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

MONTHLY REPORT

**Contract No. NASW-1867
SwRI Project No. 13-2538**

**CASE FILE
COPY**

**Chief, Dissemination Branch, Code (UT)
Technology Utilization Division
Office of Technology Utilization
NASA
Washington, D. C. 20546**

November 1972

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

MONTHLY REPORT

1 November 1972 - 30 November 1972

Contract No. NASW-1867
SwRI Project No. 13-2538

Prepared for

Chief, Dissemination Branch, Code (UT)
Technology Utilization Division
Office of Technology Utilization
NASA
Washington, D.C. 20546

Approved:



C. William Hall, M. D.
Director
Department of Bioengineering

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

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SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

SUMMARY OF ACTIVITIES FOR THE PERIOD

<u>ACTIVITY:</u>	<u>NUMBER:</u>		
	<u>This Month</u>	<u>Cumulative Since 1/ 71</u>	<u>On Page</u>
PROBLEMS			
New Problems Accepted	6	175	8
Problems Rejected	0	4	10
Problems Inactivated	52	248	11
Problems Reactivated	0	5	13
Total Problems Currently Active	120		
PROBLEM STATEMENTS			
Preliminary Problem Statements Prepared	6	175	14
Problem Statements Submitted for Review	0	8	21
Problem Statements Disseminated	0	9	22
Responses to Problem Statements	1	47	23
Cumulative Problem Statements Prepared		175	
SEARCHES			
RDC Computer Searches Initiated	15	138	25
Other Searches Initiated	2	5	34
Searches Evaluated by Team Personnel	9	138	35
Searches Evaluated by Investigator	0	65	45
APPLICATIONS ENGINEERING			
New Candidated Submitted	2	25	46
Candidates Active as of Last Month		6	49
Currently Active A. E. Candidates	7		49
Candidates Dropped	0	22	50
Cumulative A. E. Candidates Submitted		25	---
TECHNOLOGY APPLICATIONS			
Potential Techn. Appl. as of Last Month		37	---
Potential Techn. Appl. Claimed	1	38	51
Items Dropped from Pot. Techn. Appl.	0	1	
Currently Active Potential Techn. Appl.			
Technology Applications Claimed	1	29	53
CONTACTS			
Contacts with Current User Institutions	66	1934	76
Contacts with Potential User Institutions	16	149	84
Contacts with NASA Centers	43	1396	87
Other Contacts	35	1265	92
APPENDICES			
			97

SPECIAL ACTIVITIES REPORT

SPECIAL ACTIVITIES REPORT

TCD - 9

Portable Voice Amplification System for Individuals
with partially paralyzed vocal cords

Robert L. Wilbur



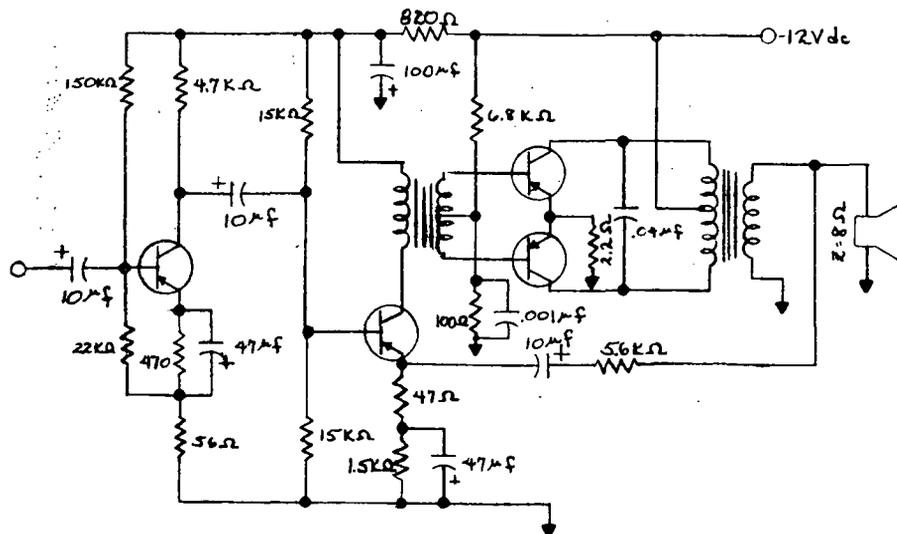
Initial evaluation reports from the problem originator on the utility of the portable voice amplification system were exceedingly encouraging.

Good results were achieved in portable use, especially in small groups or face to faces communication.

The problem originator requested that he would like to have a desk unit for his office which had more power and facilitate communication in a large room.

SwRI undertook this modest engineering effort and fabricated the unit shown below which is compatible with the ultra small microphone developed by MSC.

Shown below is the desk top device and the associated schematic. The original technology on the basic problem is documented in the 1972 Final Report on pages, 40-41.



REMOTE AMPLIFIER
SwRI BATCOM
R. L. WILBUR
M. HANZ
TCD-9

SPECIAL ACTIVITIES.....

Conference and Exhibit Activities

On November 20-22, 1972, the SwRI Team displayed the biomedical applications exhibit at the AMERICAN ASTRONAUTICAL SOCIETY CONFERENCE ON HEALTH CARE SYSTEMS USER-DEVELOPMENT. The following is a summary of the conference activities:

Tuesday, November 21, 1972

Dr. Paul B. Richards, President AAS User-Developer Conference Concept.

Dr. Vernon Wilson, Administrator, Health Services and Mental Health Administration, HEW, Washington, D. C., Keynote Address: Role of Government in Health Care.

Panel: Health Care Systems
Moderator: Dr. Eugene Konecci

Panelists:

1. Dr. Sam Poole, NASA MSC, Houston, Texas, NASA Activities
2. Dr. Horace Cromer, M. D., Austin, Texas, Practicing Physician's Point of View.
3. Dr. Michael O. Breitmeyer, Director of Clinical Laboratory, Xerox Center for Health Care, Designing Health Care Systems to User Conditions
4. Dr. Omer Bradsher, M. D., Paragould, Arkansas, Rural Medicine
5. Barney Oldfield, President, Searle Medidata, Inc., AMHT Developments
6. Dr. Jim Smith, Lockheed, Co., Houston, Texas, Systems Development Management.
7. Dr. Charles Thuss, M. D., Galindo & Thuss Associates, Pathology and Biomedical Testing.
8. Robert Pierson, Manager, Synthetic Rubber Research, Goodyear Tire and Rubber Company, Akron, Ohio, Role of Material Teaching in Developing Artificial Organs Heart.

SPECIAL ACTIVITIES...

Conference and Exhibit Activities, continued

Dinner: Speaker - Dr. Raymond Bisplinghoff, Deputy Director, National Science Foundation, Washington, D. C., Role of Government in Promoting Biomedical Research.

Wednesday, November 22, 1972

Panel: Special Health Care

Moderator: George Sullivan, M. D., General Electric Company
Philadelphia, Pennsylvania

Panelists:

1. Dr. Fred Vogt, Professor of Biomedical Engineering and Electrical Engineering, University of Texas, Emergency Health Care.
2. Paul Domanovsky, Chief Engineer, Vought Helicopter, Inc., Dallas, Texas, Emergency Health Care, Helicopter Potential
3. Haig Kafafian, President, Cybernetics Research Institute, Washington, D. C., Technology for the Handicapped.
4. Dr. Robert Lebovitz, Assistant Professor, Southwest Medical School, Dallas, Texas, Electronic Medicine.

The Conference was designed to allow the Health Care Systems developers from industry to show to the physicians that they are developing time saving systems, and not trying to practice medicine. Attendance at the BATEam exhibit was excellent, and comments regarding the display were favorable.

The SwRI Biomedical Applications Team has accepted an invitation to participate in the 50th ANNUAL CONFERENCE OF THE AMERICAN PHYSICAL THERAPY ASSOCIATION, on June 26, 1973. Sam McFarland, Biomedical Engineer, is formulating a presentation centered on contributions of the Space Program to Rehabilitation, featuring composite brace materials and the powered prosthetic hook.

SPECIAL ACTIVITIES....

Conference and Exhibit Activities, continued

Fabrication and delivery was completed by the SwRI BA Team on two evoked response audiometric helmets for use in the NASA AIRPORT DISPLAY. (Support extension of original SwRI Problem and Application efforts on SWC-1, "EEG Helmet for Infants and Children.")

Marketing/Manufacturing Potential Activities

The NASA/Langley developed PATIENT ASSIST DEVICE (documented as Problem/Application HSR-7) is receiving relatively active discussion as a manufacturing item. Contact with Mr. Charles P. Boyle at Goddard put SwRI team members in touch with State Senator Michael H. O'Keefe of New Orleans who is definitely interested in the possibility of manufacturing the patient assist device in relation to his efforts to help minority groups establish business/manufacturing setups. Two other commercial organizations have also shown interest in the manufacture of the NASA original solid-state circuitry device.

At the same time, a New York VA Hospital is working on a similar device with manufacturing potential using conventional relays. NASA Technology Utilization members in Washington are following the economics potential of these items with continued interest.

Public Information/Publicity Activities

On November 28, 1972, Sam McFarland, SwRI Biomedical Engineer, appeared on a local television news/interview program (WOAI-TV, Channel 4). Interview was conducted on the development of new composite materials for leg braces utilizing aerospace technology. Discussion centered around an explanation of the composite material, what it is, and how its potentials are being explored in the biomedical field. Mr. McFarland showed examples of conventional bulky leg braces and a new composite prototype brace being developed by NASA (documented as Problem SWR-1).

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

I. PROBLEMS
A. NEW PROBLEMS ACCEPTED

The following is a list of new Biomedical Problems accepted during the period covered by this report:

<u>Problem Number</u>	<u>Problem Title</u>	<u>Health Area</u>	<u>Probable Solution Requirements</u>
UTM-39	Multi-Channeled Hypothermia Blanket for Heart Surgery	16	D
UTM-40	Detecting Oxygen Toxicity in the Lung	18	A
UTM-41	Measurement of Thrombus Adhesion to Blood Vessel Wall	07	A
UTM-42	Composites for Internal Biocompatible Prostheses	04	E
UTM-43	Techniques for Characterizing Surface Roughness Under Electron Micrography	04	G
UTM-44	Detection/Measurement of Microbubbles or Microthrombi in the Blood	04	A

Health Area Impact

- 01 - Communicable Disease
- 02 - Multiphasic Health Screening
- 03 - Rehabilitation Medicine
- 04 - Artificial Organs
- 05 - Organ Assist Devices
- 06 - Mental Health
- 07 - Heart Disease Treatment
- 08 - Cancer
- 09 - Ecology
- 10 - Health Care Cost Reduction
- 11 - Remote Health Services
- 12 - Medical Personnel
- 13 - Kidney Disease
- 14 - Infant Mortality
- 15 - Respiratory Disease
- 16 - Surgical Procedures
- 17 - Dental Medicine
- 18 - Basic Medical Research
- 19 - Other

Requirement Code

- A - Analytic Instrument Systems
- B - System Components
- C - Computer Programs
- D - Prosthetic Devices
- E - Materials/Chemicals
- F - Therapeutic Equipment
- G - Other

HEALTH AREA IMPACT CATEGORIES

TOTAL								6
Communicable Disease								
Multiphasic Health Screening								
Rehabilitation Medicine								
Artificial Organs	1				1		1	3
Organ Assist Devices								
Mental Health								
Heart Disease Treatment	1							1
Cancer Detection								
Ecology								
Health Care Cost Reduction								
Remote Health Services								
Medical Personnel								
Kidney Disease								
Infant Mortality								
Respiratory Disease								
Surgical Procedures					1			1
Dental Medicine								
Basic Medical Research	1							1
Other								
	Analytic Inst. Systems							
	System Components (Equipt.)							
	Computer Programs							
	Prosthetic Devices							
	Materials/Chemicals							
	Therapeutic Equipment							
	Other							
	TOTAL							

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

I. PROBLEMS
 IMPACT AREA/REQUIREMENT MATRIX

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

I. PROBLEMS
C. PROBLEMS INACTIVATED

The following is a list of Biomedical Problems inactivated during the period covered by this report:

<u>Problem No.</u>	<u>Prof. Effort</u>	<u>Time Elapsed Since Accepted</u>	<u>Inactivation Code</u>
BLM-10	85.5 Hours	41 Months	C
BLM-13	101.0 Hours	38 Months	B
BLM-25	78.5 Hours	31 Months	C
BMC-1	103.5 Hours	22 Months	E
CHS-3	79.0 Hours	23 Months	E
CHS-5	74.0 Hours	23 Months	E
CHS-11	35.0 Hours	23 Months	E
CHS-12	46.0 Hours	22 Months	E
CHS-14	66.5 Hours	17 Months	E
CLA-3	73.0 Hours	15 Months	A
GLM-37	48.5 Hours	26 Months	E
GLM-41	19.5 Hours	10 Months	E
GLM-42	29.0 Hours	10 Months	E
LVA-7	47.0 Hours	29 Months	C
MHB-1	48.5 Hours	19 Months	E
MHB-2	57.0 Hours	19 Months	E
MVA-2	62.0 Hours	20 Months	E
NMA-3	33.0 Hours	29 Months	C
NMA-12	39.5 Hours	25 Months	E
OCH-7	73.0 Hours	17 Months	E
PVA-3	59.0 Hours	27 Months	B
PVA-4	43.5 Hours	27 Months	B
PVA-5	37.5 Hours	27 Months	B
PVA-6	54.5 Hours	22 Months	B
RNV-37	50.5 Hours	16 Months	F
RNV-38	62.5 Hours	15 Months	C
RNV-39	72.5 Hours	14 Months	F
RRC-7	28.5 Hours	23 Months	C

Inactivation Code:

- A - Technology Application Accomplished
- B - Investigator Has No Further Interest
- C - Investigator Has Found His Own Solution
- D - Investigator Has Left Institution
- E - No Applicable NASA Technology Was Found
- F - Other

I. Problems

C. Problems Inactivated (continued)

<u>Problem No.</u>	<u>Prof. Effort</u>	<u>Time Elapsed Since Accepted</u>	<u>Inactivation Code</u>
SJH-1	79.0 Hours	32 Months	C
SJH-2	43.0 Hours	27 Months	C
SNM-24	35.5 Hours	15 Months	B
SWC-6	55.0 Hours	31 Months	D
SWC-13	28.0 Hours	16 Months	C
TAM-1	58.0 Hours	25 Months	F
TAR-1	38.0 Hours	16 Months	E
TCB-1	63.5 Hours	18 Months	F
TCB-4	43.5 Hours	18 Months	F
TCB-5	33.5 Hours	18 Months	C
TCH-1	37.5 Hours	25 Months	B
UAD-1	35.5 Hours	15 Months	E
UAD-2	29.5 Hours	15 Months	E
UAD-5	36.0 Hours	15 Months	E
UAD-6	40.5 Hours	15 Months	E
UAM-3	36.5 Hours	26 Months	E
UAM-5	38.5 Hours	26 Months	F
UAM-12	22.5 Hours	24 Months	E
UOF-3	21.5 Hours	09 Months	E
UOW-1	40.5 Hours	09 Months	C
USC-9	03.0 Hours	27 Months	E
UTM-24	48.0 Hours	24 Months	C
UTM-35	43.0 Hours	19 Months	F
UTM-36	37.0 Hours	19 Months	F

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

I. PROBLEMS
D. PROBLEMS REACTIVATED

The following is a list of Biomedical Problems reactivated during the period covered by this report:

<u>Problem No.</u>	<u>Reason(s) for Reactivation</u>
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No problems reactivated during this report period.

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

II. PROBLEM STATEMENTS

A. PRELIMINARY PROBLEM STATEMENTS PREPARED

Listed below are the Preliminary Problem Statements which were prepared during the period covered by this report. The following pages present copies of these statements.

<u>Problem No.</u>	<u>Problem Title</u>
UTM-39	Multi-Channeled Hypothermia Blanket for Heart Surgery
UTM-40	Detecting Oxygen Toxicity in the Lung
UTM-41	Measurement of Thrombus Adhesion to Blood Vessel Wall
UTM-42	Composites for Internal Biocompatible Prostheses
UTM-43	Techniques for Characterizing Surface Roughness Under Electron Micrography
UTM-44	Detection/Measurement of Microbubbles or Microthrombi in the Blood

PRELIMINARY PROBLEM STATEMENT

IDENTIFICATION

Problem No:	UTM-39	Date of Preparation:	Nov. 8, 1972
Problem Title:	Multi-Channeled Hypothermia Blanket for Heart Surgery		
		Date of Acceptance:	Nov. 7, 1972
Institution:	University of Utah Medical School, Salt Lake City, Utah		
Department:	Artificial Organs Research		
Investigator:	C. S. Kwan-Gett, M.D.		
Consultant/Coordinator (if any):			
BATeam Personnel:	Sam McFarland		

WHAT IS NEEDED: A plastic envelope containing a convoluted channel for passage of chilled water; to be used during surgery with hypothermia to encircle the exposed heart organ.

MEDICAL SPECIALTY: 16

REQUIREMENT: D

BACKGROUND: It has been accepted by surgeons in heart surgery that heart muscle tissue survives for prolonged periods at reduced temperatures during extra-corporeal (or heart by-pass) circulation assisted surgery. Present technique involves constant bathing of the exposed organ with chilled water and attendant syphoning off of the spilled fluid from the opened pericardial cavity. The proposed surgical device could enshroud the heart in a chilled blanket, yet offer the advantages of a closed water system.

CONSTRAINTS AND SPECIFICATIONS: The material chosen should remain flexible at temperatures near 0°C. A familiar grade of vinyl or other plastic would allow modification with scalpel and surgical tools, as well as needed sterilization.

OTHER COMMENTS: The proposed device would not only clean up the present technique, but would free at least one surgical assistant.

PROBLEM STATUS: NASA Recon computer search has been initiated.

PRELIMINARY PROBLEM STATEMENT

IDENTIFICATION

Problem No: UTM-40	Date of Preparation: Nov. 8, 1972
Problem Title: Detecting Oxygen Toxicity in the Lung	Date of Acceptance: Nov. 8, 1972
Institution: University of Utah Medical School, Salt Lake City, Utah	
Department: Artificial Organs Research	
Investigator: Donald Olsen, D. V. M.	
Consultant/Coordinator (if any):	
BATeam Personnel: Sam McFarland	

WHAT IS NEEDED: Latest physiological resource information related to effects of breathing air which is rich in O₂; as well as a means of detecting these effects by some instrumentation.

MEDICAL SPECIALTY:

18

REQUIREMENT: A

BACKGROUND: Test animals (Calves and Sheep) which are being used as artificial heart transplant recipients are placed in an oxygen-rich breathing environment (approx. 85% by volume) during intensive care recovery. Since the period of IC observation is prolonged beyond normal recovery periods, the animal breathes the O₂ enriched air for long periods of time. Symptoms not unlike those of HYALIN MEMBRANE DISEASE* have been observed, leading toward suspicion that the lung gas-exchange tissues have become altered by overexposure to oxygen.

*Reduced ability to transfer O₂ and CO₂ to and from the circulatory system.

CONSTRAINTS AND SPECIFICATIONS: None at present.

OTHER COMMENTS: The researcher wonders if the NASA manned flight programs have encountered any similar phenomena and if aversive techniques or detection techniques have been developed for signaling the evidence of such effects.

PROBLEM STATUS: NASA Recon search has been initiated.

PRELIMINARY PROBLEM STATEMENT

IDENTIFICATION

Problem No: UTM-41	Date of Preparation: Nov. 9, 1972
Problem Title: Measurement of Thrombus Adhesion to Blood Vessel Wall	
	Date of Acceptance: Nov. 9, 1972
Institution: University of Utah	
Department: Materials Engineering	
Investigator: Donald Lyman, Ph.D.	
Consultant/Coordinator (if any):	
BATeam Personnel: Sam McFarland	

WHAT IS NEEDED: A means of measuring the forces of adhesion between blood vessel wall and blood clots (thrombi) by measuring forces required for thrombus removal or otherwise.

MEDICAL SPECIALTY: 7

REQUIREMENT: A

BACKGROUND: One of the major obstacles to progress in artificial heart research and cardiovascular disease treatment is insufficient understanding of causes and effects of clot formation, including the means for determining the attractive or adhesive forces between forming clots (thrombi) and vessel walls or other tissue contact surfaces. In the process of developing artificial tissues for circulatory transplant, a reduction in tendency to form and hold clots is imperative.

CONSTRAINTS AND SPECIFICATIONS: The feasibility of conducting the indicated measurements may refine itself only to artificial vessel and tissue material. An invasive technique is undesirable, since blood trauma resulting from the measurement system might confuse other observations.

OTHER COMMENTS: The problem originator proposes the possibility that a controlled beam of ultrasound might be used to shake a thrombus loose, thereby correlating sound intensity or frequency to adhesive forces.

PROBLEM STATUS: NASA Recon search has been initiated.

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

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PRELIMINARY PROBLEM STATEMENT

IDENTIFICATION

Problem No:	UTM-43	Date of Preparation:	Nov. 9, 1972
Problem Title:	Techniques for Characterizing Surface Roughness Under Electron Micrography		
		Date of Acceptance:	Nov. 9, 1972
Institution:	University of Utah, Salt Lake City, Utah		
Department:	Materials Engineering		
Investigator:	Donald Lyman, Ph.D.		
Consultant/Coordinator (if any):			
BATeam Personnel:	Sam McFarland		

WHAT IS NEEDED: Researcher needs techniques (staining, e.g.) for helping characterize tissue surfaces (roughness, topography) under Scanning of Fixed Electron Microscope.

MEDICAL SPECIALTY: 04

REQUIREMENT: G

BACKGROUND: Researcher is involved with investigating material compatibility problems related to artificial organs research. Among those areas of concern is the need to know more about the contact surface characteristics of both biological and artificial tissues such as blood vessels. Apparently no known technique helps to characterize such things as topography, depth of tissues, height of nodules and peaks, etc.

CONSTRAINTS AND SPECIFICATIONS: None at present.

OTHER COMMENTS: No further comments at this time.

PROBLEM STATUS: NASA Recon search has been initiated.

PRELIMINARY PROBLEM STATEMENT

IDENTIFICATION

Problem No:	<u>UTM-44</u>	Date of Preparation:	<u>Nov. 8, 1972</u>	
Problem Title:	<u>Detection/Measurement of Microbubbles or Microthrombi</u>		Date of Acceptance:	<u>Nov. 8, 1972</u>
	<u>in the Blood</u>			
Institution:	<u>University of Utah/Research Foundation</u>			
Department:	<u>Artificial Heart Test Facility</u>			
Investigator:	<u>Norman DeGroot</u>			
Consultant/Coordinator (if any):	<u></u>			
BATeam Personnel:	<u>Sam McFarland</u>			

WHAT IS NEEDED: Equipment or technique for detecting and measuring small gas bubbles and blood clots in the circulation.

MEDICAL SPECIALTY:

04

REQUIREMENT: A

BACKGROUND: This facility tests and evaluates extracorporeal circulation devices. Among those common effects from "heart-lung" type devices is the occurrence of micro bubbles and micro-blood clots in the circulating blood. The evaluation could be greatly assisted if the presence of these foreign substances could be quantified.

CONSTRAINTS AND SPECIFICATIONS: The equipment associated with any such measurement should be non-invasive so as not to cause blood trauma in itself. This facility has minor mechanical and electronic fabrication capability on site, as well as access to printed circuit board and microcircuit facilities and technicians. It may be desirable to eventually consider connections to an in-house physiological data-gathering system.

OTHER COMMENTS: No further comments at present.

PROBLEM STATUS: A NASA Recon search has been initiated. Results should be forwarded to Bob Wilbur for evaluation.

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

II. PROBLEM STATEMENTS

B. PROBLEM STATEMENT DRAFTS SUBMITTED FOR REVIEW

Listed below are the Problem Statement drafts for the Biomedical Problems which were submitted for review during the period covered by this report. Copies of these Problem Statements are found on the following pages.

Problem No.

Problem Title

None during this report period.

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

II. PROBLEM STATEMENTS
C. PROBLEM STATEMENTS DISSEMINATED

Listed below are Problem Statements for the Biomedical Problems which were disseminated during the period covered by this report. Copies of these Problem Statements if different from those previously submitted for review, are presented on the following pages.

<u>Problem No.</u>	<u>Distribution</u>	<u>Date Sent</u>
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None during this report period.

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

II. PROBLEM STATEMENTS

D. RESPONSES TO PROBLEM STATEMENTS RECEIVED

On the following pages are copies of responses to Problem Statements for the Biomedical Problems listed below which were received during the period covered by this report.

<u>Problem Number</u>	<u>Distribu- tion Date</u>	<u>Date of Receipt</u>	<u>Field Center</u>	<u>Initial Team Evaluation of Applicability/Utility of Response</u>
LVA-8	2 Oct 1972	16 Nov. 1972	MFSC	Forwarded information to problem originator. Awaiting response/evaluation.



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA 35812

NOV 16 1972

REPLY TO
ATTN OF:

A&PS-TU

November 13, 1972

Dr. David F. Culclasure
Biomedical Applications Program
Southwest Research Institute
8500 Culebra Road
P. O. Drawer 28510
San Antonio, Texas 78284

Dear Dave:

Jim Wiggins asked me to reply to your letter of October 2, 1972 requesting assistance for Dr. Milne of the VA Hospital, Long Beach.

Dr. Jim Stuckey, Head of the Chemistry Branch at MSFC recommends "Delrin" an acetal resin manufactured by the Cadillac Plastics & Chemicals Company, 15111 Second Avenue, Detroit, Michigan, or Vespel" a polyimide made by DuPont as possibly suitable for the mixing-bowl application.

Glad to have been of help. Best wishes.

Sincerely yours,

H. L. Martin
Technology Utilization Office

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

III. SEARCHES

A. RDC COMPUTER SEARCHES INITIATED

On the following pages are copies of RDC Computer Search forms for the Biomedical Problems listed below, for which searches were initiated during the period covered by this report.

<u>PROBLEM No.</u>	<u>R.DC SEARCH No.</u>
CHS-7	RECON (see III.C. for Report)
CPT-1	RECON (see III.C. for Report)
LSU-1	RECON
LSU-2	RECON
TTU-1	RECON
TTU-2	RECON
UTM-39	RECON (see III.C. for Report)
UTM-40	RECON
UTM-41	RECON (see III.C. for Report)
UTM-42	RECON (see III.C. for Report)
UTM-43	RECON (see III.C. for Report)
UTM-44	RECON (see III.C. for Report)
WMC-1	RECON
WMC-2	RECON
WMC-3	RECON

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: <u>LSU-1 "Physiological Effects of Motion</u>	
<u>Sickness Drugs"</u>	
RDC: <u>RECON</u>	Search Title: <u>Same</u>
Search No. <u>T612</u>	

INITIATION

Date Search Initiated: <u>11-6-72</u>	Search Terms: _____
<u>Motion sickness, drugs, specific pharmacology, nausea,</u>	
<u>antinauseants.</u>	

TEAM EVALUATION

Date Search Results Received: <u>11-20-72</u>	No. Citations: <u>142</u>
Date Evaluation Completed: _____	No. Relevant Citations: _____
Team Evaluation: _____	

Date Relevant Citations Sent to Researcher: _____	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____

No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____	Date Received: _____
Date Documents Sent to Researcher: _____	
Researcher Evaluation: _____	
_____	No. Hits: _____
HITS: _____	_____
_____	_____
_____	_____

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: LSU-2 "Whole Body Radiation Measurement"
RDC: RECON Search Title: Same
Search No. T613

INITIATION

Date Search Initiated: 11-6-72 Search Terms: _____
Radiation measurement, fallout, animal radiation measurement/effects,
radiation studies, radiation meters, indicators, human radiation
measurement/effects.

TEAM EVALUATION

Date Search Results Received: 11-20-72 No. Citations: 250
Date Evaluation Completed: _____ No. Relevant Citations: _____
Team Evaluation: _____
Date Relevant Citations Sent to Researcher: _____

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____
No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____ Date Received: _____
Date Documents Sent to Researcher: _____
Researcher Evaluation: _____
_____ No. Hits: _____
HITS: _____

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: <u>TTU-1 "Automated Instructional Activity</u> <u>Machines for Mental Retardates"</u>	
RDC: <u>RECON</u>	Search Title: <u>Same</u>
Search No. <u>T0615</u>	

INITIATION

Date Search Initiated: <u>11-6-72</u>	Search Terms: <u>Instructional machines, vocational teaching methods/rehabilitation area stimulation, psychological/environmental relationships</u>
---------------------------------------	---

TEAM EVALUATION

Date Search Results Received: <u>11-24-72</u>	No. Citations: <u>67</u>
Date Evaluation Completed: _____	No. Relevant Citations: _____
Team Evaluation: <u>Search sent to relevant on-site BAT Consultant who will evaluate search and hand deliver to Researcher for final eval.</u>	
Date Relevant Citations Sent to Researcher: <u>11-24-72</u>	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____
No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____	Date Received: _____
Date Documents Sent to Researcher: _____	
Researcher Evaluation: _____	No. Hits: _____
HITS: _____	

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: <u>TTU-2 "Vocational Assessment Apparatus</u> <u>for the Physically & Culturally Handicapped Person"</u>	
RDC: <u>RECON</u>	Search Title: <u>Evaluation of Psychomotor Skills</u>
Search No. <u>T0616</u>	

INITIATION

Date Search Initiated: <u>11-6-72</u>	Search Terms: _____
<u>Psychomotor skills, evaluation, measurement, instrumentation,</u> <u>vocational rehabilitation methods/conditioning.</u>	

TEAM EVALUATION

Date Search Results Received: <u>11-15-72</u>	No. Citations: <u>113</u>
Date Evaluation Completed: _____	No. Relevant Citations: _____
Team Evaluation: <u>Search sent to relevant on-site BAT Consultant who</u> <u>will evaluate search and hand deliver to Researcher for final eval.</u>	
Date Relevant Citations Sent to Researcher: _____	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____

No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____	Date Received: _____
Date Documents Sent to Researcher: _____	
Researcher Evaluation: _____	
_____ No. Hits: _____	
HITS: _____	

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: UTM-40 "Detecting Oxygen Toxicity in the Lung"	
RDC: RECON	Search Title: Same
Search No. T0618	

INITIATION

Date Search Initiated: 11-15-72	Search Terms:
Hyalin Membrane Disease, oxygen environmental studies, artificial heart surgery, recovery, lungs, circulatory system.	

TEAM EVALUATION

Date Search Results Received: 11-21-72	No. Citations: 463
Date Evaluation Completed:	No. Relevant Citations:
Team Evaluation:	
Date Relevant Citations Sent to Researcher:	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher:
Researcher Evaluation:
No. Documents Requested by Researcher:

DOCUMENTS

Date Documents Ordered:	Date Received:
Date Documents Sent to Researcher:	
Researcher Evaluation:	No. Hits:
HITS:	

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: <u>WMC-1 "Plethysmographic Data Interfacing System"</u>	
RDC: <u>RECON</u>	Search Title: <u>Same</u>
Search No. <u>T614</u>	

INITIATION

Date Search Initiated: <u>11-6-72</u>	Search Terms: _____
<u>Plethysmography, computer programs, pattern recognition, data systems.</u>	

TEAM EVALUATION

Date Search Results Received: <u>11-20-72</u>	No. Citations: <u>202</u>
Date Evaluation Completed: _____	No. Relevant Citations: _____
Team Evaluation: _____	

Date Relevant Citations Sent to Researcher: _____	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____

No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____	Date Received: _____
Date Documents Sent to Researcher: _____	
Researcher Evaluation: _____	
_____	No. Hits: _____
HITS: _____	

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: WMC-2 "Identification of Korotkoff
Diastolic Point"
RDC: RECON Search Title: Same
Search No. T617

INITIATION

Date Search Initiated: 11-6-72 Search Terms:
Bioinstrumentation, blood pressure, systolic, diastolic,
computer methods, techniques, phase detection, waveforms,
monitors.

TEAM EVALUATION

Date Search Results Received: 11-20-72 No. Citations: 114
Date Evaluation Completed: _____ No. Relevant Citations: _____
Team Evaluation: _____
Date Relevant Citations Sent to Researcher: _____

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____
No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____ Date Received: _____
Date Documents Sent to Researcher: _____
Researcher Evaluation: _____ No. Hits: _____
HITS: _____

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: <u>WMC-3 "Optimum Methodology for</u> <u>Analyzing Cardiovascular Data"</u>	
RDC: <u>RECON</u>	Search Title: <u>Same</u>
Search No. <u>T614</u>	

INITIATION

Date Search Initiated: <u>11-6-72</u>	Search Terms: _____ <u>Electrocardiography, computer programs, data systems,</u> <u>instrumentation, methodology.</u>
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TEAM EVALUATION

Date Search Results Received: <u>11-20-72</u>	No. Citations: <u>202</u>
Date Evaluation Completed: _____	No. Relevant Citations: _____
Team Evaluation: _____	
Date Relevant Citations Sent to Researcher: _____	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____
No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____	Date Received: _____
Date Documents Sent to Researcher: _____	
Researcher Evaluation: _____	No. Hits: _____
HITS: _____	

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

III. SEARCHES
B. OTHER SEARCHES INITIATED

The following is a list of Biomedical Problems for which searches other than RDC Computer searches were conducted during the period covered by this report:

<u>Problem No.</u>	<u>Description of Search and Search Results</u>
AEB-4	Manual search of NASA Tech Briefs...located B72-10032 "An Improved Aesthesiometer". Sent for engineering package at MSC. Letter returned from John Wheeler yielded sufficient engineering support and patent information. Copies of all documentation in hands of Problem Originator who reports enthusiasm to proceed with fabrication of instrument.
TCB-18	Manual search of NASA Tech Briefs...located B72-10337 "Nonflammable Potting, Encapsulating and/or Conformal Coating Compound" Technical support package was already on file at SwRI from MSC. Presently in contact with our automotive research dept. at SwRI who is currently working with a similar compound for highway safety. Plans call for coating the canes for the blind (see original problem statement) with this compound for evaluation (reflectivity, abrasive resistance, etc) and evaluating the mix reported in the above Tech Brief for possible NASA application to problem.

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

III. SEARCHES

C. SEARCHES EVALUATED BY TEAM PERSONNEL

On the following pages are copies of RDC Computer Search forms for the Biomedical Problems listed below for which searches have been evaluated by the Team personnel during the period covered by this report.

<u>Problem No.</u>	<u>Search No.</u>	<u>No. Citations</u>	<u>No. Relevant</u>
CHS-7	RECON T609	69	18
CPT-1	RECON T611	196	17
UTM-39	RECON T620	120	5
UTM-41	RECON T621	80	0
UTM-42	RECON T619	21	3
UTM-43	RECON T0622	225	17
UTM-44	RECON T621	80	3
TCB-18	RECON T537	41	0
TCB-19	RECON T00538	32	1

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: <u>CHS-7 "Magnetic Stimulation for Deaf-Blind Patients"</u>	
RDC: <u>RECON</u>	Search Title: <u>Microelectrode Stimulation of the</u>
Search No. _____	_____

INITIATION

Date Search Initiated: <u>11-6-72</u>	Search Terms: <u>Brain, stimulus, electrodes, implants, motivation, biocontrol systems, biotelemetry, electronic control, sensory stimulation.</u>
_____	_____
_____	_____

TEAM EVALUATION

Date Search Results Received: <u>11-20-72</u>	No. Citations: <u>69</u>
Date Evaluation Completed: <u>11-24-72</u>	No. Relevant Citations: <u>18</u>
Team Evaluation: <u>Search citations showed increase in development of sensory stimulation instrumentation/conditioning for human subjects.</u>	
Date Relevant Citations Sent to Researcher: <u>11-24-72</u>	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____

No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____	Date Received: _____
Date Documents Sent to Researcher: _____	_____
Researcher Evaluation: _____	_____
_____	No. Hits: _____
HITS: _____	_____
_____	_____
_____	_____

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: CPT-1 "Head Control Conditioning and/or Teaching Methods for Athetoids"

RDC: RECON Search Title: Same

Search No. T611

INITIATION

Date Search Initiated: 11-6-72 Search Terms: Muscles, function, training, conditioning, teaching, head, posture, eye movement, conditioned response, vestibular tests, education, learning.

TEAM EVALUATION

Date Search Results Received: 11-27-72 No. Citations: 196

Date Evaluation Completed: 11-27-72 No. Relevant Citations: 17

Team Evaluation: Very good results from search particularly in design approach

Date Relevant Citations Sent to Researcher: 11-30-72

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____

Researcher Evaluation: _____

No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____ Date Received: _____

Date Documents Sent to Researcher: _____

Researcher Evaluation: _____

_____ No. Hits: _____

HITS: _____

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: <u>UTM-39 "Multi-Channeled Hypothermia</u> <u>Blanket for Heart Surgery:"</u>	
RDC: <u>RECON</u>	Search Title: <u>Liquid cooling enclosure</u>
Search No. <u>T620</u>	<u>for heart surgery</u>

INITIATION

Date Search Initiated: <u>11-15-72</u>	Search Terms: <u>Cooling systems,</u> <u>liquids, jackets, envelopes, coverings, hypothermia, surgery,</u> <u>channel flow, protective clothing.</u>
--	--

TEAM EVALUATION

Date Search Results Received: <u>11-27-72</u>	No. Citations: <u>120.</u>
Date Evaluation Completed: <u>11-27-72</u>	No. Relevant Citations: <u>5</u>
Team Evaluation: <u>References indirect, may need to redefine with</u> <u>new search terms and re-search the problem.</u>	
Date Relevant Citations Sent to Researcher: <u>11-28-72</u>	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____
No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____	Date Received: _____
Date Documents Sent to Researcher: _____	
Researcher Evaluation: _____	No. Hits: _____
HITS: _____	

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: UTM-41 "Measurement of Thrombus Adhesion to Blood Vessel Wall"	
RDC: RECON	Search Title: Same as Title
Search No. T621	

INITIATION

Date Search Initiated: 11-15-72	Search Terms: Bioinstrumentation, blood vessels, clotting, measurement, ultrasonics, adhesion, arteries.

TEAM EVALUATION

Date Search Results Received: 11-27-72	No. Citations: 80
Date Evaluation Completed: 11-27-72	No. Relevant Citations: 0
Team Evaluation: Attempt to redefine search terms and re-search the problem.	
Date Relevant Citations Sent to Researcher: 11-28-72	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____
No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____	Date Received: _____
Date Documents Sent to Researcher: _____	
Researcher Evaluation: _____	No. Hits: _____
HITS: _____	

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: <u>UTM-42 "Composites for Internal Biocompatible Protheses"</u>	
RDC: <u>RECON</u>	Search Title: <u>Biocompatible Internal</u>
Search No. <u>T619</u>	<u>Composite Materials.</u>

INITIATION

Date Search Initiated: <u>11-15-72</u>	Search Terms: <u>Prosthetics,</u>
<u>biocompatibility, implantation, composite materials, bone interfaces.</u>	

TEAM EVALUATION

Date Search Results Received: <u>11-24-72</u>	No. Citations: <u>21</u>
Date Evaluation Completed: <u>11-27-72</u>	No. Relevant Citations: <u>3</u>
Team Evaluation: <u>Citations rather sketchy, but latest composite materials development could prove useful.</u>	
Date Relevant Citations Sent to Researcher: <u>11-28-72</u>	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____

No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____	Date Received: _____
Date Documents Sent to Researcher: _____	
Researcher Evaluation: _____	
_____	No. Hits: _____
HITS: _____	_____
_____	_____

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: <u>UTM-43 "Techniques for Characterizing</u> <u>Surface Roughness Under Electron Micrography"</u>	
RDC: <u>RECON</u>	Search Title: <u>Same as Title</u>
Search No. <u>T0622</u>	

INITIATION

Date Search Initiated: <u>11-15-72</u>	Search Terms: <u>Tissue, skin,</u> <u>surface roughness, measurement, electron micrography, membranes,</u> <u>topography.</u>

TEAM EVALUATION

Date Search Results Received: <u>11-24-72</u>	No. Citations: <u>225</u>
Date Evaluation Completed: <u>11-27-72</u>	No. Relevant Citations: <u>17</u>
Team Evaluation: <u>Search might be too general. Results possibly too</u> <u>broad. Need possible redefinition of the problem.</u>	
Date Relevant Citations Sent to Researcher: <u>11-28-72</u>	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____

No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____	Date Received: _____
Date Documents Sent to Researcher: _____	
Researcher Evaluation: _____	
_____ No. Hits: _____	
HITS: _____	

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: UTM-44 "Detection/Measurement of	
Microbubbles or Microthrombi in the Blood"	
RDC: RECON	Search Title: Same as Title
Search No. T621	

INITIATION

Date Search Initiated: 11-15-72	Search Terms: Bioinstrumentation,
	blood vessels, clotting, measurement, ultrasonics, bubbles, arteries

TEAM EVALUATION

Date Search Results Received: 11-27-72	No. Citations: 80
Date Evaluation Completed: 11-27-72	No. Relevant Citations: 3
Team Evaluation: Minimal application, send to Problem Originator	
for further input or restatement of search terms.	
Date Relevant Citations Sent to Researcher: 11-28-72	

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____

No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____	Date Received: _____
Date Documents Sent to Researcher: _____	
Researcher Evaluation: _____	
_____	No. Hits: _____
HITS: _____	_____
_____	_____

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: TCB-18 "Permanent Reflective Coating for
use on Canes for the Blind"
RDC: RECON Search Title: Light Reflective Coatings
Search No. T537

INITIATION

Date Search Initiated: 5-1 -72 Search Terms: _____
Light reflective coatings

TEAM EVALUATION

Date Search Results Received: 5-12-72 No. Citations: 41
Date Evaluation Completed: 11-24-72 No. Relevant Citations: 0
Team Evaluation: None readily applicable to problem, most coatings
too heavy for subject material.
Date Relevant Citations Sent to Researcher: 11-14-72

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: _____
Researcher Evaluation: _____

No. Documents Requested by Researcher: _____

DOCUMENTS

Date Documents Ordered: _____ Date Received: _____
Date Documents Sent to Researcher: _____
Researcher Evaluation: _____

No. Hits: _____
HITS: _____

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM
COMPUTER SEARCH REPORT

IDENTIFICATION

Problem No. and Title: <u>TCB-19 "Navigation Assistance to Keep Blind on a Set Direction"</u>
RDC: <u>RECON</u> Search Title: <u>Guidance Systems</u>
Search No. <u>T00538</u>

INITIATION

Date Search Initiated: <u>5-1-72</u> Search Terms: _____
<u>Very broad terms: gyroscopes, instrumentation, terms.</u>

TEAM EVALUATION

Date Search Results Received: <u>5-10-72</u> No. Citations: <u>32</u>
Date Evaluation Completed: <u>11-14-72</u> No. Relevant Citations: <u>1</u>
Team Evaluation: <u>Results sketchy as expected, but bibliography of value in general.</u>
Date Relevant Citations Sent to Researcher: <u>see below</u>

RESEARCHER EVALUATION

Date Evaluation Received from Researcher: <u>11-14-72 by phone</u>
Researcher Evaluation: <u>Discussed search by phone. P.O. gave go-ahead to order the one relevant document.</u>
No. Documents Requested by Researcher: <u>(1)</u>

DOCUMENTS

Date Documents Ordered: <u>11-14-72</u> Date Received: _____
Date Documents Sent to Researcher: _____
Researcher Evaluation: _____
_____ No. Hits: _____
HITS: _____

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

III. SEARCHES

D. SEARCHES EVALUATED BY THE INVESTIGATOR

On the following pages are copies of RDC Computer Search forms for the Biomedical Problems listed below for which documents have been reviewed by the problem originator during the period covered by this report.

<u>Problem No.</u>	<u>Search No.</u>	<u>No. Citations</u>	<u>No. Relevant</u>	<u>No. Hits</u>
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No search evaluations received from investigators this report period.

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

IV. APPLICATIONS ENGINEERING
A. NEW CANDIDATES

<u>Applicable NASA Technology and Source</u>	<u>Problem Number</u>	<u>A. E. Start Date</u>	<u>Current Status</u>
NASA Digital Thermometer (under contract NAS9-7852) applied to Skylab Project	UAD-3		Work can begin upon approval as candidate
NASA microminiature biopotential transmitter developed at Ames	UAD-7		Work can begin upon approval as candidate.

BIOMEDICAL APPLICATIONS TEAM
SOUTHWEST RESEARCH INSTITUTE

DATA CONCERNING APPLICATIONS ENGINEERING NOMINATION

Problem # UAD-3

Title: Determination of Tooth Vitality

Description of technological requirement not commercially satisfied:

A rapid, convenient, and inexpensive means of determining tooth temperature (a function of tooth vitality) is required to supplement knowledge obtained from examination of dental X-rays.

Medical Significance: Development of a device to measure tooth temperature would greatly supplement and actuate determination of tooth vitality presently determined by much "professional guesswork"

Contribution of Aerospace Technology: The digital thermometer was developed for NASA under Contract NAS9-7852 by Southwest Research Institute (Project No. 16-2327-01) and subsequently applied in the Mass Measurement Program for the NASA Skylab Project.

Resources Required:

Estimate \$500. parts

Delivery Schedule:

90 Days after approval

Does the problem originator appear to have sufficient expertise/understanding and/or technical support to successfully utilize the innovation?
Describe:

The problem originator is a researcher and teacher at the University of Alabama Dental School. One of his prime concerns is that area of dental research that deals with preventative medication and techniques.

BIOMEDICAL APPLICATIONS TEAM
SOUTHWEST RESEARCH INSTITUTE

DATA CONCERNING APPLICATIONS ENGINEERING NOMINATION

Problem # UAD-7

Title: Telemetry of Oral pH for Determination of Linkage to Cavity
Formation.

Description of technological requirement not commercially satisfied:

pH telemetry units small enough to be implanted in the oral cavity are not commercially available, nor does a commercial solution appear to be available in the foreseeable future.

Medical Significance: pH information on the formation of caries may well lead to significant advances in the formation of preventative medication to reduce the incidence of cavities particularly in children.

Contribution of Aerospace Technology: Microminiature biopotential transmitter and other microminiaturization techniques developed for the space program.

Resources Required:

\$500.00 Parts and Labor

Delivery Schedule:

90 Days

Does the problem originator appear to have sufficient expertise/understanding and/or technical support to successfully utilize the innovation?
Describe:

The problem originator is a researcher and teacher at the University of Alabama Dental School. He intends to have the transmitter installed in his own mouth and is very aware of the significance of pH and its relationship to the formation of dental caries.

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

IV. APPLICATIONS ENGINEERING
B. EFFORTS IN PROGRESS

<u>Applicable NASA Technology and Source</u>	<u>Problem Number</u>	<u>A. E. Start Date</u>	<u>Current Status</u>
NASA Tech Brief 69-10301	AEB-1		Work on prototype to be initiated in near future.
NASA Tech Brief 68-10363	BVA-1		Electrode material sent to problem originator for evaluation. Awaiting response.
Response to disseminated problem statements from Naval Weapons Center.	OVA-2		Awaiting approval as AE candidate.
NASA's advanced miniaturization technology at MSFC	SWC-2		MSFC expects completion of this project by Dec., 1972.
Design developed by Mr. Hassan & Mr. Nichols at Langley Research Center	TCD-2,3		Work in progress at Langley Research Center.
New Technology Report, MSFC, MFS-20418 "Low Frequency Tachometer" (Heart Rate)	TVA-2		Completed and in test prior to delivery.
IEEE Transactions on Biomedical Engineering, Oct. 1970, Capacitative Type Electrode.	UAM-1		Work in progress at SwRI.

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

IV. APPLICATIONS ENGINEERING
C. PROJECTS INACTIVATED

<u>Applicable NASA Technology</u> <u>and Source</u>	<u>Problem</u> <u>Number</u>	<u>A. E. Start</u> <u>Date</u>	<u>Current Status</u>
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None during this report period

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

V. TECHNOLOGY APPLICATIONS
A. POTENTIAL TECHNOLOGY APPLICATIONS DEVELOPED

On the following pages are descriptions of the Biomedical Problems listed below which have attained the status of Potential Technology Applications during the period covered by this report:

<u>Problem No.</u>	<u>Problem Title</u>
WMC-1	Plethysmographic Data Interfacing System

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

POTENTIAL TECHNOLOGY APPLICATION REPORT

IDENTIFICATION

Problem No: <u>WMC-1</u>	Date of Preparation: <u>30 Nov. 1972</u>
Problem Title: <u>Plethysmographic Data Interfacing System</u>	
Date Problem Accepted: <u>21 Sept 1972</u>	
Institution: <u>University of Wisconsin Medical College at Milwaukee</u>	
Department: <u>Physiology</u>	
Investigator: <u>Dan McDermott, Ph. D., & J. J. Smith, M. D., Ph. D.</u>	
BATEam Personnel: <u>C. J. Laenger, & R. L. Wilbur</u>	
Estimated Time to Complete Application: <u>8 Hours</u>	

DISCUSSION OF PROBLEM AND REASON FOR POTENTIAL
TECHNOLOGY APPLICATION CLASSIFICATION:

Physicians at the University of Wisconsin are clinically measuring cardiac output by various methods. One of the primary problems is analyzing the data rapidly and efficiently. Clinically, they have been hand analyzing this data utilizing the Gerber method.

Recently, this team of physicians have been using the Kubicek Impedance Plethysmograph, also known as the Minnesota Impedance Plethysmograph. As these physicians have been instrumental in developing the method from the beginning, they soon realized that computer analysis was the only practical method of reducing the data.

After attending the SwRI BATEam symposium in Milwaukee and seeing that the Kubicek method had been computerized in conjunction with the IMBLMS program, they became keenly interested in acquiring the program.

Interaction with personnel of Manned Spacecraft Center led to the acquisition of the program which was removed from restriction on October 1, 1972. This information was scanned and deemed potentially useful and sent to the problem originators.

The SwRI BATEam wishes to thank MSC and General Electric for making this information available to the medical community.

SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM

V. TECHNOLOGY APPLICATIONS
B. TECHNOLOGY APPLICATIONS CLAIMED

Below is a list of Biomedical Technology Applications claimed during the period covered by this report. On the following pages are Technology Applications Reports for those claimed.

<u>Problem No.</u>	<u>Problem Title</u>
BVA-4	Portable ECG Telemetry Receiver and Chart Recorder (Additional Support Documentation)

**SOUTHWEST RESEARCH INSTITUTE
BIOMEDICAL APPLICATIONS TEAM**

TECHNOLOGY APPLICATION REPORT

IDENTIFICATION

Application No: <u>BVA-4</u>	Date of Report: <u>Nov. 15, 1972</u>
Application Title: <u>Portable ECG Telemetry Receiver & Chart Recorder</u>	
	Application Date: <u>Nov. 30, 1972</u>
Institution: <u>Veterans Administration Hospital, Bay Pines, Florida</u>	
Department: <u>Surgery</u>	
Investigator: <u>Chief of Surgery, Thomas M. Dunn, M. D.</u>	
Consultant/Coordinator (if any): _____	
BATeam Personnel: <u>Robert L. Wilbur</u>	
Professional Hours Spent: <u>6</u>	Medical Specialty: <u>03</u>
Solution Requirement: <u>Sent application package to Problem Originator</u>	
<u>No hardware fabricated.</u>	

The convalescence regimen prescribed for heart patients at this facility require them to be occupied in a variety of activities in several locations within the hospital complex. Many of the activities are located at considerable distance from available electrocardiograph (ECG) recording equipment. It has been necessary in the past to provide staff personnel and visit the patients in these remote locations to determine their well being.

The problem originator sought a means for quantitatively evaluating the condition of these convalescing heart patients. He needed a portable system to monitor the ECG transmitters on each patient, and a receiver-demand-recorder in the hands of a staff member. That technology would readily provide an ideal solution to the problem he presented to the NASA Southwest Research Institute Biomedical Applications Team.

A search retrieved NASA Technical Brief 64-10171, which described a biopotential telemetry transmitter. The technical support package was requested and was found to contain the desired demodulator. The Southwest Research Institute engineers proposed the addition of a small, portable strip chart recorder to the receiving package for a complete instrumentation package with all specifications requested by the problem originator.

A copy of the technical support package is enclosed to illustrate the solution proposed. The problem originator feels this is ideal and is attempting to acquire funds to realize the system.

TECHNICAL SUPPORT PACKAGE FOR
BIOPOTENTIAL MONITORING WITH INEXPENSIVE
OFFICE-TYPE CASSETTE RECORDERS

NASA BIOMEDICAL APPLICATIONS TEAM
SwRI INSTITUTE

Problems GLM-32 & SNM-26
Problem BVA-4 (Telemetry Option)

September 27, 1972

BIOPOTENTIAL MONITORING WITH INEXPENSIVE OFFICE-TYPE CASSETTE RECORDERS

Abstract

Monitoring vital signs of hospital and ambulatory patients is becoming more necessary as new sophisticated medical treatment becomes available. Acquiring and analyzing this data from patients in intensive care units (ICU) and other medical environments has been reasonably routine and requires little additional equipment over and above that normally found in the hospital. Medical personnel, handling large numbers of cardiac outpatients through clinics, rehabilitation centers and home or office routines, need methods to acquire, store, and analyze the medical data. One method of achieving this is to place the data on magnetic tape. Medical grade recording systems exist to hard wire record biopotential signals, but they are so expensive that they price themselves outside most physicians' means. This paper describes a low cost system that will accept either hard wire or tele-metered data and store it on an office-type cassette recorder. Replay features are also built into the recorder package and FM radio-recorder combinations are commercially available. Commercial medical units at present do not include the telemetry feature.

Brief Technical Description of Biopotential Monitoring with Inexpensive Office-Type Cassette Recorder

This system has the ability to monitor ECG, GSR, EEG, temperature, and pressure and with proper signal conditioning either hard wire or telemeter the data to the cassette recorder. Once the information is stored on tape, the system also demodulates the digitized data for analog presentation. The entire system is fabricated into the carrying case of the recorders maintaining the portability feature.

NOTE: This paper describes only ECG and pressure features.

The system includes three subsystems:

1. Signal conditioner - modulator/transmitter
2. Cassette Recorder/FM receiver
3. Demodulator

The signal conditioner properly amplifies the ECG or the pressure signal and is pulse rate modulated at a center frequency best suited for the recorder utilized. Modulation is necessary because of the low frequency limitation of the recorder. If telemetry is desired, a transmitter is added to the signal conditioner and packaged for remote use.

Assembly 2 consists of an inexpensive cassette recorder. If the telemetry option is to be used, a combination FM radio-cassette recorder is utilized.

The demodulator accepts any pulse rate modulated signal placed on the tape. This type of demodulator is not locked to the modulator so is independent of modulating frequency and battery voltage fluctuations. Therefore, accurate time measurements are not assured. If accurate time measurements are desired, a phase locked loop demodulator is used.

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I. Introduction

The cassette recorder approach to medical monitoring was developed in response to many physicians' needs for a low cost, light weight, portable recording instrument. Cassette recorders in their original condition do not have a frequency response amenable with low frequency biomedical signals. Therefore, signal conditioning is required to raise these low frequency signals to a frequency band that provides the best fit to the cassette recorder utilized.

The design goals were to (1) develop low cost interface signal conditioners for low cost cassette recorders, (2) provide sufficient versatility in design to allow recording of a wide range of biomedical signals, and (3) fabricate the system in such a way as to maintain the portability of the entire package.

It was found that a wealth of NASA developed electronic circuits existed which could be incorporated to achieve all the design goals. Actually, many NASA developed circuits exist that could be incorporated into the system to further diversify the system on a modular basis.

II. Operating Instructions

Hard wire recording of ECG, pressure, or other biopotential signals is accomplished by connecting electrodes or transducer leads into the input amplifier-modulator (See Figure 1). Setting the function switch to DIRECT prepares the recorder for use. The standard controls for operation of the recorder are then used to record.

Telemetry recording follows by applying electrodes or transducer to the patient and connecting them to the transmitter. Switch the function to RADIO which prepares the recorder for use with telemetry.

Voice recording is achieved by plugging in the microphone and turning the function switch to OFF. The off position returns the cassette recorder to its unmodified state.

Turning the function switch to REPLAY and utilizing the playback controls on the recorder engages the demodulator which changes the PRM signals into the original biopotential signals.

Each of the functions are independent of one another and few problems arise in operation. The electronics can be packaged into the accessory compartment of the recorder case.

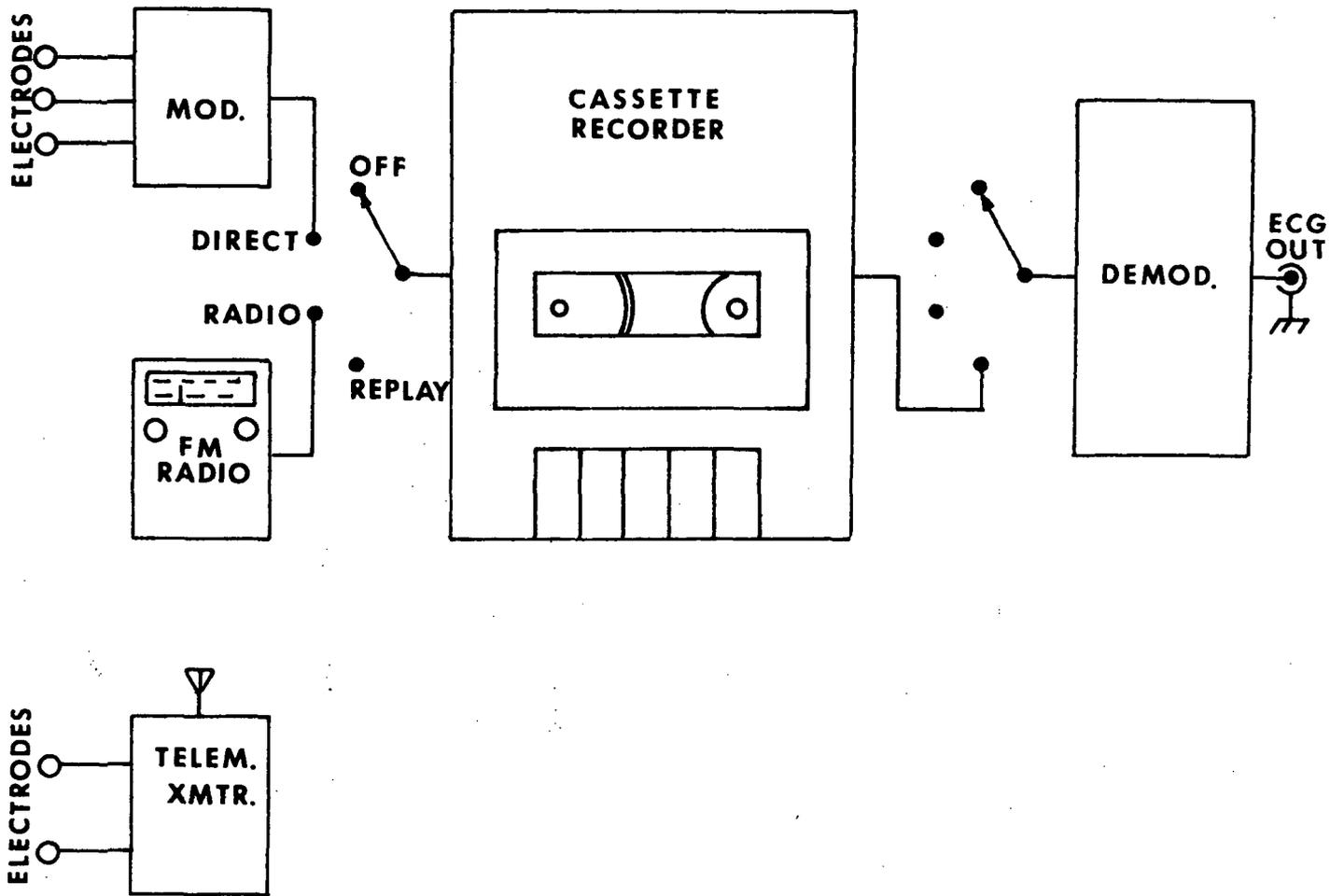


FIGURE 1. SYSTEM BLOCK DIAGRAM

III. Technical Discussion

Office type cassette recorders costing under \$100 offer automatic level control, multiplicity of inputs, AM-FM radio, light weight and battery operation, all desirable for portable recording.

The frequency response of these recorders at 1-7/8 ips tape speed normally lies between 60Hz - 10 kHz. Much useful biomedical data lies between DC and 100 Hz. For the recorder to handle this information, it is necessary to condition this information at a frequency amenable to the recorder, preferably the mid-range response.

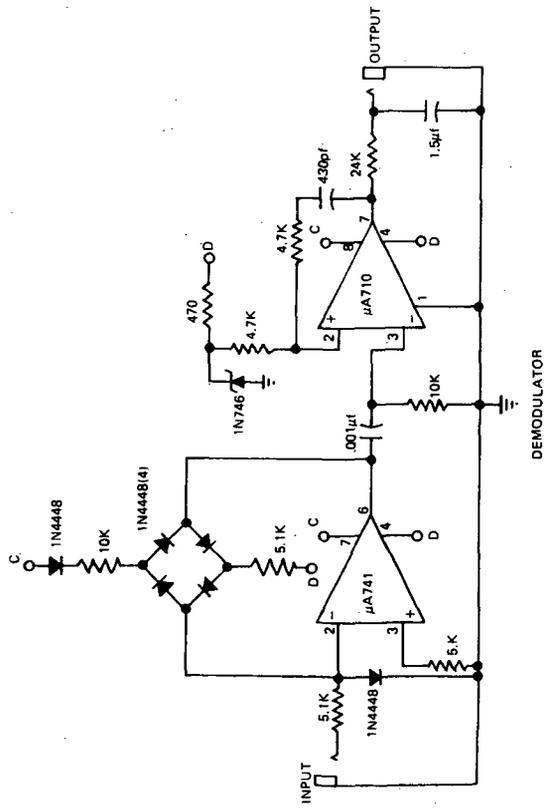
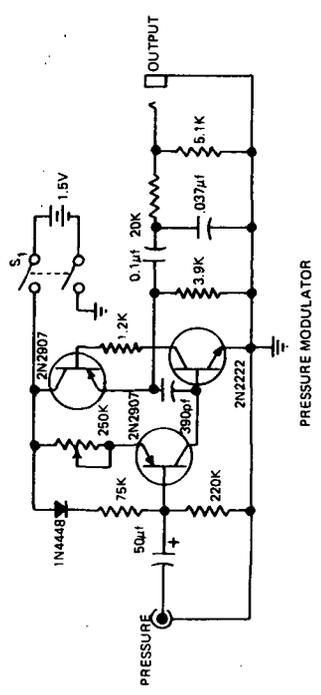
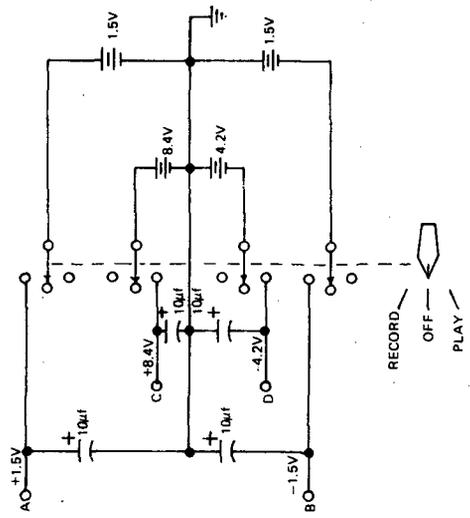
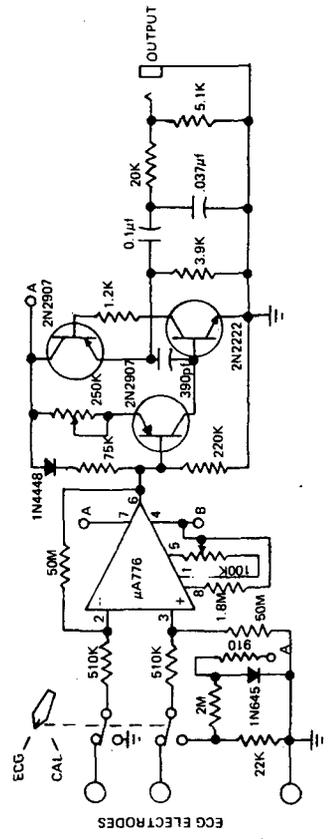
FM modulation was chosen to raise the low frequency signals to typically 2-5 kHz. This allows for rejection of AM noise and the use of FM broadcast band telemetry with a minimum of circuitry. For ease of design and cost, pulse rate modulation (PRM) was chosen over the more complicated pulse width modulation designs used in the more expensive commercial models.

Amplifier-Modulator

To amplify low level biopotential signals acquired by electrodes, a micropower programmable operational amplifier is utilized (Figure 2). The Fairchild amplifier is characterized by large open loop gain, high input impedance, high common mode rejection, low offset current and voltage, and very low power consumption.

As shown the amplifier has a gain of approximately 100 with an operating current of 1.5 microamps, well within the safety limits for human use. A calibration switch is incorporated to insert a reference level if desired. This signal is generated by reading the portion of the forward voltage drop (V_f) on the diode (1N645).

The three transistor circuit following the preamplifier and also in the pressure unit comprise the modulator. This provides a deviation sensitivity of $\pm 10\%$ for ± 10 millivolts at the base of the input 2N2907. Collector current of this transistor is linearly related to the input voltage at the base. The 390pf capacitor is charged by this collector current and the voltage resulting from this charge in turn controls the period of the oscillator.



MEDICAL MONITORING WITH ECONOMICAL CASSETTE RECORDERS	
ENGR.	Robert S. Wilbur
TECH.	Menan C. King
DATE	29 Sep 72
APPROVED	<i>[Signature]</i>
-GLM-32 & SNM-26	

FIGURE 2. SYSTEMS SCHEMATIC

The 250 kilohm potentiometer and the 390 pf capacitor set the period of the oscillator. The time required to charge this capacitor to the potential necessary to flip the circuit is about 100 times as long as the on time established by storage-time effects. The resulting one percent duty cycle accounts in part for the low power dissipation of the circuit. The output pi filter alters the square wave into triangular waveshapes which reduces the harmonic content and produces better recordings.

To use telemetry, the same modulator is utilized. A simple transmitter (Figure 3), is added to the modulator for short range telemetry. The 250 kilohm pot sets the subcarrier oscillator frequency to approximately 2kHz.

Demodulator

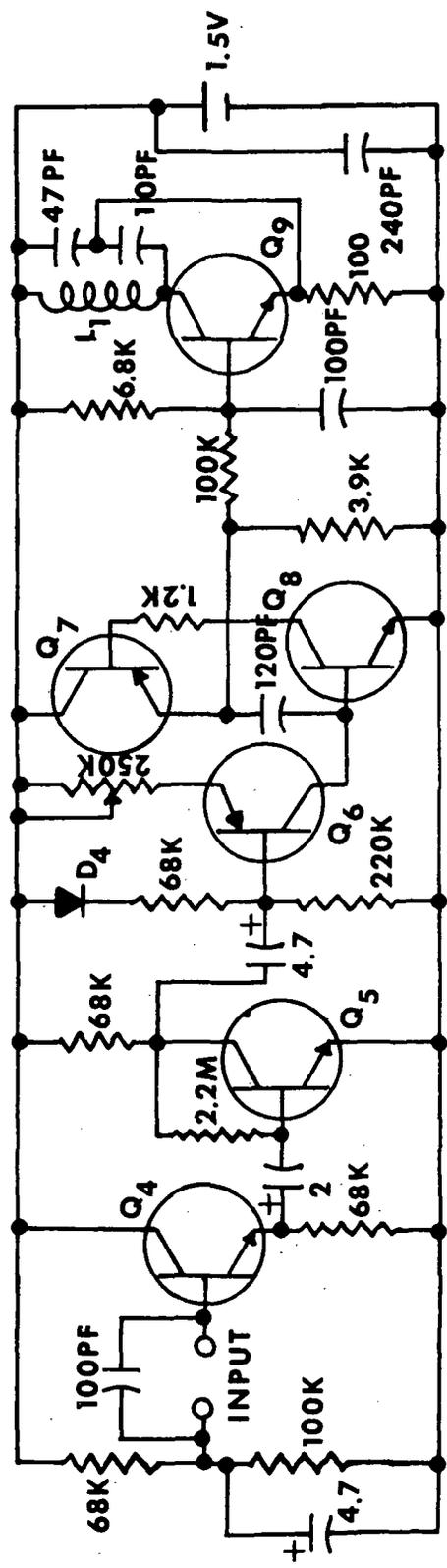
Demodulation is achieved with the zero crossing detector/one-shot multivibrator and integrator.

An output signal from the tape recorder is sampled by the zero crossing detector and provides a sharp transition for each zero crossing. These are differentiated and applied to the multivibrator. Negative triggers into the multivibrator produce positive output pulses which are smoothed by the integrator reproducing the original signal.

Component values of the differentiator and integrator are dependent upon the center frequency (f_0) of the modulator. It is easiest to determine this empirically as the type and quality of the tape recorder will be the controlling parameter.

For time accurate demodulation, a phase locked loop is utilized (See Figure 4). The voltage controlled oscillator (VCO) in the NE561B is set at the modulator quiescent frequency by C_2 and the potentiometer. The circuit will then capture signals up to deviations of $\pm 20\%$ of the VCO frequency.

BIOPOTENTIAL TRANSMITTER



- Q₄, Q₅, Q₈ - 2N2222
- Q₆, Q₇ - 2N2907
- Q₉ - MPS 6531
- D₄ - 1N4149

L₁ - 3 TURNS NO.28 WIRE

FIGURE 3.

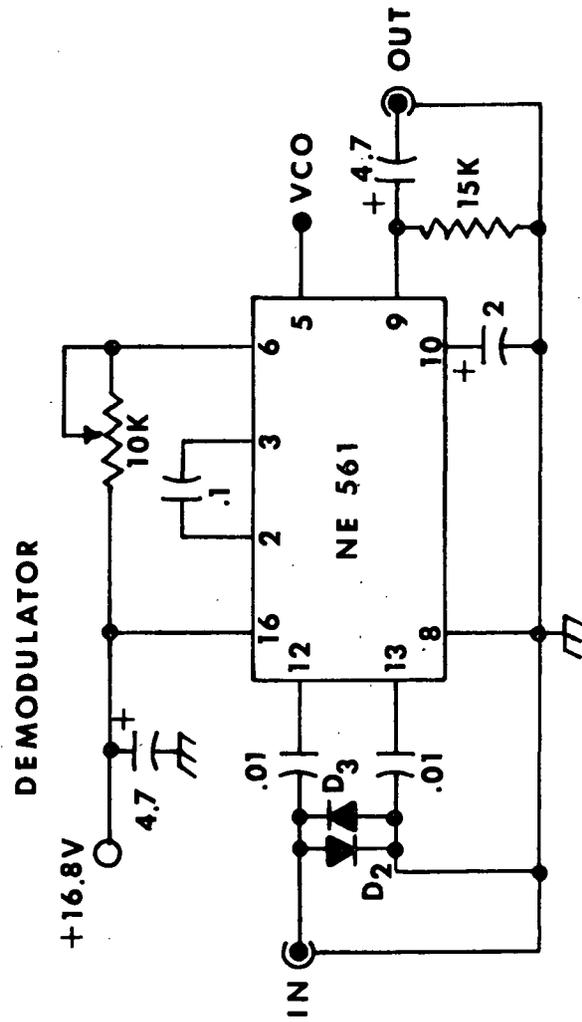


FIGURE 4

IV. Summary

With the values shown, the system will operate with a 2kHz center frequency, 100 Hz bandwidth and track at least $\pm 20\%$ from center frequency and remain within 1% distortion. The signal to noise ratio measured at tape speed of 1-7/8 inches per second is 35 dB and is comparable to commercial instrumentation costing 10 times as much per channel of data.

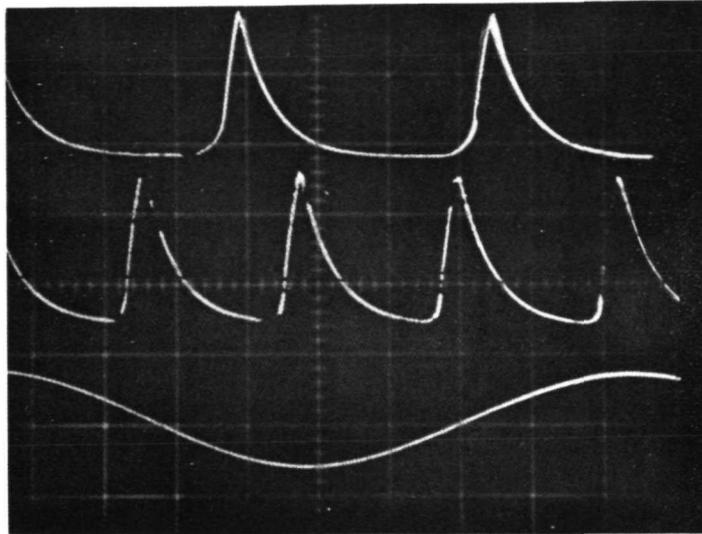
Waveshapes at selected points are shown in the Appendix.

APPENDIX

Selected Waveshapes of Cassette Recorder and Signal Conditioners

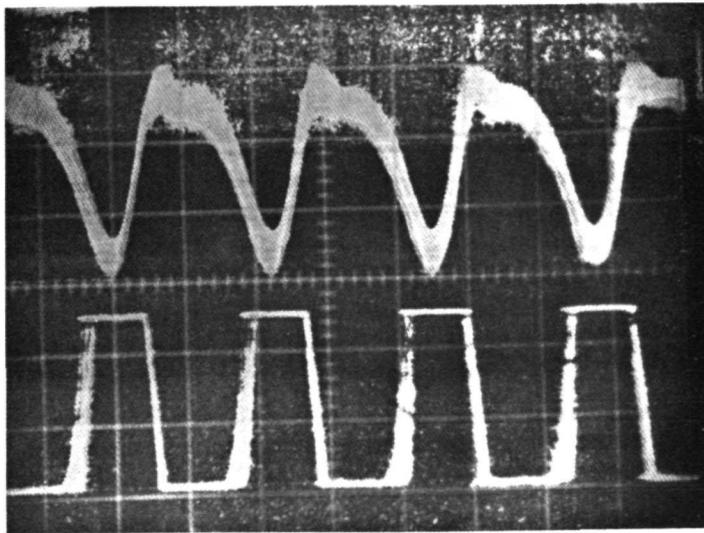
WAVEFORMS FOR SNM-26

Photograph #1



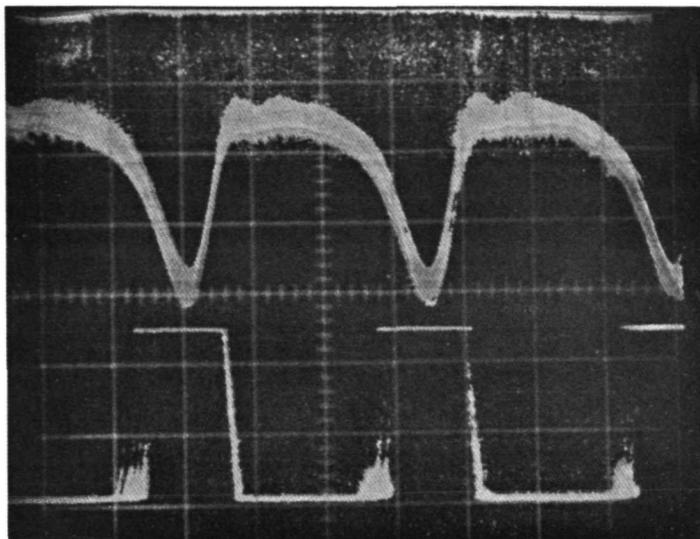
Output of SCO minimum frequency (approx. 1.6 kHz)
 Output of SCO maximum frequency (approx. 2.4 KHz)
 Horiz. --.2msec/div Vert. --.1v/div
 Modulating Signal 150mv .1 Hz
 Horiz. --1sec/div Vert. --.05v/div

Photograph #2



Output of Tape Recorder--Input to Zero Crossing Detector
 Horiz. --.2msec/div Vert. --1v/div
 Output of Zero Crossing Detector--Input to Differentiator
 Horiz. --.2msec/div Vert. --5v/div

Photograph #3



Output of Tape Recorder--Input to Zero Crossing Detector

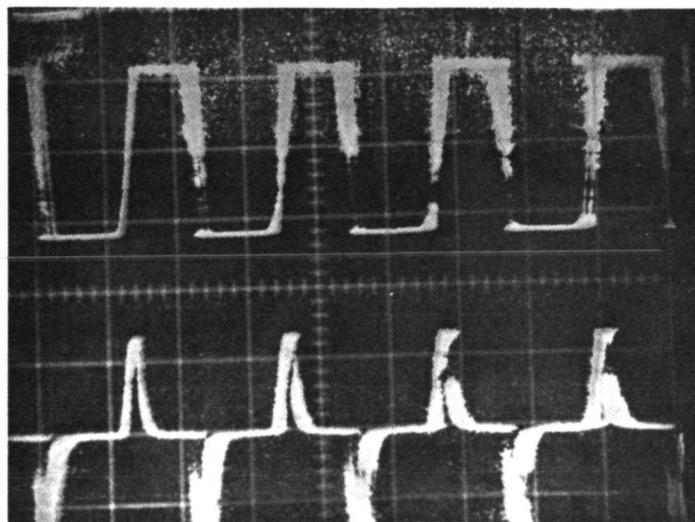
Horz. ---.2msec/div Vert. --1v/div

Output of Zero Crossing Detector--Input to Differentiator

Horz. ---.2msec/div Vert. --5v/div

Photo #2 shows maximum frequency and Photo #3 shows minimum frequency

Photograph #4



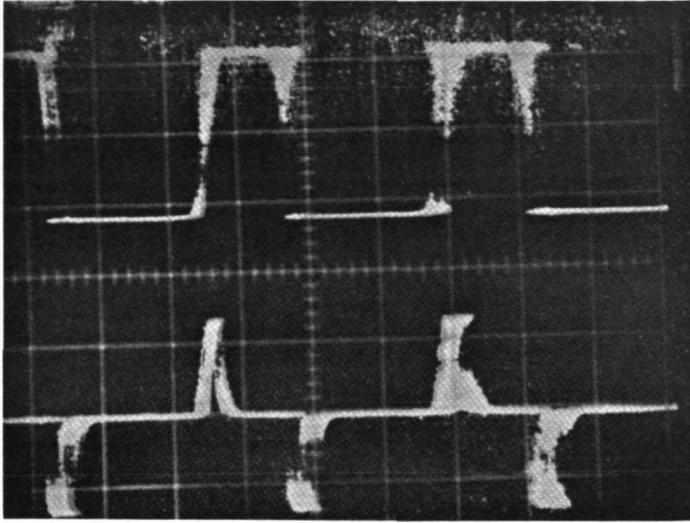
Output of Zero Crossing Detector--Input to Differentiator

Horz. ---.2msec/div Vert. --5v/div

Output of Differentiator--Input to Pulse Counting Demodulator

Horz. ---.2msec/div Vert. --2v/div

Photograph #5



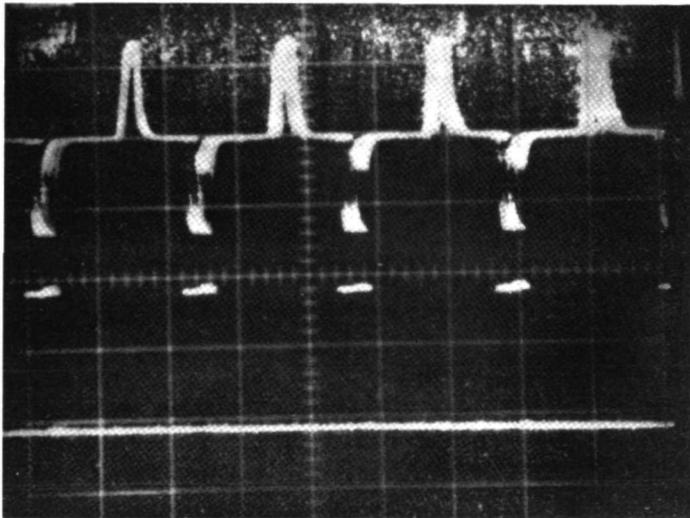
Output of Zero Crossing Detector--Input to Differentiator

Horz. --. 2msec/div Vert.--5v/div

Output of Differentiator--Input to Pulse Counting Demodulator

Horz. --. 2msec/div Vert.--2v/div

Photo #4 shows maximum frequency and Photo #5 shows minimum frequency



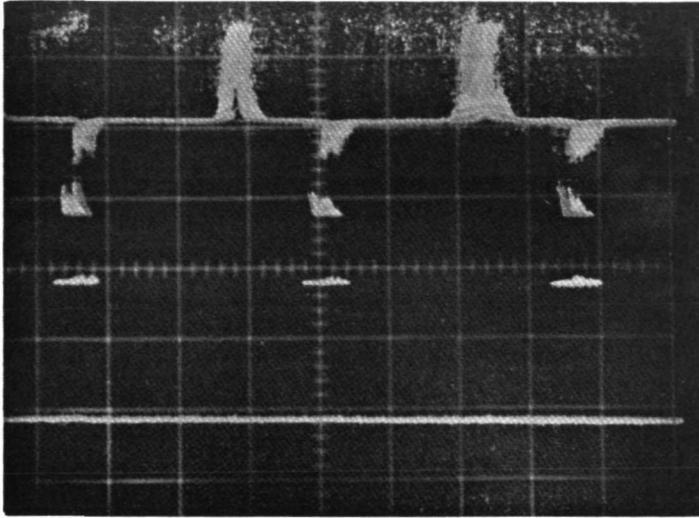
Output of Differentiator--Input to Pulse Counting Demodulator

Horz. --. 2msec/div Vert. --2v/div

Output of Pulse Counting Demodulator--Input to Integrator

Horz. --. 2msec/div Vert. --2v/div

Photograph #7



Output of Differentiator--Input to Pulse Counting Demodulator

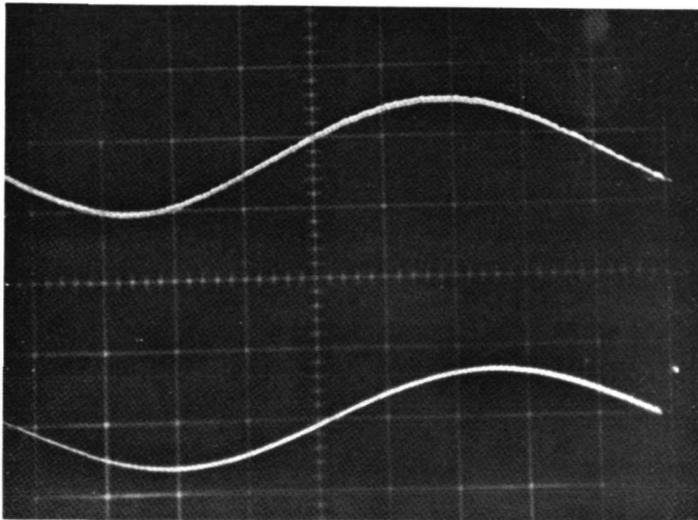
Horz. ---.2msec/div Vert. --2v/div

Output of Pulse Counting Demodulator--Input to Integrator

Horz. ---.2msec/div Vert. --2v/div

Photo #6 shows maximum frequency and Photo #7 shows minimum frequency

Photograph #8



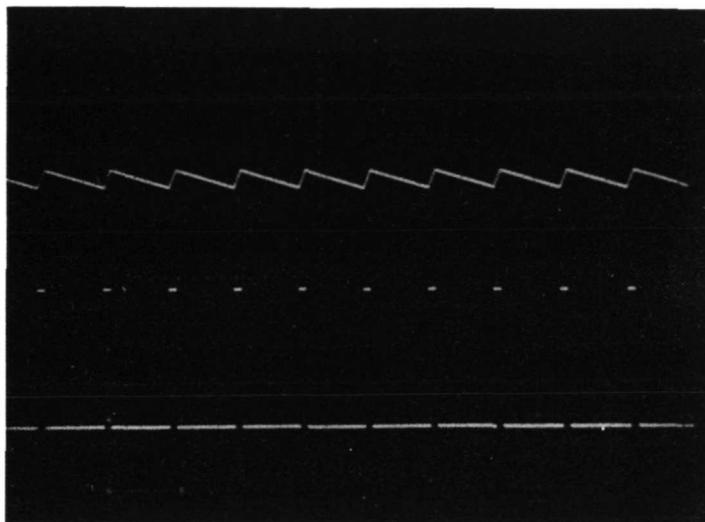
Output of Integrator--Signal to Recorder

Horz. --1sec/div Vert. --.1v/div

Modulating Signal

Horz. --1sec/div Vert. --.1v/div

Photograph #9

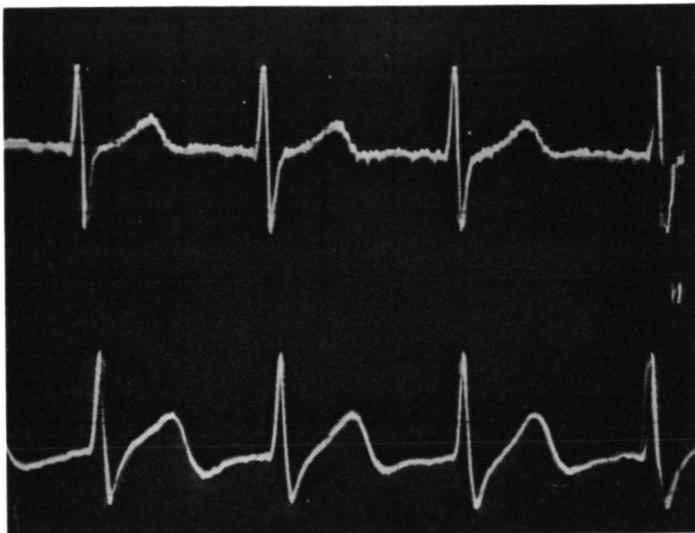


Output of Integrator--Signal to Recorder

Horz. ---.5msec/div Vert. ---.02v/div

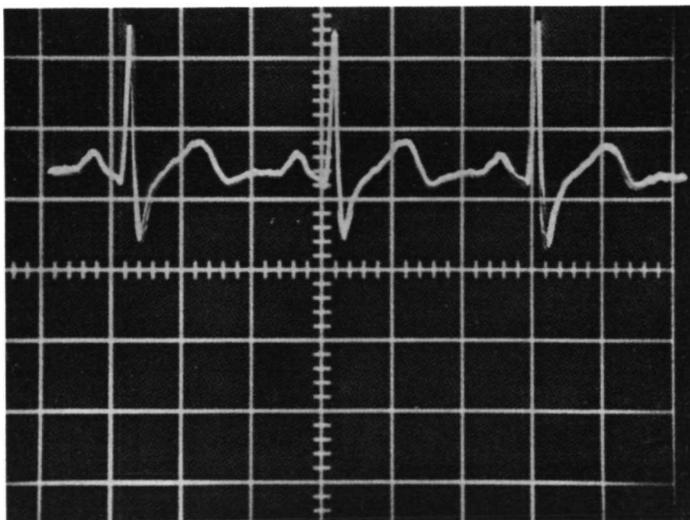
Output of Pulse Counting Demodulator--Input to Integrator

Horz. ---.5msec/div Vert. --2v/div



Reference
ECG

Direct
ECG



Telemetered
ECG

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BIOMEDICAL APPLICATIONS TEAM

VL CONTACTS

A. CONTACTS WITH CURRENT USER INSTITUTIONS

On the following pages are described contacts with currently active user institutions that occurred during the period covered by this report.

1 November 1972 F. Hermann Rudenberg, University of Texas Medical School, discussed consultant arrangement at the medical school with David Culclasure, SwRI.

1 November 1972 Sam McFarland, SwRI, visited Donald Olsen, D. V. M., University of Utah Medical School, and discussed problem of oxygen toxicity in the lung due to O₂ rich extracorporeal circulation. Interested in NASA input.

1 November 1972 Sam McFarland, SwRI, visited Dr. Jeffrey Peters, Division of Artificial Organs Research, University of Utah School of Medicine, and discussed use of Doppler flowmeters catheter equipment.

1 November 1972 Sam McFarland, SwRI, visited Wm. Dobelle, Ph. D., University of Utah Medical School, and discussed current M. O. of BAT program and validity of previous problems he had derived NASA help on. Dr. Dobelle has interest in materials applications.

1 November 1972 Sam McFarland, SwRI, visited Clifford Kwan-Gett, University of Utah, and made further definitions on prototype work.

1 November 1972 Sam McFarland, SwRI, visited Steve Greenhalgh, University of Utah Medical School, to deliver Doppler flow catheter and discuss operation and viewed test equipment.

2 November 1972 Charles Laenger, SwRI, telephoned Dr. J. J. Smith, Medical College of Wisconsin, to locate IMBLMS film. Dr. Smith said he would locate the film and have it forwarded to SwRI.

2 November 1972 Albert E. Chandler, New Mexico Vocational Rehabilitation Commission, requested assistance from David Culclasure, SwRI, in image amplification techniques for the partially blind.

2 November 1972 Sam McFarland, SwRI, visited Don Lyman, Ph. D., Department of Engineering, University of Utah, and discussed problems related to measurement and characterization of surface roughness diffusion, adhesion of biological membranes.

2 November 1972 Jean Carter, SwRI, forwarded additional reference on search T0594 (Methods, instrumentation, etc. for tactile discrimination (AEB-4).

2 November 1972 Pat McGraw, Ph. D., University of Texas Medical Branch, Galveston, telephoned Charles Laenger, to discuss changes in GLM-35 requirements and tentatively scheduled a meeting for 8 November at Galveston.

2 November 1972 Harold Viaille, Ph.D., SRS-Dallas, telephoned Charles Laenger, SwRI, requesting several articles identified in the search results that were sent him.

2 November 1972 Sam McFarland, SwRI, telephoned Jerry Foote, Ph.D., College of Engineering, University of Utah, to offer assistance in Dr. Foote's problems relating to use of ultrasonics in measuring occlusion buildup in blood vessels.

2 November 1972 Sam McFarland, SwRI, visited John Ward M.D., Arthritis Ward, University of Utah, and discussed needs for new materials in prosthetics/orthotics which would be quick forming and inexpensive.

2 November 1972 Sam McFarland, SwRI, visited Mary E. Riley, Ron Webb and Earl Shields, Brace Shop, University of Utah, and discussed practical problems related to handling /fabrication in braces and artificial limbs.

2 November 1972 Sam McFarland, SwRI, visited Jeffrey Peters, Ph.D., Artificial Organs, University of Utah, and discussed indirect means of measuring atrial pressure changes in artificial heart models.

2 November 1972 Sam McFarland, SwRI, visited Joseph Andrade, Ph.D., College of Engineering, University of Utah, and discussed blood interface problems related to artificial organ materials.

3 November 1972 Sam McFarland, SwRI, visited Mrs. Kersenbrock, Director of Nursing, Craig Rehabilitation Hospital, Denver, Colorado. Thirty-five members of her staff were present to discuss problems related to equipment for assistance of paralytics.

3 November 1972 Sam McFarland, SwRI, visited Dr. David Hahn, Craig Rehabilitation Hospital, Denver, and discussed problems related to "distal elevating arm" orthosis.

3 November 1972 Sam McFarland, SwRI, visited Tom Wertz, Craig Rehabilitation Hospital, Denver, and discussed some of his ideas for patient assist devices, including an inflatable cushion for repositioning a wheelchair patient.

6 November 1972 Jean Carter, SwRI, telephoned Dr. J. J. Smith, Medical College of Wisconsin, to try again to locate IMBLMS film. Dr. Smith thought it was at the Curative Workshop in Milwaukee with Dr. Torti. Dr. Smith requested more copies of Benefits From Space Research be forwarded.

7 November 1972 Sam McFarland, SwRI, wrote a letter to follow up his visit to Jeffrey Peters, Ph. D., University of Utah, and invited Dr. Peters to visit SwRI on a forthcoming trip to Texas.

7 November 1972 Sam McFarland, SwRI, wrote a letter to follow up his visit to Bill Dobell, Ph. D., Artificial Organs, University of Utah.

7 November 1972 Charles Laenger, SwRI, telephoned F. Hermann Rudenberg, University of Texas at Galveston, to inform him that Mr. Laenger would visit the University 8 November 1972.

7 November 1972 Sam McFarland, SwRI, wrote letter thanking Wm. S. Partridge, Ph. D., Vice President for Research, University of Utah, for scheduling contacts on recent visit to Salt Lake City.

7 November 1972 Sam McFarland, SwRI, wrote letter as followup on visit to Reed Gardner, Ph. D., LDS Hospital, Salt Lake City, and established plan of action on three potential problem statements.

7 November 1972 Sam McFarland, SwRI, wrote letter as a follow up on visit to Joseph Andrade, Ph. D., University of Utah.

7 November 1972 Sam McFarland, SwRI, wrote a letter to Donald Lyman, Ph. D., University of Utah, to follow up his visit.

7 November 1972 Sam McFarland, SwRI, wrote John Ward, M. D., University of Utah, to follow up his visit and to inform Dr. John Ward of plan of action.

7 November 1972 Sam McFarland, SwRI, wrote Dr. Kwan-Gett, University of Utah, as followup to visit and to inform him of plan of action.

8 November 1972 Charles Laenger, SwRI, visited C. P. McGraw, K. Iwata, F. H. Rudenberg, et al, The University of Texas at Galveston, and discussed new requirements for radiation detector instrument. A much shorter catheter is needed for direct jugular bulb puncture. A lumen for pulling blood or some other means for assuring that the catheter tip is in the vessel lumen is needed.

8 November 1972 Charles Laenger, SwRI, visited Joe Jameson, Texas Institute for Rehabilitation and Research, and discussed status of their tests and utilization of Kubicek apparatus for measuring stroke volume. It was explained that the SwRI BA Team was attempting to meet with MSC people—those concerned with IMBLMS—to learn how they are processing data and interfacing with computer.

8 November 1972 Charles Laenger, SwRI, visited with Joe Canzoneri and Joe Jameson, TIRR, to continue discussion of utilization of Kubicek method which they are currently using.

Dr. Walker was on loan to Speech and Hearing Facility next door to TIRR and Mr. Laenger was unable to see her. Mr. Canzoneri said she wishes to measure blood flow at selected sites in extremities in attempt to correlate such data with spinal cord lesions.

8 November 1972 Sam McFarland, SwRI, wrote Reed Hacker, Director, Heart Test Facility, University of Utah, to follow up on visit and to inform him of plan of action on his potential problem areas.

8 November 1972 Sam McFarland, SwRI, wrote Tom Veerty, Fort Collins, Colorado, to follow up on visit and suggest plan of action on two problems discussed.

8 November 1972 Sam McFarland, wrote Mrs. Margaret Kersenbrock, Craig Rehabilitation Hospital, Denver, to follow up on visit and respond to problem ideas.

9 November 1972 Anne Kohler, Governors Committee on Aging, requested team interaction with the governors committee on aging.

10 November 1972 John Sigmon, SwRI MSC, forwarded xerox copy of NASA Tech Brief B72-10032, An Improved Aesthesiometer, concerning AEB-4.

13 November 1972 Joe Canzoneri, TIRR, telephoned Charles Laenger, SwRI, to say that Dr. Wallace wants to measure blood flow in the femoral vein—this relates to atrophy of limbs in quadriplegics.

13 November 1972 Robert Wilbur, SwRI, forwarded information on Bone Densitometer Instrument to Ross Davis, private practitioner.

13 November 1972 P. C. McGraw, The University of Texas at Galveston, telephoned Robert Wilbur, SwRI, to say he has experienced calibration difficulties in reproducing data from day to day. Most likely it will require a visit to clarify procedure.

14 November 1972 Jean Carter, SwRI, in a letter to William Winkley, Criss Cole Rehabilitation Center, Austin, Texas, updated status of TCB-17, -18, and -19. Mr. Winkley was also informed that additional documentation was on order and will be forwarded for evaluation.

17 November 1972 Jean Carter, SwRI, forwarded David B. Milne, Ph. D., Long Beach VA Hospital, two sources for abrasive resistant material to line mixing bowls to help eliminate trace element contamination of food from the metal bowls presently used. (LVA-8)

17 November 1972 Pat McGraw, Ph. D., University of Texas Medical Branch at Galveston, telephoned Robert Wilbur, SwRI, to make arrangements to run calibration tests Monday 27. Demodulator has been exhibiting poor blanking.

20 November 1972 John Ross, private practitioner, telephoned Robert Wilbur, SwRI, to inquire if application engineering has been approved on the patient medication reminder unit. He was informed that it was under serious consideration. (PPR-1)

20 November 1972 John Ward, M. D., University of Utah, expressed appreciation for visit of Sam McFarland and requested a sustained contact on brace problems.

21 November 1972 Sam McFarland, SwRI, contacted R. Schleicher, SwRI, to check out and take receipt of prototype heart cooling blanket for Dr. Kwan-Gett.

22 November 1972 Ms. Billie Elder, Arkansas Enterprises for the Blind, in a letter to David Culclasure, SwRI, indicated the light cane for the blind had been sent to MSFC per our request.

22 November 1972 David Culclasure, SwRI, forwarded search on problem TTU-2 for evaluation to Dr. Charles Holcomb, Texas Tech University.

22 November 1972 David Culclasure, SwRI, forwarded search on TTU-2 for evaluation to Dr. B. J. Locke, Texas Tech University.

22 November 1972 Sam McFarland, SwRI, forwarded two prototype models of the heart "cooling blanket" outlined in problem UTM-39 to Dr. Kwan-Gett.

24 November 1972 Jean Carter, SwRI, forwarded Dr. Aram Glorig, Callier Hearing & Speech Center, results on "Microelectrode Stimulation of the Brain" relating to the whole set of CHS problems. Eighteen references out of 69 could prove useful for his problems.

24 November 1972 Sam McFarland, SwRI, advised Mrs. James Wyeth we had received additional internal funding to go ahead with another set of prototype leg braces (SWR-1).

27 November 1972 Sinner Sancar, Huntsville Hospital, telephoned David Culclasure, SwRI, to discuss the patient assist system being installed at the Huntsville Hospital.

27 November 1972 Jean Carter, SwRI, forwarded Elmo Knoch, Arkansas Enterprises for the Blind, an engineering package for an aethesiometer received from MSC in regard to Tech Brief TSP72-10032 and our problem AEB-4.

28 November 1972 Jean Carter, SwRI, forwarded David B. Milne, Ph. D., VA Hospital, Long Beach, an article cost display on zirconium crucibles with price list in regard to LVA-8, "Abrasive Resistant Coating For Diet Mixing Bowls."

28 November 1972 Sam McFarland, SwRI, forwarded Dr. Donald Lyman, University of Utah, RECON search results on two problems, UTM-42 "Composites For Biocompatible Protheses" and UTM-34 "Techniques For Characterizing Surface Roughness Under Electron Micrography."

28 November 1972 Sam McFarland, SwRI, forwarded Norman DeGroot, University of Utah, RECON search results for UTM-44, "Detection/Measurement of Microbubbles or Microthrombi in the Blood."

28 November 1972 Jean Carter, SwRI, forwarded C. S. Kwan-Gett, M. D., Utah Medical School, RECON search results for UTM-39, Location Multi-Channeled Hypothermia Blanket for Heart Surgery.

28 November 1972 Robert Wilbur, SwRI, telephoned Pat McGraw, The University of Texas Medical School at Galveston, and made arrangements to calibrate system 29 November and discuss GLM-44, 45, 46, and 50.

28 November 1972 Robert Wilbur, SwRI, telephoned H. R. Hoenecke, St. Josephs Hospital, Phoenix, regarding SJH-1. Mr. Hoenecke stated that problems should be dropped. His inability to acquire schematics for interfacing his equipment to the computer has resulted in alternate solutions outside NASA.

29 November 1972 Robert Wilbur, SwRI, visited Pat McGraw, Ph. D., The University of Texas at Galveston, and attempted to rectify demodulator calibration difficulties and simplify adjustment procedures. (GLM-5)

29 November 1972 Robert Wilbur, SwRI, visited F. Hermann Rudenberg, The University of Texas Medical School at Galveston, and discussed search results and progress on these mechanical problems.

30 November 1972 Jean Carter, SwRI, telephoned William Winkley, Criss Cole Rehabilitation Center, to advise him that SwRI automotive research was mixing a glass bead/enamel coating. If Mr. Winkley can get a couple of canes for the blind as soon as possible, they can be sample coated here and returned for immediate evaluation. Also discussed NASA applicability of special coating in Tech Brief 72-10337 with an even smaller glass mesh content that could possibly be economically developed or made available for TCB-19. Mr. Winkley was very pleased to hear of the development and promised two canes immediately.

30 November 1972 Anne Kohler telephoned David Culclasure to request team participation in the 10th Annual Governors Conference on Aging.

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VI. CONTACTS

B. CONTACTS WITH POTENTIAL USER INSTITUTIONS

On the following pages are described contacts with potential user institutions that occurred during the period covered by this report.

1 November 1972 Sam McFarland, SwRI, telephoned Marie Holm, Administrator, Crippled Childrens Hospital, Salt Lake City, Utah, to attempt to establish appointment time, but her schedule was filled at this time.

1 November 1972 Sam McFarland, SwRI, visited Dr. Norman De Groat, Heart Test Facility, Salt Lake City, Utah. Dr. De Groat is interested in ways to measure microbubbles and micro thrombes in the blood. Discussed problem statement.

1 November 1972 Sam McFarland, SwRI, telephoned Dr. Andrew Diess; VA Hospital, Salt Lake City, Utah. However, they were having a staff visit and had no time for appointments for that day.

1 November 1972 Sam McFarland, SwRI, visited Reed Harker, Director, Heart Test Facility, Salt Lake City, Utah, to discuss problems relating to telemetry and communication.

2 November 1972 Sam McFarland, SwRI, visited Reed Gardner, Ph.D., L.D.S. Hospital, University of Utah Computer Lab, Salt Lake City, Utah, and introduced BAT program. Discussed problems related to catheter tip manometers, catheter measurement of ventricular diameter, simplified telephone communication hooking for computer.

2 November 1972 Sam McFarland, SwRI, visited Thomas R. Harris, Administrator, L.D.S. Brimary Childrens Hospital, Salt Lake City, Utah. Left BAT program literature with secretary and promised contact on next visit.

2 November 1972 Sam McFarland, SwRI, visited L. Breat Coates, Administrator, L.D.S. Hospital, Salt Lake City, Utah. Left BAT program literature with secretary and promised contact on next visit.

2 November 1972 Sam McFarland, SwRI, visited Dr. Ted Beck, Psychologist, V.A. Hospital, Salt Lake City, Utah, and discussed problems related to motion artifact in electrical connections to brain pedestal on behavioral research primate animals.

3 November 1972 Sam McFarland, SwRI, telephoned Dr. John Franks, Assoc. Chief of Staff, University of Colorado Medical School, to rearrange schedule for a future visit to Denver.

7 November 1972 Charles J. Laenger, SwRI, telephoned Phillip Loy, TRIMS, and made arrangements for a preliminary visit to discuss the BAT program.

7 November 1972 Sam McFarland, SwRI, wrote to Andrew Deison, Ph.D., V.A. Hospital, Salt Lake City, thanking him for arranging contact with Dr. Ted Beck.

8 November 1972 Charles Laenger, SwRI, visited Phillip Loy, Biochemist, Texas Research Institute for the Mental Sciences (TRIMS), Texas Medical Center, and explained function of BAT program. He requested additional information which he will pass to others. They are using gas chromatography and related techniques for detecting drugs in urine.

13 November 1972 Charles Laenger, SwRI, forwarded Phillip Loy, TRIMS, information on active problems in biochemistry we now have with slant toward analysis of trace elements in system for such things as drug screening, alpha conditioning, etc.

14 November 1972 Charles Laenger and David Culclasure, SwRI, visited Fred Windbeck, HEW, Social Rehabilitation, to explain the BAT program.

14 November 1972 Charles Laenger and David Culclasure, SwRI, visited Doris Harr, HEW Clinical Services Mental Retardation, and explained the BAT program.

21 November 1972 David Culclasure, SwRI, visited Dr. Paul B. Richards, Naval Research Lab, to acquaint him with the NASA TU program and function of the SwRI BATeam.

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C. CONTACTS WITH NASA CENTERS

On the following pages are described contacts with NASA Field Centers that occurred during the month covered by this report. The contacts are divided into two groups: problem-related contacts and non-problem related contacts.

- 1 November 1972 Dr. Milton DeLucci, Consultant (MSC) telephoned David Culclasure, SwRI, to provide information on the SCI soft cap as a potential candidate for use with the EEG evoked response audiometric apparatus.
- 3 November 1972 David Culclasure, SwRI, forwarded materials to acquaint Dr. Poole, MSC, with team activities.
- 3 November 1972 Tom Wakefield, NASA Headquarters, telephoned David Culclasure, SwRI, to discuss status of the radiation probe and status of contract renewal.
- 3 November 1972 Howard Maaks, NASA, provided David Culclasure, SwRI, a copy of document NASA D-6310 requested by SwRI team.
- 3 November 1972 Tom Wakefield, NASA Headquarters, telephoned Charles Laenger, SwRI, to discuss status of GLM-35 (catheter tip radiation detector). SwRI and the University of Texas at Galveston plan to submit a joint proposal to HEW for continuation of this work.
- 3 November 1972 John Wiggins, TUO/MSFC, forwarded desired information on Bone Densitometer to Robert Wilbur, SwRI.
- 6 November 1972 John Samos, TUO/Langley, forwarded logos for use on AE prototypes to David Culclasure, SwRI.
- 7 November 1972 Jean Carter, SwRI, telephoned Mr. Torti, Curative Workshop in Milwaukee, Wisconsin, in an effort to locate the IMBLMS film. They had the film and will forward it to us tomorrow.
- 8 November 1972 Bradford Evans, TUO/Ames, provided a response to circulated problem statement on the trace element problem.
- 9 November 1972 Donald S. Friedman, TUO/Goddard, telephoned Robert Wilbur, SwRI, to request information on the status of the audiometric system. He was referred to the TU office at MSC.
- 13 November 1972 Harrison Allen, Lewis, in a letter to David Culclasure, SwRI, requested use of the BAT exhibit for the Cleveland Health Museum.
- 14 November 1972 Charles Laenger and David Culclasure, SwRI, visited Tom Wakefield, NASA Headquarters, to discuss NASA project business.

14 November 1972 Charles Laenger and David Culclasure, SwRI, visited Jeff Hamilton, TUO Headquarters, to discuss interaction of project work.

14 November 1972 Charles Laenger and David Culclasure, SwRI, visited Wayne Chen, Don Friedman and Charles Boyle, NASA Goddard, to discuss interaction of NASA project work.

14 November 1972 Charles Laenger and David Culclasure, SwRI, visited Mr. Johnson, Marshall, to discuss interaction of NASA BAT program.

14 November 1972 Jean Carter, SwRI, ordered NASA Tech Brief TSP72-10337, Conformal Coating Compound, in reference to Problem TCB-18.

15 November 1972 Jean Carter, SwRI, wrote letter to Henry Martin, Marshall, to report no success in inquiry put to Spenco Medical Corp in Waco, Texas, involving an emulsion they manufacture for comfort cushions for rehabilitation. They have a patent pending on this and declined further release of information.

18 November 1972 Dr. Sam Pool, MSC, telephoned David Culclasure, SwRI, to suggest the team take the BAT exhibit to a medical meeting in Dallas sponsored by Neruosystems.

18 November 1972 David Culclasure, SwRI, requested one of the complex coordinators for evaluation from John Samos, TUO/Langley.

20 November 1972 Jean Carter, SwRI, wrote a letter thanking H. L. Martin, MSFC, for his efforts in locating a source for an abrasive resistant coating to line diet mixing bowls for our problem LVA-8.

21 November 1972 David Culclasure, SwRI, visited with Dr. Sam Poole, MSC, at an aerospace association meeting in Dallas and discussed team activities and projected date for the on site team member to report for duty.

22 November 1972 Charles Laenger, SwRI, telephoned Tom Wakefield, TAD/NASA, and discussed the interest of Thunder Corporation and a New Orleans-based minority group in manufacturing the Patient Assist Device. Mr. Wakefield will consider this conflict and discuss this with us later.

22 November 1972 John Sigmon, SwRI/MSC, visited Dr. Paul B. Richards, Naval Research Laboratory, President, American Astronautical Society, and explained the Biomedical Application Team and demonstrated patient assist unit.

22 November 1972 John Sigmon, SwRI/MSC, discussed the future of the NASA program with Bob Zimmerman, NASA/Washington.

22 November 1972 John Sigmon, SwRI/MSC, visited with Horace Cromer, MD., Austin, and discussed the possible manufacture of a patient assist unit for the quadraplegic son of Allen Shivers, ex-governor of Texas.

27 November 1972 James Richards, TAD/NASA, telephoned David Culclasure, SwRI, to discuss a visit he plans to make to SwRI.

27 November 1972 James Wiggins, TUO/MSFC, provided NASA New Technology Certificates for Robert Wilbur and Bill Carpenter on the work on the light probe for the blind.

27 November 1972 Juan Pizarro, MSFC, telephoned David Culclasure, SwRI, to discuss the patient assist device set up in the Huntsville Hospital.

27 November 1972 John Sigmon, SwRI/MSC, telephoned David Culclasure, SwRI, discussed a problem which Dr. Pook desired to pursue at Tulane University (involving a liquid cooled soft cap for use during chemotherapy).

28 November 1972 D. A. Bettker, LRC, provided data on flow reactions requested by SwRI team earlier.

28 November 1972 Hank Martin, MSFC, telephoned David Culclasure, SwRI, to acknowledge receipt of the "light" cane for the blind which will be updated at MSFC.

28 November 1972 Jack Wheeler, MSC/TUO, telephoned David Culclasure, SwRI, to invite the team to MSC to discuss procedures for team interaction.

28 November 1972 John Sigmon, SwRI/MSC, provided a report of team activities at MSC.

28 November 1972 Charles Laenger, SwRI, telephoned Tom Wakefield and Bob Zimmerman, NASA, to discuss patient assist device. Mr. Wakefield requested we telephone Mr. Malone of Essex to learn more details on the Bronx V. A. patient assist device they are using.

28 November 1972 Wayne Chen, Goddard, telephoned Charles Laenger, SwRI, to inquire about status of patient assist device. He had contacted Dr. Freis at the V. A. Hospital in Washington, D. C., who referred him to Dr. Massaleone. Dr. Massaleone said that if a prototype were made available, it would be tested at the VA Rehabilitation Devices at the VA Hospital in New York.

29 November 1972 John Sigmon, SwRI/MSC, telephoned Jose E. Torres, M. D., Department of Obstetrics and Gynecology, Louisiana State University Medical Center, New Orleans, and set of appointment for December 8 to discuss scalp cooling cap for Sam Poole.

29 November 1972 John Sigmon, SwRI/MSC, talked with Dr. Milton DeLucchi, Consultant, about BA Team problems on which he was working.

29 November 1972 Charles Laenger, SwRI, telephoned Tom Wakefield, TAD/NASA, to inform him of VA interest and activity relative to patient assist devices.

30 November 1972 Dr. Graves, MSC, telephoned Robert Wilbur, SwRI, to request background information on the complex coordinator and its ultimate manufacture. He was referred to Tom Wakefield for particulars.

30 November 1972 David Culclasure, SwRI, forwarded Floyd Fish, NASA, EEG helmets for display being constructed by NASA exhibits section.

30 November 1972 David Culclasure, SwRI, visited Jack Wheeler, TUO/MSC, to discuss how team representative at MSC might productively interface with TU Office.

30 November 1972 David Culclasure, SwRI, visited Bill Chymlak, MSC, to discuss material provided on the trace metal/diet study problem.

30 November 1972 John Sigmon, SwRI/MSC, telephoned Jean Carter, SwRI, to inquire about getting additional copies of SwRI BA Team literature for distribution by Dr. Poole.

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D. OTHER CONTACTS

On the following pages are described other Team contacts that occurred during the period covered by this report.

2 November 1972 Jean Carter, SwRI, telephoned Bill Tyler, NASA STIF, for Billie Elder, Arkansas Enterprises for the Blind, to see if RECON searches could be put out on computer cards instead of data printout sheets so that cards from a search could be fed into the Arkansas facility equipment which in turn emit braille printouts of same. Problem originator is legally blind and wanted to evaluate search in this manner if possible. NASA STIF does not have this ability. Mr. Tyler suggested logical method was just to have someone literally read the search to originator. The BA Team has screened the search, so this should be reasonably easier to accomplish. Search had 83 relevant citations.

2 November 1972 Sam McFarland, SwRI, telephoned Don Kettering, President, Vital Assists, Inc., to discuss NASA assist on dialyzing membrane production, but Mr. Kettering was out of town.

6 November 1972 Charles Laenger, SwRI, sent letters to the following thanking them for attending the October 31 meeting, "Medical Benefits of Space Research" in Leavenworth, Kansas: Lloyd McClure, Jr. Speech Pathologist, V.A. Center; A. B. Williamson, Jr., M.D., Neurology; John J. Dooner, D.D.S., Dental; George H. Hassard, M.D., Leavenworth, Kansas.

6 November 1972 Linda Eckhardt, SwRI, initiated searches on problems CPT-1, LSU-1, LSU-2, TTU-1, TTU-2, WMC-1, WMC-2, and WMC-3.

7 November 1972 R. P. Fritz, Midwest Research, requested information on the sight switch from David Culclasure, SwRI.

9 November 1972 John M. Fuerst, Jersey Enterprises, Inc., contacted David Culclasure, SwRI, to acquaint team with new thermoplastic composites.

9 November 1972 John Sigmon, SwRI, telephoned G. W. Ulrich, Douglas Corporation, St. Louis, for additional information on locking device for RRC-9 (Automatic Locking Prosthetic Leg).

10 November 1972 Ernie Harrison, RTI, telephoned David Culclasure, SwRI, to request information on use of composite materials.

13 November 1972 Tom Wooten, RTI, telephoned David Culclasure, SwRI, to coordinate LSU problems. There is some team overlap that needs clarifying.

13 November 1972 Jean Carter, SwRI, forwarded information on source for composite material for prosthetic devices to Ernie Harrison, RTI.

13 November 1972 Harvey Gilbert, McDonnell-Douglas (St. Louis), telephoned Sam McFarland, SwRI, to better define information needed on Latch Mechanism (RNV) per Geo. Ulrich (MSFC). He will be the man to contact for further information in this regard.

14 November 1972 Jean Carter, SwRI, forwarded information to Karen Harrison, NE London Polytechnic, London, England, on HSR-7, Patient Assist Device, and booklet on NASA contributions to rehabilitation.

15 November 1972 Jean Carter, SwRI, forwarded a copy of 1971-72 BAT report to S. R. Mogford, Research & Engineering Design, Inc., Ontario, Canada. This firm is moving into the area of engineering design being applied to the biomedical field.

15 November 1972 Jean Carter, SwRI, forwarded information to Dominic J. Searle, Library Cottage, Gibraltar, Europe, on Clean Room Technology (NASA SP-5074) and problem statement and NASA Tech Brief B66-10252 on the biomedical radiation probe.

15 November 1972 Jean Carter, SwRI, initiated RECON searches on six UTM new problems (biocompatible artificial organ implant materials, new composites for prostheses, electron micrography methods for tissues, etc.). Also search for "Ultrasonic Methods for Measurement of Blood Vessel Walls."

16 November 1972 Gus Ruggeri, Thunder Corporation, telephoned Robert Wilbur, SwRI, to ask for all letters of reference on the patient assist device.

20 November 1972 Sinner Sencar, Huntsville Hospital, telephoned David Culclasure, SwRI, to discuss the patient assist system installed at Huntsville Hospital. The hospital will re-align the system more to NASA technology.

20 November 1972 Jean Carter, SwRI, forwarded information to John Sigmon, SwRI BAT Representative, on documentation order for Kubicek Plethysmograph Method.

20 November 1972 Dennis Jamvold, SwRI, telephoned Frank Ponders, LTV Space Systems, Dallas, to make arrangements for NASA exhibit at the AAS User Developer Conference on Health Care Systems.

20 November 1972 H. D. Carmichael, User Developer Conference on Health Care Systems, telephoned Dennis Jamvold, SwRI, to request that the NASA exhibit be left in the Dallas museum for a few days. We regrettably informed him that it had already been committed for the Aerospace Surgeons conference.

20 November 1972 Dennis Jamvold, SwRI, visited the American Astronautical Society User Developer Conference for Health Care Systems in Dallas at the request of Dr. Sam Poole, MSC., attended conference and displayed NASA exhibit to conference participants.

21 November 1972 Sinner Sencar, Huntsville Hospital, telephoned to request a list of hospitals, institutions, etc., who might be interested in environmental control system for handicapped, sight switch, etc.

21 November 1972 David Culclasure, SwRI, visited H. A. Bowers, Neuro Systems Inc., to discuss possible use of NASA flexible electrodes with the Neuro Systems electro-sleep apparatus.

22 November 1972 Dr. DeLucchi, Consultant, telephoned Charles Laenger, SwRI, to advise that he has located information on the Kubicek method (and IMBLMS) and wishes to discuss this and our hardware effort. We will arrange a visit for the week of 27 November.

24 November 1972 Jean Carter, SwRI, forwarded Sam Schiflett, Texas Tech, two RECON searches for TTU-1 and -2. Also forwarded additional NASA rehabilitation booklets and copies of all current rehabilitation problem statements.

24 November 1972 David Culclasure, SwRI, visited James P. Dawson, Oklahoma Foundation for Research and Development, to discuss possible interaction with the BA Team, particularly with regard to aids to the handicapped. Mr. Dawson is the Governor's Science Advisor.

27 November 1972 F. Thomas Wooten, RTI, telephoned David Culclasure, SwRI, to request Technical Support Package on vital signs monitor.

27 November 1972 Dr. DeLucchi, Consultant, telephoned Robert Wilbur, to make arrangements to acquire information on WMC-1.

28 November 1972 David Culclasure, forwarded documentation on the vital signs monitor (CMR-3) to F. Thomas Wooten, RTI.

28 November 1972 David Culclasure, SwRI, forwarded Dr. Charles Bechtol, Los Angeles California Private Practitioner, RECON search on high altitude physiology (as it relates to hemoglobin count).

28 November 1972 Jean Carter, SwRI, forwarded David Myers, Vocational Rehabilitation Division, New Orleans, a completed unit for TCD-9, Portable Amplifier System for Patients with Partially Inactivated Vocal Cords.

28 November 1972 Mr. Shenk, Essex Corporation, Alexandria, Va., telephoned Charles Laenger, SwRI, to report on his visit to the V. A. Hospital in New York. Mr. Shenk relayed names of people to contact at the Castle Point and the Bronx V. A. Hospital on the patient assist device.

28 November 1972 Charles Laenger, SwRI, telephoned T. V. Malone of the Essex Corporation to advise that Mr. Shenk had made the visit to the V. A. Hospital in the Bronx.

29 November 1972 Charles Laenger, SwRI, telephoned Ron Lipskin, Staff Engineer, V. A. Hospital, New York. They are interested and agree that there is a need for such an apparatus, but it must be inexpensive. His people are building a conventional relay-operated device which should be ready for production in six to eight months.

29 November 1972 Robert Wilbur, SwRI, visited Dr. DeLucchi, Consultant, and acquired computer program to put the Kubicek method into a computer. Discussed alternative solutions to WMC-2 and WMC-3.

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APPENDIX A
CURRENTLY ACTIVE PROBLEMS
STATUS CODE DEFINITIONS

A. Problem Definition

Problem definition includes the identification of specific technology-related problems through discussions with biomedical investigators and the preparation of function descriptions of problems using nondisciplinary terminology.

B. Information Searching

Information relevant to a solution is being sought by computer and/or manual information searching.

C. Problem Abstract Dissemination

An information searching has revealed no potential solutions and a problem abstract is being circulated to individual scientists and engineers at NASA centers and contractor facilities to solicit suggestions.

D. Evaluation

Potentially useful information or technology has been identified and is being evaluated by the team and/or the problem originator.

E. Potential Technology Application

Information or technology has been evaluated and found to be of potential value but has not been applied.

F. Follow-Up Activity

Useful information has been identified, but further activity (i. e., documentation, obtaining experimental validation of utility, continuing modification, etc.) is required.

G. Prototype Hardware

Prototype hardware has been sent to problem originator for evaluation.

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APPENDIX A
CURRENTLY ACTIVE PROBLEMS

<u>Problem Number</u>	<u>Status Code</u>	<u>Problem Title</u>
AEB-1	D	Method for Identifying Denominations of Paper Money
AEB-2	E	Measurement of Physiologic Stress Parameters
AEB-3	A	A Light Sensitive Vocation Rehabilitation Aid
AEB-4	E	Apparatus for Measuring Tactile Spatial Separation
AVA-2	D	Carotid Artery Pressure Waveform Measurement
BLM-17	B	Improved Procedures to Measure Regional Blood Flow in Kidney
BMC-4	D	Improved Arch Support Material
BMC-6	D	Bio-feedback Training of Experimental Subjects
BUD-1	D	Heat and Stress Resistant, High Strength Plastic for Fabrication of Orthotic Devices
BVA-1	G	X-Ray Transparent Electrodes and Leads
BVA-4	E	Portable ECG Telemetry Receiver and Tape Recorder
CHS-10	D	Hearing Aid Malfunction System
CPT-1	D	Head Control Conditioning and/or Teaching Methods for Athetoids
DLM-14	D	Detection of Kidney Stones During Surgery
FTZ-1	E	On-Line Breath Analyzer
FTZ-2	D	Invasive Means for Measuring Blood Gases
GLM-32	G	ECG Preamplifier for Home Tape Recorder
GLM-35	E	Beta Radiation Catheter Probe
GLM-39	E	Artificial Speech Synthesizer

APPENDIX A....CURRENTLY ACTIVE PROBLEMS...continued

Problem Number	Status Code	Problem Title
GLM-40	D	Telemetry from Divers
GLM-43	D	Quick Attachment/Release Clamp
GLM-44	B	Quickly Adjustable Crutch
GLM-45	B	Material for Water Immersible Stretcher
GLM-46	B	Adjustable Cradle to Cover Burned Patients
GLM-47	D	Improved Stretcher Design
GLM-48	B	Ceiling Attachments in Hydrotherapy Room
GLM-49	B	Monorail Patient Transport System
GLM-50	B	Catheter Support for Rehabilitation Patients
GVA-6	D	Respiration Monitor
HPH-1	D	Particle Detector Monitor for Clean Room Surgery
HSR-1	E	Impression Material for Making Pattern of Lower Trunk
HSR-2	E	Resilient, Breathing Contour Seat Material
HSR-6	E	Sight Switch Operated Prehension Device
HUV-20	D	Perceptual Motor Testing of the Severely Disabled
HUV-22	D	Automobile Driving Assist for Triplegic
HUV-23	E	Automatically Operated Magnetic Tape Cassette Recorder
IOU-1	B	Method for Measurement of the Amount of Humidity Present in the Lower Respiratory Tract
LLU-10	D	Non-Invasive Techniques for Measuring Oxygen Count in the Blood
LSU-1	D	Physiological Effects of Motion Sickness Drugs
LSU-2	D	Whole Body Radiation Measurement

APPENDIX A... CURRENTLY ACTIVE PROBLEMS... continued

Problem Number	Status Code	Problem Title
LVA-3	D	Radioactive Microcell Counting Techniques for Diagnosis and Treatment of Leukemic Disorders
LVA-8	D	Abrasive-resistant Plastic Material for use in Trace Element Research Programs
MHH-1	E	Rapid Identification of Surgical Instruments
NMA-1	D	Program to Establish Electrical Safety Standards for Equipment and Instruments Used Around Patients
NMA-10	D	Video Tape Programming for Speech Therapy
NMV-1	D	Control System to Permit Quadriplegics to Operate Long Playing Recording Devices
NUM-1	D	Methods for Interpreting Ultrasonic Doppler Blood Flow Velocity Signals
NUM-2	D	Measure Diameter of Femoral Artery by Ultrasonic Pulse-Echo Method
OCH-1	E	Plastic Long Leg Braces for Children
OCH-5	C	Failure Resistant Cerebrospinal Fluid Shunt
OCH-6	D	Sensory Hemiplegiac Stimulator
OVA-2	E	Measurement of Lung Compliance
OVA-4	G	Assessing Sleep Psychophysiology in Extreme Environments
PPR-1	B	Home Paging System for Reminding Elderly Patients of Medication Times
RNV-32	D	Measurement of Energy Expended in Walking
RNV-34	D	Pressure Sensitive Device for Use in Tongue Operated Control Systems for Artificial Organs and Wheelchairs
ROS-1	D	Constant Velocity Vehicle for Small Laboratory
ROS-2	D	Method for Measuring Blood Gas Without Breaking the Skin

APPENDIX A... CURRENTLY ACTIVE PROBLEMS... continued

<u>Problem Number</u>	<u>Status Code</u>	<u>Problem Title</u>
RRC-1	D	High Energy Cost Exerciser with Ergometric Monitor
RRC-2	G	Accurate Cardiac Telemetry from Active Subjects
RRC-6	B	Lightweight, Portable Cushion Seat Jack for Weak or Paralyzed Patients
RRC-8	E	Ultra Thin Electromyographic Needles
RRC-9	D	Automatic Locking Prosthetic Leg
SNM-13	D	Miniature pH Electrode for Fetus
SNM-14	D	Fetal ECG Telemetry
SNM-15	D	Uterine Pressure Telemetry
SNM-25	B	Development of an In Vivo Blood Glucose, pH and pO ₂ Analyzer
SNM-26	E	Monitoring of Pelvic Pressure of Women During Labor
SWC-2	E	Cortical Audiometry Measurements
SWR-1	F	Custom Fitted Composite Leg Brace
TCB-2	C	Blind Person Guidance Detector of Impregnated Paint or Wire Boundary Market
TCB-17	D	Acoustic Signal to alert Blind Persons to Obstacles between the Waist and Head
TCB-18	E	Permanent Reflective Coating for Use on Canes for the Blind
TCB-19	B	Navigation Assistance to keep Blind on a Set Direction of Travel
TCD-1	F	Portable Sound Meter for Use by Deaf
TCD-2	G	Warning System for Use by Deaf
TCD-3	G	Portable Substitute for Door/Telephone Bell for Deaf
TCD-4	E	Noise Activated Flasher Warning for Deaf Driver

APPENDIX A... CURRENTLY ACTIVE PROBLEMS... continued

<u>Problem Number</u>	<u>Status Code</u>	<u>Problem Title</u>
TCD-5	D	Speech Analyzer
TCD-9	G	Portable Amplifier System for Patient with Partially Inactivated Vocal Cords
TCM-3	D	Peak Detector for Signal Conditioning of Blood in Basic Medical Research
TPR-1	G	Electro-Sleep Electrodes
TPR-2	B	Device to Correct Foot Pronation
TTU-1	D	Automated Instructional Activity Machines for Mental Retardates
TTU-2	D	Vocational Assessment Apparatus for the Physically and Culturally Handicapped Person
TVA-2	G	Portable Heart Rate Indicator for Active Patients
UAD-3	E	Determination of Tooth Vitality
UAD-4	D	Tooth Vitality Measured by Nerve Condition
UAD-7	E	Telemetry of Oral pH for Determination of Linkage to Cavity Formation
UAM-1	E	Capacitative ECG Electrodes
UAM-2	G	Heart Sounds Telemetry
UAM-8	D	Electrical Safety for Hospital Patients
UAM-13	E	Flexible Oral Transducer Matrix
UFM-6	D	Xeroradiography of Mammary Glands for Cancer Detection and Multiphasic Health Screening
UFM-7	D	Methods for Computer Analysis of EEG for Health Care Cost Reduction
UOF-2	D	Low-Level Non-Invasive Blood Pressure Measurement
UOF-4	B	A Method for Determining Blood Coagulation by Phonocardiography

APPENDIX A... CURRENTLY ACTIVE PROBLEMS... continued

<u>Problem Number</u>	<u>Status Code</u>	<u>Problem Title</u>
UTH-1	D	A Tactile Projector for Teaching Blind Students
UTM-1	D	Physiologic Data Handling - Systems Approach
UTM-25	B	Ionizing Radiation Detection of Thrombogenesis
UTM-27	D	Miniature Mosaic TV Camera
UTM-30	D	Biocompatible Bone Interface for Prostheses
UTM-31	D	Plastic Prosthetic Materials
UTM-32	D	Improved Design for Foot Supports
UTM-33	E	Form-Fitted Foot Pad Brace
UTM-34	E	Lining Absorbs Pressure and Friction Forces
UTM-37	E	Butt-Welded Fine Gage Wire
UTM-38	D	Improved Urethral Valve for Nonsurgical Implantation
UTM-39	D	Multi-Channeled Hypothermia Blanket for Heart Surgery
UTM-40	D	Detecting Oxygen Toxicity in the Lung
UTM-41	D	Measurement of Thrombus Adhesion to Blood Vessel Wall
UTM-42	D	Composites for Internal Biocompatible Prostheses
UTM-43	D	Techniques for Characterizing Surface Roughness Under Electron Micrography
UTM-44	D	Detection/Measurement of Microbubbles or Microthrombi in the Blood
WLH-2	G	Device to Clinically Evaluate Nasal-Airway Obstructions
WLH-3	D	Elasticity in Long Bones to Determine Optimum Fracture Knitting Condition
WLH-4	B	Myoelectric Powered Prosthesis

APPENDIX A... CURRENTLY ACTIVE PROBLEMS... continued

<u>Problem Number</u>	<u>Status Code</u>	<u>Problem Title</u>
WMC-1	E	Plethysmographic Data Interfacing System
WMC-2	D	Identification of Korotkoff Diastolic Point
WMC-3	D	Optimum Methodology for Analyzing Cardiovascular Data

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APPENDIX B
PLANS FOR UPCOMING MONTH

1. During the upcoming month the team will participate in the 79th Annual Meeting of the Military Surgeons of the United States to be held 10-13 December 1972. This will include display of the NASA BA Team exhibit.
2. The team will also set up the BA Team exhibit at MSC during the upcoming Apollo mission at the request of Dr. Sam Poole.
3. Team visits will be made to user institutions in Denver, Texas, and Louisiana.
4. At the request of Dr. Sam Poole, the team's resident MSC representative will visit Tulane University with regard to a liquid cooled cap that is being developed for therapeutic applications (to prevent hair loss during certain therapies). This should not be construed as SwRI team interference with RTI's team effort at Tulane. Rather, it is a special assignment given the team by virtue of the team's in-house representation at MSC.
5. Southwest Research Institute has provided from its internal research funds an additional sum to continue the team's work with lightweight composites for orthotic and prosthetic applications. This will permit the orthotic braces for Mrs. Wyeth to be finalized and tested. (SWR-1)
6. Work will be continued on the money denomination identifier for the blind by the team, and other pending AE projects.
7. Team visits will be made to Langley Research Center and Marshall Space Flight Center in conjunction with prototype development activity being carried on at these centers. Time permitting, a visit will also be made to Kennedy Space Center to discuss prototype development for aids for the handicapped.