division, Electromechanical Research; Mr. Grant Coon, Electromechanical Research; and Dr. Harold Sandler. He received information about the technical and proprietary aspects of the transducer technology. This technology seems to have great potential for solving pressure measurement problems in biomedical applications. Practical ways of effecting this transfer are being explored.

SEARCH HISTORY:

7 August 1967 Second search request was sent to KAS Center.

28 August 1967 Following a conference at KAS Center, it was decided to re-submit this problem for a third round of searching, including, on this round, a broader information base to be searched.

SRS-3

TITLE: Locating Tip of Stomach Tube

DATE SUBMITTED: 7 March 1967

SOURCE: Julius Wenger, M.D., Assistant Chief Medical Service, VA Hospital, Georgia

PROBLEM ABSTRACT DISSEMINATED: 11 August 1967

OTHER COMMUNICATIONS:

21 August 1967 Negative search evaluation received.

SRS-4

TITLE: Materials Suitable for Dry Electrode Fabrication

DATE SUBMITTED: 7 March 1967

SOURCE: J.B. Johnson, Assistant Chief, Biomedical Instrumentation Section, VA Hospital, Arkansas

COMMUNICATIONS WITH NASA CENTERS:

6 June 1967 Dr. Ware called Mr. C. Johnson, Technology Utilization Officer, Edwards Flight Research Center, and obtained information on the commercial source of the silver powder used in the dry electrodes.

BLM-1

TITLE: Noiseless Gas Valves for "Artificial Heart" Use

DATE SUBMITTED: 26 August 1966

SOURCE: C.W. Hall, M.D., Assistant Professor, Department of Experimental Surgery, Baylor University Medical School, Houston, Texas

COMMUNICATIONS WITH RESEARCH CENTERS:

6 June 1967 Dr. Ware discussed availability of hardware and technical information and received references from Mr. Clinton T. Johnson, Technology Utilization Officer, Edwards Flight Research Center. Additional material will be furnished through the mail by Mr. Johnson.

29 June 1967 Information was obtained from Mr. Clinton T. Johnson regarding Flexbelt valve assembly and the sliding stem proportional valve. Information was also received from Lewis Research Center on a fluid pneumatic valve and its associated fluid control circuit developed by Vernon E. Gebben. This material was forwarded to the problem originator.

20 July 1967 Two responses to Problem Abstract received from Lewis Research Center via Dr. Hartwig's office.

BLM-5

TITLE: Transthoracic Energy Coupling Devices

DATE SUBMITTED: 7 February 1967

SOURCE: C.W. Hall, M.D., Assistant Professor, Department of Experimental Surgery, Baylor University Medical School, Houston, Texas

COMMUNICATIONS:

28 August 1967 Materials on new type of D.C. brushless motor developed for aerospace use (Globe Industries, Inc.; Aeroflex Labs, Inc.) sent to problem originator.

BLM-7

TITLE: Telemetry of Cardiovascular Data from Free-Ranging Animals

DATE SUBMITTED: 7 February 1967

SOURCE: C.W. Hall, M.D., Assistant Professor, Department of Experimental Surgery, Baylor University Medical School, Houston, Texas

SEARCH HISTORY:

28 August 1967 Following a conference at KAS Center, it was decided to re-submit this problem for a second round of searching.

BLM-8

TITLE: Miniature Tape Recorder for Biological Data

DATE SUBMITTED: 22 February 1967

SOURCE: Dr. L. Lamb, Baylor University Medical School, Houston, Texas

COMMUNICATIONS WITH NASA CENTERS:

6 June 1967 Dr. Ware discussed the availability on loan of the recorders with Mr. Clinton Johnson, Technology Utilization Officer, Edwards Flight Research Center, who will explore the loan possibilities.

29 June 1967 Technical information about data tape recorders was furnished by Mr. Johnson, and forwarded to consultant at Baylor University, College of Medicine.

BLM-9

TITLE: Cyclic Variation of Body Temperature in Mammals

DATE SUBMITTED: 1 June 1967

SOURCE: Henry S. Lipscomb, M.D., Chairman, Department of Biochemistry, Baylor University, College of Medicine, Houston, Texas

INITIAL DISPOSITION: 19 June 1967

Information on applicable technology at Ames Research Center located in connection with previously submitted problems, was forwarded to problem originator.

COMMUNICATIONS:

7 July 1967 Problem originator expressed thanks for the useful information provided by the NASA "backup package" on telemetry and temperature measurement technology. He requested additional information about the type of aid provided by the Biomedical Applications Program. He could not be contacted during the summer, and it is planned to communicate with him during September, 1967.

GLM-2

TITLE: Monitoring of Blood Pressure by Extra-Vascular Sensor, Using Wireless Telemetry of Information

DATE SUBMITTED: 16 February 1967

SOURCE: C.E. Hall, Ph.D., Professor of Physiology, University of Texas Medical Branch, Galveston, Texas

COMMUNICATIONS WITH NASA CENTERS:

In accordance with the problem originator's request of 27 July for fabrication information on technology described in the Ames "backup telemetry package", Mr. George Edwards, Technology Utilization Officer, was contacted by letter. Mr. Edwards, in his response of 18 August, provided information on the commercial availability of these telemetry devices.

OTHER COMMUNICATIONS:

Requested references from computer search were sent to problem originator 20 June, 27 June, 5 July, 6 July and 7 August.

GLM-3

TITLE: Determination of Local Blood Flow, Blood Gas Concentration, and Blood PH in Small Portion of an Organ

DATE SUBMITTED: 9 March 1967

SOURCE: Dr. F.H. Rudenberg, Associate Professor of Physiology, University of Texas Medical Branch, Galveston, Texas

COMMUNICATIONS:

Various references listed in the computer search returns were requested by the problem originator on 5 August, following a very favorable evaluation of the search results 26 July 1967. The reference requests are being processed.

GLM-4

TITLE: Implanted Blood Pressure Transducer

DATE SUBMITTED: 9 March 1967

SOURCE: Dr. F.H. Rudenberg, Associate Professor of Physiology, University of Texas Medical Branch, Galveston, Texas

SEARCH HISTORY:

28 August 1967 Second round of searching requested.

COMMUNICATIONS WITH NASA CENTERS:

15 June 1967 Mr. Laenger visited Ames Research Center where he met with Mr. George Edwards, Technology Utilization Officer; Mr. Horace Emerson, Staff member of the Technology Utilization Office; Mr. John Dimeff, Chief, Instrumentation Division, Electromechanical Research; Mr. Grant Coon, Electromechanical Research; and Dr. Harold Sandler. He received information about the technical and proprietary aspects of the transducer technology.

OTHER COMMUNICATIONS:

27 July 1967 Mr. Berger discussed problem with problem originator. The Ames (Coon) pressure transducer will continue to be followed up for possible use, but a transducer referenced in the search of GLM-2 (A65-10725 Biophysical Monitoring of Experimental Animals) looks as though it could provide useful technology. The authors of this reference are Gorman and Grau. The reference is being studied by the researcher.

PROBLEM ABSTRACT DISSEMINATED: 3 July 1967

(Same as SRS-2, GLM-5.)

GLM-5

TITLE: Chronic Intracranial Pressure Measurement in Man

DATE SUBMITTED: 9 March 1967

SOURCE: Dr. F.H. Rudenberg, Associate Professor of Physiology, University of Texas Medical Branch, Galveston, Texas

SEARCH HISTORY:

Results forwarded to researcher 19 June 1967.

26 July 1967 Unfavorable evaluation by researcher: researcher does not feel that the search has come to grips with the problem. The references do not seem applicable.

7 August 1967 Second round of searching requested.

28 August 1967 Following a conference at KAS Center, it was decided to re-submit this problem for a third round of searching.

PROBLEM ABSTRACT DISSEMINATED: 3 July 1967

(Same as SRS-2, GLM-4.)

GLM-6

TITLE: A Model Vascular System

DATE SUBMITTED: 9 March 1967

SOURCE: Robert N. Cooley, M. D., Professor and Chairman, Department of Radiology, University of Texas Medical Branch, Galveston, Texas

SEARCH REQUEST SENT TO SEARCH CENTER: 11 JULY 1967
RETURNED FROM SEARCH CENTER: 4 AUGUST 1967
RESULTS FORWARDED TO RESEARCHER: 7 AUGUST 1967

OTHER COMMUNICATIONS:

27 July 1967 Gave consultant references obtained during Dr. R. Ware's visit to Lewis Research Center.

GLM-7

TITLE: Viscosity Measurement of Minute Samples of Blood

DATE SUMBITTED: 17 May 1967

SOURCE: Dr. F.H. Rudenberg, Associate Professor, University of Texas Medical Branch, Galveston, Texas

INITIAL DISPOSITION:

It was decided to simultaneously search the NASA data bank and prepare an abstract draft.

SEARCH REQUEST SENT TO SEARCH CENTER: 30 August 1967

GLM-8

TITLE: Computer Program for Electroencephalograph: Period Analysis

DATE SUBMITTED: 17 May 1967

SOURCE: Dr. F.H. Rudenberg, Associate Professor, University of Texas Medical Branch, Galveston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank

SEARCH REQUEST SENT TO SEARCH CENTER: 10 August 1967 (same as GLM-12)

COMMUNICATIONS WITH NASA CENTERS:

20 June 1967 Additional backup information requested from Marshall Space Flight Center on Tech Brief 66-10539, Computer Programs Perform Spectral Analysis of up to Seven Time Series. It seems likely that these computer techniques may be applicable to EEG analysis.

GLM-9

TITLE: Measurement of Local Tissue Oxygen Consumption *In Vivo*

DATE SUBMITTED: 17 May 1967

SOURCE: Dr. F.H. Rudenberg, Associate Professor, University of Texas Medical Branch, Galveston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank

SEARCH REQUEST SENT TO SEARCH CENTER: 11 July 1967
RETURNED FROM SEARCH CENTER: 4 August 1967
RESULTS FORWARDED TO RESEARCHER: 7 August 1967

COMMUNICATIONS WITH NASA CENTERS:

22 August 1967 A favorable evaluation by researcher was received. Various references were requested and the remaining problems were listed. Further action on this problem will be decided on after the referenced documents have been evaluated.

GLM-10

TITLE: Computer Program for Flame Spectrophotometry

DATE SUBMITTED: 17 May 1967

SOURCE: Dr. F.H. Rudenberg, Associate Professor, University of Texas Medical Branch, Galveston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank

SEARCH REQUEST SENT TO SEARCH CENTER: 30 August 1967

GLM-11

TITLE: Elimination of Electrostatic Charge in Experimental Animals

DATE SUBMITTED: 17 May 1967

SOURCE: Colin G. McDiarmid, Ph. D Research Scientist, University of Texas Medical Branch, Galveston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank

SEARCH REQUEST SENT TO SEARCH CENTER: 11 July 1967
RETURNED FROM SEARCH CENTER: 4 August 1967
RESULTS FORWARDED TO RESEARCHER: 7 August 1967
EVALUATION BY RESEARCHER: 22 August 1967
Evaluation favorable. Degree of solution of problem unknown until cited documents have been studied.

OTHER COMMUNICATIONS:

27 July 1967 Problem originator was interviewed to obtain information on what solutions had been attempted to date, and what requirements and constraints on possible solutions would be.

22 August 1967 Selected references from the search results were requested.

GLM-12

TITLE: Computer Selection and Elimination of Artifacts

DATE SUBMITTED: 18 May 1967

SOURCE: Colin G. McDiarmid, Ph.D., Research Scientist, University of Texas Medical Branch, Galveston, Texas

INITIAL DISPOSITION:

Computer search of NASA Data Bank.

SEARCH REQUEST SENT TO SEARCH CENTER:

10 August 1967 (Same as GLM-8.)

OTHER COMMUNICATIONS:

10 July 1967 Letter sent to consultant requesting additional information on parameters required to mathematically specify the problem.

17 July 1967 Problem originator provided, by means of a letter, further technical details, including a discussion of known noise characteristics.

27 July 1967 Tech Brief 63-10003 was given to problem originator. He agreed that the described technology seemed applicable and that further information would be desirable. Accordingly, a backup package on this Tech Brief was requested from Ames Research Center 31 July 1967, and was forwarded 23 August to the problem originator.

GLM-13

TITLE: Multiple Co-Spectral Density Analysis of Time - Series Data

DATE SUBMITTED: 18 May 1967

SOURCE: Colin G. McDiarmid, Ph.D., Research Scientist, University of Texas Medical Branch, Galveston, Texas

INITIAL DISPOSITION:

Problem abstract draft preparation.

PROBLEM ABSTRACT DRAFT SUBMITTED: 11 July 1967
DRAFT APPROVED: 3 August 1967
DISSEMINATED: 11 August 1967

OTHER COMMUNICATIONS:

8 August 1967 Problem originator was called for additional information (L. Berger). Researcher cleared up questions of terminology.

GLM-14

TITLE: Repetitive Measurement of Kidney Mass in Intact Animal

DATE SUBMITTED: 8 August 1967

SOURCE: Dr. Wiktor Nowinski, Research Professor Biochemistry, Department of Surgery, University of Texas Medical Branch, Galveston, Texas

INITIAL DISPOSITION:

Computer search of NASA Data Bank.

SEARCH REQUEST SENT TO SEARCH CENTER: 30 August 1967

GLM-15

TITLE: Respiration Volume and Rate Measurements in Unencumbered (Free) Child

DATE SUBMITTED: 19 August 1967

SOURCE: Roy D. Wilson, M.D., Assistant Professor, Department of Anesthesiology, Univeristy of Texas Medican Branch and Shrine Burn Center, Galveston, Texas

INITIAL DISPOSITION:

Computer search of NASA Data Bank. Search statement in preparation of Southwest Research Institute.

WLH-1

TITLE: Blood Recirculation Technology

DATE SUBMITTED: 2 May 1967

SOURCE: Major Roger Breslau, Vascular Surgery Department, Wilford Hall Hospital, San Antonio, Texas

COMMUNICATIONS:

10 June 1967 Dr. Ware met with Dr. R. Breslau to discuss details of the problem. The problem originator demonstrated his present laboratory apparatus for salvaging blood during operations for re-infusion, and discussed shortcomings of present techniques. A computer search of the NASA literature and a problem abstract draft is in preparation.

REVERSE PROBLEM CASE HISTORY

DATE IDENTIFIED: 31 October 1966

SOURCE: Southwest Research Institute Biomedical Applications Team

COMMUNICATIONS:

12 July 1967 Dr. Quentin Hartwig, in a letter to Mr. W. E. Cory, Director, Electronic Systems Research, Southwest Research Institute, reported that Mr. George Edwards, Technology Utilization Officer, Ames Research Center, is attempting to complete arrangements for a meeting between Mr. Engen and Mr. Vykukal.

18 August 1967 Mr. Edwards notified the Biomedical Applications Team that a tentative meeting date of 18 September for Mr. Engen and Mr. Vykukal has been arranged at Ames Research Center.

BIOMEDICAL PROBLEM ABSTRACT

"This problem abstract is designed to call to the attention of NASA personnel (and others who have agreed to participate) significant barriers that impede the progress of biomedical research and health care. The purpose is to bring to bear on these problems the expertise that resides in NASA. If you feel you can make a contribution, please communicate your suggestions to the Technology Utilization Officer at your installation. Also, alert him to any suggestions which can constitute inventions so that patent application may be made. Thank you".

December 1966 RCU-1

"ARTIFICIAL HEART" CONTROL SYSTEM TECHNOLOGY

PREPARED FOR NASA

SOUTHWEST RESEARCH INSTITUTE
8500 Culebra Road — San Antonio, Texas 78206
Telephone: Area Code 512 — OV 4-2000

NASA TECHNOLOGY UTILIZATION DIVISION
BIOMEDICAL APPLICATION PROGRAM

December 1966 RCU-1

"ARTIFICIAL HEART" CONTROL SYSTEM TECHNOLOGY

What is needed:

Information relating to control systems. Of particular interest are theoretical or experimental studies of nonlinear control systems applicable to the system illustrated in Figure 1.

Background:

In spite of significant recent progress in applications of artifical heart assist devices to the treatment of heart disease, inherent difficulties exist in the coordination of two coupled pumps: the ventricle (pumping chamber) of the natural heart and the artificial assist device. This is so because the assist device must be controlled to adapt its performance to the changing needs of the natural system. An approach which is currently used takes advantage of the natural regulatory mechanisms concerned with heart rate by synchronizing the artificial pump to the patient's own heartbeat. In a cardiovascular system damaged by disease, however, natural control mechanisms may not be functioning adequately even though pumping capacity be restored by means of the assist device. In these instances, additional control function must therefore be furnished by the artificial system.

As illustrated in Figure 1, the system to be controlled consists of a damaged natural pump (the left ventricle of the heart) in parallel with an artificial pump powered by pulsating gas pressure. The output of the combined system must supply the needs of the patient at rest and during moderate exercise, when the demand may be doubled or tripled--i.e., the peripheral flow resistance may be reduced to 1/2 or 1/3 of its resting value. Because the performance of the biological heart is difficult to assess, the artificial assist device must be controlled on the basis of limited information (or alternatively, better means must be devised to monitor the response of the damaged, natural heart to a changing load imposed by the body). At present, the only information available to monitor the performance of the natural or combined pumping system is rate of natural heartbeat, and pressures in the inlet and outlet tubing of the artificial heart, constituting measurement of left arterial and left ventricular pressure, respectively.

The specialized field of control theory as it applies to complicated, nonlinear systems is not readily accessible to medical researchers. An adequate statement of the "artificial heart" control system problem presents a difficult challenge in itself. This problem abstract is submitted to solicit information concerning (1) approaches to specific control system designs and rationales, and (2) general theoretical information relating to control of parallel or series coupled hydraulic, stroking pumps. For example, discussions of the cost and benefits provided by trade-offs of performance (error) monitoring versus output control would be welcome.

PLEASE ADD YOUR SUGGES'

A suitable control system would be sufficiently flexible to allow moderate physical activity with minimum risk of catastrophic failure of the pumping system. Obviously, extreme reliability would be paramount.

References:

1. Hiller, K. W., Seidel, W., and Kolff, W. J., "An Electronic-Mechanical Control for an Intrathoracic Artificial Heart," Amer. J. of Medical Electronics, Vol. 2, p. 212, 1963.

2. Kolff, W. J., Seidel, W., "Servo Mechanism to Drive an Artificial Heart Inside the Chest," Trans. of Am. Soc. for Artificial Heart, Vol. 8, p. 125, 1962.

3. Kolff, W. J., Hiller, K. W., and Seidel, W., "Results Obtained with Artificial Drive with NASA Servo Mechanism," Trans. of Am. Soc. for Artificial Heart, Vol. 8, p. 139, 1962.

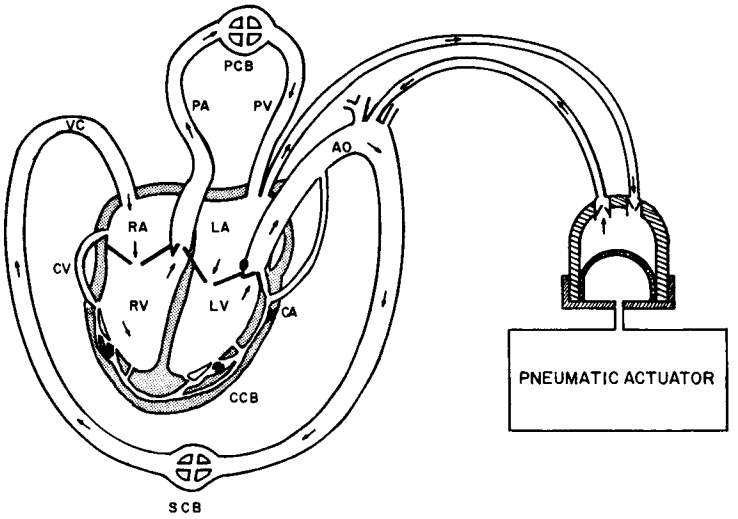

Figure 1. Artificial Heart Connected for Left Ventricular Bypass

PCB	Pulmonary circulatory bed (lungs)		
SCB	Systemic circulatory bed (muscles, kidney, skin, brain, etc.)		
CCB	Coronary circulatory bed (the heart muscle itself)		
VC	Vena Cava	LA	Left Atrium
RA	Right Atrium	LV	Left Ventricle
RV	Right Ventricle	AO	Aorta
PA	Pulmonary artery	CA	Coronary arteries
PV	Pulmonary vein	CV	Coronary veins

Source: Dr. William W. Akers
Director, Biomedical Engineering Laboratory
Rice University
Houston, Texas

C. W. Hall, M.D.
Assistant Professor
Department of Surgery
Baylor University College of Medicine
Houston, Texas

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RWW/LSB/pb

BIOMEDICAL PROBLEM ABSTRACT

"This problem abstract is designed to call to the attention of NASA personnel (and others who have agreed to participate) significant barriers that impede the progress of biomedical research and health care. The purpose is to bring to bear on these problems the expertise that resides in NASA. If you feel you can make a contribution, please communicate your suggestions to the Technology Utilization Officer at your installation. Also, alert him to any suggestions which can constitute inventions so that patent application may be made. Thank you".

May 1967 SRS-2

CATHETER TIP TRANSDUCERS

PREPARED FOR NASA

SOUTHWEST RESEARCH INSTITUTE
8500 Culebra Road San Antonio, Texas 78206
Telephone: Area Code 512 — OV 4-2000

NASA TECHNOLOGY UTILIZATION DIVISION
BIOMEDICAL APPLICATION PROGRAM

May 1967 SRS-2

Catheter Tip Transducers

What is needed:

Design techniques for miniature transducers suitable for mounting in the tip of a small diameter tube (catheter) for direct measurement of blood pressure and blood flow velocity. These transducers are to be inserted into the human heart and blood vessels.

Background:

Insertion of the catheter into arteries or veins through which it is passed into the heart (cardiac catheterization) constitutes a surgical procedure which is required in certain instances for diagnosis of abnormalities or disease of the heart and its associated large blood vessels. Development of sufficiently small, accurate transducers would permit insertion of the catheter-probe into the blood vessel via a hypodermic needle. Because such small transducers are not now available, it is currently necessary to surgically expose the blood vessel to allow direct insertion of the transducer, and for proper control of the bleeding which would follow withdrawal of a large catheter. Thus, use of smaller diameter catheter-mounted pressure and flow transducers introduced through hypodermic needles would result in significantly lower risk of injury or complications during a catheterization procedure and would contribute to improved care of such patient

Only a few manufacturers offer units as small as 0.083 inch in diameter (#6.5 French) which is considered to be the maximum tolerable diameter for insertion via a hypodermic needle. Existing commercially available catheter tip pressure transducers of less than 0.100-inch diameter are not satisfactory because they are fragile, require special handling, are subject to drift and require complicated and costly electronics equipment. Furthermore, they are difficult and costly to manufacture. Delivery is usually poor; in fact, some devices which are widely advertised have been found to be practically unavailable. Based on current technology, there is little promise that smaller, reliable pressure transducers will be developed soon for this application. Catheter mounted transducers for measuring arterial blood flow velocity are not commercially available.

For human blood pressures, the range of interest is 0 to 300 millimeters mercury (0 to 6 psi), while human blood flow velocities range from 0.3 to 3.0 centimeters per second. The desired resolution for each of these measurements is 1 percent of full scale. Transducer diameter as small as 0.050 inch (#4 French) is hoped for.

Source: Jack Johnson
Assistant Chief
Southern Research Support Center
Veterans Hospital
Little Rock, Arkansas

CJL/RWW/bjf

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BIOMEDICAL APPLICATION PROGRAM

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BIOMEDICAL APPLICATION PROGRAM

SRS-2

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BIOMEDICAL PROBLEM ABSTRACT

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May 1967 SRS-3

LOCATION OF STOMACH TUBE

PREPARED FOR NASA

SOUTHWEST RESEARCH INSTITUTE

8500 Culebra Road -:- San Antonio, Texas 78206

NASA TECHNOLOGY UTILIZATION DIVISION
BIOMEDICAL APPLICATION PROGRAM

May 1967 SRS-3

LOCATION OF STOMACH TUBE

What is needed:

1. A method for locating small magnets within the human body.

2. A method, utilizing active techniques, for locating the position of the tip of a 5-millimeter diameter tube (a catheter) within the human body.

Background:

In conjunction with medical research in diseases of the stomach and bowel, the location of the tip of the tube used to collect juices from and to irrigate the stomach of human patients must be determined with a tolerance of ± 1 centimeter in 3 dimensions. One approach to locating the tip of a tube makes use of permanent magnets, while another approach is through use of active methods.

Some researchers (including the submitter of this problem) object to the passage of electrical wires or insertion of active devices into the body cavities and are committe to the use of permanent magnets encapsulated in the tip of the catheter. These researchers have used a compass to locate the magnetic tip of a catheter within the stomach to the accuracy specified above, but the method is of limited sensitivity, and only fairly large magnets are adequate. More sensitive magnetometric methods would allow the clincian to locate smaller tubes in the patient's body. The use of smaller tubes is desirable from the standpoint of patient safety and comfort.

Since other researchers are not committed to any single method, worthwhile nonmagnetic approaches are also welcome. An active device located at the tip, or a passive device which can be interrogated externally (e.g., resonant coil or piezoelectri transducer) may provide a superior solution. Regardless of the approach used, the severe environment inside the stomach (pH = 1) must also be considered, even though the tube will remain in place for only a few hours at a time.

Any proposed method should not introduce hazards to the patient. Great complication in the device or measurement procedure should likewise be avoided. X-ray or other techniques involving ionizing radiation should not be used.

Reference:

The Lancet, Jan. 27, 1951, p. 209.

Source: Julius Wenger. M. D.
Assistant Chief Medical Service
Veterans Hospital
Atlanta, Georgia

CJL/RWW/cc

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NASA TECHNOLOGY UTILIZATION DIVISION
BIOMEDICAL APPLICATION PROGRAM

SRS-3

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BIOMEDICAL PROBLEM ABSTRACT

"This problem abstract is designed to call to the attention of NASA personnel (and others who have agreed to participate) significant barriers that impede the progress of biomedical research and health care. The purpose is to bring to bear on these problems the expertise that resides in NASA. If you feel you can make a contribution, please communicate your suggestions to the Technology Utilization Officer at your installation. Also, alert him to any suggestions which can constitute inventions so that patent application may be made. Thank you".

July 1967 HUV-2

ADVANCED COMPUTER INTERFACE TECHNOLOGY

PREPARED FOR NASA

SOUTHWEST RESEARCH INSTITUTE

8500 Culebra Road -:- San Antonio, Texas 78206

(3) Terminal Portability. Because of the variety of locations at which terminal equipment is needed in a hospital, and the need for economy, it would be desirable to have terminals easily portable. It would be advantageous to have a flexible arrangement which would allow jack (plug-in) operation.

(4) Compatibility. The hospital computer system would very likely be assembled from subsystems derived from various commercial and other sources. Procedures for matching these diverse subsystems to one another, including appropriate computer programs, are of interest.

(5) Ease of Use. The computer users in clinical environments do not, as a rule, have special training in programming or advanced mathematics. The means of interrogating the computer would therefore have to be matched to the limited mathematical capabilities of the hospital personnel that would constitute the majority of users of the communications system. The requested data would also have to be displayed in easily understandable form.

(6) Hardware Problems. The generation of excessive amounts of heat and acoustic noise, which would unacceptably stress the hospital patients, should be avoided.

(7) Cost. Since a large number of terminals in institutions which are generally hard-pressed financially would be required, terminal costs must be kept at a nominal level. A cost of approximately $1500 per terminal would represent an acceptable level.

The state-of-the-art equipment with which the problem originators are familiar ails to satisfactorily meet all of these requirements. It is hoped that current research nd developments may produce technology which would, to a great extent, meet the bulk f these criteria. Technical aid in any or all of the above listed areas is sought. In ddition, effective and rapid personnel training techniques for the terminal user would lso be of interest, since application of such techniques could, by increasing the user kills, reduce the severity of the technological requirements for the input/output equipnent, and favorably affect the design criteria.

ome Representative References from NASA Information Retrieval System:

J66-28287, "Computers and Displays/Controls," (State-of-the-Art Technology Studies).
J65-19633, "General Purpose Display System."
J65-14839, "Command Research Laboratory: The Variable Display System."
J64-28464, "The Rand Tablet: A Man-Machine Graphical Communication Device."
A66-32943, "Direct Editing of Research Data by Application of Computer Display Techniques."
A66-26916, "Information Display."

LSA/RWW/pab

COMMENTS ON BACK PAGE

Source: C. Vallbona, M.D.
Associate Professor
Texas Institute for Rehabilitation and Research
Houston, Texas

NASA TECHNOLOGY UTILIZATION DIVISION
BIOMEDICAL APPLICATION PROGRAM

HUV-2

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Title_____

Organization_____

BIOMEDICAL PROBLEM ABSTRACT

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July 1967 GLM-13

ANALYSIS OF DATA DERIVED FROM BRAIN POTENTIAL MEASUREMENTS

PREPARED FOR NASA

SOUTHWEST RESEARCH INSTITUTE

8500 Culebra Road -:- San Antonio, Texas 78206

NASA TECHNOLOGY UTILIZATION DIVISION
BIOMEDICAL APPLICATION PROGRAM

July 1967 GLM-13

Analysis of Data Derived from Brain Potential Measurements

What is needed:

Mathematical techniques that will allow a parsimonious representation of the tim series data obtained while measuring electrical potentials in various portions of the brain.

Background

In studying which portions of the brain may be involved in the inhibition of gross behavior, brain potentials deriving from a number of different regions in the brain are monitored. Thus, each monitored potential gives rise to time series data. It is hoped that correlation of these data with stimuli which initiate or inhibit certain behavior will enable investigators to better localize various control centers in the brain. These experiments are being performed with squirrel monkeys.

In analyzing the brain potential data, it is planned to make use of spectral and cross-spectral densities computed over relatively brief time periods. This general approach has been employed successfully by Walter and Adey.* It is desired to establis whether or not there are mathematical techniques analogous to the factor analysis of correlation matrices which would enable one to duplicate the cross-spectra obtained wit data from a given number of different recording sites by regarding the time series recorded at each site as a combination of a lesser number of theoretical time series. Each of these theoretical basis series would be an independent, complex series of specifiable spectral density. Each observed series would be specifiable as a linear combination of these basis series, allowing for the possibility that each basis series had been operated on by an appropriate delay parameter. Reduction of the observed series to a basis series representation would provide a means for postulation of the existence of a reduced number of recording sites.

It is desired to establish whether or not such basis series are uniquely determinable. Should this type of representation be possible, mathematical procedures (including computer programs) for obtaining the basis series from the experimentally derived series would be sought.

References

1. Blackman, R. B., and Tukey, J. W., The Measurement of Power Spectra. Dover: New York, 1959.

*See References.

PLEASE ADD YOUR SUGGES

2. Goodman, N. R., "Measuring Amplitude and Phase." J. Franklin Inst., 1960, 270, 437-450.

3. Walter, D. O., "Spectral Analysis of Electroencephalograms: Mathematical Determination of Neurophysiological Relationships from Records of Limited Duration." Exper. Neurol., 1963, 8, 155-181.

4. Walter, D. O., and Adey, W. R., "Spectral-Analysis of EEGs Recorded During Learning in the Cat, Before and After Subthalmic Lesions." Exper. Neurol., 1963, 7, 481-501.

LSB/WLA/pb

Source: Colin G. McDiarmid, Ph.D.,
Research Scientist
Behavioral Science Laboratory
University of Texas Medical Branch
Galveston

NASA TECHNOLOGY UTILIZATION DIVISION
BIOMEDICAL APPLICATION PROGRAM

GLM-13

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4. Documents Furnished to Program Participants

Documents listed in this section were either cited in computer searches of the NASA Data Bank, or came to the attention of members of the Biomedical Applications Team because of their knowledge of a participating institution's profile. In some cases, general references were requested by problem originators and consultants in response to NASA document listings distributed in the course of the program as part of the information disseminating service.

Problem No.: HUV-2

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
A66-32943	Direct Editing of Research Data By Application of Computer Display Techniques	17 May	22 May	5 July	5 July
A66-26916	Information Display	17 May	22 May	5 July	5 July
N65-14839	Command Research Laboratory: The Variable Display System	17 May	22 May	20 June	20 June
N65-19633	General Purpose Display System	17 May	22 May	20 June	20 June
N64-28464	The Rand Tablet: A Man-Machine Graphical Communication Device	17 May	22 May	20 June	20 June
A65-22039	Advances in Techniques for Large Dynamic Display Devices	13 June	7 August	28 August	
A65-22041	An Evaluation of Orbitan Rendezvous Displays Through Simulation	13 June	7 August	28 August	
A65-22046	A Modular Electroluminescent Crossed Grid Display for Graphical Data	13 June	7 August	28 August	
A65-22043	General Purpose Display	13 June	7 August	28 August	
A65-22048	Technologies for 1970 Era Tactical	13 June	7 August	28 August	
A65-22697	Computer-Driven Display System	13 June	7 August	28 August	
A65-13277	20,000 Character Per Second Printer System	13 June	7 August	28 August	

Problem No.: HUV-2 (cont.'d)

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
A63-21395	New Light on Air Traffic: Bright Plan Display with Alphanumerics	13 June	7 August		
A64-22531	Information Transfer Between Men and Computers	13 June	7 August		
A63-13586	Practical Solid State Three Dimensional (3-D) Display	13 June	7 August		
N66-28273	Investigation of an Analog Technique to Decrease 10-Tracking in Computer Displays	13 June	7 August		
N66-19547	Research on Advanced Dynamic Attribute Extraction Techniques	13 June	7 August		
N66-18548	A Stereoscopic Display for On-Line Monitoring or Simulating Terminal Engagement	13 June	7 August	23 August	25 August
N65-19975	Computer Activated Electroluminescent Display Screen. Application of Light and Image Intensification Techniques.	13 June	7 August	23 August	25 August
N65-20611	Experimental Investigation of Optical Presentation of Three-Dimensional Display	13 June	7 August	28 August	
N65-19300	Human Use of Short-Term Memory in Processing Information of a Console	13 June	7 August	23 August	25 August
N65-19633	General Purpose Display System	13 June	7 August	23 August	25 August

Problem No.: HUV-2 (cont.'d

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
N65-11774	Decision Sciences Laboratory Biannual Progress Report, July 1962-June 1964	13 June	7 August	23 August	
N65-14839	Command Research Laboratory: The Variable Display System	13 June	7 August		
A66-22960	Principles of 3-D CRT Displays	13 June	7 August	28 August	
A66-23176	Design Techniques Emerging From Man-Computer Graphic Communication	13 June	7 August	28 August	
N66-28287	Computers and Displays/Controls	13 June	7 August	28 August	

All of the preceeding references were furnished in response to cited documents in the computer search returns.

24 August — Lunar Orbiter Data Conversion System Familiarization Manual; Precision Color Dot Generator, Model 101-A; Hydra I Display System; and Loki Documentation Preparation System were furnished by Manned Spacecraft Center via Mr. Jack Wheeler's office, as a result of 12 June visit. Forwarded to consultant.

Problem No.: HUV-3

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
A64-14701	Critical Path Resources Simulation and Scheduling	26 July	7 August		
N65-13982	Critical Path Scheduling With Resource Leveling on the IBM-7090	26 July	7 August		
A65-10378	Press - The Poor Man's Pert	26 July	7 August	28 August	
A66-28437	Automation in Range Scheduling	26 July	7 August	28 August	
N63-13276	Graphical CPM	26 July	7 August		
N62-16407	Critical Path Scheduling: A Preliminary Literature Search	26 July	7 August	23 August	25 August
A65-16855	Tools in Airline Management	26 July	7 August	28 August	
A65-29269	Program Management - In Theory and in Practice	26 July	7 August	28 August	
N66-24535	Computer Equipment for the Automatic Construction of Time Graphs in Operational Control Systems	26 July	7 August	23 August	25 August
N66-10210	Finding Critical Paths in Network Schedules	26 July	7 August	28 August	
A65-11942	Pert/PDM-Project Monitoring Device	26 July	7 August	28 August	

All of the preceeding references were furnished in response to cited documents in the computer search returns.

TB66-10506	Computer Size Determines Inventory Size	Reviewed and sent to consultant 13 July 1967.

Problem No.: HUV-7

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
N63-12067	Recording of Physiological Functions in Man While Performing Physical Work	26 July	7 August	23 August	25 August
A63-18271	Management of an Independent Laboratory	26 July	7 August		
N64-19919	Methods of the Manual Analysis of Multi-Source, Continuously Recorded Biomed Data	26 July	7 August		
A64-13117	Good Management Insures Progress	26 July	7 August		

All of the preceeding references were furnished in response to cited documents in the computer search returns.

Problem No.: HUV-12

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
26 July	Consultant given a copy of NASA Tech Brief 65-10318, titled "Remote Control Electrical Switching has a 1000 Output Capability".				

Problem No.: HUV-14

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
A65-19211	Geometric Computing. I - The Method and Its Application - Electronic Geometry for Semiautomated Design	11 July	12 July	3 August	3 August
A65-35325	Queueing Theory in Fast Time Simulation of Air Traffic Control	11 July	12 July	3 August	3 August
A65-30463	Man-Computer Graphics	11 July	12 July	3 August	3 August
A66-15199	Project for an Airport Building (Das Project Fur Das Flughafengebaude)	11 July	12 July	3 August	3 August
A67-17514	Man-Computer Graphics for Computer-aided Design	11 July	12 July	12 July	12 July
N66-17722	Computer-Aided Design for Civil Engineering Structures	11 July	12 July	3 August	3 August
N66=24455	Can A Machine Create A Design	11 July	12 July	3 August	3 August
N66-29261	Anthropometry of Common Working Positions	11 July	12 July	3 August	3 August

All of the preceeding references were furnished in response to cited documents in the computer search returns.

NASA Tech Brief 67-10114 "Integrated Mobility Measurement and Notation System" was sent to problem originator 19 June 1967, since it seemed to be relative to his problem. A positive response was received 12 July, and backup material was requested from Manned Spacecraft Center. It was forwarded to the problem originator 26 July 1967.

Problem No.: BLM-9

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
	Letter to problem originator, enclosure of NASA "backup package" on telemetry and temperature measurement technologies: TB66-10057, Miniature Bioelectronic Device Accurately Measures and Telemeters Temperature; TB66-10624, Miniature Telemetry System Accurately Measures Pressure; TB66-10536, Helmet System Broadcasts Electroencephalograms of Wearer; TB65-10203, Tiny Biomedical Amplifier Combines High Performance, Low Power Drain; TB64-10171, Subminiature Biotelemetry Unit Permits Remote Physiological Investigations. (19 June 1967)				

Problem No.: BLM-5

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
28 August	Material on new types of DC brushless motors developed for Aerospace use (Glove Industries, Inc.; Aeroflex Labs, Inc.), sent to problem originator.				

Problem No.: GLM-2

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
A63-23506	A Microwatt VHF Telemetry System for Implantation in Small Animals	10 May	16 May	7 August	7 August
A65-10725	Biophysical Monitoring of Experimental Animals	10 May	16 May	5 July	6 July
A63-19640	The Development of an Implantable, Nonocclusive, Non-Invasive Blood Pressure Measuring System	17 May	26 May	5 July	5 July
N65-32277	Development of a Blood Pressure Transducer for the Temporal Artery	17 May	26 May	20 June	20 June
N62-13733	A transducer for the Continuous External Measurement of Arterial Blood Pressure	17 May	26 May	27 June	27 June
N64-27840	A Method of Continuous Registration of Local Cerebral Blood Flow in Acute and Chronic Experiments	17 May	26 May		
N65-11900	Instrument for Recording the Pulse Waves and Determining the Blood Pressure in Animals	17 May	26 May	20 June	20 June
A65-26600	Concerning Certain Methodological and Technical Problems Posed by Rocket Experiments Involving Animals	17 May	26 May	5 July	5 July

All of the preceeding references were furnished in response to cited documents in the computer search returns.

Problem No.: GLM-2 (cont.'d)

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
A65-81057	A Progress Report on Radio Telemetry from Inside the Body				
A66-81864	Telemetry of Blood Pressure in Free-Ranging Animals via an Intravascular Gauge				

These references were obtained by the problem originator.

Problem No.: GLM-3

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
N64-27634	Application of Polargraphic Method of Determination of Oxygen Tension in Tissues of Brain during High Altitude Flight	5 August	10 August		
N65-27028	Use of a Gold-Iron Electrode Pair for the Electromechanical Recording of Tissue Oxygen *In Vivo.*	5 August	10 August	28 August	
N67-11474	The Bioelectric Reactions and Oxygen Tension of Certain Parts of the Brain in the Case of Hypoxic Hypoxia	5 August	10 August	28 August	
A65-81996	pO_2 Measurement in Tissues	5 August	10 August	28 August	
N65-13705	Effect on Brain Oxygenation of Breathing Oxygen during Accelerations	5 August	10 August		

All of the preceeding references were furnished in response to cited documents in the computer search returns.

These referenced documents appear applicable to GLM-9 also.

A reference cited in Midwest Research Institute's current quarterly report in connection with their problem KU-3 seems applicable to GLM-3, and accordingly was forwarded to problem originator: "Blood Gases: Continuous In Vivo Recording of Partial Pressure by Mass Spectrography" S. Woldring, G. Owens and D.C. Woolford, Science, August, 1967, pp. 885-887.

Problem No.: GLM-4, -5

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
N64-20588	A Study of Auscultatory Blood Pressure in Simulated Arteries	27 July	7 August		
N64-22425	Auscultatory vs. Direct Pressure Results for Newtonian Fluids and for Blood in Simulated Arteries	27 July	7 August		
Requested for application to GLM-6.					
N66-22247	Final Report on Space Physiology	5 August	10 August	31 August	

All of the preceeding references were furnished in response to cited documents in the computer search returns.

Problem No.: GLM-5

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
27 July	Problem originator was given Tech Brief 66-10539, "Computer Programs Perform Spectral Analysis of up to Seven Time Series." Additional backup information requested from Marshall Space Flight Center, 20 June 1967.				

Problem No.: GLM-9

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
N65-17769	Oxygen Pressure in Tissues of Dog Brain during Respiration of Gas Mixtures	16 August	23 August		
N65-24878	Scientific Conference on the Determination of Oxygen Pressure in Living Tissue by Polargraphic Method	16 August	23 August		

Five references cited in search for problem GLM03 appear applicable to problem GLM-9 as well:

N64-27634	Application of Polargraphic Method of Determination of Oxygen Tension in Tissues of Brain during High Altitude Flight	5 August	10 August		
N65-27028	Use of a Gold-Iron Electrode Pair for the Electromechanical Recording of Tissue Oxygen *In Vivo*	5 August	10 August	28 August	
N67-11474	The Bioelectric Reactions and Oxygen Tension of Certain Parts of the Brain in the Case of Hypoxic Hypoxia	5 August	10 August	28 August	
N65-81996	pO_2 Measurement in Tissues	5 August	10 August	28 August	
N65-13705	Effect on Brain Oxygenation of Breathing Oxygen during Accelerations	5 August	10 August		

Problem No.: GLM-9 (cont.'d)

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher

Obtained by Researcher:

A65-81147 "Electrode Size and Tissue pO_2 Measurements in Rats Exposed to Air on High Pressure Oxygen"

A65-81727 "A Method for Continuous Measurement of Oxygen in the Aqueous Humor and the Lens of the Living Eye."

All of the preceeding references were furnished in response to cited documents in the computer search returns.

Problem No.: GLM-11

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
N64-15699	The Effect of Antistatic Agents on Fabrics Woven from Synthetic Fibers	10 August	22 August		
N66-25912	Potential Applications of Polymetal Phosphates: Antistatic Coatings Multi-purpose Thickners and Exploratory Studies on Their Thermally Stable Elastomers	10 August	22 August		
N67-16215	Conductive Transparent Thermoplastic Films	10 August	22 August		
N64-16668	Current Methods of EEG Analysis	16 August	23 August		

All of the preceeding references were furnished in response to cited documents in the computer search returns.

Tech Brief 67-10132, "Static Electricity of Palmars Reduced by Treatment with Iodine" appears to be applicable to this problem and was sent to problem originator 24 August 1967.

Problem No.: GLM-12

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
TB63-10003	"New Low-Level AC Amplifier Provides Adjustable Noise Cancellation and Automatic Temperature Compensation" was given to problem originator 27 July 1967. A backup package was requested from Ames Research Center. This supplementary information was forwarded to researcher 23 August.				
TB-67-10262	"Solid State Circuit Averages Multiple Signals and Rejects those Varying Significantly from the Average" was sent to problem originator.				

Problem No.: GLM-13

Ref. No.:	Reference Title	Chronology: Requested by Originator	Request processed at SwRI	SwRI Obtained Reference	Forwarded to Researcher
TB66-10057	From this Tech Brief, "Miniature Bioelectric Device Accurately in Telemeters Temperature," Reference 3 was requested: Bliss, D.I. Periodic Regression in Biology and Climatology, Conn. Agr. Exp. Sta. New Haven Bull. 615, June 1958.	16 August	23 August		

GENERAL REFERENCES FORWARDED

Ref. No.	Reference Title	Date
Sent to TIRR:		
SP-72	Symposium on the Analysis of Central Nervous System and Cardiovascular Data Using Computer Methods	25 August
SP-5067	Assessing Technology Transfer	25 August
SP-5041	NASA Contributions to Cardiovascular Data Using Computer Methods	25 August
SP-5038	Magnetic Tape Recording Technology	25 August
SP-5031	Microelectronics in Space Research	25 August
SP-5044	Selected Casting Techniques	3 August
SP-5021(02)	Cumulative Index to NASA Tech Brief 1963-1965	3 August
SP-5036	Bibliography on Electromechanical Transducers	3 August
SP-5022	Micropower Logic Circuits	3 August
SP-5019	Advanced Valve Technology	3 August
SP-5006	The Measurement of Blood Pressure in the Human Body	3 August
SP-7010	Clarity in Technical Reporting	3 August
SP-7012	The International System of Units - Physical Constants and Conversion Factors	3 August

GENERAL REFERENCES FORWARDED

Ref. No.	Reference Title	Date
Sent to University of Texas Medical Branch:		
SP-5046	Selected Electronic Circuitry	16 August
SP-5031	Microelectronics in Space Research	On Order

C. TRANSFER IDENTIFICATION

Applicable case history material for the period prior to 30 May 1967, reprinted from Southwest Research Institute Quarterly Progress Report No. 3, is presented in the appendix.

1. Transfers Accomplished

   (a) GLM-1

   (b) HUV-1 (Part I)

2. Transfers in Progress

   (a) HUV-1 (Part II)

   (b) HUV-8

   (c) SNM-1

   *(d) HUV-12

3. Applicable Technology Identified

   (a) HUV-13

   *(b) RCU-1

   *(c) SRS-1

   *(d) SRS-2

   *(e) BLM-1

   (f) BLM-2

   (g) BLM-3

   *(h) BLM-5

   (i) BLM-6

* See also Section B-2, this report

*(j) BLM-7

*(k) BLM-8

*(l) GLM-2

*(m) GLM-4

*(n) GLM-5

*(o) GLM-6

* See also Section B-2, this report

D. SPEECHES AND PUBLICATIONS

No speeches nor publications were presented during this period.

E. CONTRIBUTIONS TO THE TRANSFER PROCESS

A small percentage of the project time is formally devoted to studies pertaining to the information transfer processes, including development of a pilot system tailored specifically to the storage and retrieval of information in the biomedical-physical science area. A paper discussing this effort is in preparation.

F. PROJECTIONS FOR THE NEXT QUARTER

A proposal to continue the Biomedical Applications Program for a second year has been submitted to NASA's Technology Utilization Division.

APPENDIX

GLM-1

TITLE: Analysis of Transitional Flow-Convection/Diffusion

DATE SUBMITTED: 14 February 1967

SOURCE: H. G. Swann, Ph.D., Professor of Physiology, University of Texas Medical Branch at Galveston, Galveston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank

SEARCH REQUEST SENT TO SEARCH CENTER: 23 February 1967
RETURNED FROM SEARCH CENTER: 21 March 1967
RESULTS FORWARDED TO RESEARCHER: 18 April 1967
EVALUATION BY RESEARCHER: 10 May 1967: very favorable

COMMUNICATIONS:

15 January 1967 Dr. Ware interviewed Dr. Swann to round out details concerning this problem before submission as computer search.

24 April 1967 Letter received from Dr. Swann expressing his appreciation for the information transferred.

10 May 1967 Dr. Ware and Mr. Berger visited the University of Texas Medical Branch, Galveston, and interviewed Dr. Swann concerning his intended application of the information returned. Dr. Swann stated that the information had been instrumental in his decision not to undertake further research in the area of analysis of transitional flow in view of the substantial amount of information revealed by the computer search. Dr. Swann felt that the information received was most useful and that it allowed him to turn his attention to other pressing matters.

HUV-1

TITLE: Reduced Workload Environment for Physically Handicapped Patients

DATE SUBMITTED: 28 December 1966

SOURCE: Miss Miriam Partridge, Director, Dept. of Physical Therapy, Texas Institute for Rehabilitation and Research

INITIAL DISPOSITION: Applicable technology was disclosed in NASA TND-2641, "Exploratory Study of Man's Self-Locomotion Capabilities with a Space Suit in Lunar Gravity," and TND-3363, "Comparative Measurements of Man's Walking and Running Gaits in Earth and Simulated Lunar Gravity." Direct contact with Langley Research Center was therefore initiated.

COMMUNICATIONS WITH NASA CENTERS:

27 September 1966 Dr. Ware, Mr. Berger, Dr. Vallbona (Director of Research, TIRR), and Dr. Hartwig, NASA consultant, visited Langley Research Center to survey a typical NASA research center in order to orient the Biomedical Applications Team with respect to NASA organization and procedures. During this visit, it was planned to arrange a site visit for the Texas Institute for Rehabilitation and Research staff members who are concerned with this problem.

23 February 1967 Mr. Berger called Mr. Shufflebarger, TU Officer, Langley Research Center, to plan site visit regarding this problem.

13 April 1967 Dr. Ware, and Miss Miriam Partridge and Mr. Joe Canzoneri of Texas Institute for Rehabilitation and Research visited the lunar gravity simulator. Both Miss Partridge and Dr. Ware tried out the 1/6 g simulator. Miss Partridge spent over an hour in the sling suspension system in order to evaluate problems which might be anticipated in applying this technology to handicapped patients. Conference was held with Mr. Amos Spady, Jr., Mr. W. Krasnow and Mr. Don Hughes. Information and sketches were passed to Miss Partridge, the researcher. This site visit was considered to be outstandingly successful from the standpoint of transferring the desired technology. Documenting photographs were taken as illustrated in Section C of this report.

OTHER COMMUNICATIONS:

25 April 1967 Dr. Ware and Mr. Berger called Mr. Canzoneri to inform him of currently appearing literature applicable to this problem (Aerospace Medicine, "Metabolic Rates During Lunar Gravity Simulation," Vol. 38, pp. 380-382, April 1967.)

16 May 1967 During a visit by Mr. Berger to Texas Institute for Rehabilitation and Research, he was informed by Mr. Canzoneri that a grant application based upon technology transferred in answer to this problem statement was in preparation and would be submitted by the end of the month. Information copies of the application were promised.

31 May 1967 A copy of Problem Abstract HUV-10 was mailed to Miss Partridge, as some of the instrumentation sought in HUV-10 could be applied to evaluation of HUV-1.

The technology made available to this investigator has been used as the basis for preparation of a document (a grant request). Accomplishment of a major actual transfer is contingent upon the outcome of the grant request.

HUV-8

TITLE: Mechanisms of Onset of Orthostatic Hypotension

DATE SUBMITTED: 18 January 1967

SOURCE: J. C. Walker, Ph.D., Directress, Biochemistry Laboratory, Texas Institute for Rehabilitation and Research

INITIAL DISPOSITIONS:

Computer search of NASA data bank

SEARCH REQUEST SENT TO SEARCH CENTER: 31 January 1967
RETURNED FROM SEARCH CENTER: 10 February 1967
RESULTS FORWARDED TO RESEARCHER: 3 March 1967
EVALUATION BY RESEARCHER: 10 May 1967; very favorable

COMMUNICATIONS WITH RESEARCHER:

7 April 1967 Dr. Walker was interviewed about the evaluation of the search results by L. Berger during his visit to Texas Institute for Rehabilitation and Research. She stated that she was very pleased with the search results and that the searches completely met her needs. She has not as yet requested any particular references. Applications of search returns have been requested from the problem originator for documentation of the transfer.

SNM-1

TITLE: Enhancement of X-ray Contrast Study Films

SYNOPSIS:

During a tour of the facilities of the University of Texas Medical School at San Antonio, Dr. Ware disclosed to Dr. Peter Zanca (Chairman, Radiology Department), the technology developed by Jet Propulsion Laboratories for digital processing and enhancement of television or other digitized images. Dr. Zanca immediately expressed interest in evaluating this process on a series of X-ray films taken during his research on slow intravenous drip methods for contrast study in cholangiography and renography.

COMMUNICATIONS WITH NASA CENTERS:

25 April 1967 Dr. Ware called Dr. R. Nathan at Jet Propulsion Laboratories to Discuss Dr. Zanca's request. Dr. Nathan expressed his willingness to process, on a pilot basis, the aforementioned X-ray photographs.

8 May 1967 The X-ray films were mailed directly to Dr. Nathan.

OTHER COMMUNICATIONS:

25 April 1967 Dr. Ware called Dr. Peter Zanca to notify him of Dr. Nathan's willingness to process his X-ray photographs.

2 May 1967 Dr. Ware telephoned Dr. Peter Zanca to make final arrangements for sending the set of X-ray films to Jet Propulsion Laboratories for digital processing and enhancement. Dr. Zanca also promised to send reprints describing his research to Dr. Nathan.

HUV-12

TITLE: Special Automobile Modifications for Disabled Persons

DATE SUBMITTED: 22 February 1967

SOURCE: Miss Mary Joyce Newsom

INITIAL DISPOSITION:

It was decided that this problem required further clarification and possible subdividing into several problem areas before beginning formal action.

COMMUNICATIONS WITH NASA CENTERS:

21 March 1967 Mr. G. Edwards, TU Officer, Ames Research Center, gave backup material on special electrical switches (proportional controllers), described in Mr. Minefee's invention disclosures, to Dr. Ware and L. Berger.

8 May 1967 L. Berger, in telephone call to Mr. George Edwards, requested hardware described in Mr. Minefee's inventions. Mr. Edwards advised that he would investigate the matter.

9 May 1967 Dr. Ware called Mr. J. Wheeler, TU Officer, Manned Spacecraft Center, and obtained reference to two NASA researchers, Mr. Van Artsdalen and Mr. Miller, who are involved in simulation work. They were called, and the driver simulation needs existing at TIRR were explained to them.

19 May 1967 L. Berger called Mr. Van Artsdalen and Mr. Miller (MSC). Tentative arrangements were made to visit their facilities, and a reference was obtained to simulation work done by Goodyear in Akron, Ohio.

24 May 1967 Visit for 12 June confirmed (telephone call to Manned Spacecraft Center, L. Berger).

OTHER COMMUNICATIONS:

7 April 1967 L. Berger met with Dr. Spencer, Director, Texas Institute for Rehabilitation and Research and other TIRR staff members (Mr. Canzoneri, Miss Keenan, Mr. Langford) to clarify the problem

statement. It was decided that a schedule of priorities for this research would be set up at Texas Institute for Rehabilitation and Research.

18 April 1967 Backup package on special electrical switches, obtained from Ames Research Center, was sent to Texas Institute for Rehabilitation and Research.

8 May 1967 L. Berger met with Texas Institute for Rehabilitation and Research staff members Langford, Tettamante, Poor, Canzoneri, to discuss research protocol plans, and the program needs for specialized servosystems, motors, and hydraulic assist devices. A visit to Manned Spacecraft Center to investigate their technology was tentatively planned for early June.

HUV-13

TITLE: Human Transfer Function Measurements

DATE SUBMITTED: 9 March 1967

SOURCE: C. Vallbona, M. D., Associate Professor, Texas Institute for Rehabilitation and Research

COMMUNICATIONS WITH NASA CENTERS:

23 January 1967 Letter to Mr. C. C. Shufflebarger, TU Officer, Langley Research Center, requesting information on subject Tech. Brief (TB 66-10379) in response to Dr. Vallbona's specific questions. (L. Berger)

15 February 1967 Letter from Mr. Shufflebarger to L. Berger reporting that the requested information had been sent to Dr. Vallbona, including a complete description of the system by Mr. James J. Adams who developed it at Langley, and Tech. Notes D-2569, -1952, -2394, and -2177, all providing backup information on subject Tech. Brief.

OTHER COMMUNICATIONS:

30 December 1966 This problem statement arose in connection with a letter from L. Berger to Dr. Vallbona, calling his attention to Tech. Brief 66-10379, Human Transfer Functions Used to Predict System Performance Parameters, which was thought to be of possible interest to him as indicated by the interest profile.

18 January 1967 Dr. Vallbona requested specific information about the Tech. Brief in a letter to L. Berger.

25 April 1967 Call by Dr. Ware and L. Berger to Mr. Canzoneri and Dr. Vallbona with a further reference: Critical Re-evaluation of Human Transfer Function Problem in Aerospace Medicine, Vol. 38, pp. 383-389, April 1967.

8 May 1967 Dr. Vallbona expressed continuing interest in the problem to L. Berger during visit to Texas Institute for Rehabilitation and Research.

RCU-1

TITLE: "Artificial Heart" Control System Technology

DATE SUBMITTED: 9 December 1966

SOURCE: Dr. William Akers, Director, Biomedical Engineering Laboratory, Rice University and C. W. Hall, M. D., Assistant Professor, Department of Surgery, Baylor University Medical School, Houston, Texas

INITIAL DISPOSITION:

Selected for Problem Abstract preparation.

COMMUNICATIONS WITH NASA CENTERS:

19 May 1967 Dr. Ware and Dr. C. W. Hall visited Lewis Research Center where applicable technology was discovered. The following NASA personnel participated in a briefing on the subject of artificial heart controls: Mr. Kirby Hiller, Mr. Vernon Gebben and Mr. Mike Crosby.

PROBLEM ABSTRACT DRAFT SUBMITTED TO NASA: 18 May 1967

OTHER COMMUNICATIONS:

9 January 1967 Problem abstract draft sent to Dr. W. W. Akers, Rice University, for references and supplementary information.

25 April 1967 Abstract draft sent to Dr. C. W. Hall, Baylor University Medical School, for additional references.

15 May 1967 Dr. Ware called Dr. C. W. Hall to obtain further reference information.

31 May 1967 Dr. Hartwig requested additional modification of Problem Abstract draft.

SRS-1

TITLE: Indirect Measurement of Blood Pressure During Rest and Exercise on Arms and Legs

DATE SUBMITTED: 3 February 1967

SOURCE: George W. Molnar, Ph. D., Coordinator for Professional Services, Southern Research Support Center, VA Hospital, Little Rock, Arkansas

INITIAL DISPOSITION:

Computer search of NASA data banks

SEARCH REQUEST SENT TO SEARCH CENTER: 24 February 1967 (part 2)
RETURNED FROM SEARCH CENTER: 21 March 1967
RESULTS FORWARDED TO RESEARCHER: 31 March 1967

COMMUNICATIONS WITH NASA CENTERS:

21, 22 March 1967 Dr. Ware and L. Berger investigated this problem during their visit to Ames Research Center. Mr. G. Edwards, TU Officer, provided backup packages on telemetry technology and arranged a visit with Mr. T. Fryer, who described current developments at Ames in miniaturized implantable biotelemetry packages.

OTHER COMMUNICATIONS:

31 January 1967 C. J. Laenger, Southwest Research Institute engineer, discussed problem with the problem originator and Mr. J. Johnson during visit to Southern Research Support Center.

8 February 1967 Mr. C. J. Laenger discussed problem with Mr. Johnson via telephone and arranged for a conferences on specific problems.

17 February L. Berger wrote letter to Midwest Research Institute requesting information concerning possible overlap with their problem KU-4.

28 February 1967 Mr. C. J. Laenger visited Mr. Johnson and the problem originator at Southern Research Support Center and discussed details of the problem, including specific approaches to its solution.

SRS-2

TITLE: Catheter Tip Transducer for Blood Pressure and Flow Measurement

DATE SUBMITTED: 7 March 1967

SOURCE: J. B. Johnson, Assistant Chief, Biomedical Instrumentation Section, VA Hospital, Arkansas

INITIAL DISPOSITION:

Computer search of NASA data bank; this search also covers problems GLM-4 and GLM-5.

SEARCH REQUEST SENT TO SEARCH CENTER: 26 May 1967

COMMUNICATIONS WITH NASA CENTERS:

21, 22 March 1967 Dr. Ware and Mr. Berger investigated this problem during their visit to Ames Research Center. Mr. G. Edwards, TU Officer, provided backup packages on the pressure transducers developed by Mr. G. Coon, researcher at Ames, and also arranged for a meeting with Mr. Coon. In the meeting, Mr. Coon demonstrated his devices and supplied information on current developments in his program to reduce the size of his capacitance pressure transducers still further.

24 May 1967 Dr. Ware called Dr. H. Sandler, Ames Research Center, to make further arrangements on transferring capacitance manometry technology.

29 May 1967 Mr. Berger advised Mr. G. Edwards of the tentatively scheduled visit to Ames Research Center to further the transfer of the capacitance transducers.

PROBLEM ABSTRACT DRAFT SUBMITTED: 25 May 1967 (applicable also to problems GLM-4 and GLM-5).

OTHER COMMUNICATIONS:

28 February 1967 Mr. C. J. Laenger, Senior Research Engineer, Southwest Research Institute, discussed catheter tip transducers during his visit to SRSC with the consultant, Mr. J. Johnson, and Dr. Molnar, a physiologist, SRSC, who is interested in acquisition of data with such devices.

BLM-1

TITLE: Noiseless Gas Valves for "Artificial Heart" Use

DATE SUBMITTED 26 August 1966

SOURCE: C. W. Hall, M.D., Assistant Professor, Department of Experimental Surgery, Baylor University Medical School, Houston, Texas

INITIAL DISPOSITION:

Because of recent publication of NASA Technology Survey SP 5019, Advanced Valve Technology, search of NASA computer data bank was not indicated. Decision was made to prepare problem abstract.

COMMUNICATIONS WITH NASA CENTERS:

24 February 1967 Dr. Ware called Mr. Clinton Johnson, TU Officer, Edwards Flight Research Center, to seek information on valves mentioned in the NASA Advanced Valve Technology Survey. Mr. Johnson agreed to initiate a search for available examples and additional technical information as available.

22 April 1967 Dr. Ware called Mr. Clinton Johnson to follow up on valve information. Mr. Johnson indicated that the curtain flap proportional valve (illustrated in Fig. 24a, p. 126, SP 5019) was not available at Edwards. He suggested contacting the manufacturer. He felt that the sliding stem proportional valve (illustrated in Fig. 23, p. 125) might be available and promised to attempt to obtain an example of this valve for Dr. Hall's evaluation.

PROBLEM ABSTRACT DRAFT SUBMITTED: 20 December 1966
DRAFT APPROVED: 12 January 1967
DISSEMINATED: 15 February 1967

OTHER COMMUNICATIONS:

9 January 1967 Draft of Problem Abstract sent to Dr. C. W. Hall and Dr. W. W. Akers for review and possible suggested additions.

30 January 1967 Advanced Valve Technology Survey, SP 5019, was reviewed and pertinent chapters marked for Dr. Hall's attention, and copies mailed to Dr. Hall.

BLM-2

TITLE: Support Slings for Post-Operative Care of Large Animals

DATE SUBMITTED: 7 February 1967

SOURCE: C. W. Hall, M.D., Assistant Professor, Department of Experimental Surgery, Baylor University Medical School, Houston, Texas

INITIAL DISPOSITION:

Technology possibly applicable to this problem was disclosed in NASA TND-2641, Exploratory Study of Man's Self-Locomotion Capabilities with a Space Suit in Lunar Gravity and TND-3363, Comparative Measurements of Man's Walking and Running Gaits in Earth and Simulated Lunar Gravity. Since a site visit to Langley Research Center was already scheduled in connection with Problem HUV-1, action was postponed until evaluation of sling techniques in use at Langley were made with respect to this problem.

COMMUNICATIONS WITH NASA CENTERS:

12, 13 April 1967 Dr. Ware visited Langley Research Center to inspect the lunar gravity simulator facility primarily to determine applicability of the simulator technique to Problem HUV-1. It appeared that lunar gravity sling techniques might be applicable to the support of large animals.

OTHER COMMUNICATIONS:

10 May 1967 The above information was given to Dr. C. W. Hall, the problem originator, during Dr. Ware's visit to Baylor University Medical School.

19 May 1967 This problem was further discussed with Dr. Hall during his and Dr. Ware's visit to Lewis Research Center. The suggested use of Velcro to prevent slings from slipping posed a problem of method of attachment to the large animals. Dr. Ware suggested that the animal could be prepared in advance by surgical implantation of a patch of Velcro using the velour skin substitute technique developed by Dr. Hall.

BLM-3

TITLE: Triggering on R Wave of ECG

DATE SUBMITTED: 7 February 1967

SOURCE: C. W. Hall, M.D., Assistant Professor, Department of Experimental Surgery, Baylor University Medical School, Houston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank

SEARCH REQUEST SENT TO SEARCH CENTER: 28 March 1967
RETURNED FROM SEARCH CENTER: 20 April 1967
RESULTS FORWARDED TO RESEARCHER: 27 April 1967

COMMUNICATIONS WITH NASA CENTERS:

19 May 1967 Dr. Ware and Dr. C. W. Hall visited Lewis Research Center where additional pertinent technology was discovered in the form of a technique for triggering on R-wave of ECG. It was developed by NASA engineer Vernon D. Gebben, who made prepublication copies of a description of his technique available to the researcher, Dr. Hall.

BLM-5

TITLE: Transthoracic Energy Coupling Devices

DATE SUBMITTED: 7 February 1967

SOURCE: C. W. Hall, M.D., Assistant Professor, Department of Experimental Surgery, Baylor University Medical School, Houston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank

SEARCH REQUEST SENT TO SEARCH CENTER: 28 March 1967
RETURNED FROM SEARCH CENTER: 20 April 1967
RESULTS FORWARDED TO RESEARCHER: 27 April 1967

COMMUNICATIONS:

17 February 1967 Overlap identified with Midwest Research Institute's problem UM-3.

2 March 1967 Letter from Mr. Bendersky, Project Leader, Midwest Research Institute Biomedical Applications Team, referred to possibly pertinent work on energy cells conducted at Jet Propulsion Laboratory and suggested NASA Resident Officer, John C. Drane, as the appropriate contact for the follow-up.

27 April 1967 Backup package on NASA brushless DC motors was sent to researcher, Dr. C. W. Hall.

BLM-6

TITLE: Biocompatible Spray-On Plastics, Impermeable to Bacteria

DATE SUBMITTED: 7 February 1967

SOURCE: C. W. Hall, M.D., Assistant Professor, Department of Experimental Surgery, Baylor University Medical School, Houston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank

SEARCH REQUEST SENT TO SEARCH CENTER: 28 March 1967
RETURNED FROM SEARCH CENTER: 20 April 1967
RESULTS FORWARDED TO RESEARCHER: 27 April 1967

COMMUNICATIONS:

Potentially applicable technology was discovered in the form of a research contract at NASA Manned Spacecraft Center, Houston, for development of edible food covering films. Although none of the films developed before termination of the project were directly applicable, commercial sponsorship of further work in this area was obtained by the contractor. Negotiations are now under way with the commercial sponsor to obtain permission to evaluate more recently developed plastic films which have already been shown to be biocompatible. A sample of one of these films sprayed on to nylon velour was provided to the researcher, Dr. C. W. Hall, on 14 April 1967.

BLM-7

TITLE: Telementry of Cardiovascular Data from Free-Ranging Animals

DATE SUBMITTED: 7 February 1967

SOURCE: C. W. Hall, M.D., Assistant Professor, Department of Experimental Surgery, Baylor University Medical School, Houston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank

SEARCH REQUEST SENT TO SEARCH CENTER: 24 February 1967 (same as Part I, GLM-2)
RETURNED FROM SEARCH CENTER: 21 March 1967
RESULTS FORWARDED TO RESEARCHER: 27 April 1967

COMMUNICATIONS WITH NASA CENTERS:

27 April 1967 Dr. Ware and Mr. Berger visited Ames Research Center where backup packages on NASA telemetry developments were obtained and sent to the researcher, Dr. C. W. Hall.

OTHER COMMUNICATIONS:

17 February 1967 Overlap with Midwest Research Institute, Problem KU-4 was identified.

2 March 1967 A letter from Mr. Bendersky, Director of Midwest Research Institute Biomedical Applications Team, disclosed their results on the Problem KU-4 and made reference to NASA Technology Utilization Report No. ST-5023, Medical and Biological Applications for Space Technology, by stating that although there are several telemetry systems on the commercial market which have evolved from systems developed for NASA, the systems were not being offered at competitive prices for a small number of channels.

NOTE: The US Air Force Aeromedical Research Laboratory, Holloman Air Force Base, New Mexico, is presently sponsoring contracted research for development of telemetry techniques for use on free ranging chimpanzees. Relevant information may become available later.

BLM-8

TITLE: Miniature Tape Recorder for Biological Data

DATE SUBMITTED: 22 February 1967

SOURCE: Dr. L. Lamb, Baylor University Medical School, Houston, Texas

INITIAL DISPOSITION:

At the time of receipt of this problem, potentially applicable technology was known to exist at Edwards Flight Test Center in the form of a miniature multichannel biologic data tape recorder in use by Dr. Roman for evaluation of physiologic performance of aerospace pilots.

COMMUNICATIONS WITH NASA CENTERS:

24 February 1967 Dr. Ware called Mr. Clinton Johnson, TU Officer, Edwards Flight Research Center regarding this problem. Mr. Johnson began to assemble technical information available on the miniature personal tape recorder used in the pilot data enhancement system by NASA investigator, Major James A. Roman.

15 March 1967 Dr. Ware called Dr. C. W. Hall to pass on information received from Mr. Johnson about the NASA tape recorder and to call his attention to current literature including Roman, Older, and Jones, Flight Research Program: Medical Monitoring of Navy Carrier Pilots in Combat, Aerospace Medicine, Vol. VII, pp. 133-139, February 1967.

25 April 1967 Dr. Ware called Dr. C. W. Hall to verify that the problem originator, Dr. L. Lamb, had received the available information concerning the NASA personal tape recorder developed and fabricated by Air Research Manufacturing Division, Garrett Company.

GLM-2

TITLE: Monitoring of Blood Pressure by Extra-Vascular Sensor, Using Wireless Telemetry of Information

DATE SUBMITTED: 16 February 1967

SOURCE: C. E. Hall, Ph.D., Professor of Physiology, University of Texas Medical Branch, Galveston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank

SEARCH REQUEST SENT TO SEARCH CENTER: 24 February 1967 (Parts 1 & 2)
RETURNED FROM SEARCH CENTER: 21 March 1967
RESULTS FORWARDED TO RESEARCHER: 18 April 1967
EVALUATION BY RESEARCHER: 10 May 1967
Evaluation favorable. Search provided partial solution to problem.

COMMUNICATIONS WITH NASA CENTERS:

21, 22 March 1967 Dr. Ware and L. Berger investigated this problem during their visit to Ames Research Center. Mr. G. Edwards, TU Officer, provided backup packages on telemetry technology, and arranged a visit with Mr. T. Fryer, Ames Research Center scientist, who described current developments in miniaturized implantable bio-telemetry packages.

18 April 1967 Backup packages from Ames were sent to problem originator.

OTHER COMMUNICATIONS:

17 February 1967 L. Berger wrote a letter to Midwest Research Institute requesting information concerning possible overlap with their problem KU-4.

2 March 1967 Letter from Midwest Research Institute described results of their investigations. Possibilities of overlap are still being followed up.

GLM-2 (cont'd)

20 April 1967 Problem originator sent supplementary information, noting that the application to small mammals, e.g., a rat, was not sufficiently emphasized in his problem statement.

2 May 1967 Telephone call by L. Berger to Mr. Canter, Assistant Director, KASC, University of Pittsburgh, discussing the question of repeat searching of an already searched problem. It was noted that this service is included in the search fee.

10 May 1967 Applicable NASA technology and the search applications were further discussed by the problem originator with Dr. Ware and L. Berger during their trip to the Medical School.

16 May 1967 Letter to Mr. Canter requesting further communication about possibility of re-searching this problem, and requesting two references: A63-23506, A Microwatt VHF Telemetry System for Implanatation in Small Animals; A65-10725, Biophysical Monitoring of Experimental Animals.

17 May 1967 Letter from problem originator requesting six references:

N6213733--A Transducer for the Continuous External Measurement of Arterial Blood Pressure

A65-26600--Concerning Certain Methodological and Technical Problems Posed by Rocket Experiments Involving Animals

N64-27840--A Method of Continuous Registration of Local Cerebral Blood Flow in Acute and Chronic Experiments

N65-32277--Development of a Blood Pressure Transducer for the Temporal Artery

N65-11900--Instrument for Recording the Pulse Waves and Determining the Blood Pressure in Animals

A63-19640--The Development of an Implantable, Nonocclusive, Non-Invasive Blood Pressure Measuring System

In addition, he will himself obtain the following references: A65-81057, a Progress Report on Radio Telemetry from Outside the Body and A66-81864, Telemetry of Blood Pressure in Free-Ranging Animals Via an Intravascular Gauge.

GLM-4

TITLE: Implanted Blood Pressure Transducer

DATE SUBMITTED: 9 March 1967

SOURCE: Dr. F. H. Rudenberg, Associate Professor of Physiology, University of Texas Medical Branch, Galveston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank; this search also covers Problems GLM-5 and SRS-2.

SEARCH REQUEST SENT TO SEARCH CENTER: 26 May 1967 (same as SRS-2, GLM-5)

COMMUNICATIONS WITH NASA CENTERS:

21, 22 March 1967 Dr. Ware and Mr. Berger investigated this problem during their visit to Ames Research Center. Mr. G. Edwards, TU Officer, provided backup packages on the pressure transducers developed by Mr. G. Coon, researcher at Ames, and also arranged for a meeting with Mr. Coon. In the meeting, Mr. Coon demonstrated his devices and supplied information on current developments in his program to reduce the size of his capacitance pressure transducers still further.

24 May 1967 Dr. Ware called Dr. H. Sandler, Ames Research Center, to make further arrangements on transferring capacitance manometry.

29 May 1967 Mr. Berger advised Mr. G. Edwards of the tentatively scheduled visit to Ames Research Center to further the transfer of the capacitance transducers.

PROBLEM ABSTRACT DRAFT SUBMITTED: 25 May 1967 (same as SRS-2, GLM-5)

OTHER COMMUNICATIONS:

18 April 1967 Ames' backup package on miniaturized pressure transducers was sent to problem originator.

GLM-4 (cont'd)

10 May 1967 Dr. Ware and L. Berger visited problem originator and further explained details of construction and performance characteristics of Mr. Coon's family of capacitance devices.

GLM-6

TITLE: A Model Vascular System

DATE SUBMITTED: 9 March 1967

SOURCE: Robert N. Cooley, M.D., Professor and Chairman, Department of Radiology, University of Texas Medical Branch, Galveston, Texas

INITIAL DISPOSITION:

Computer search of NASA data bank was deferred until after direct contact with Lewis Research Center because it was understood that NASA research personnel there had utilized models of the cardiovascular system and were familiar with the literature.

COMMUNICATIONS WITH NASA CENTERS:

21 April 1967 Dr. Ware and Mr. Berger visited Ames Research Center where Mr. George Edwards, TU Officer, Ames Research Center, cited two reports of interest in connection with cardiovascular modeling. These were NASA Contractor Reports Nos. 162 and 214 prepared by the Vidya Corporation.

26 May 1967 Dr. Ware called Mr. Kirby Hiller, Lewis Research Center, to continue discussion initiated during site visit on 19 May. Mr. Hiller indicated that although the mathematical models which he had utilized were not reduced to hardware form, hardware models potentially applicable to this problem were in use at the Cleveland Clinic.