Experiment I-b Test Report
"Space Environment Simulator Test Program"
Contract NAS 9-3414

PERFORMANCE & THERMAL RESPONSE OF THE GEMINI EXTRAVEHICULAR SPACE SUIT - EXPERIMENT I-b

Report Number 00.573

23 December 1964

Submitted By
LTV Astronautics
P.O. Box 6267 - Dallas 22, Texas

To

National Aeronautics & Space Administration
Manned Spacecraft Center - Houston, Texas

Prepared By:

R. O. Pearson

T. E. Mouritsen

F. H. Goodnight

Checked By:

G. B. Whisenhunt

Approved By:

W. C. Trent, Manager
Propulsion & Environment

V. G. Polevkas
R & D Projects

FOREWORD

This report describes the results of a Space Environment Simulator test of a prototype Gemini extravehicular space suit (Model GH-2C-18) conducted by LTV Astronautics for the NASA Manned Spacecraft Center. This test (Experiment I-b) was conducted November 5, 9 and 12, 1964 at the LTV Astronautics facility in Dallas, Texas. Experiment I-b is one of 12 space suit thermal evaluation tests being conducted in the LTV Astronautics Space Environment Simulator under contract NAS 9-3414. This contract covers a twelve month effort and is scheduled for completion on July 30, 1965. Mr. J. C. Poradek and Mr. R. F. Schwartz of the NASA-MSC, Systems Test Branch are the technical monitors for this contract.

Experiment I-b was conducted in accordance with LTV report number 00.520 "Gemini Extravehicular Suit Performance and Thermal Response Test" submitted to NASA-MSC for approval on 21 October 1964. This report presents the results of Experiment I-b and is submitted in accordance with contract NAS 9-3414.

TABLE OF CONTENTS

	Page
LIST OF FIGURES	iv
LIST OF TABLES	vii
1.0 SUMMARY	1
2.0 INTRODUCTION	4
3.0 TEST PROGRAM	5
3.1 Test Objectives	5
3.2 Description of Test Article	5
3.3 Test Equipment	9
3.3.1 Test Facility	9
3.3.2 Special Test Equipment	16
3.3.2.1 Thermal Dummy	16
3.3.2.2 Earth Emission & Albedo Simulator	16
3.3.2.3 Spacecraft Surface Simulator	16
3.3.2.4 Specimen Rotation	21
3.3.2.5 Suit Gas Supply System	21
3.4 Instrumentation	26
3.4.1 Measurements on Suit and Thermal Dummy	26
3.4.2 Facility (SES) Instrumentation	42
3.4.3 Data Recording	42
3.4.4 Data Accuracy	43
3.5 Description of Tests	43
3.5.1 Test Procedure	44
3.6 Variances	44
3.6.1 Solar Source	44
3.6.2 Thermal and Albedo Simulation	51

TABLE OF CONTENTS (Continued)

		Page
3.6.3	Chamber and Walls	56
3.6.4	Pressure	57
4.0	RESULTS AND DISCUSSION	59
4.1	Results	59
4.2	Discussion	59
4.2.1	Suit Temperatures and Pressures	59
4.2.2	Suit Net Heat Balance	70
4.2.3	Net Heat Gain or Loss Through Visor	74
4.2.4	Visor Frosting	75
4.2.5	Thermal Adequacy of Suit	75
4.2.6	"Hot Spots" Resulting from Contact with Spacecraft Surface	76
4.2.7	Suit Gas Leakage	76
4.2.8	Effect of Compression Under Parachute Harness	76
5.0	CONCLUSIONS AND RECOMMENDATIONS	78
APPENDICES		
A.	Tabulated Test Data	79
B.	Instrumentation Accuracies	208
C.	View Factor Calculations	214
REFERENCES		221

LIST OF FIGURES

		Page
1.	Gemini Space Suit Assembly Installed in the LTV Space Environment Simulator Showing the Earth and Spacecraft Simulators (Test Day No. 3).	6
2.	Description of Gemini Extravehicular Suit Layers.	7
3.	Gemini Space Suit Assembly Instrumentation Details (Test Day No. 1).	8
4.	LTV Space Environment Simulator.	10
5.	SES Pressure History - Test Day No. 2.	11
6.	a. Specimen Relationship to Solar Source Calibration.	13
	b. LTV Space Environment Simulator Solar Flux Distribution at Test Plane.	14
	c. LTV Space Environment Simulator Solar Flux Distribution at Test Plane.	15
7.	Thermal Dummy - Assembled.	17
8.	Thermal Dummy Partially Disassembled Showing Sections and Heaters.	18
9.	Gemini Space Suit Assembly installed in LTV Space Environment Simulator showing Earth and Spacecraft Simulators (Rear View of Suit).	19
10.	Spacecraft Simulator in Contact with Gemini Space Suit Assembly.	20
11.	Air Cylinder Utilized to Provide Movement of Gemini Spacecraft Simulator.	22
12.	Suit Rotation Mechanism.	23
13.	Aluminum Support for Gemini Spacecraft Simulator.	24
14.	Suit Flow System - Experiment I-b.	25
15.	Thermocouple Locations on Front Surface of Thermal Dummy and Constant Wear Garment.	27
16.	Thermocouple Locations on Back Surface of Thermal Dummy and Constant Wear Garment.	28

		Page
17.	Thermocouple Locations on Interior and Exterior Surfaces on Front of Gemini Space Suit.	29
18.	Thermocouple Locations on Interior and Exterior Surfaces on Back of Gemini Space Suit.	30
19.	Block Diagram of Thermocouple Recording System.	39
20.	Block Diagram of Suit Pressure Instrumentation.	40
21.	Gemini Space Suit Assembly Installed in LTV Space Environment Simulator (Test Day No. 2).	46
22.	Gemini Space Suit Assembly Installed in LTV Space Environment Simulator Showing Position of Left Leg (Test Day No. 2).	47
23.	Orbital Positions for Space Suit Assembly and Earth Simulator.	48
24.	Reflectance of HT-1 Nylon (Four Layers).	49
25.	Spectral Reflectance of SES Earth Simulator Paint.	52
26.	Test Plane Distribution of Reflected Energy from Earth Simulator.	54
27.	Distribution of Reflected Energy from Rotated Earth Simulator (Measured at Test Plane Centerline).	55
28.	Effect of Pressure on Conductivity of Typical Superinsulations.	58
29.	Temperature History of Suit Surface, Dummy Surface and Ventilation Gas, Day No. 1.	60
30.	Temperature History of Suit Surface, Dummy Surface, and Ventilation Gas, Day No. 2.	61
31.	Temperature History of Suit Surface, Dummy Surface, and Ventilation Gas, Day No. 3.	62
32.	Temperature History of Suit Interlayers (Lower Left Back), Day No. 1	63
33.	Temperature History of Suit Interlayers (Lower Left Back), Day No. 2.	64

		Page
34.	Temperature History of Suit Interlayers (Lower Left Back), Day No. 3.	65
35.	Temperature History of Feet and Right Hand, Day No. 1	66
36.	Temperature History of Feet and Right Hand, Day No. 2.	67
37.	Temperature History of Feet and Right Hand, Day No. 3.	68
38.	Effect of Mechanical Loading on Thermal Conductivity of Aluminized Film.	77

LIST OF TABLES

		Page
I.	Spectral Energy Distribution of 2.5 KVA Mercury-Xenon (Hanovia) Sources as Installed in the LTV Solar Simulator.	12
II.	Experiment I-b Thermocouple Locations.	31
III.	Summary of Experiment I-b Test Conditions.	45
IV.	Comparison of Measured Suit Surface Temperatures and Calculated Values for a 200 Nautical Mile Orbit.	69
V.	Calculated Net Suit Heat Leakage.	73

1.0 SUMMARY

Experiment I-b of NASA-MSC Contract NAS9-3414 requires that tests be conducted to evaluate the performance and thermal response of a prototype Gemini extravehicular space suit in a simulated 200 nautical mile earth orbit. A prototype Gemini extravehicular suit assembly (Serial Number GH-2C-18) was instrumented for temperature and pressure measurements and was exposed to the simulated space environment created by the LTV Space Environment Simulator (SES). A thermal dummy capable of providing the sensible heat of a man was placed in the suit assembly to closely simulate manned occupancy of the space suit. Testing was conducted over a three day period under the following conditions: (1) cold soak with -320°F SES walls, (2) conditions simulating a earth orbit, (3) contact with a heated spacecraft surface and (4) high solar heat inputs. The principle objective of the test series was to determine the design adequacy of the prototype suit assembly for operation in the environmental conditions encountered in extravehicular earth orbit operations. The specific test objectives were to determine:

1. Suit temperatures and pressures as functions of time, orbit position and suit rotation position.

2. Suit net heat gain or loss as a function of time, orbit position and suit rotation position.

3. Net heat gain or loss through the suit visor.

4. Evidence of visor frosting.

5. Thermal adequacy of suit.

6. "Hot spots" or "cold spots" on the suit resulting from contact with simulated spacecraft surfaces.

7. Suit leakage under simulated space thermal & vacuum conditions.

8. Effect of compression under the parachute harness on suit thermal performance.

Simulation of the thermal and pressure environments during the tests included the following:

1. Astronaut body temperatures.
2. Deep space heat sink.
3. Solar heat flux.
4. Earth thermal radiation.
5. Earth albedo.
6. Hot spacecraft surface.
7. Vacuum.

Astronaut body temperatures and sensible metabolic heat output were simulated by a fiberglass and copper articulated dummy. The shell type construction of the dummy provides an outer layer of material which approximates the conductance of human skin. An electrical heater network covers the interior of the dummy shell and the dummy surface temperatures are controlled by regulating the power to the heaters.

The radiation heat sink of space was simulated by the liquid nitrogen shroud surrounding the test section of the SES. The simulated solar heat flux was provided by a bank of Mercury-Xenon lamps installed at one surface of the test chamber. A pressure of less than 10^{-4} mm Hg was maintained throughout the tests by the SES vacuum pumping system. Earth thermal radiation and reflected solar radiation (albedo) were simulated by use of a dished aluminum plate located opposite the suit from the solar lamps and coated with a controlled emittance paint. The thermal radiation from the earth simulator was controlled by regulating the simulator surface temperature. This was accomplished by varying the power input to electrical heaters attached to the back of the plate. Incident energy from the SES lamp bank was reflected from the dished plate to simulate the earth albedo radiation. The simulated spacecraft surface was provided by a section of aluminum structure which could be moved into contact with the suited dummy. The surface of the structure was adjustable to simulated spacecraft surface temperatures by electrical resistance heaters.

The prototype Gemini extravehicular space suit consists of a pressure restraint inner assembly and a thermal protective outer assembly fabricated to produce a single piece garment. The thermal protective provisions include seven layers of aluminized mylar covered by a nylon felt layer. The outer wearing surface of the suit is a lightweight nylon cloth. Thermocouples were attached to the outer surface and at various locations on the interior layers to monitor the thermal performance of the insulative layers. Visor and helmet temperature as well as suit pressures were also monitored during the tests.

The results of this experiment indicate that suit outer surface temperatures did not exceed +200°F or fall lower than -200°F during simulated extravehicular operations in an earth orbit. Maximum heat loss during deep space operation should not exceed 250 BTU/hr. The maximum heat leakage into the suit should not exceed 20 BTU/hr under maximum heating conditions. Visor heat loss to deep space was approximately 30 to 40 BTU/hr while visor heat gain under direct solar radiation was approximately 40-50 BTU/hr. The overall conductance of the suit was estimated to be between 0.017 and 0.024 $\frac{BTU}{hr\ ft^2\ {}^oF}$. Contact with a 180°F spacecraft surface or compression points under the parachute harness did not produce any measurable hot spots on the interior surface of the suit.

A positive indication of visor frosting was not obtained in this experiment. Based on visor temperature and the relative humidity measurements, visor frosting very likely did occur. A direct measurement of heat flux through the visor was not obtained due to equipment malfunction.

Suit pressures ranged from 3.8 to 4.4 psia during the test while the pressure differential or loss across the suit varied between 0.08 and 0.12 psi. Suit gas leakage varied between 140 and 190 scc/min during the course of the tests.

The foregoing results indicate that the Gemini prototype suit assembly tested should provide satisfactory thermal protection for manned use during earth orbit extravehicular operations. Additional testing, however, will be required to determine the adequacy of thermal protection about the hands and feet.

2.0 INTRODUCTION

Extravehicular operation in earth orbit requires protection of the astronaut from his environment. An important component of the protective system is the extravehicular space suit. This suit provides both protection from the low pressure of space as well as protection from the extreme heat sources and heat sinks. LTV Astronautics in accordance with Contract NAS9-3414 is engaged in a comprehensive un-manned test program to evaluate the performance of space crew equipment in a simulated space environment. The experimental test results detailed in this report cover the first of twelve space suit thermal evaluation experiments to be conducted in the LTV Space Environment Simulator for the NASA Manned Spacecraft Center. The first experiment (Experiment I-b) subjected the Gemini prototype extravehicular space suit assembly containing a thermal dummy to the low pressures and extreme temperature conditions of a simulated near earth environment. The experiment was performed to permit an evaluation of the thermal performance of this specific suit under space environment conditions similar to those encountered exterior to the Gemini spacecraft while in orbit.

This report presents a description of Experiment I-b, the results obtained, and an extrapolation of the test results to define the actual space conditions anticipated.

3.0 TEST PROGRAM

3.1 TEST OBJECTIVES

The overall objective of Experiment I-b was to evaluate the thermal performance characteristics of the Gemini extravehicular space suit during a simulated near earth orbit. The specific test objectives were as follows:

1. Suit temperatures and pressures as functions of time, orbit position and suit rotation position.

2. Suit net heat gain or loss as a function of time, orbit position and suit rotation position.

3. Net heat gain or loss through the suit visor.

4. Evidence of visor frosting.

5. Thermal adequacy of suit.

6. "Hot spots" or "cold spots" on the suit resulting from contact with simulated spacecraft surfaces.

7. Suit leakage under simulated space thermal & vacuum conditions.

8. Effect of compression under the parachute harness on suit thermal performance.

3.2 DESCRIPTION OF TEST ARTICLE

The test article was a Gemini space suit (GH-2C-18) which is the prototype of the insulated G-4C Gemini extravehicular suit. During the test, the suit was worn by a thermal dummy (described in paragraph 3.3.2.1)wearing a conventional underwear garment. Figure 1 shows the suit and dummy installed in the Space Environment Simulator for testing.

The test suit consists of a pressure garment with integral thermal insulation (Figure 2). The innermost layer is a lightweight nylon "comfort liner" which is worn next to the astronaut. Outside the comfort liner is the heavier pressure seal which is the airtight layer. Immediately outside the pressure layer is a "restraint net" which provides additional strength for containing the suit burst pressure forces. Following the restraint layer are two layers of light-weight nylon (du Pont HT-1 "Nomex"), seven layers of aluminized mylar superinsulation, the layer of Nomex felt and a Nomex outer layer. The test article included superinsulation gloves and mittens and insulation covers over the inlet and return hose connections to reduce the heat shorts of these areas. An insulation hood to place over the entire helmet was also provided for this test. The hood was provided to allow determination of heat leaks through the helmet and visor.

The left glove of the suit and the left hand of the dummy were removed and a special feed through was fitted to the wrist disconnect for the purpose of withdrawing internal instrumentation leads (Figure 3). The special feed through and leads were protected by a superinsulation cover during the experiment.

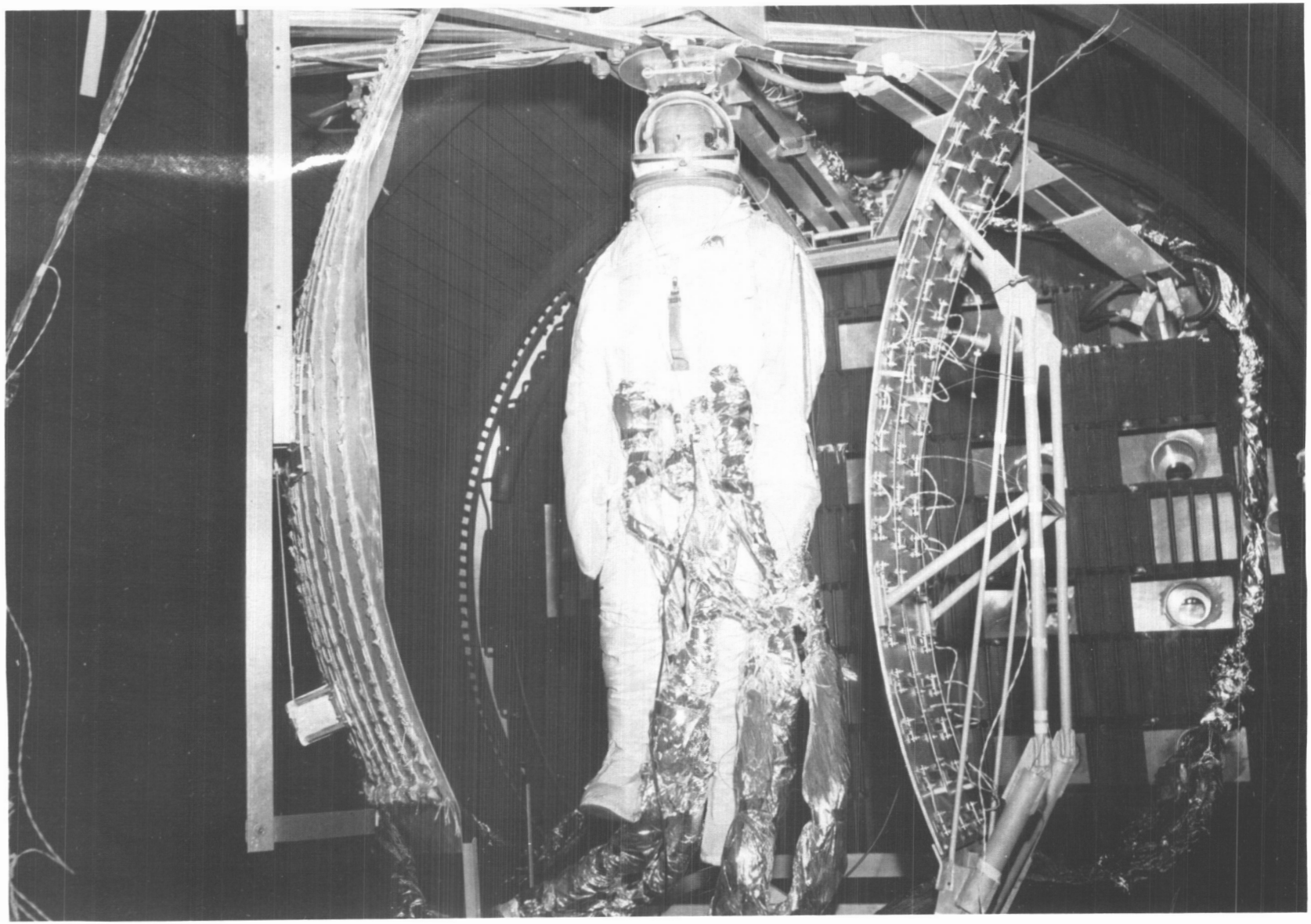


FIGURE 1 GEMINI SPACE SUIT ASSEMBLY INSTALLED IN THE LTV SPACE ENVIRONMENT SIMULATOR SHOWING THE EARTH AND SPACECRAFT SIMULATORS (TEST DAY #3)

a) Comfort liner (inner layer)
b) Gas bladder
c) Restraint net
d) Two HT-1 "NOMEX" layers (7 oz/sq yd)
e) Seven layers NRC-2 superinsulation with batt dacron spacers
f) "NOMEX" felt barrier (14 oz/sq yd)
g) Uncoated HT-1 "NOMEX" outer layer (7oz/sq yd)

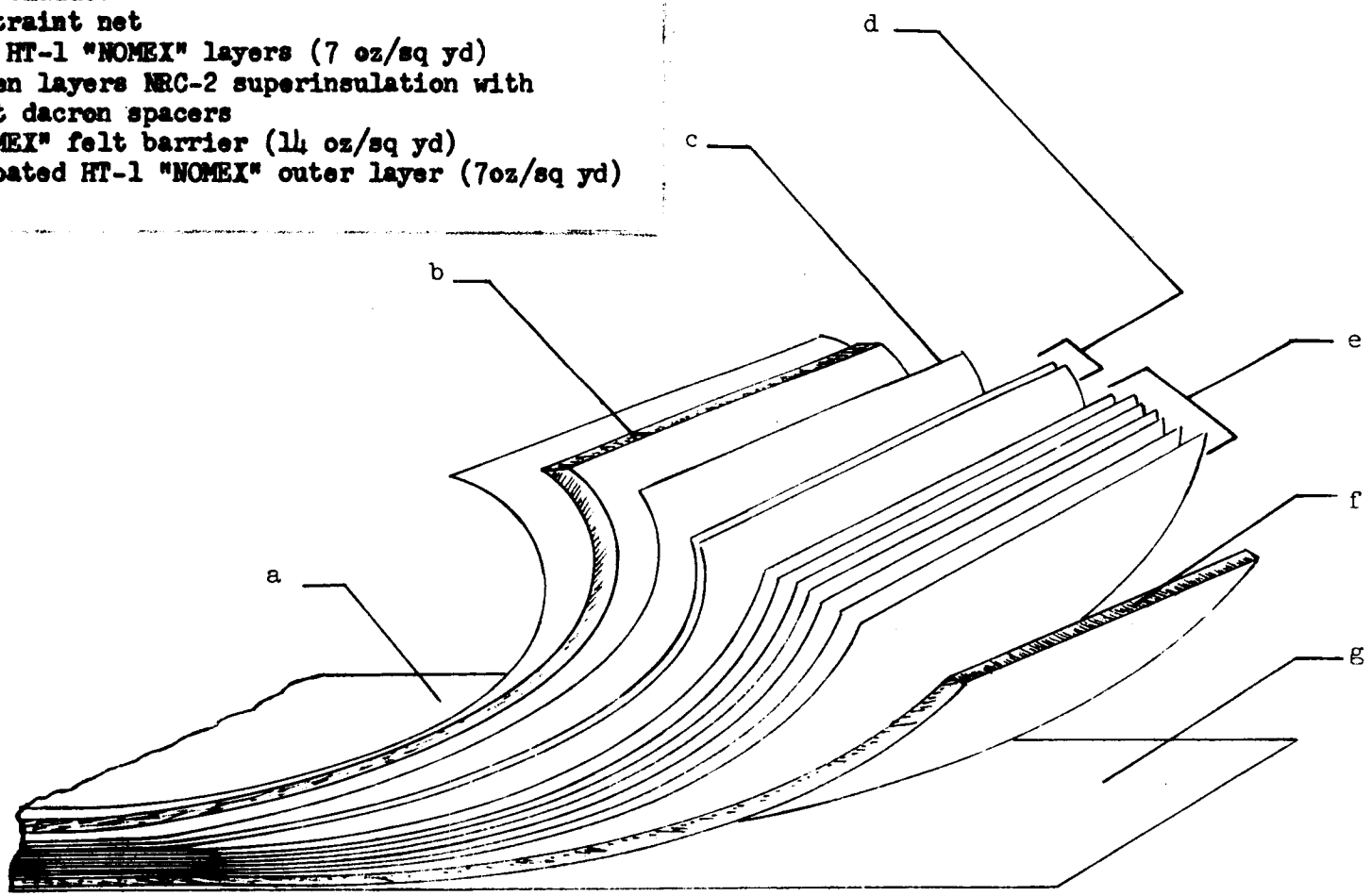


FIGURE 2

DESCRIPTION OF GEMINI EXTRAVEHICULAR SUIT LAYERS

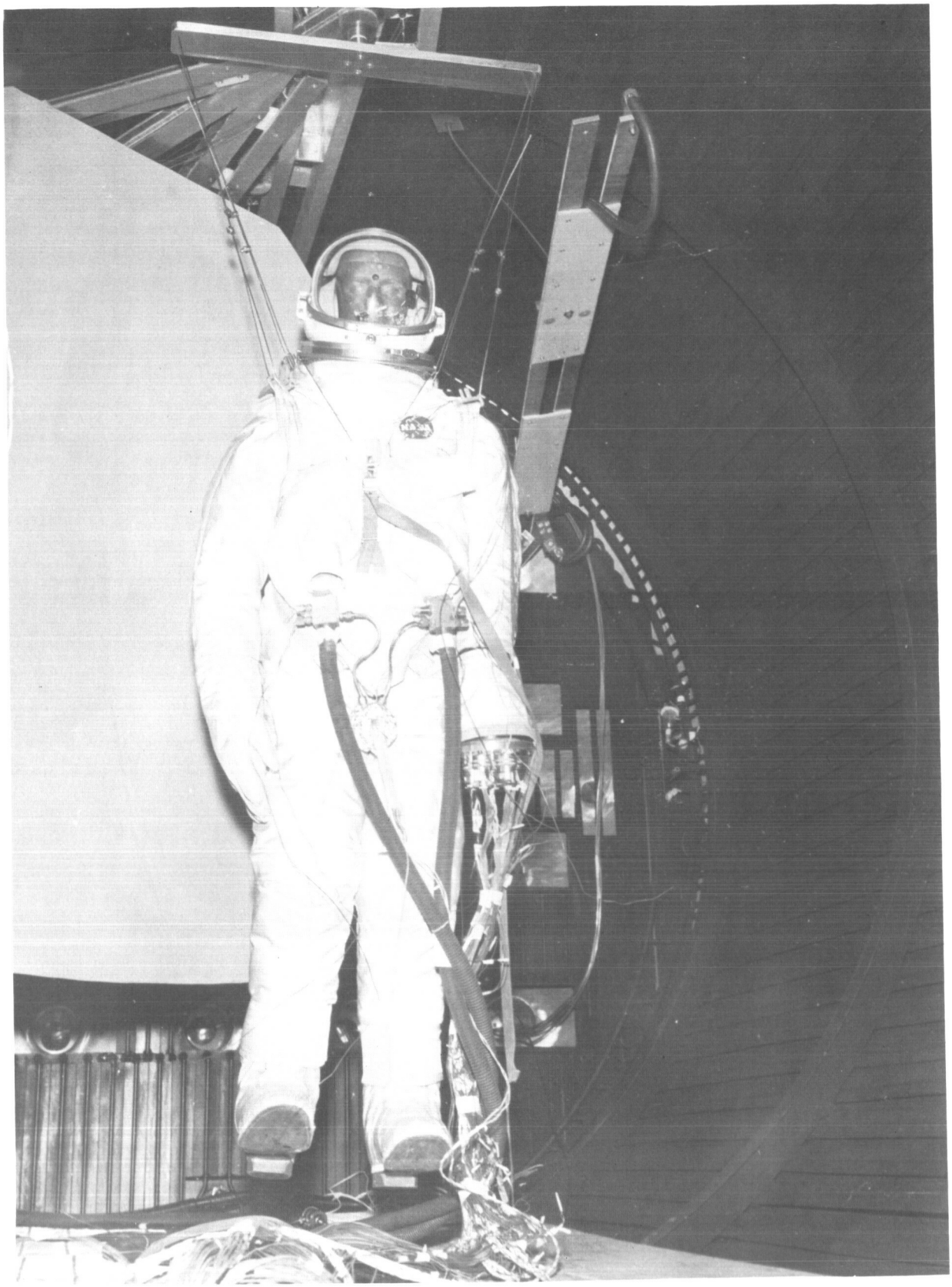


FIGURE 3 GEMINI SPACE SUIT ASSEMBLY INSTRUMENTATION DETAILS (TEST DAY #1)

3.3 TEST EQUIPMENT

3.3.1 TEST FACILITY

Experiment I-b was conducted in the LTV Space Environment Simulator (SES). The SES has a 10 ft. diameter by 10 ft. long test chamber which provides the simulated vacuum heat sink conditions of outer space and radiation of the sun. An overall view of the facility is presented by Figure 4.

The SES vacuum capability is provided by three, 32-inch oil diffusion pumps with an ejector and mechanical forepumping system. The ultimate vacuum capability of the chamber is approximately 4×10^{-8} mm Hg. During this test, the SES pressure was maintained at approximately 5×10^{-5} mm Hg. This was the minimum pressure attainable with the suit and gas supply system leakage. Figure 5 shows chamber pressure vs time during the second day of testing and is representative of the chamber pressure throughout the entire test. Figure 5 also shows the SES pumpdown time to be approximately 3 hours.

The heat sink conditions of space are simulated by a liquid nitrogen cooled shroud or cryowall which covers the entire inner surface of the SES with the exception of two viewing ports and twenty ports used to allow passage of the solar heat flux. The total uncooled wall area represented by these ports is 3 percent of the total shroud area. The cryowall is a multifinned, aluminum tube bank cooled by liquid nitrogen. The cryowall surface was refinished recently with Minnesota Mining and Manufacturing Company Series 101C-10 Black Velvet coating which has an absorptivity of approximately 0.98 in the solar spectrum.

Simulated solar radiation is supplied by twenty, 2500-watt Mercury-Xenon high pressure arc lamps mounted outside the chamber and focused through quartz ports such that the mean flux over a six-foot plane near the center of the chamber is approximately uniform. The flux at the test plane is controllable over the range of 285 to 445 BTU/hr. ft^2. Power is supplied to the solar simulator lamps by a regulated power supply capable of limiting power fluctuations to +1% of the operating level.

The spectral distribution of flux from the SES solar simulator lamps is typical of Mercury-Xenon arc lamps. The spectral distribution of the lamps as installed in the SES has been measured and the results are reported in Reference 1. Table 1 is a tabulation of the spectral measurements obtained. The data presented by Table 1 are considered to be valid for Experiment I-b and do not change significantly throughout the life of the lamps. Paragraph 3.6.1 presents a discussion of the methods used during Experiment Ib to compensate for the spectral mismatch of the solar simulator lamps with the sun. Figure 6 presents the measured distribution of simulated solar flux over a plane in the SES at the point where the test specimen was located. The measurements presented by Figure 6 were obtained by scanning the test plane with a certified thermopile (Eppley Serial No. 5380) which was purchased for the solar source calibration. The measurements were made immediately before the conduct of Experiment I-b.

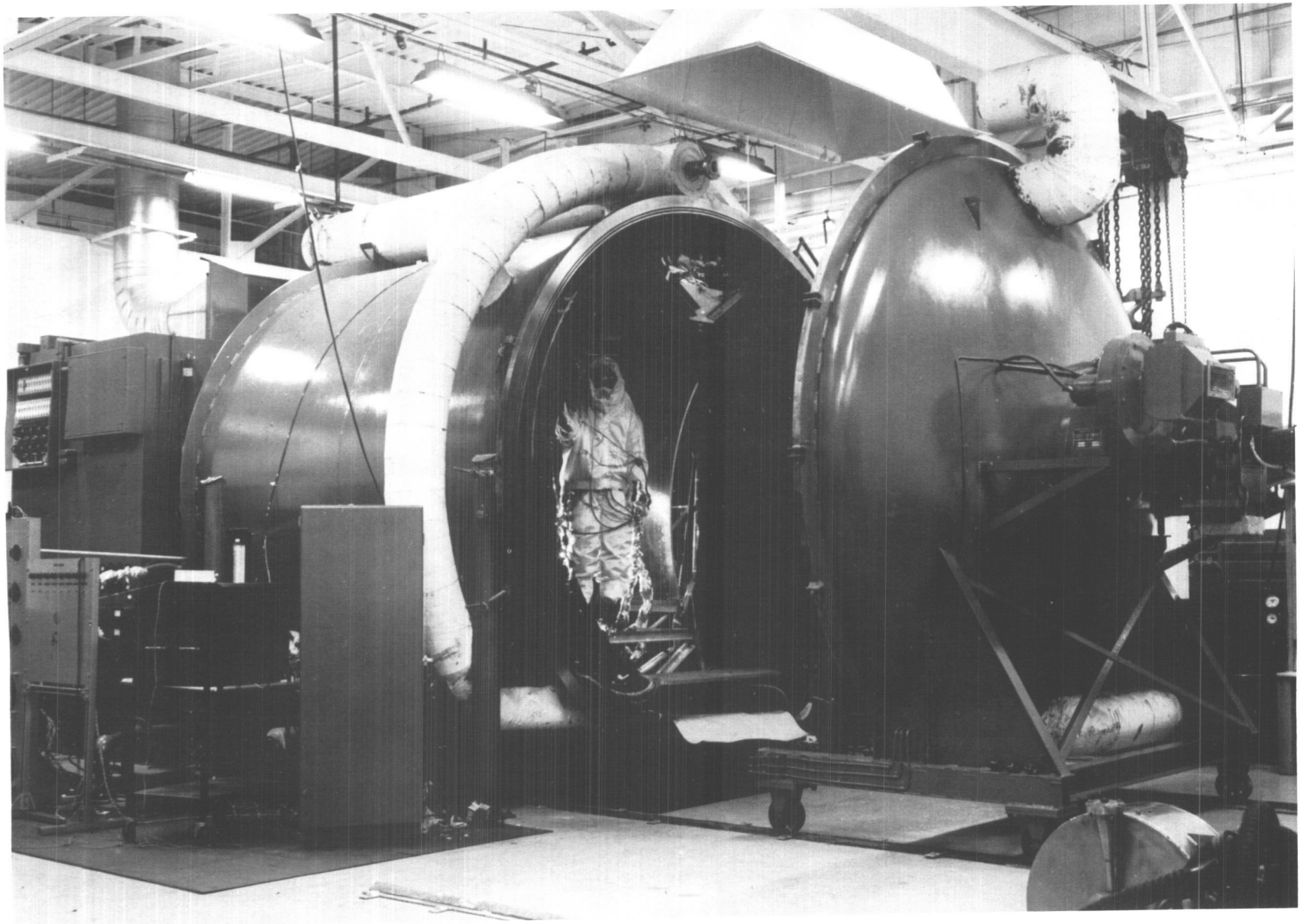


FIGURE 4 LTV SPACE ENVIRONMENT SIMULATOR

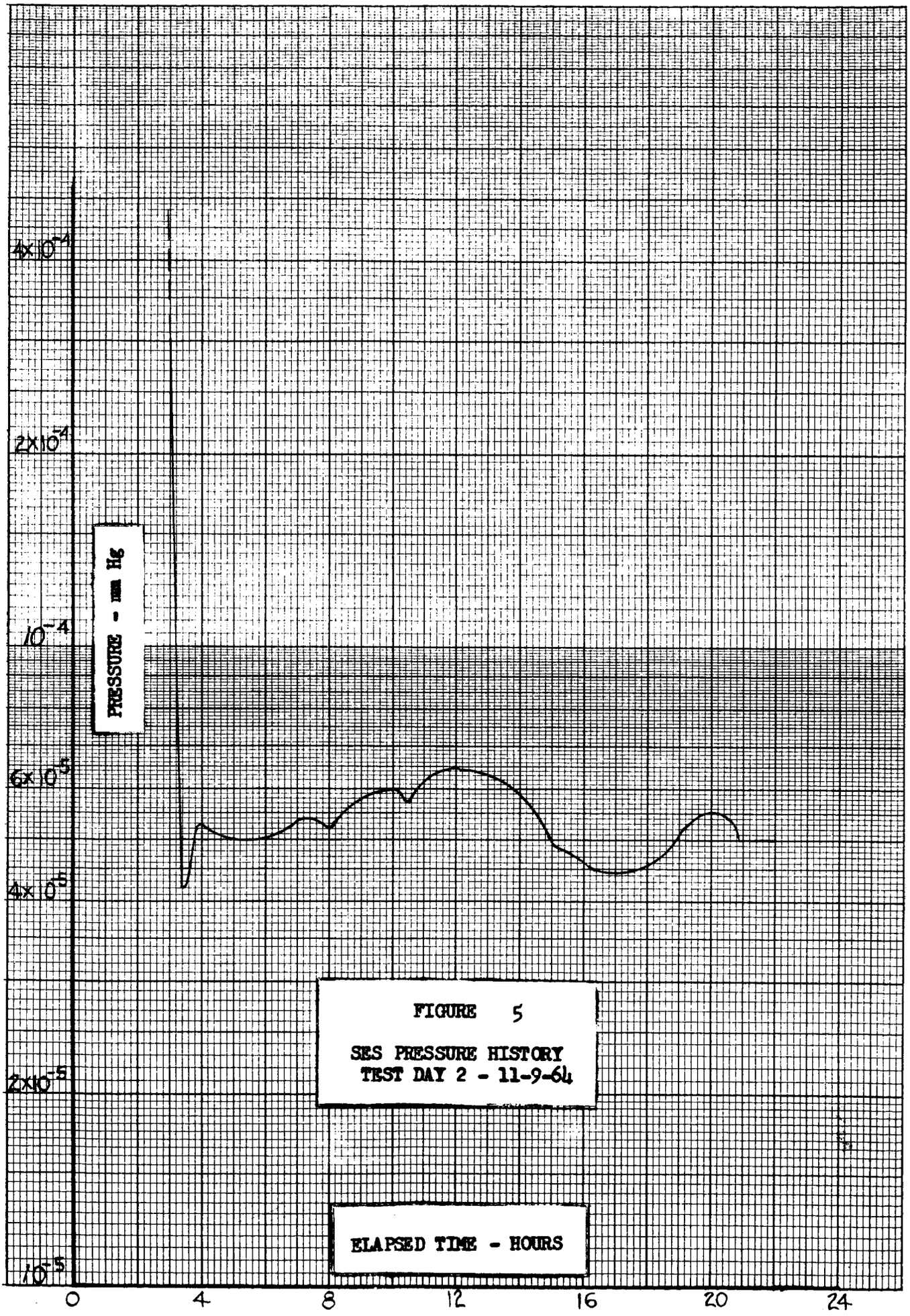


FIGURE 5

SES PRESSURE HISTORY
TEST DAY 2 - 11-9-64

K&E SEMI-LOGARITHMIC 359-63

TABLE I

SPECTRAL ENERGY DISTRIBUTION OF 2.5 KVA MERCURY-XENON (HANOVIA) SOURCES AS INSTALLED IN THE LTV SOLAR SIMULATOR

Wavelength Band, Millimicrons	Energy in Band, Milliwatts/cm^2	Wavelength Band, Millimicrons	Energy in Band, Milliwatts/cm^2
<260			
260	(0.5)	560-70	0.2
260-70	1.0	70-80	2.7
70-80	1.5	80-90	2.2
80-90	1.7	590-600	0.2
290-300	2.0	600-10	0.1
300-10	2.5	10-20	0.6
10-20	2.6	20-30	0.1
20-30	0.4	30-40	0.1
30-40	1.2	40-50	0.1
40-50	0.2	50-60	0.1
50-60	0.4	60-70	0.1
60-70	3.6	70-80	1.1
70-80	3.5	80-90	0.4
80-90	0.3	690-700	0.1
390-400	0.2	700-750	0.5
400-10	1.7	750-800	0.4
10-20	0.2	800-850	0.7
20-30	0.3	850-900	1.0
30-40	3.4	900-950	0.9
40-50	0.2	950-1000	1.0
50-60	0.2	1000-1100	2.0
60-70	0.1	1100-1200	1.8
70-80	0.1	1200-1300	0.9
80-90	0.1	1300-1400	1.9
490-500	0.2	1400-1500	0.4
500-10	0.1	1500-1600	0.5
10-20	0.1	1600-1700	0.5
20-30	0.1	1700-1800	0.5
30-40	0.2	1800-1900	0.2
40-50	2.5	1900-2000	0.1
550-60	0.3		

Total	49.8	%
UV (380 mu and below)	18.1	36
VIS (380-750 mu)	18.9	38
NIR (above 750 mu)	12.8	26

Source: Measurements by Dr. A. J. Drummond, Eppley Laboratories, Newport, Rhode Island

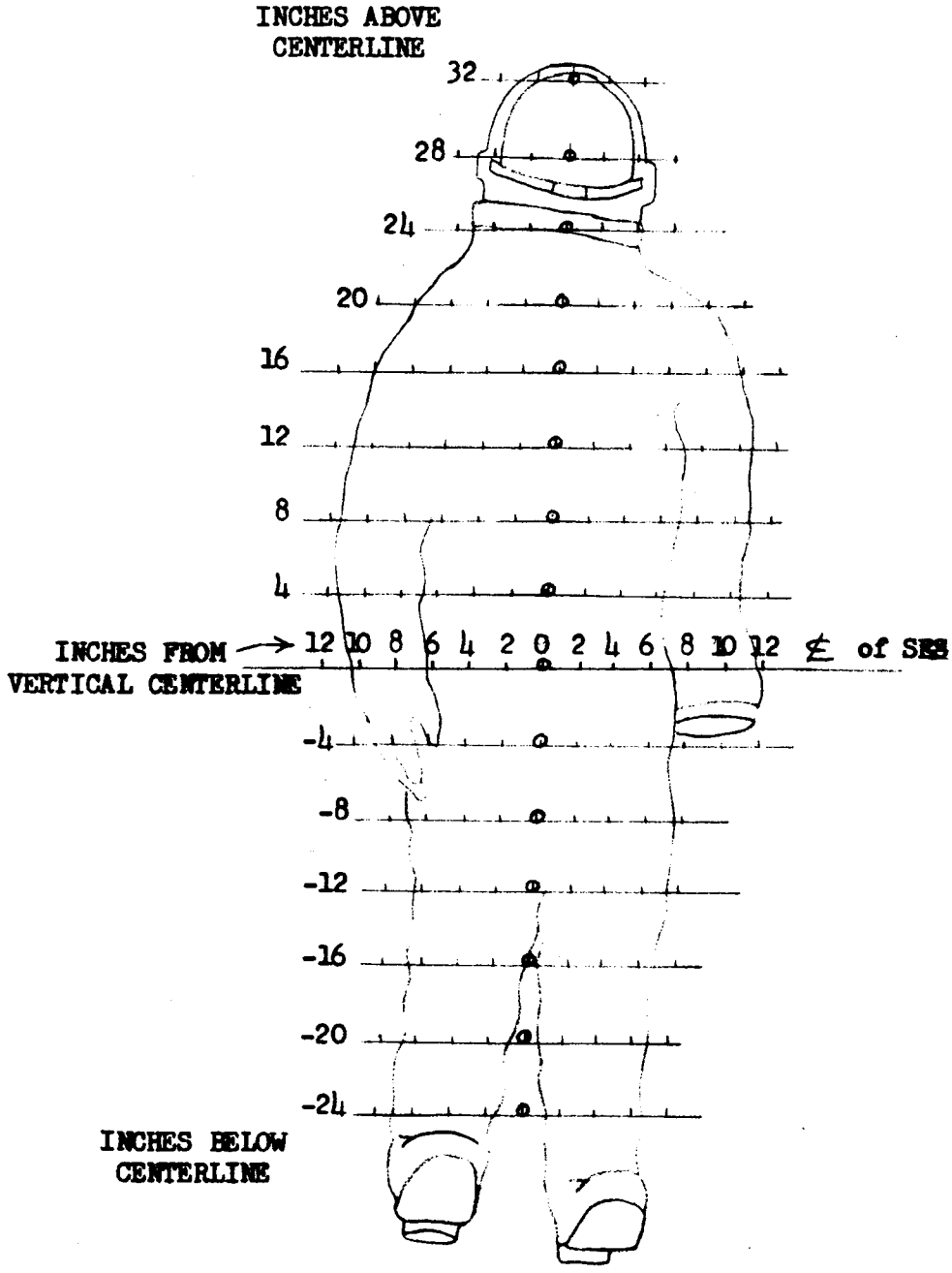


FIGURE 6a

SPECIMEN RELATIONSHIP TO SOLAR SOURCE CALIBRATION

FIGURE 6b

LTV SPACE ENVIRONMENT SIMULATOR
SOLAR FLUX DISTRIBUTION AT TEST PLANE

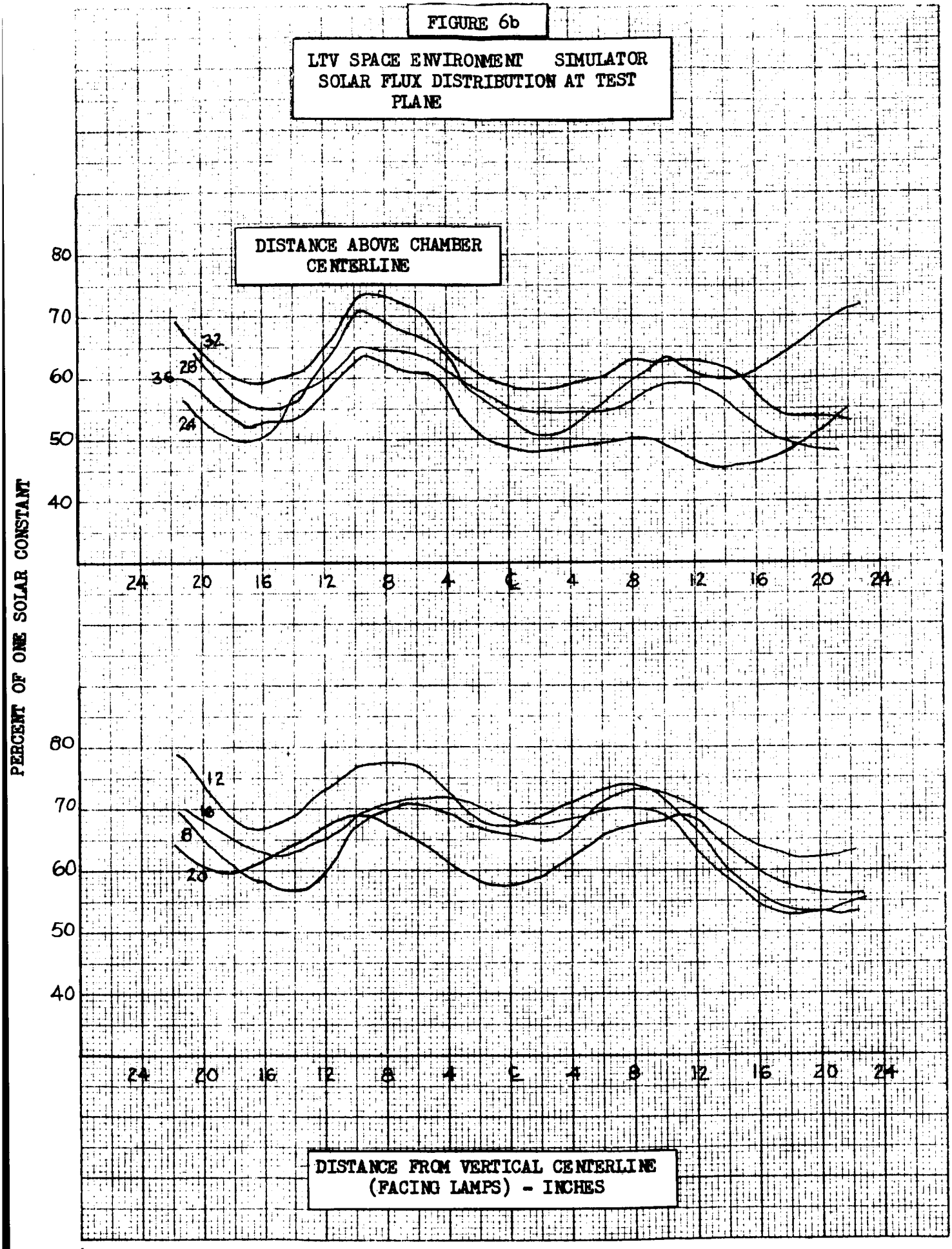
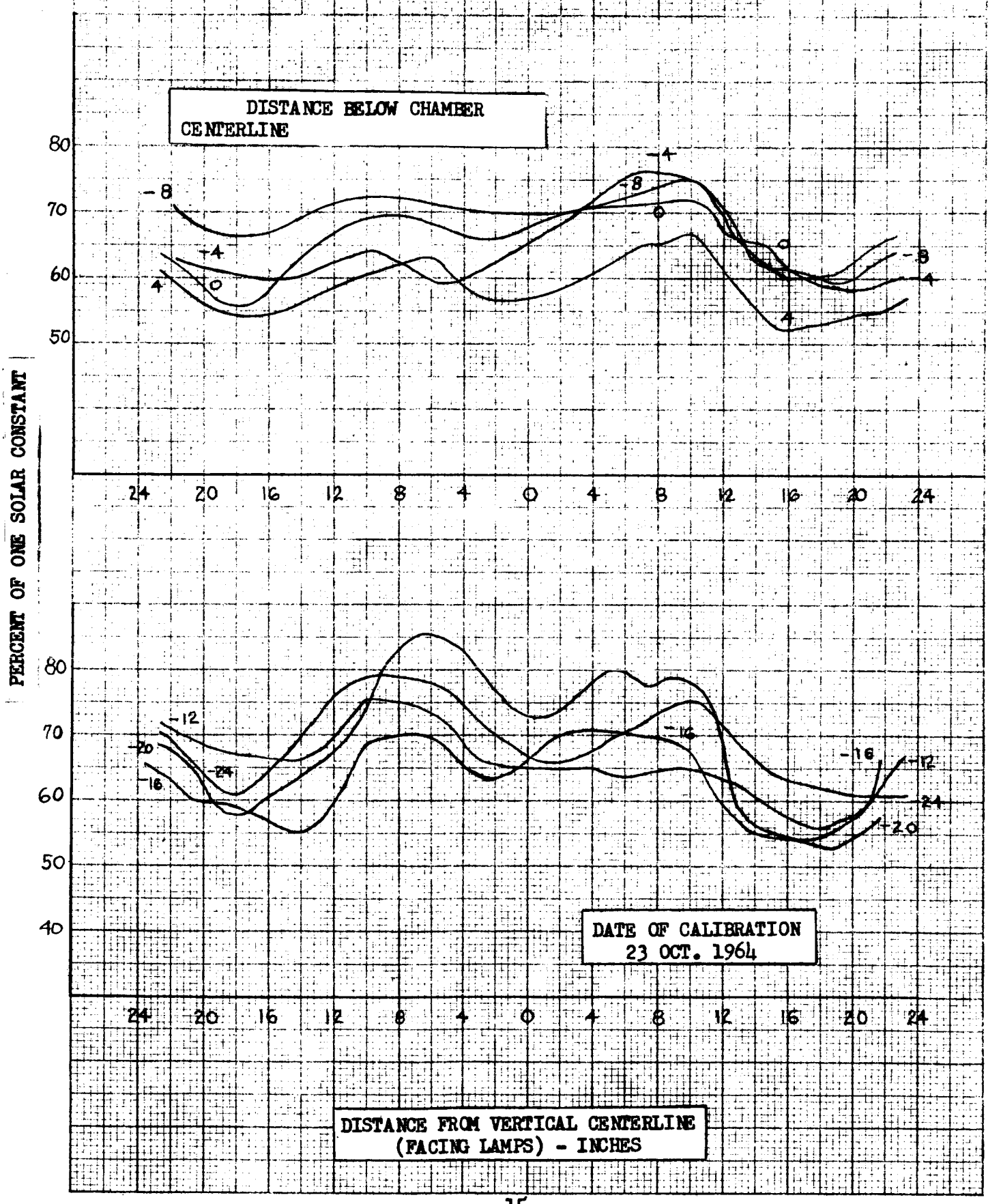


FIGURE 6c

LTV SPACE ENVIRONMENT SIMULATOR
SOLAR FLUX DISTRIBUTION AT TEST PLANE
(CONTINUED)



3.3.2 SPECIAL TEST EQUIPMENT

3.3.2.1 Thermal Dummy

The space suit used for Experiment I-b was worn over a thermal dummy throughout the test. Figures 7 and 8 show two views of the dummy. The dummy is heated in order to simulate the sensible metabolic heat of a man and also allows duplication of suit ventilation flow patterns in the suit. The dummy is constructed such that the conductance of the shell approximates the average conductance of human skin (7 BTU/hr ft^2 ^oF).

The thermal dummy was manufactured by the Sierra Engineering Company of Sierra Madre, California. It is constructed in a phenolic-fiberglass laminate shell with articulation of the head, shoulders, hips, knees and ankles. Access is provided to the inside of the head and torso. The dummy conforms to a 15th percentile man. Each body segment has an individual electrical resistance heater circuit so that power can be supplied and controlled individually to each of the segments. A thin copper plate is formed into the fiberglass shell to insure an even distribution of heat over the surfaces of the dummy. Unheated hands and feet were used during Experiment I-b.

3.3.2.2 Earth Emission and Albedo Simulator

The earth's albedo and thermal radiation were simulated by a dished aluminum reflector (earth simulator) located opposite the test plane from the solar lamps. Figure 1 is a photograph of the test installation showing the earth simulator on the left. Strip heaters electrically insulated with glass tape were attached to the back as shown in the photograph and were used to control the earth simulator temperature and therefore its thermal radiation. The reflected solar energy from the earth was simulated by painting the side facing the lamps with paint of appropriate reflectance. Figure 9 is a photograph of the back of the suit showing the earth simulator rotated 180° from its normal position so that it is between the suit and solar lamps. In this photograph the painted side faces the front of the suit and its dull gray appearance can be compared with the shiny, bare aluminum, simulated spacecraft surface at the right. The paint used on the earth simulator was Cat-a-Lac Thermoflect 463-3-41 TRS 5569 (manufactured by Finch Paint Company). This paint has a total reflectance of 0.32 in the SES lamp spectrum and a reflectance of 0.45 in the solar spectrum. A reflectance of 0.35 is generally accepted as the average reflectance of the earth (Reference 2).

3.3.2.3 Spacecraft Surface Simulator

The curved surface shown at the right of Figure 9 was used in the evaluation of the effects of direct contact between an extravehicular suit and a spacecraft surface. The surface has the curvature of the Gemini spacecraft adapter section and can be acutated to move against the suit (Figure 10) or be retracted from it. The desired temperature of the simulated spacecraft surface can be obtained by supplying electrical energy to its electrical resistance heaters or by allowing it to cool by radiation to the SES cryowalls.

FIGURE 7 THERMAL DUMMY ASSEMBLED

FIGURE 8 THERMAL DUMMY PARTIALLY DISASSEMBLED SHOWING SECTIONS AND HEATERS

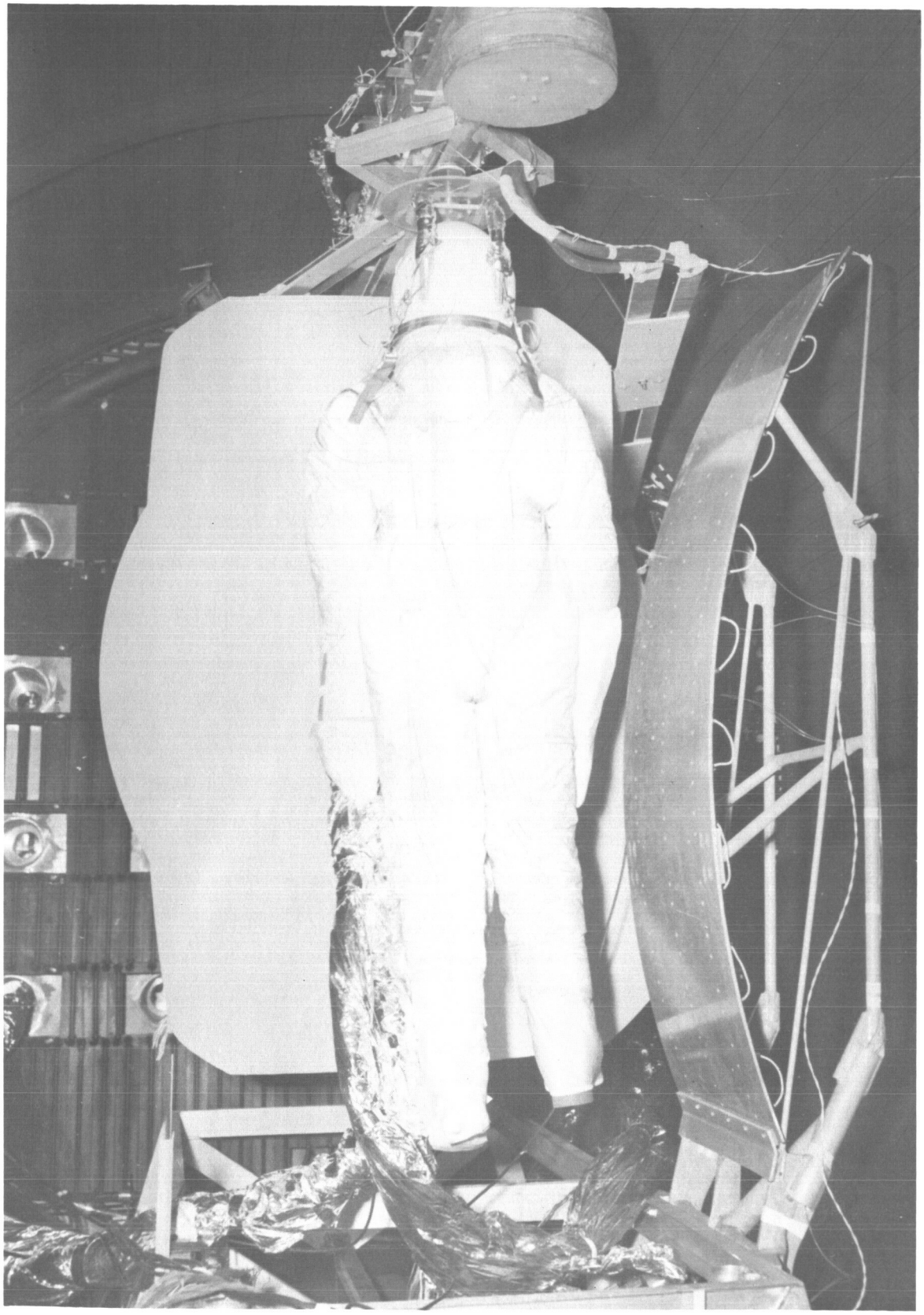


FIGURE 9 GEMINI SPACE SUIT ASSEMBLY INSTALLED IN LTV SPACE ENVIRONMENT SIMULATOR SHOWING EARTH AND SPACECRAFT SIMULATORS (REAR VIEW OF SUIT)

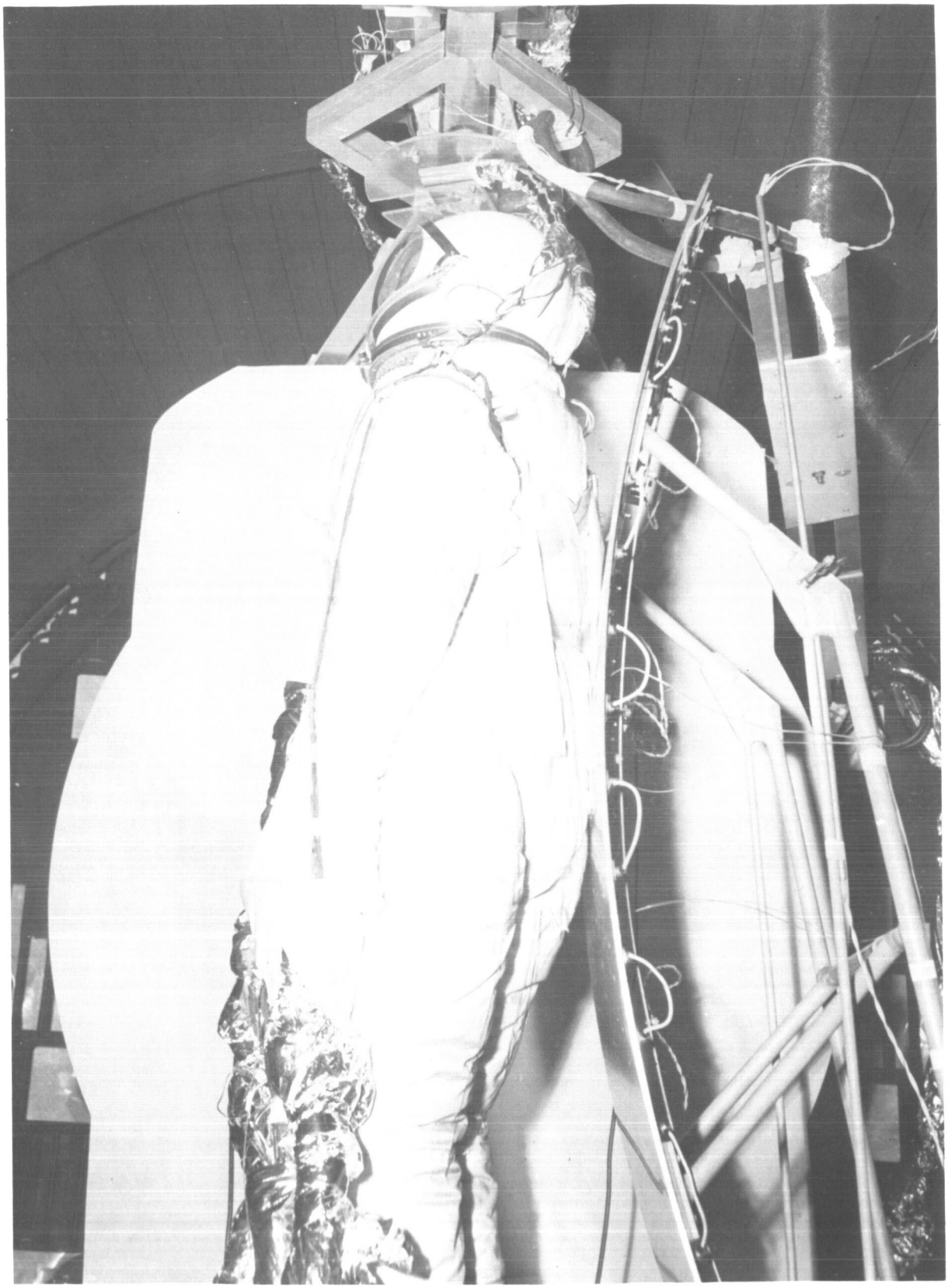


FIGURE 10 SPACECRAFT SIMULATOR IN CONTACT WITH GEMINI SPACE SUIT ASSEMBLY

Movement of the spacecraft surface simulator is accomplished by the pneumatic cylinder mechanism shown on Figure 11. The force exerted against the suit is determined by the amount of compression in a specially designed spring in the actuating mechanism. Prior to the beginning of testing the force required is preset into the actuating mechanism by bringing the spacecraft surface in contact with the suit and adjusting the amount of travel. The mechanism was adjusted prior to Experiment I-b such that the force exerted against the suit by the simulator was approximately fifteen pounds.

3.3.2.4 Specimen Rotation

The gear and rack drive mechanism shown in Figure 12 was operated by air cylinders and allowed rotation of the suit through an angle of approximately $\pm 190^{\circ}$. The suit rotation mechanism and earth simulator were supported by an overhead beam attached to the top of the chamber as shown in Figure 1. The simulated spacecraft surface was supported by the welded aluminum base shown in Figure 13 which fastened to rails in the bottom of the chamber.

3.3.2.5 Suit Gas Supply System

The open loop gas supply system used in the test is shown Schematically in Figure 14. Two nitrogen supplies were provided; one for operation and the other for suit leakage testing. The main supply of nitrogen was regulated to atmospheric pressure then passed through a heat exchanger where its temperature could be raised or lowered as desired before entering the suit. The suit exhaust was dumped to the atmosphere vacuum pump. A suit vent line was provided to prevent suit overpressure during pumpdown. During pumpdown, valve B (Figure 14) is open opened to allow the suit to vent into the chamber. As operating pressures are approached, valve B is closed, valves A and C are opened, and the suit exhausts completely through the vacuum pump with positive flow through the system. During suit leakage testing valves A, B, and C are closed, valve D is opened, and the flow is measured. Valves E and F are manually controlled to provide the desired suit inlet gas temperature.

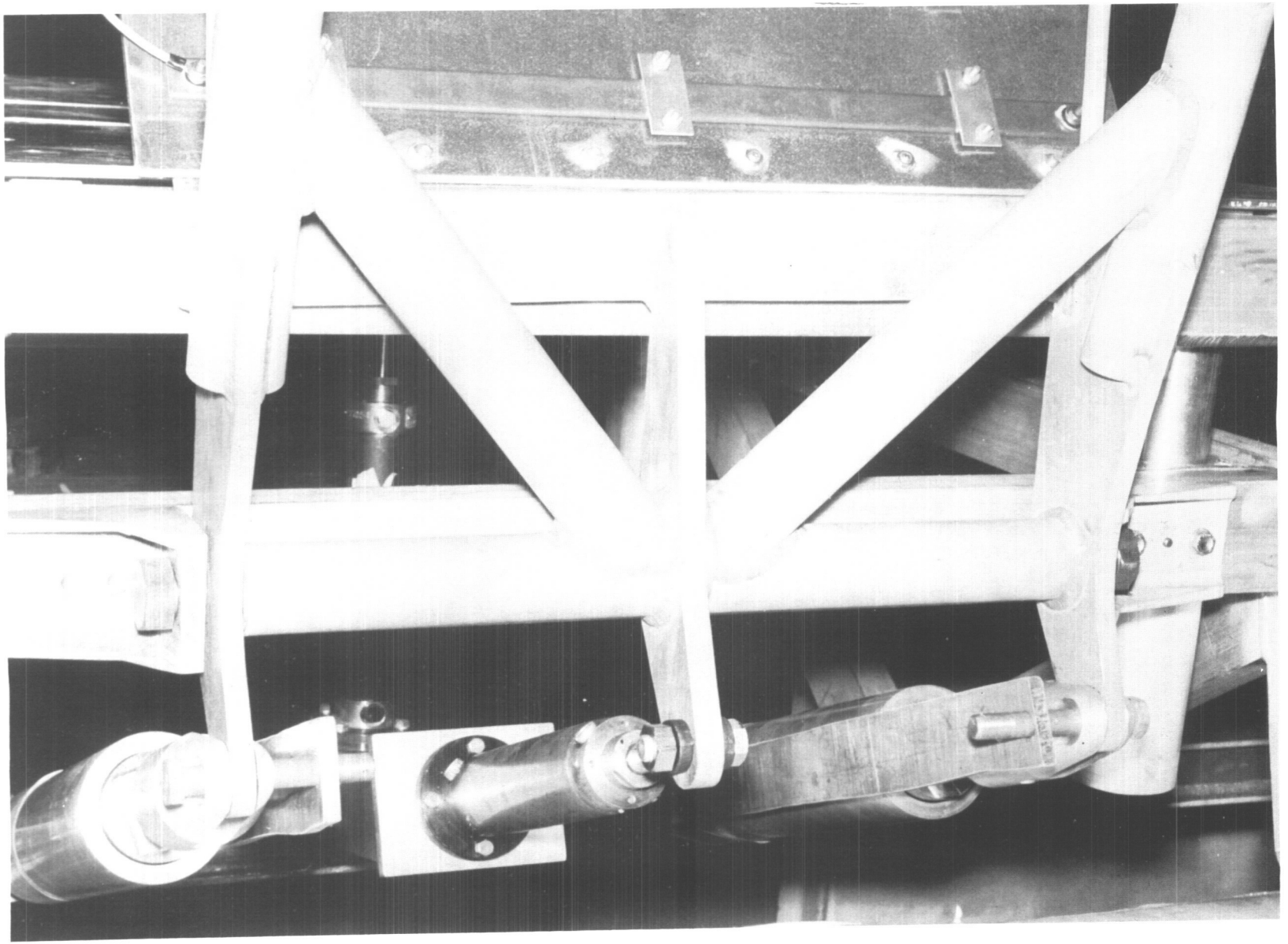


FIGURE 11 AIR CYLINDER UTILIZED TO PROVIDE MOVEMENT OF GEMINI SPACECRAFT SIMULATOR

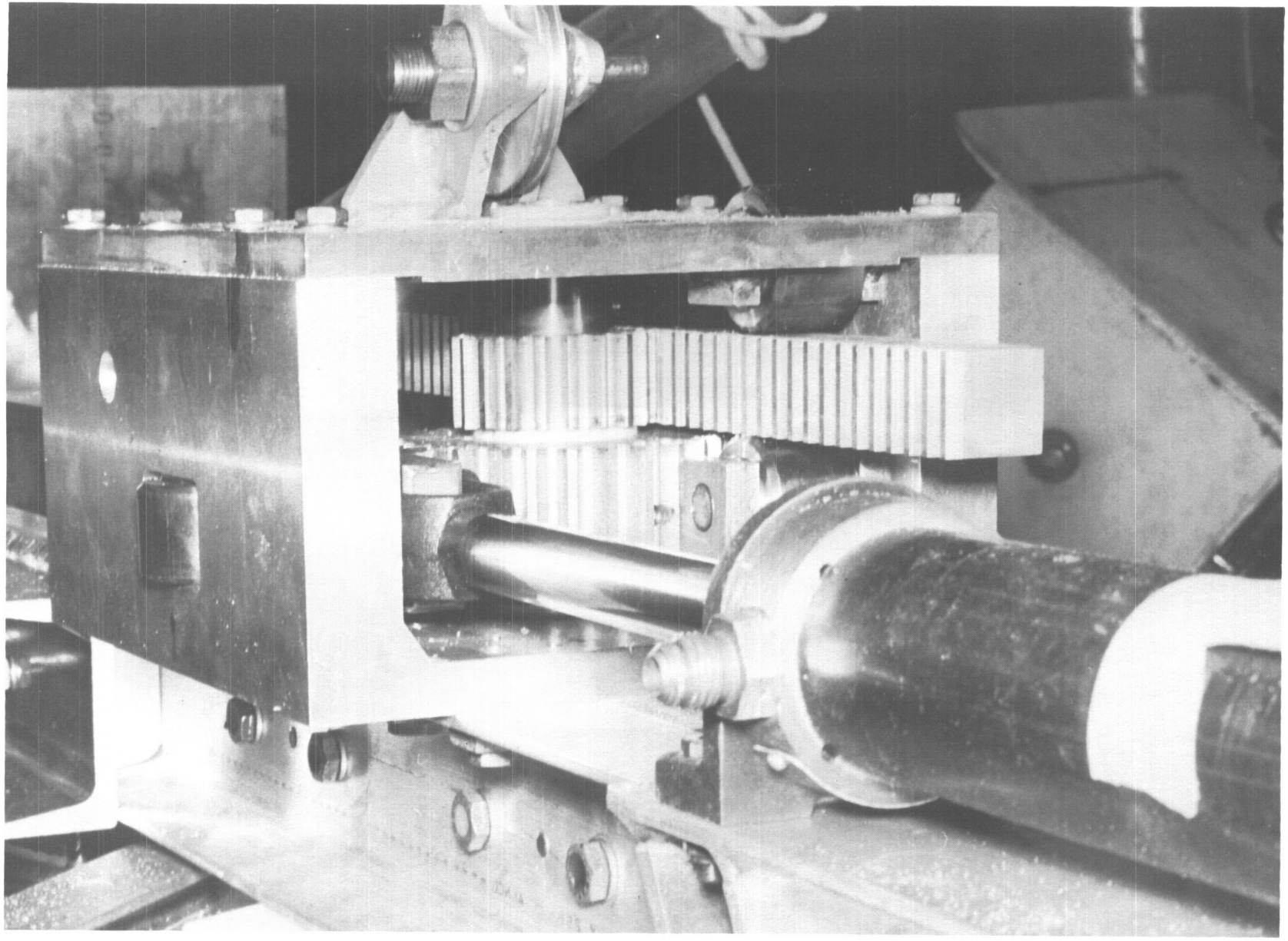


FIGURE 12 SUIT ROTATION MECHANISM

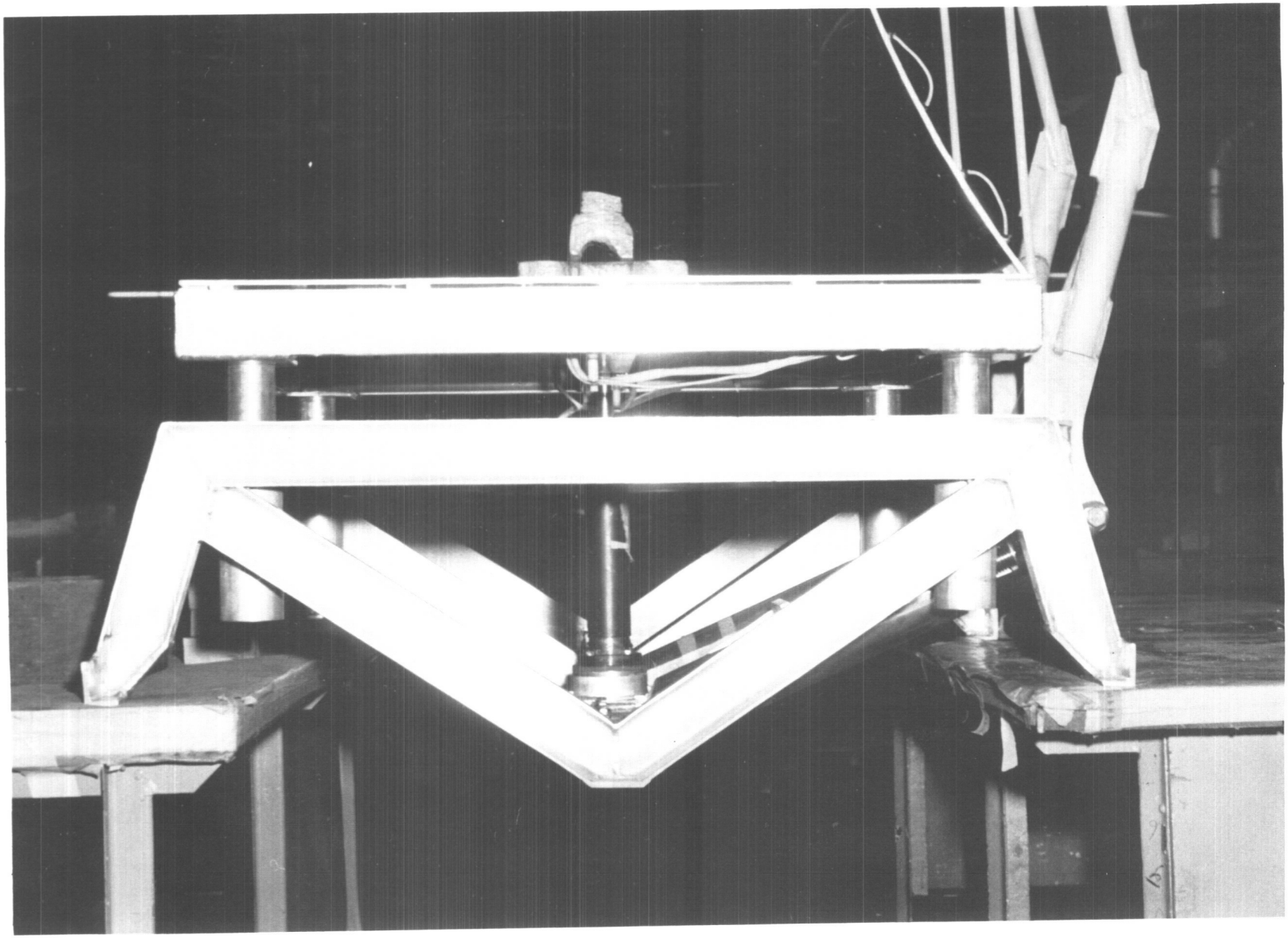


FIGURE 13 SUPPORT FOR GEMINI SPACECRAFT SIMULATOR

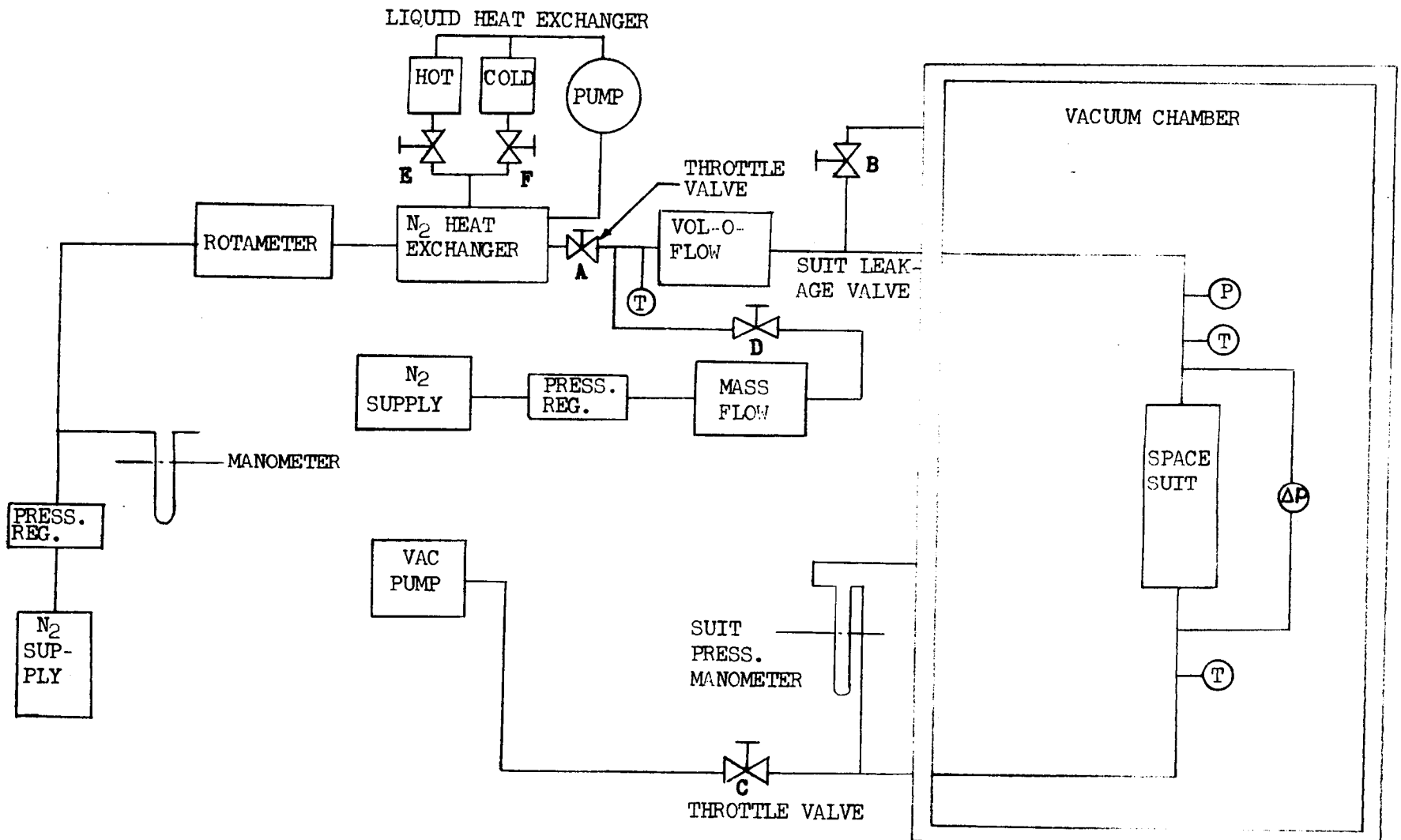


FIGURE 14

SUIT FLOW SYSTEM - EXPERIMENT Ib

3.4 INSTRUMENTATION

Instrumentation was selected for Experiment I-b which would:

(a) Provide suit test data required to make the evaluations and determinations stated by the test objectives in paragraph 3.1;

(b) Determine the degree to which the tests simulated the actual orbit conditions represented by the test points;

(c) Monitor the progress of the test and the facility operation.

This section of the report describes the measurements that were made, data acquisition equipment, measurement and recording techniques, and an error analysis of the data as recorded.

3.4.1 MEASUREMENTS ON SUIT AND THERMAL DUMMY

Temperatures - The suit and dummy were instrumented for temperature measurements on the dummy surfaces, constant wear garment (underwear), inside and outside suit surfaces, selected interlayer locations, and on the helmet. The measurement locations were selected to provide data on suit hot and cold spots, material performance, thermal dummy temperatures and control, suit thermal response, and the effects of mission and configuration variables.

Figures 15 through 18 and Table II present a complete list and description of the temperature measurements with their corresponding recorder channel number. The locations presented by Table II were coordinated with the contract technical monitor.

All temperature measurements on Experiment I-b were made by copper-constantan thermocouples. All thermocouples, except those used for ventilation gas temperature measurements, were constructed of forty-gauge wire (0.003 in. diameter) and beaded by a resistance welder. Forty-gauge wire was utilized for the thermocouples in order to minimize the effects of possible measurement error due to thermal conduction along the lead wire to or from the junction.

Thermocouples located on the outer fabric surfaces of the suit were sewn into the material and secured with the junction in contact with the fabric. The thermocouple junctions were painted with Finch Paint Co. "Cat-A-Lac" white paint previous to installation. This paint has emissive properties comparable to the HT-1 suit cover and was applied in order to reduce possible temperature errors resulting from differences between the emissive properties of the thermocouples and the surrounding fabric to which they were attached.

Thermocouples located on the NRC-2 suit superinsulation were attached by aluminized mylar tape. The thermocouples on metal surfaces were attached by electric welding where possible and Humiseal cement was used for

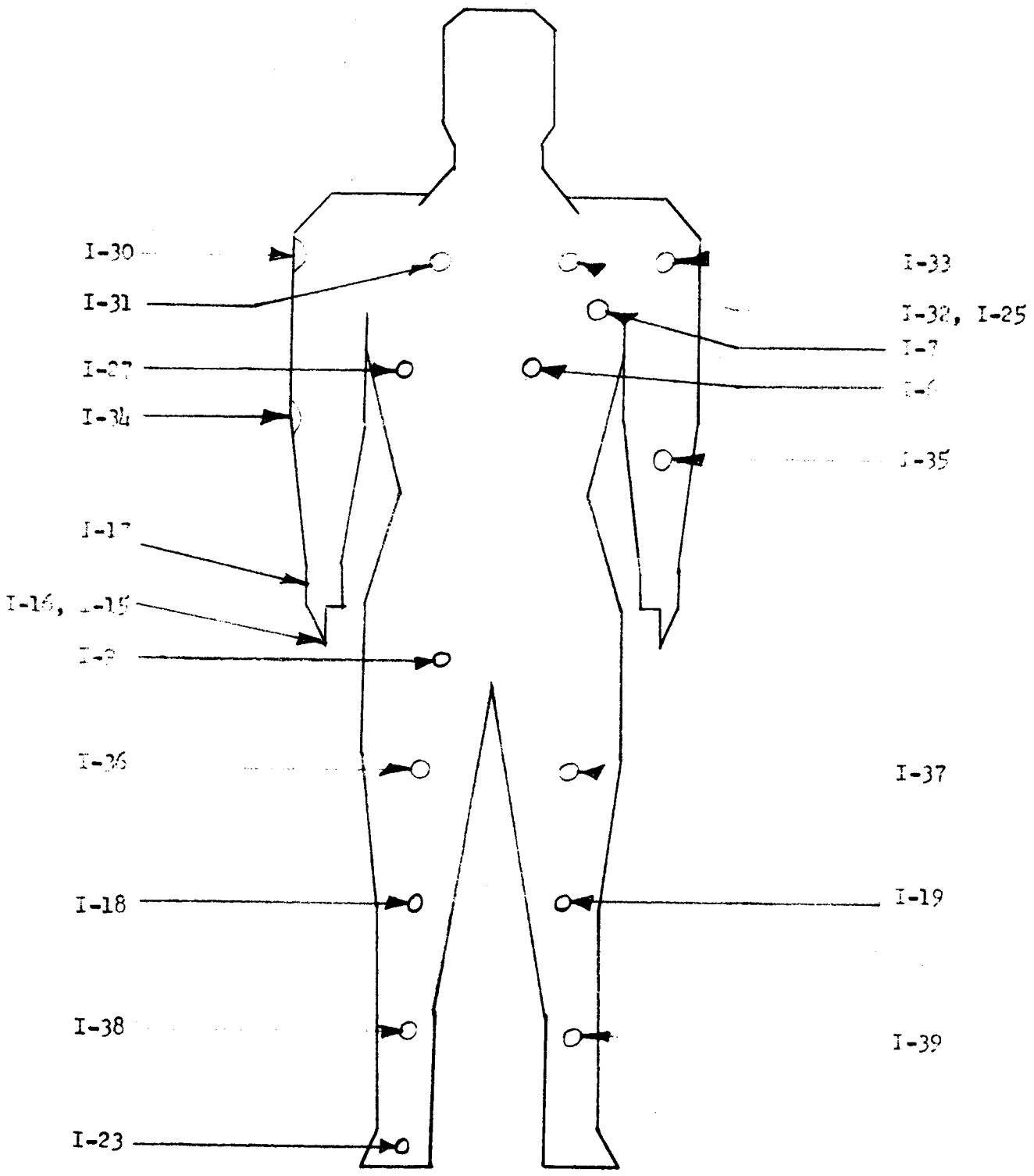


FIGURE 15

THERMOCOUPLE LOCATIONS ON FRONT SURFACE OF THERMAL DUMMY AND CONSTANT WEAR GARMENT

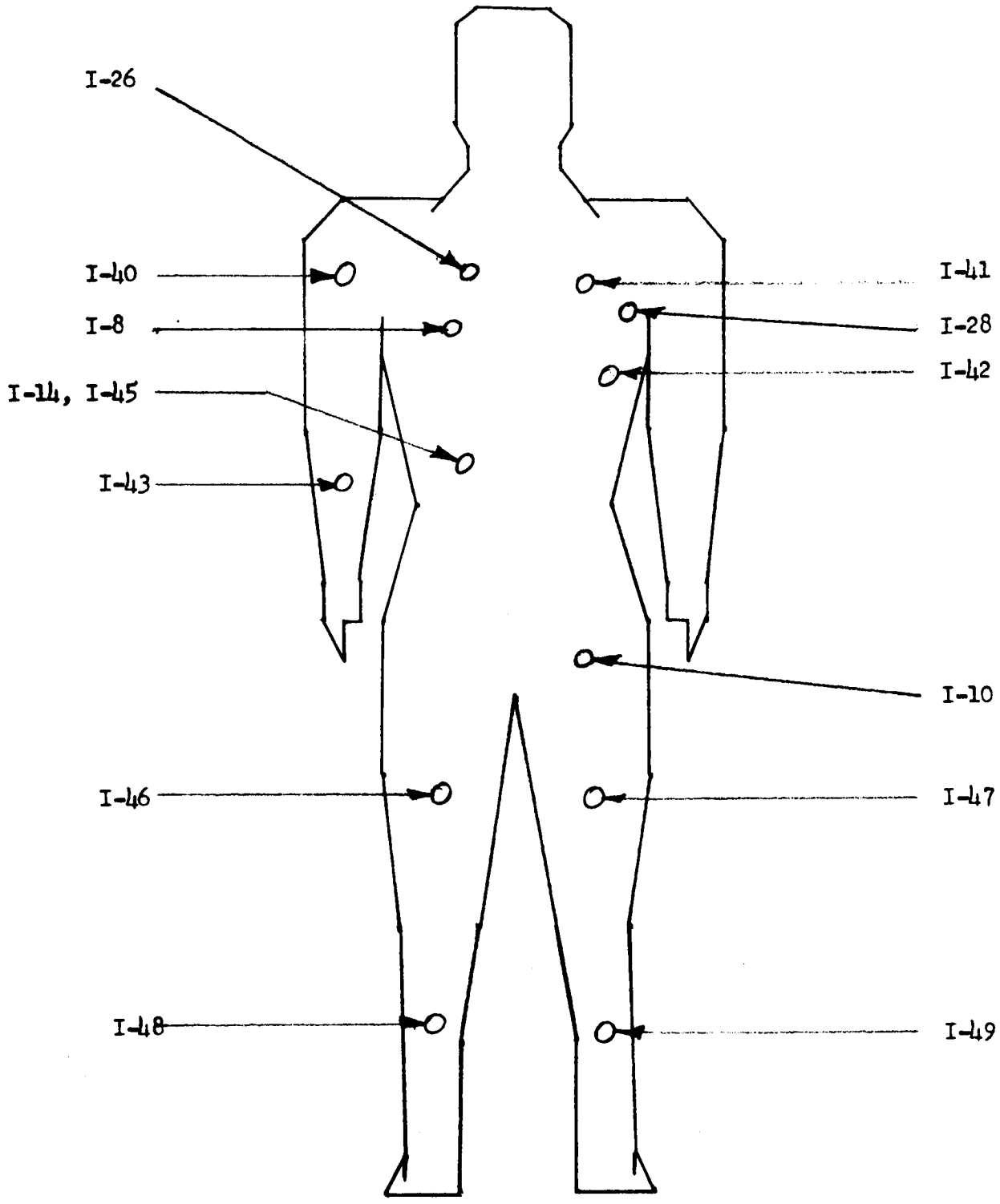


FIGURE 16

THERMOCOUPLE LOCATIONS ON BACK SURFACE OF THERMAL DUMMY AND CONSTANT WEAR GARMENT

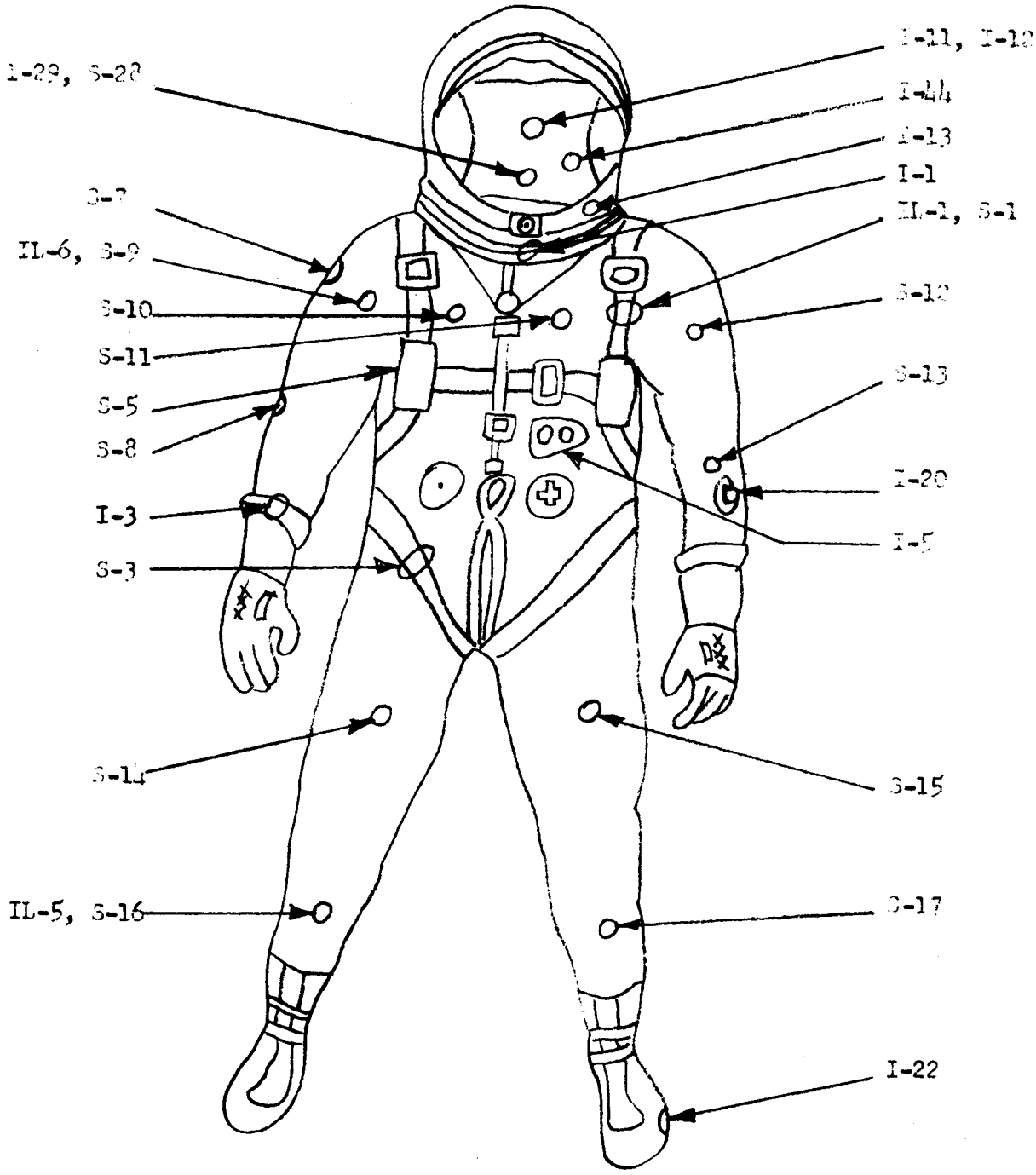


FIGURE 17

THERMOCOUPLE LOCATIONS ON INTERIOR AND EXTERIOR SURFACES ON FRONT OF GEMINI SPACE SUIT

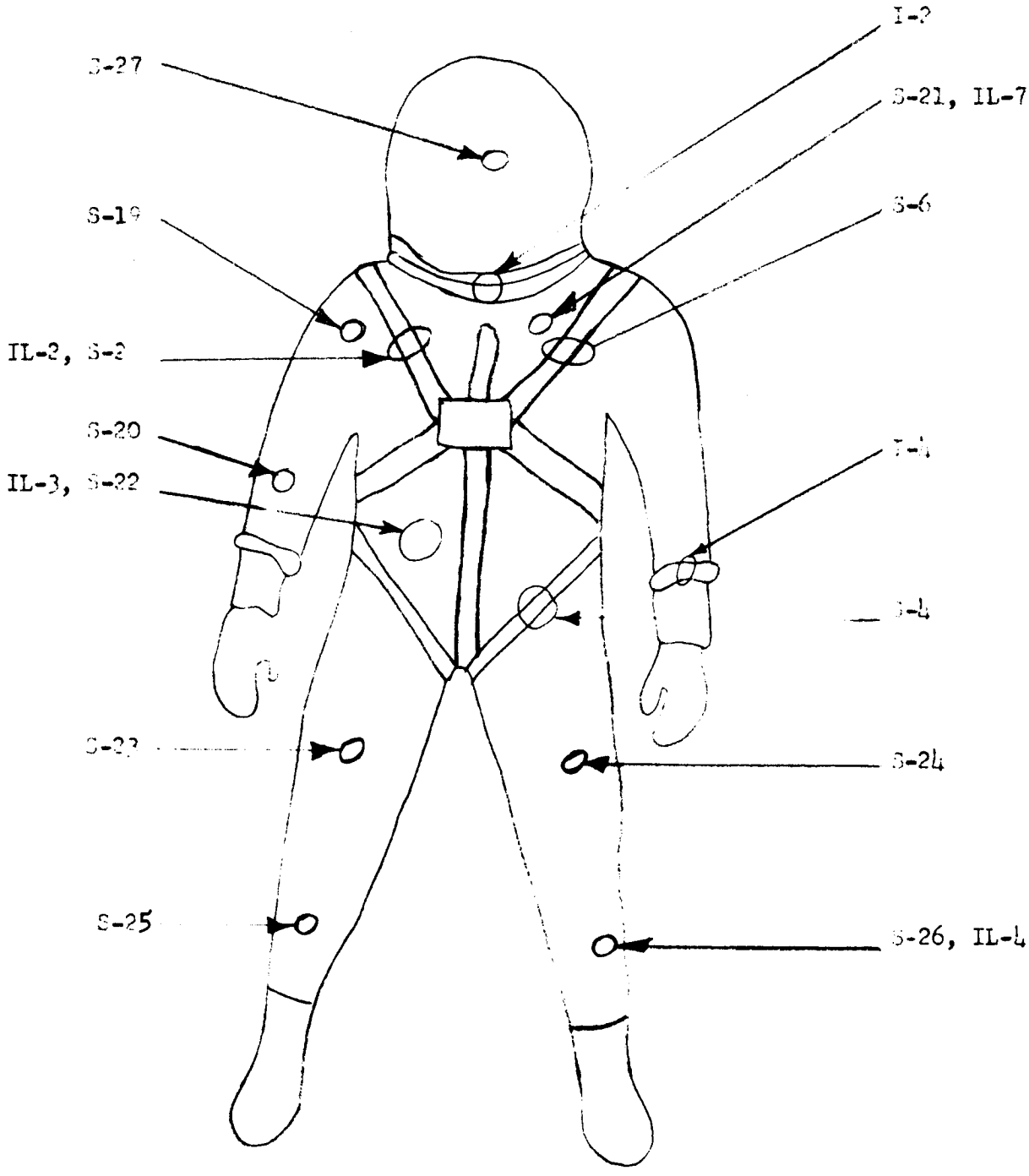


FIGURE 18

THERMOCOUPLE LOCATIONS ON INTERIOR AND EXTERIOR SURFACES ON BACK OF GEMINI SPACE SUIT

TABLE II

EXPERIMENT I-b THERMOCOUPLE LOCATIONS

LOCATION CODE:

I - Inside Pressure Garment

IL - Thermal Garment

S - Exterior Surface of Thermal Garment and Helmet

CHAN. NO.	CODE	LOCATION AND REMARKS
1	I-1	Front of helmet disconnect bearing
2	I-2	Back of helmet disconnect bearing
3	I-3	Front of right glove disconnect bearing
4	I-4	Back of right glove disconnect bearing
5	I-5	Interior of pressure suit between bio-communications connector and blood pressure fitting
6	I-6	Constant wear garment, under front buckle on horizontal harness strap
7	I-7	Constant wear garment in area of suit interlayer thermocouples on front of suit coded IL-1 - Open during test
8	I-8	Constant wear garment in area of suit interlayer thermocouples on upper back coded IL-2
9	I-9	Constant wear garment at upper, right, front thigh - under harness
10	I-10	Constant wear garment at upper, right, rear thigh - under harness
11	I-11	Helmet at back, between helmet pad and helmet outer shell on days #1 and 2. On day #3, helmet bearing at right side under dummy right ear
12	I-12	Helmet pad between dummy head and pad
13	I-13	Helmet on metal surface at front near microphone
14	I-14	Constant wear garment at back in area of suit interlayer - thermocouples - lower, left, back

TABLE II (Continued)

CHAN. NO.	CODE	LOCATION AND REMARKS
15	I-15	Cotton glove on end of index finger
16	I-16	Cotton glove on end of little finger
17	I-17	Cotton glove on back of right hand
18	I-18	Constant wear garment in right knee cap area
19	I-19	Constant wear garment in left knee cap area
20	I-20	Inside pressure suit on interior side of suit pressure gage
21	I-21	Sock on bottom of right foot
22	I-22	Outer left side of left boot at sole and super insulation interface
23	I-23	Sock on top, front of right foot under boot "lacing" zipper
24	I-24	Sock on bottom of left foot
25	I-25	Constant wear garment on upper left chest
26	I-26	Constant wear garment on upper left back
27	I-27	Constant wear garment in right chest area under harness
28	I-28	Constant wear garment in right back area under harness
29	I-29	Interior, center of helmet visor
		NOTE: Thermocouple Numbers 30 - 43 and 45 - 59 were located on the dummy surface in the following locations:
30	I-30	Outer, upper, right arm (shoulder)
31	I-31	Upper, right chest area
32	I-32	Upper, left chest area
33	I-33	Front, upper, left arm
34	I-34	Outer, lower, right arm (elbow)
35	I-35	Front, lower, left arm

TABLE II (Continued)

CHAN. NO.	CODE	LOCATION AND REMARKS
36	I-36	Front, upper, right thigh
37	I-37	Front, upper, left thigh
38	I-38	*Front, lower, right shin
39	I-39	*Front, lower, left shin
40	I-40	*Back, upper, left arm
41	I-41	*Upper right back
42	I-42	Under right shoulder blade
43	I-43	Back, left, lower arm
44	I-44	Inside helmet on visor near reflector used for visor frosting indication
45	I-45	Lower left back in area of suit interlayer thermocouples coded IL-3
46	I-46	Back, upper, left thigh
47	I-47	Back, upper, right thigh
48	I-48	Back, lower, left leg
49	I-49	Back, lower, right leg
		IL-1 interlayer temperature measurements in upper, left chest area, under harness
50	IL-1-b-1	Exterior side of nomex felt - open during test
51	IL-1-b-2	Interior side of nomex felt - open during test
52	IL-1-c-2b	Exterior side of second layer of aluminized mylar - open during test
53	IL-1-c-2d	Exterior side of fourth layer of aluminized mylar - open during test
54	IL-1-c-2f	Exterior side of sixth layer of aluminized mylar - open during test
55	IL-1-c-1	*Between interior layers of nylon cloth, open on days #1 and #2. On day #3, this channel was used to monitor a thermocouple on the suit front surface near the helmet hold - down pulley

TABLE II (Continued)

CHAN NO.	CODE	LOCATION AND REMARKS
		IL-2 interlayer temperature measurements in upper, left, back area, under harness
56	IL-2-b-1	Exterior side of nomex felt - open during test
57	IL-2-b-2	Interior side of nomex felt
58	IL-2-c-2b	Exterior side of second layer of aluminized mylar - open during test
59	IL-2-c-2d	Exterior side of second layer of aluminized mylar
60	IL-2-c-2f	Exterior side of sixth layer of aluminized mylar - open during test
61	IL-2-e-1	Between interior layers of nylon cloth - open during test
		IL-3 interlayer temperature measurements in lower, left back area, not under harness
62	IL-3-b-1	Exterior side of nomex felt
63	IL-3-b-2	Interior side of nomex felt
64	IL-3-c-2b	Exterior side of second layer of aluminized mylar
65	IL-3-c-2d	Exterior side of fourth layer of aluminized mylar - open during test
66	IL-3-c-2f	Exterior side of sixth layer of aluminized mylar - open during test
67	IL-3-e-1	Between interior layers of nylon cloth
		Thermocouple No. 68-94 are located on the suit surface as follows:
68	S-1	Front, upper, left chest area under harness - Note: Exposed during test due to harness distortion
69	S-2	Back, upper, left area under harness
70	S-3	Front, upper, right, thigh area, under harness
71	S-4	Back, upper, right, thigh area under harness - Note: Exposed due to harness distortion
72	S-5	Front, right, chest area under harness

TABLE II (Continued)

CHAN. NO.	CODE	LOCATION AND REMARKS
73	S-6	Upper, right, back area under harness
74	S-7	Upper, outer, right arm (shoulder)
75	S-8	Lower, outer, right arm (elbow)
76	S-9	Front, upper, right arm
77	S-10	Upper, right chest
78	S-11	NASA insignia patch, upper, left chest
79	S-12	Front, upper, left arm
80	S-13	Front, lower, left arm
81	S-14	Front, right, thigh
82	S-15	Front, left, thigh
83	S-16	Front, left shin
84	S-17	Front, right, shin
85	S-18	Back, under right shoulder blade. Note: This thermocouple was no good. It indicates as increasing temperature when temperature is decreasing and vice-versa. The Cu-Cn leads were reversed at a junction.
86	S-19	Back, upper, left arm
87	S-20	Back, lower, left arm
88	S-21	Upper, right, back
89	S-22	Lower, left, back
90	S-32	Back, left, thigh
91	S-24	Back, right, thigh
92	S-25	Back, lower, left leg
93	S-26	Back, lower, right leg
94	S-27	Back, exterior helmet shell
95	G-1	Suit "nitrogen out" temperature #1, 24 gage thermocouple connected in parallel with thermocouple #128 on day #1 only.

TABLE II (Continued)

CHAN. NO.	CODE	LOCATION AND REMARKS
96	G-2	Suit "nitrogen in" temperature #1, 24 gage thermocouple on days #1 and #2. 36 gage thermocouple on day #3. Connected in parallel with thermocouple #127 on day #1 only.
97	A-1	Top, right albedo simulator back.
98	A-2	Top, left albedo simulator back
99	A-3	Left, center albedo simulator back
100	A-4	Bottom, left albedo simulator back
101	A-5	Bottom, right albedo simulator back
102	A-6	Right, center albedo simulator back
103	SPC-1	*Near top of spacecraft simulator, used on day #3 only
104	SPC-1	*Near center of spacecraft simulator, used on day #3 only
		NOTE: Channels 105 - 108 were not used during this test
109	W-1	*SES Chamber Walls
110	W-2	*SES Chamber Walls
111	W-3	*SES Chamber Walls
112	W-4	*SES Chamber Walls
113	W-5	*SES Chamber Walls
114	W-6	*SES Chamber Walls
115		Mounted near I-31 with fiberglass tape
116		Mounted near I-45 with fiberglass tape
117		Thermopile inlet water
118		Thermopile outlet water

TABLE II (Continued)

CHAN. NO.	CODE	LOCATION AND REMARKS
119		Open - Not used
120	S-28	Outside surface of pressure visor
121		Outside surface of gas inlet thermocouple manifold
122		Outside surface of gas outlet thermocouple manifold
123	IL-4	Nomex felt at back of right leg
124	IL-5	Nomex felt at front of right leg
125	IL-6	Nomex felt at front of right arm
126	IL-7	Nomex felt at back of right shoulder
127		*Suit "nitrogen in" temperature #2 24 gage thermocouple. Connected in parallel with thermocouple #96 on day #1 only (Downstream from thermocouple #96)
128		*Suit "nitrogen out" temperature #2 connected in parallel with thermocouple #95 on day #1 only. 24 gage thermocouple days #1 and #2. Changed to 36 gage thermocouple on day #3 (upstream from thermocouple 95)

*On 32°F reference junction, all others on 150°F reference junction.

attachment on the thermal dummy and fabrics inside the suit. Visor and helmet thermocouples were secured by transparent Scotch tape.

The thermocouple recording system is shown in diagram form in Figure 19.

Pressures - Suit pressures were measured during this test to provide both suit gas flows and a history of pressure within the suit. Pressures were measured at the suit inlet and in the visor area while a differential pressure across the inlet and exit were measured.

The suit inlet pressure transducer (Dynisco Model APT 25-10) was mounted on a manifold in the nitrogen inlet hose at a point near the entrance to the suit. The temperature of the inlet nitrogen was sufficiently high to keep the transducer temperature within its specified temperature range of -65°F to +300°F. The helmet pressure transducer, also Dynisco APT 25-10, was cemented under the chin of the dummy with Densifoam cement. The temperature inside the helmet was within the specified operating temperature range of the transducer. The suit pressure drop transducer (Dynisco Model PT 14-05) was connected between the inlet gas manifold and the outlet gas manifold. A strip heater was installed on this transducer to maintain the temperature of the transducer within its specified operating temperature range of -65°F to +300°F. Each of the exposed pressure transducers was wrapped with superinsulation to reduce radiant heat loss to the chamber walls.

The pressure transducers incorporate a miniature unbonded strain gauge in the configuration of a four active-arm resistive wheatstone bridge. The output voltages of the three gauges were connected to a bridge balance box which served to zero the gauges at some reference pressure. The signals from the bridge balance box were recorded by a CEC Model 5-123 recording oscillograph which provided a continuous record of suit pressures throughout the test. Figure 20 shows a block diagram of the suit pressure instrumentation.

Suit Leakage - The suit leakage to low vacuum environment of orbit must be determined to ascertain the endurance capability in orbit. This test arrangement utilized a Hastings-Radist LF-1000, 0 to 1000 sccm mass flowmeter installed in a suit feed line (Figure 14) to determine the suit leakage. An additional indication of leakage which might develop during the course of a test was provided by six Phillips cold cathode ionization gages (CEC Model PHG-026) mechanically positioned around the exterior of the suit. These gauges were coded and positioned as follows:

P-1 - Zipper in crotch area.

P-2 - Biomedical connector.

P-3 - Right wrist disconnect bearing.

P-4 - Left wrist disconnect bearing.

P-5 - Helmet disconnect bearing.

P-6 - Zipper area on back.

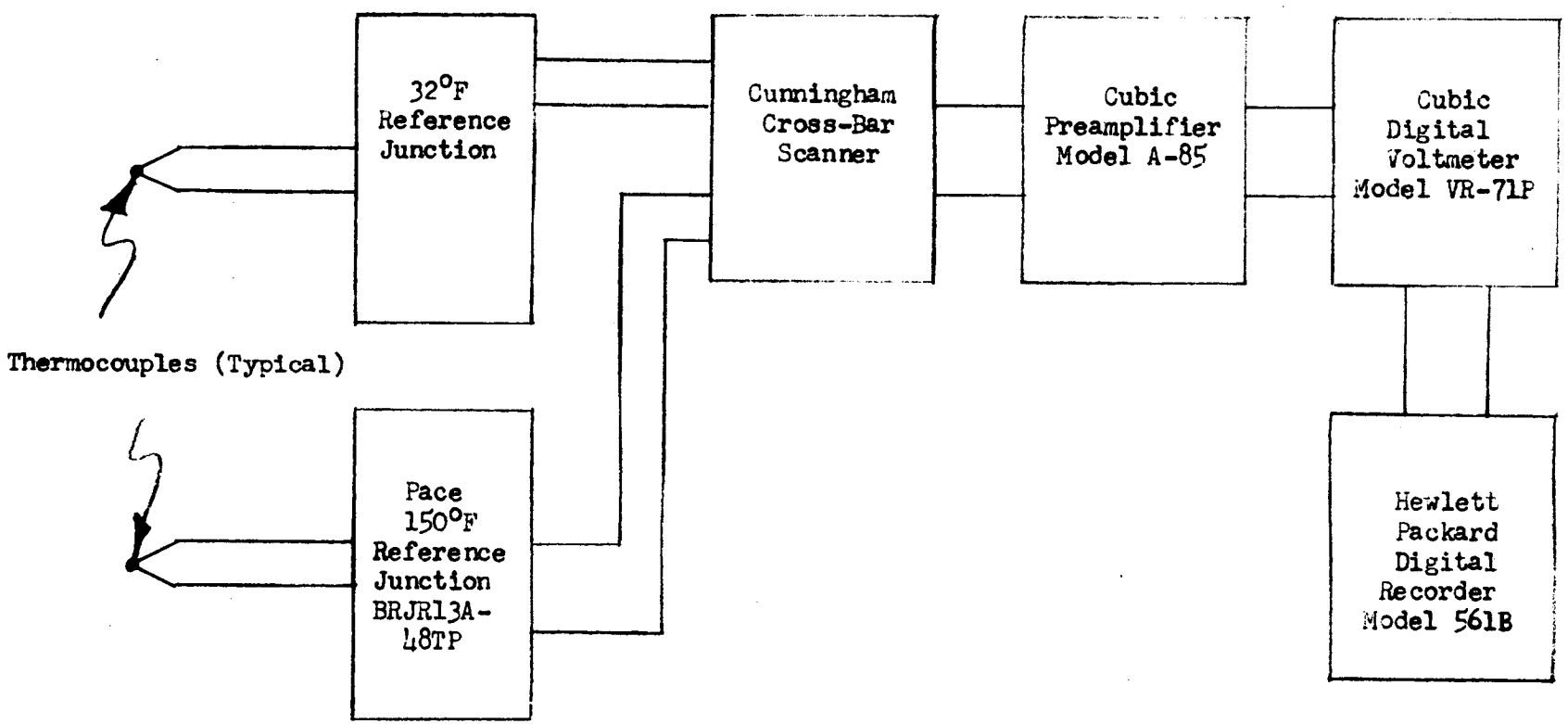


FIGURE 19

BLOCK DIAGRAM OF THERMOCOUPLE **RECORDING SYSTEM**

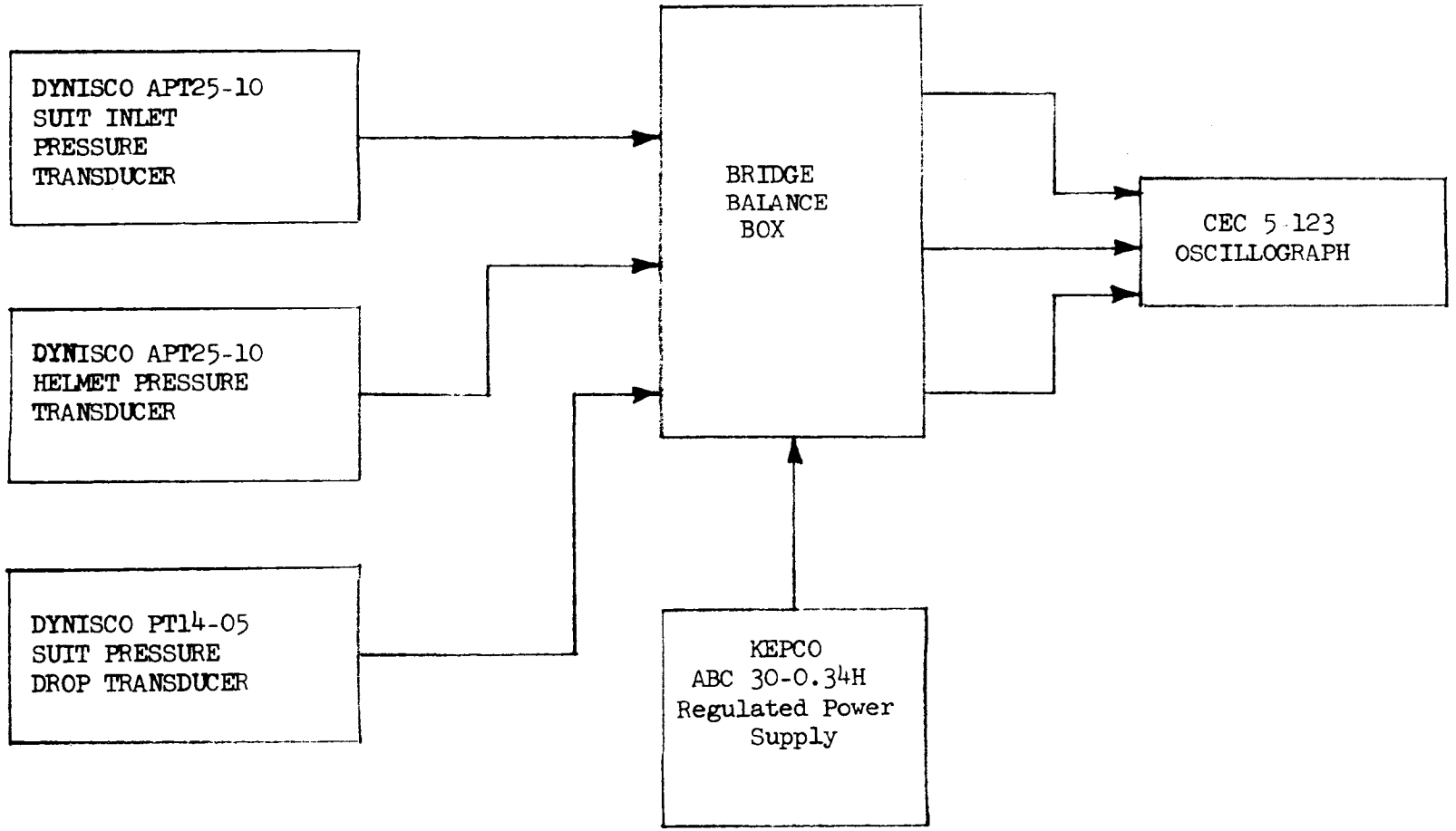


FIGURE 20

BLOCK DIAGRAM OF SUIT PRESSURE INSTRUMENTATION

These gauges were positioned to indicate the general area of leakage about the suit rather than indicate on exact leakage value.

Suit Gas Flow - The suit flow was continuously monitored and controlled by the suit flow system (Figure 14). The measurement of the flow of conditioned nitrogen to the suit was accomplished by using two flowmeters in series. A Fischer-Porter 36" laboratory type rotameter was utilized as the basis of flow control. In addition a National Instrument Laboratory Vol-O-Flow Model 10-1-15 flowmeter with a digital voltmeter readout was utilized to measure suit flow rate in actual cubic feet per minute based on the suit inlet pressure and temperature.

Relative Humidity and Visor Frosting - Relative humidity and visor frosting indications were included in this experiment to determine both the extent and possible effect of visor frosting during the various orbit conditions. A relative humidity sensor (Johnson Service Company Model WQ 9140 A) was installed in the water vapor inlet line to detect the relative humidity of the water vapor injected into the helmet. Water vapor (steam) was produced in a small container outside the SES and fed through copper tubing to finally impinge on the helmet visor. The relative humidity detector measured the relative humidity of the water vapor present while a light-photocell and mirror arrangement was used to detect any change in the reflection of light from the visor. The presence of such a change was an indication of visor frosting.

Energy Input to Visor - The measurement of energy passing into or out of the helmet visor is most essential to the thermal evaluation of the space suit assembly. To assist with this evaluation, an Eppley thermopile was mounted in the head of thermal dummy facing the visor. Cooling water for the thermopile was supplied by circulating water lines from outside of the chamber.

3.4.2 FACILITY INSTRUMENTATION

The SES instrumentation acquisition and recording system is designed to control system operation, collect data pertinent to the test, and supply recorded data suitable for reduction and analysis.

The recording devices utilized for acquisition of data during the test included:

1. Oscillograph: 50 channel direct writing CEC Model 5-123.
2. Recorders: Brown multipoint, 24 channel.
3. Digital Voltmeter: Cubic 300 channel with automatic print out.

Instrumentation feed-throughs in the chamber walls accomodate the following numbers and types of thermocouples.

1. 198 copper-constantan.
2. 108 iron-constantan.
3. 72 chromel-alumel.

Feed-throughs are also provided for cooling water, gas flow and power into the chamber. Vacuum measurements are continuously monitored and for such measurements the following instruments are available.

1. CVC GMA-140 Magnevac. (Range 760 mm to 10^{-3} mm Hg).
2. CVC GIC-100 Ionization gauge. (Range 10^{-3} to 10^{-10} mm Hg).
3. CVC PHG-9 Phillips gauge. (Range 0.5 to 10^{-3} mm Hg).
4. CVC GM 110 McLeod gauge. (For vacuum calibration).

A CEC Model 24-120 mass spectrometer is used for vacuum leak detection.

3.4.3 DATA RECORDING

The data collected during this test included:

a. Manual hand written data.
b. Digital voltmeter automatic print-out data.
c. Brown recorder data.
d. Oscillograph data.
e. Pressure recorder data.
f. Log book data.

Correlation on these various items included test point designations and time and date. The raw data has been reduced and assembled in Appendix A of this report.

3.4.4 DATA ACCURACY

The following is a summary of the accuracy of the data measurements made during this test.

- Temperatures (inside suit): $\pm$ 1.7°F.
- Temperatures (outside of suit): $\pm$ 3.1°F. RMS recording error plus thermocouple installation error.
- Suit ventilation gas temperatures: $\pm$ 3°F.
- Suit Pressures: $\pm$ 0.15 psi.
- Suit ventilation gas flow rate: $\pm$ 3% of indication.
- Suit leakage rate: $\pm$ 2.1%.
- Local SES pressures (ionization gauges): $\pm$ 15% of indication (estimated).
- Relative humidity in helmet area: $\pm$ 10%.
- Visor frosting indicator: qualitative measurement.
- Energy in visor: instrument accuracy estimated at $\pm$ 1.5%.

A derivation of the accuracies presented above and a discussion of thermocouple attachment errors are presented in Appendix B of this report.

3.5 DESCRIPTION OF TESTS

Experiment I-b was conducted in three parts (three days of tests) on November 5, 9 and 12, 1964. The test was conducted according to the test plan (Reference 3) and was completed approximately as planned. During each of the three days of tests, the suit configuration was changed in order to evaluate the effects of:

(a) Clear versus tinted helmet visor.

(b) Compression of parachute harness.

(c) Exposed and uninsulated helmet versus a completely covered helmet.

(d) Insulated boots.

(e) Insulated versus uninsulated suit gloves.

(f) Proximity of and contact with a spacecraft surface.

(g) Heated versus unheated dummy surfaces.

The test points conducted included a variety of suit/environmental conditions with the three test configurations including minimum temperature cold soaks, maximum combined orbital heat fluxes and a simulated moving orbital condition.

Table III summarizes the tests performed and a description of the specimen during each of the three test days. Figures 3, 21, 22 and 1 show the specimen in the test position for the first, second and third days of test, respectively. Figure 23 relates position and time of the suit and flux sources during the simulated orbit tests performed on November 12, 1964, (test points 5 and 6).

3.5.1 TEST PROCEDURE

Reference 3 (Test Plan for Experiment I-b) outlined the test procedure that was followed throughout the testing. Table III presents the sequence of test points that were performed.

3.6 VARIANCES

3.6.1 SOLAR SOURCE

The solar simulation provided by the SES lamps differs from the true solar in three respects: (1) spectral energy distribution, (2) energy flux distribution and (3) collimation. The spectral distribution of these lamps is typical of Xenon or Mercury-Xenon lamps in that a large percentage of the energy is at shorter wavelengths than solar energy. The spectral distribution of the solar lamps as installed in the SES has been measured by Eppley Laboratories. The results of these measurements are presented in Table I and in Reference 1.

The effects of a spectral mismatch between the SES solar source and the sun is a function of the spectral characteristics of the surfaces being irradiated. For example, if the reflectance of the surface is relatively constant over the range of about 0.26 to 1.5 microns, the absorptance of the surface to SES solar radiation will be the same as for the true solar. However, if the reflectance of the surface changes significantly in this band (especially near the center of the solar spectrum), the SES absorptance can be significantly different from true solar absorptance. This latter case applies to the HT-1 nylon outer cover of the Gemini extravehicular suit. Figure 24 shows reflectance versus wavelength for HT-1 nylon. The absorptance of the nylon to the SES or solar spectrum was determined by first computing the reflectance and then solving for the absorptance from the equation

$$\alpha = 1 - \rho$$

TABLE II

SUMMARY OF TEST Ib TEST

DATE	SUIT CONFIGURATION	TEST POINT	SOLAR SOURCE	SUIT ORIENTATION	EARTH AND ALBE SIMULATOR
1st Day (11-5-64)	. Suit hung by parachute harness and tie-down cable . Suit glove on right hand . Insulated hood not on helmet . Clear helmet visor (Ref. Figure 3)	1	Off		Unheated
		2	Off	Back to Earth Simulator	Heated; facing solar source
		3	On	Facing solar lamps	Heating; facir solar source
		4	On	Right side to sun, left side to earth simu.	Heated; facing sun
		5	Off		Unheated
2nd Day (11-9-64)	. Suit hung by parachute harness and tie-down cable . Helmet not covered by insulated hood . Right hand suit glove exposed . Tinted visors on helmet . Left leg fixed in 90° bend position (Ref. Figures 21 & 22)	1	Off		Unheated
		2	Off		Unheated
		3	On	Facing solar source	Heated; facing solar source
		4	On	Back to sun	Heated; facing solar source
		5	Off	Front to earth simulator	Heated; facing suit
3rd Day (11-12-64)	. Suit suspended from helmet . Clear helmet visor installed . Helmet not covered by insulated hood . Insulated mitten on right hand . Left foot insulated (Ref. Figure 1)	1	On	See Description	Heated; facing solar source
		2	On	Facing solar source	Heated; facing solar source
		3	On	Facing solar source	Heated; facing solar source
		4	On	Facing solar source	Heated; facing solar source
		5	Simulated moving orbital condition wi (solar on 60 min., off 30 min.) (See		
	*Dummy hands and feet were not heated at any time during the tests.	6	Simulated orbital condition with rota on 60 min., off 30 min.,) (See Figur		

I

CONDITIONS

DO	DESCRIPTION	DUMMY * SKIN HEATERS	DURATION
	Steady state, suit cold soak test (no incident radiation)	On	2 hours (1200-1400)
;	Steady state, simulated orbit in earths shadow, suit back to earth	On	2 hours (1720-1920)
ng	Steady state, simulated orbit over earth subsolar point, suit facing sun	On	3 hours (1920-2220)
;	Steady state, simulated orbit over earth subsolar point, suit right side to sun	On	0.50 hours (0015-0045)
	Steady state, cold soak test. (No incident radiation)	On	4 hours (0100-0500)
	Steady state cold soak test	On	3.5 hours (0630-1000)
	Steady state cold soak test	Off	2.25 hours (1000-1215)
;	Steady state, simulated orbit over earth subsolar point, suit facing sun	Off	3 hours (1545-1845)
;	Steady state, simulated orbit over earth subsolar point, suit back to sun	Off	1.25 hours (1845-2000)
;	Steady state, simulated orbit in earths shadow, front of suit to earth	Off	3.1 hours (2000-2310)
;	Suit rotated continuously until average surface temperature of 75±5°F achieved (1 hour)	Off	1.4 hours (0800-0925)
;	Steady state, simulated maximum heat flux condition (over earth subsolar point), suit facing sun	Off	1.4 hours (0935-1100)
;	Steady state, simulated close proximity of hot spacecraft surface (not touching)	Off	2.5 hours (1100-1330)
;	Steady state, simulated hot spacecraft surface pressed against right side of suit, maximum incident space fluxes	Off	2 hours (1330-1530)
th rotation of suit and earth simulater Figure 23)		Off	1.5 hours (1545-1715)
tion of suit and earth simulator (solar e 23)		Off	1.5 hours (1715-1845)

FIGURE 21 GEMINI SPACE SUIT ASSEMBLY INSTALLED IN LTV SPACE ENVIRONMENT SIMULATOR (TEST DAY #2)

FIGURE 22 GEMINI SPACE SUIT ASSEMBLY INSTALLED IN LTV SPACE ENVIRONMENT SIMULATOR SHOWING POSITION OF LEFT LEG (TEST DAY #2)

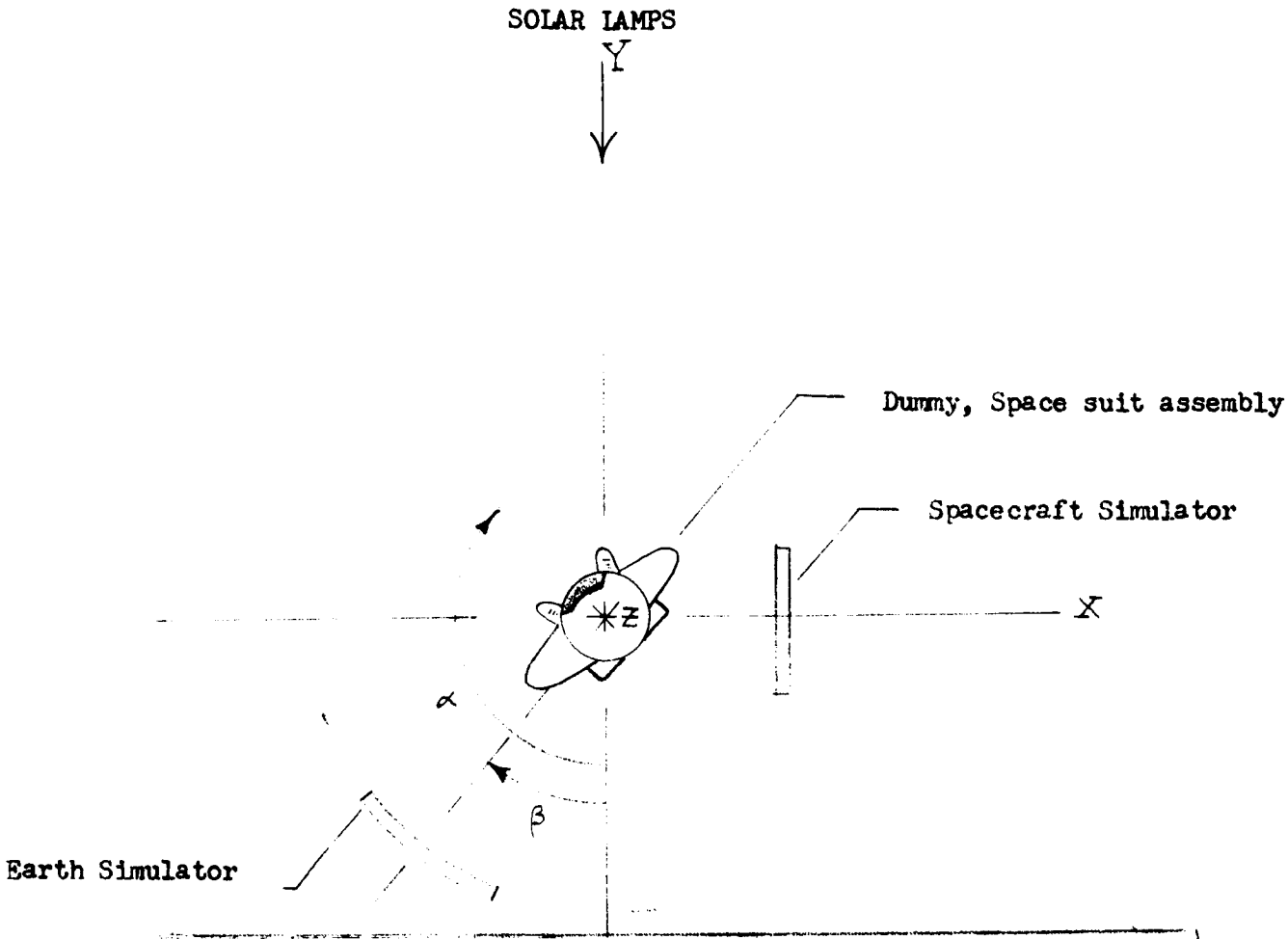


FIGURE 23

ORBITAL POSITIONS FOR SPACESUIT ASSEMBLY

AND EARTH SIMULATOR

a. Solar Portion - 60 minutes

Time Minutes	E.S. Position, β Degrees	SSA Position, α Degrees
0-7½	0	180
7½-15	0	0
15-22½	30	0
22½-30	30	180
30-37½	60	180
37½-45	60	0
45-52½	90	0
52½-60	90	180

b. Dark Portion - 30 minutes

0-7½	90	180
7½-15	90	0
15-22½	45	0
22½-30	45	180

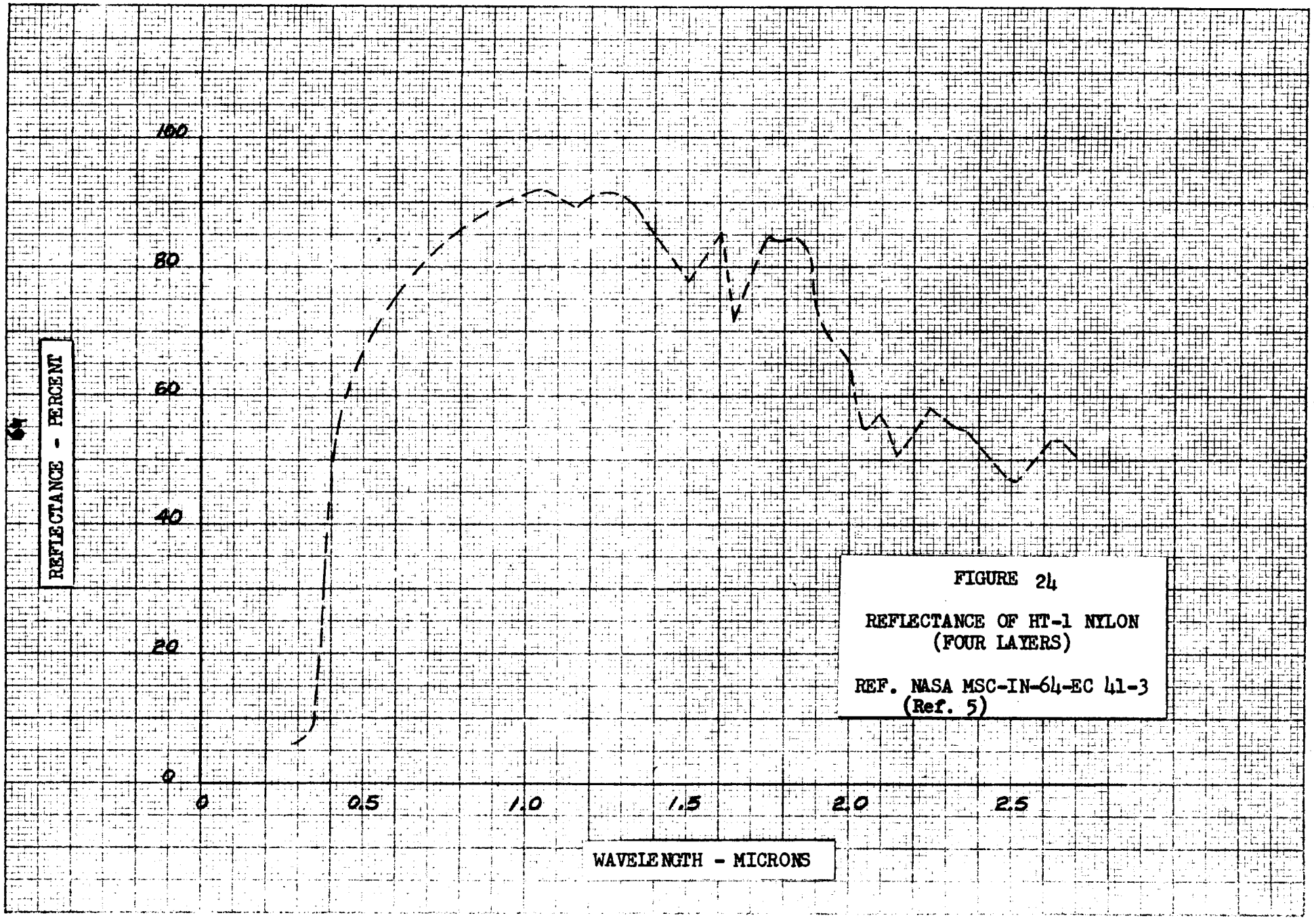


FIGURE 24

REFLECTANCE OF HT-1 NYLON
(FOUR LAYERS)

REF. NASA MSC-IN-64-EC 41-3
(Ref. 5)

where the transmittance is assumed to be zero. The reflectance was calculated by a computer program which evaluates the following expression:

$$\rho = \frac{\int \rho_\lambda E_\lambda \, d\lambda}{\int E_\lambda \, d\lambda}$$

Where

ρ = reflectance at wavelength λ

E_λ = monochromatic emissive power

The limits of integration are chosen as appropriate to the spectrum being considered, i.e. SES or Solar. The computer program inputs include material reflectance data from Figure 23, the Johnson data for the solar spectrum (Reference 4) and the data shown in Table I for the SES lamp spectrum. The absorptances of the nylon outer cover to the SES and solar spectrums were computed to be as follows:

$$\alpha_{SES} = 0.273$$

$$\alpha_{Solar} = 0.497$$

In order for the suit to absorb approximately the same amount of energy, whether exposed to the SES lamps or true sunlight, the following relationship must be maintained:

$$\alpha_{SES} \, S_{SES} = \alpha_{Solar} \, S_{Solar}$$

Where

S_{SES} = flux at test plane of SES

S_{Solar} = solar constant (443 BTU/hr ft^2)

The required flux at the test plane is than calculated to be

$$S_{SES} = S_{Solar} \frac{\alpha_{Solar}}{\alpha_{SES}}$$

$$S_{SES} = 443 \left(\frac{.273}{.497}\right) = 443 \, (.55)$$

$$S_{SES} = 243 \text{ BTU/hr ft}^2$$

However, for stable operation, the SES lamps cannot be operated below a flux of 288 BTU/hr ft^2 (or 65% of the solar constant). This lamp power setting was employed during the tests resulting in a higher heat absorbed during the experiment than would actually occur in space.

Flux distribution at the test plane was measured before and after the test using the thermopile described in paragraph 3.3.1. The results of these measurements are shown in Figure 6.

Collimation of the SES lamps varies from 0 to 13° whereas rays from the sun are essentially parallel. However, the cones formed by rays from the different lamps intersect in front of the test plane. This helps to smooth out the flux distribution. Because of this overlapping, collimation variances are not considered to be significant.

3.6.2 THERMAL AND ALBEDO SIMULATION

Accurate simulation of earth thermal and albedo radiation depends on the configuration or view factor between the earth simulator and the test plane and the radiant heat transfer properties of the earth simulator. The variances in SES simulation of earth thermal and albedo radiation are discussed in this section.

The view factor from the test plane to the earth simulator has been calculated to be approximately 0.81 as shown by the analyses included in Appendix C. Reflectance measurements for the earth simulator paint, as measured by a Gier-Dunkle Integrating Sphere Reflectometer are shown in Figure 25. The reflectance of the paint for the SES lamp spectrum was then computed to be approximately 0.32 using the computer program described in paragraph 3.6.1.

The heat flux at the test plane due to the earth simulator albedo (reflected energy) can be shown to be

$$q'_a = F \rho S_{SES}$$

$$q'_a = .81\ (.32)\ (288)$$

$$q'_a = 75 \frac{BTU}{hr.\ ft^2}$$

Where:

F = View factor from test plane to earth simulator.

ρ = Reflectance of earth simulator for SES lamp spectrum.

S_{SES} = Flux at test plane from SES lamps, BTU/hr. ft^2.

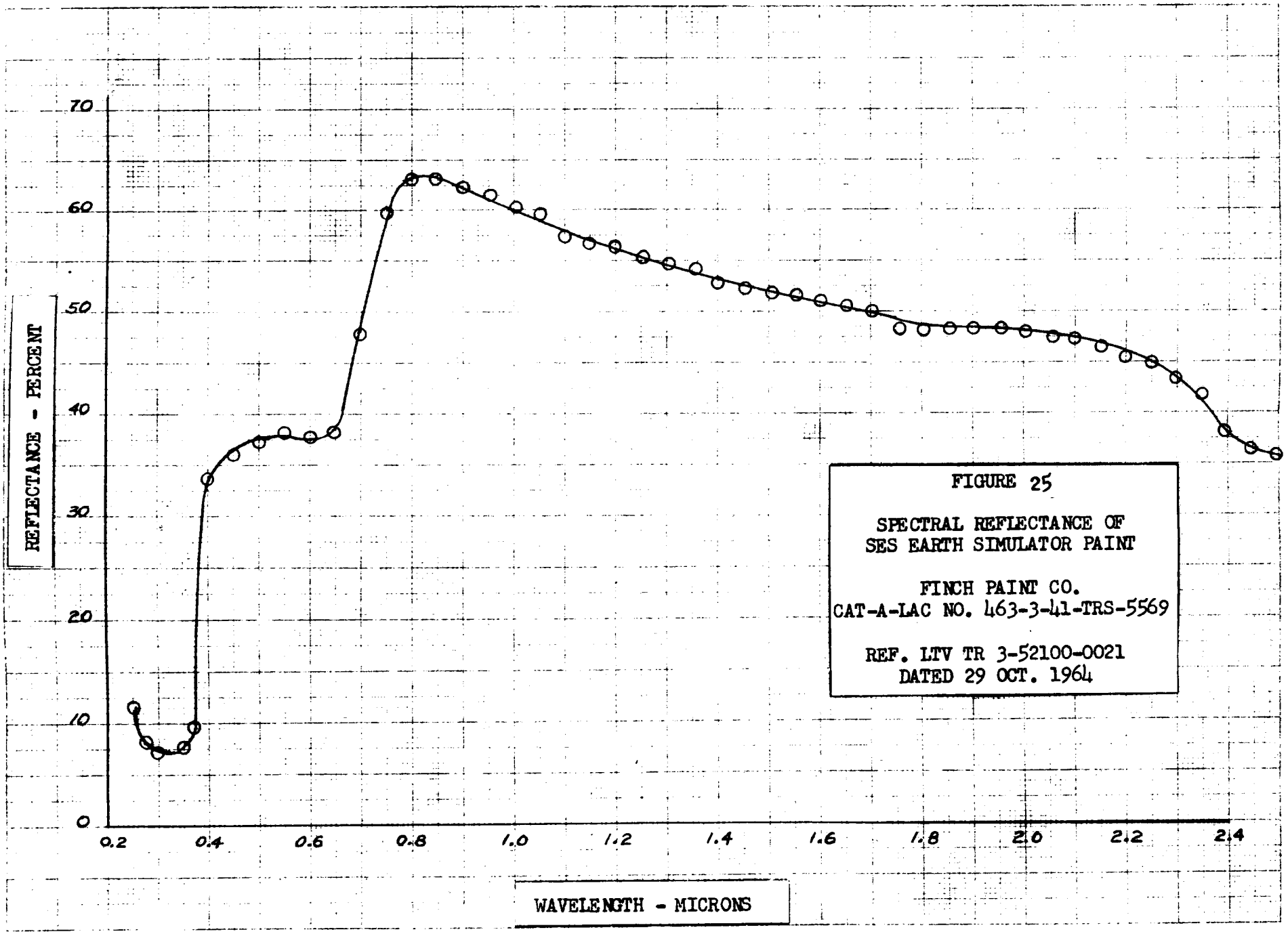


FIGURE 25

SPECTRAL REFLECTANCE OF
SES EARTH SIMULATOR PAINT

FINCH PAINT CO.
CAT-A-LAC NO. 463-3-41-TRS-5569

REF. LTV TR 3-52100-0021
DATED 29 OCT. 1964

The distribution of reflected energy from the earth simulator at the test plane was measured using the thermopile described in 3.3.1. Figure 26 shows the distribution in flux for a horizontal traverse at different locations on the earth simulator vertical centerline. These data indicate the maximum flux measured was approximately 55 BTU/Hr. ft^2 with the earth simulator parallel to the test plane. The variation in flux as the earth simulator is rotated about the test plane is shown in Figure 27 for a traverse along the test plane vertical centerline. These flux measurements are believed to be somewhat lower than the actual flux due to the Fresnel reflection of the quartz lens in the thermopile.

The maximum heat flux incident on a flat plate in a 200 nautical mile earth orbit due to reflected solar energy from the earth is:

$$q_a = F\ a\ S$$

$$q_a = (0.9)\ (0.35)\ (443)$$

$$q_a = 139\ \frac{BTU}{hr.\ ft^2}$$

Where:

a = earth albedo

S = Solar constant, $\frac{BTU}{hr.\ ft.^2}$

F = Flat plate view factor

Reflected solar energy from the earth is generally assumed, for calculation purposes, to be in the same spectrum as the sun. If the same assumption is made for the earth simulator; that is, reflected energy from the earth simulator is in the same spectrum as the solar lamps, then the required earth simulator reflected energy (at the test plane), is:

$$q'_a = 139\ \frac{\alpha_{solar}}{\alpha_{SES}}$$

$$q'a = 139\ \frac{.273}{.497}$$

$$q'a = 139\ (0.55)$$

$$q'a = 76\ \frac{BTU}{hr.\ ft^2}$$

for accurate simulation of true space conditions. Therefore, the required flux at the test plane is calculated to be 76 BTU/(hr. $ft.^2$) and the actual flux is calculated to be 75 BTU/(hr. $ft.^2$) based on physical dimensions and measurements of SES lamp heat flux and earth simulator reflectance.

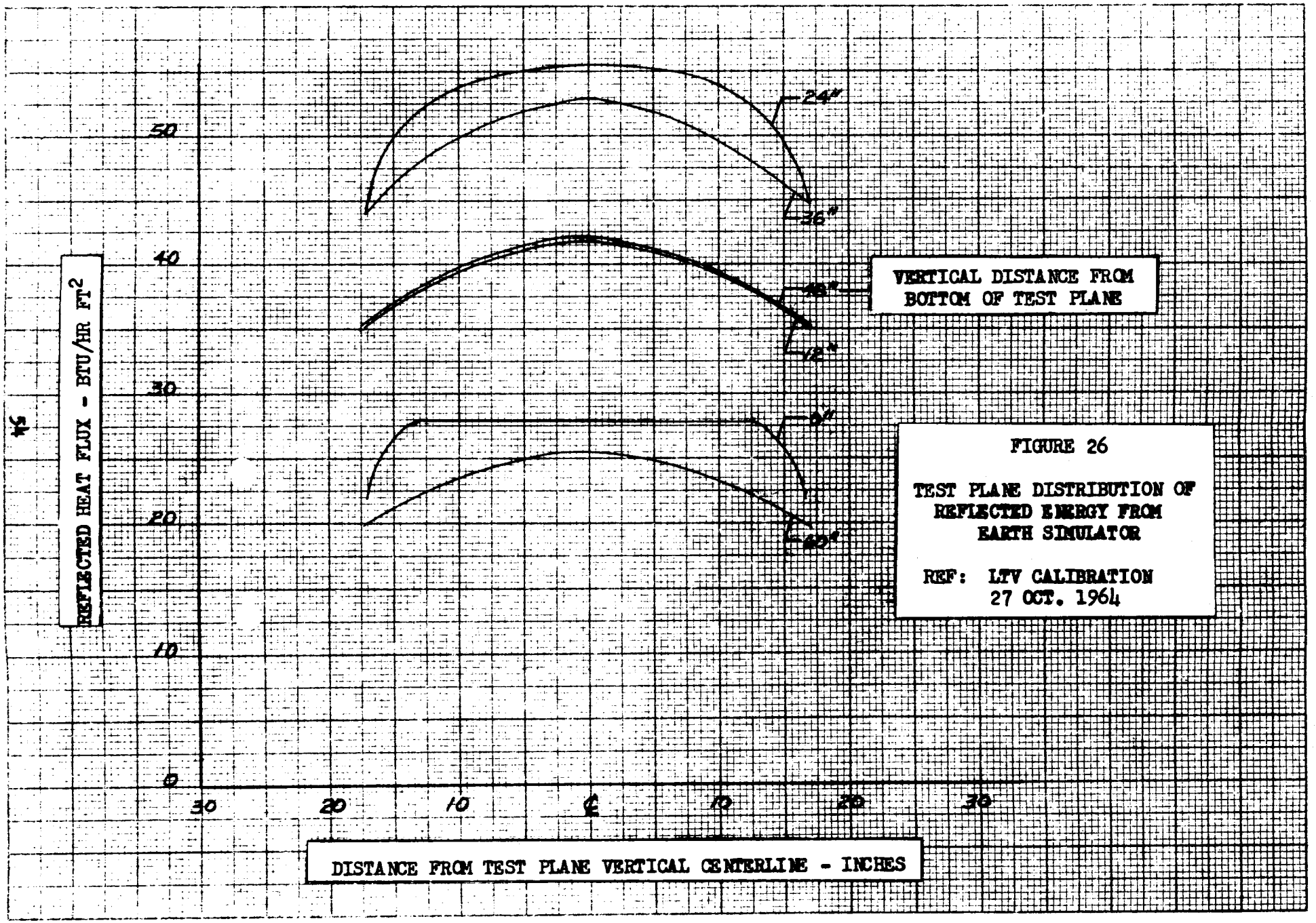


FIGURE 26

TEST PLANE DISTRIBUTION OF REFLECTED ENERGY FROM EARTH SIMULATOR

REF: LTV CALIBRATION 27 OCT. 1964

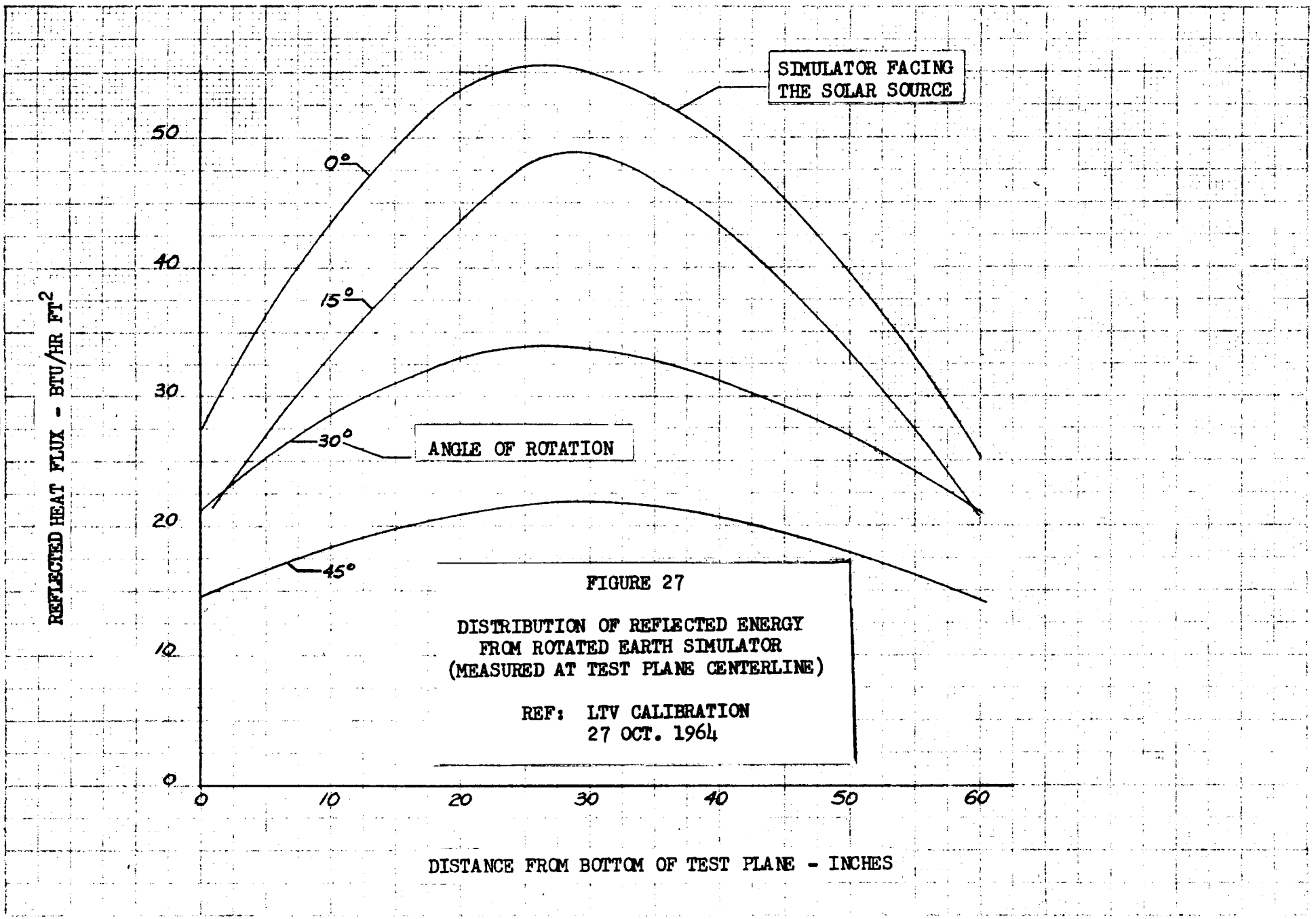


FIGURE 27

DISTRIBUTION OF REFLECTED ENERGY FROM ROTATED EARTH SIMULATOR (MEASURED AT TEST PLANE CENTERLINE)

REF: LTV CALIBRATION 27 OCT. 1964

Simulation of the earth's thermal radiation is accomplished by controlling the earth simulator temperature. The heat flux at the test plane due to thermal radiation from the earth simulator at a temperature of 70°F can be calculated as follows:

$$q'_e = F \epsilon \sigma T^4$$

$$q_e = (0.81)\ (0.60)\ (0.171\ 3x10^{-8})\ (530)^4$$

$$q_e = 67\ \frac{BTU}{hr.\ ft.^2}$$

Where:

F = View factor from test plane to earth simulator.

ϵ = Emittance of earth simulator

σ = Stefan-Boltzmann constant

T = Temperature °R

In a 200 nautical mile earth orbit the maximum heat flux incident on a flat plate due to the earth's thermal radiation is:

$$q_e = F \sigma T^4$$

$$q_e = (0.893)\ (0.1713x10^{-8})\ (454)^4$$

$$q_e = 64\ \frac{BTU}{hr.\ ft.^2}$$

(This assumes the earth to emit as a black body at -6°F, Reference 2).

Therefore, the thermal radiation from the earth simulator is calculated to be 67 BTU/(hr. ft.^{2}) at a temperature of 70°F and the thermal radiation from the earth incident on a flat plate in actual 200 nautical mile earth orbit is calculated to be 64 BTU/(hr. ft.^{2}).

3.6.3 CHAMBER AND WALLS

The SES chamber and wall geometry as compared with actual earth orbit introduces relatively minor variances in the space simulation test program. The solar flux reflected by the rear wall of the SES to the test specimen will be approximately 8.0 BTU/hr. ft.^{2}. The fraction of this energy absorbed by the test specimen will be the product of the view factor and the absorptance of the specimen surface. The value of energy transported will be in the order of 0.18 BUT/hr. ft.^{2} or less than 1% of the direct flux on the test specimen.

The chamber walls radiate some energy to the test specimen. The emitted radiation of the black walls at the liquid nitrogen temperature level is .36 BTU/ft.^{2} hr or about 0.1% of the solar flux.

The openings in the liquid nitrogen cooled shroud for admitting the solar flux to the chamber interior present another item of variance when compared with actual earth orbital conductors. These twenty openings in the cold wall have a total area of 13 square feet and are located approximately 9 feet from the test plane. The view factor from these sources to to the test specimen is approximately 0.024. The solar openings represent a source temperature of approximately 250°F during lamp operation and have an effective of about 0.8. The flux incident on the test specimen will be

$$Q/A = \sigma \epsilon F T^4 = (.173 \times 10^{-8})\ (0.8)\ (0.24)\ (710)^4 = 7.35\ \frac{\text{BTU}}{\text{Hr. ft.}^2}$$

During periods of simulated darkness, these sources will be at room temperature and heat fluxes incident on the test specimen areless than 3 BTU/hr. ft^2. These fluxes do not result in a significant variance when compared to the test results.

3.6.4 PRESSURE

The primary potential variance attributable to the SES chamber pressure is the effect of pressure on the thermal protective characteristics of the space suit. The apparent thermal conductivity of superinsulations is minimized and becomes essentially independent of pressure below about 10^{-4} mm Hg, Figure 28. If the interlayer pressures of the suit exceed 10^{-4} mm Hg at any time, the thermal protective features of the suit become progressively ineffective. The interlayer pressures of the thermal protective layers while in space will be determined largely by the leakage rate of the suit through the pressure seals and joints. With chamber pressures remaining below 10^{-4} mm of Hg during the operational portions of this experiment, the variance due to chamber pressure is not believed to be significant. A plot of the chamber pressure during the second test day is shown in Figure 5.

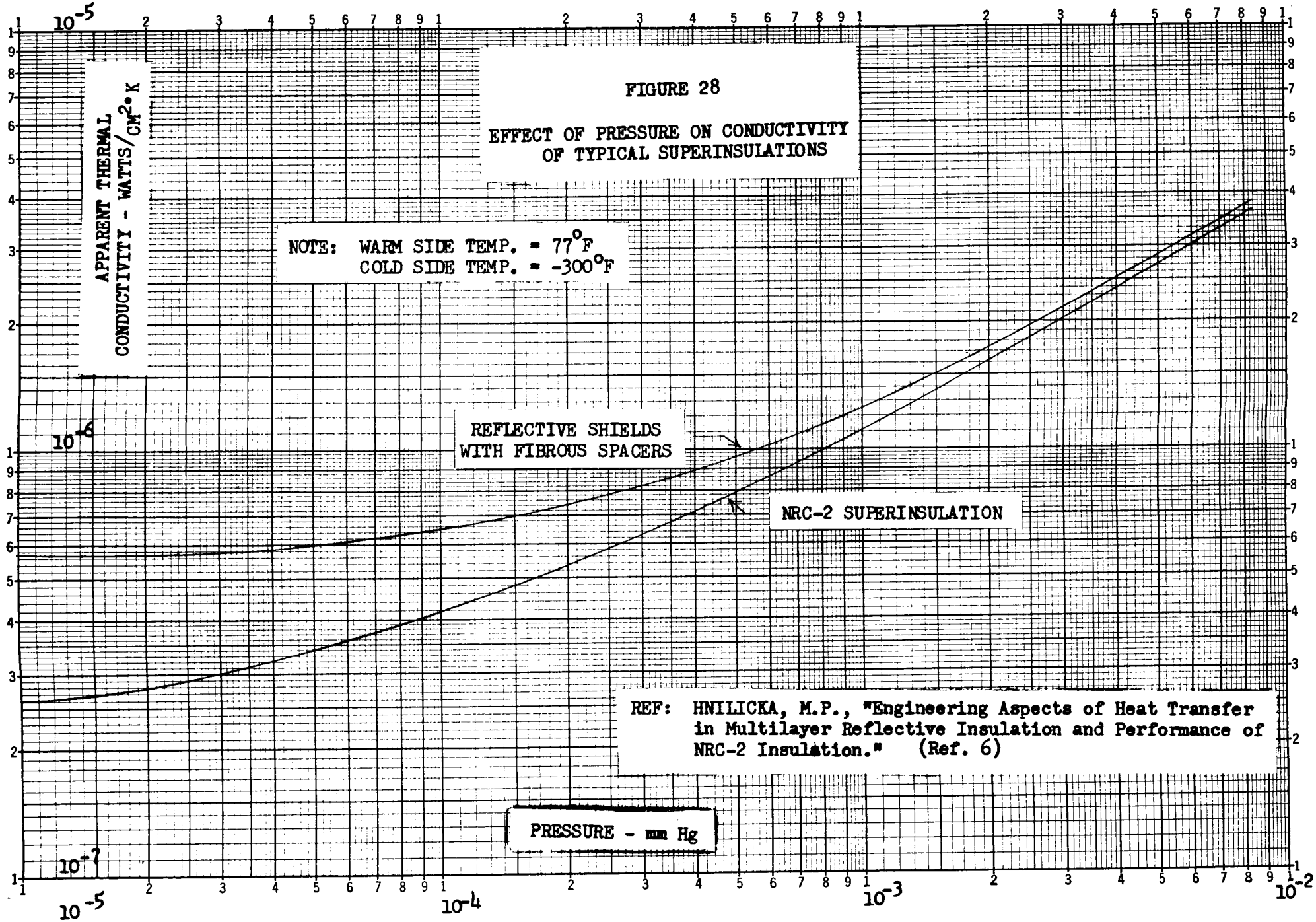


FIGURE 28

EFFECT OF PRESSURE ON CONDUCTIVITY OF TYPICAL SUPERINSULATIONS

4.0 RESULTS AND DISCUSSION

4.1 RESULTS

Tabulated data for all three test days are included in Appendix A. A brief description of each test day and test point is included with the data. Temperature data have been reduced at intervals ranging from every five minutes to every hour, depending on the length of the test point and the test objective. The test day number and test point number are noted on each page and the time of day is given above each data column. Immediately after the temperature data for each test day, thermal dummy heater power and suit flow system data are tabulated.

In Figures 29 through 37 selected temperatures have been plotted for each test point and test day. Significant events occurring during each test point, such as solar lamps on, are noted at the top of each figure.

4.2 DISCUSSION

4.2.1 SUIT TEMPERATURES AND PRESSURES

During this experiment, measured suit surface temperatures ranged from approximately -200°F to +200°F. Table IV compares measured suit surface temperatures with calculated values for actual earth orbit. The higher measured temperature facing the sun resulted from the flux at the test plane being approximately 65% of one solar constant, (Figure 6), compared to the required 55% calculated from the ratio of solar and SES absorptances as outlined in Paragraph 3.6.1. During the simulated dark part of earth orbit (Test Point No. 2, Day No. 1) suit surface temperatures facing the earth simulator varied from -26°F to -40°F in locations other than the one (lower left back) given in Table IV. Therefore, the deviation from true space conditions is probably not as large as would appear (4°F compared to -20°) in the Table.

In general, reproducibility of suit surface temperatures from one test day to the next was good. For example, the suit surface temperature in the upper right chest area varied only 3°F (from 142 to 145°F) when facing the solar lamps on all three test days. Larger temperature variations were noted on the arms and legs. Temperatures in these locations were affected by peaks in the flux distribution at the test plane as shown in Figure 6, and by the location of the ventilation gas lines and thermocouple harnesses, Figure 1.

In Figs. 29 through 31 measured suit surface temperatures in the upper right chest and upper right back locations are plotted for each test point and test day. The variation in suit surface temperature in the lower left back area is shown in Figures 32 through 34. These figures show that the suit surface temperatures respond rapidly to a change in test conditions, such as solar lamps on, and reach steady state within approximately 30 minutes. When the lamps are turned off, suit surface temperatures drop rapidly at first but require two to three hours to reach essentially steady state conditions.

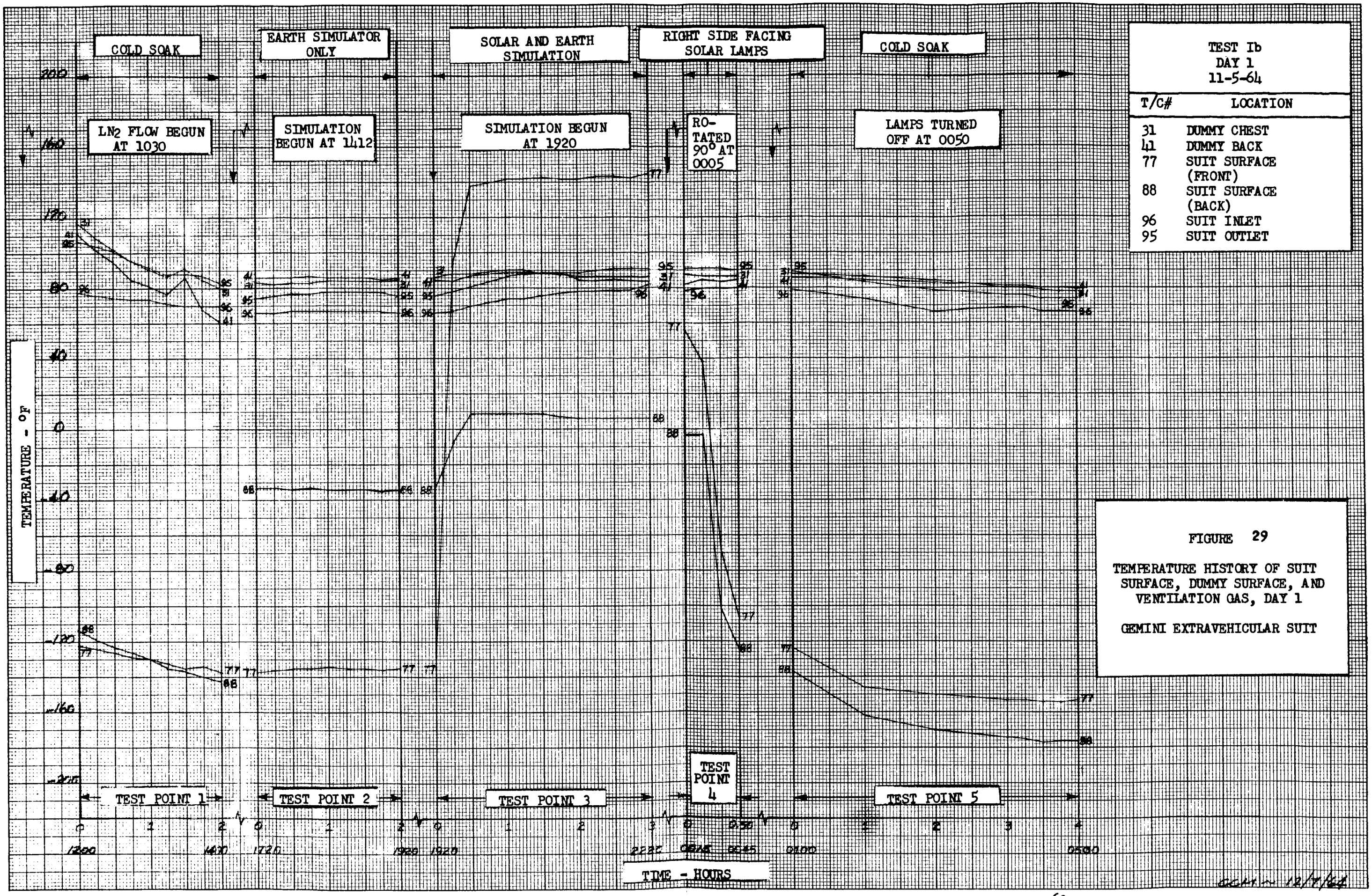


FIGURE 29

TEMPERATURE HISTORY OF SUIT SURFACE, DUMMY SURFACE, AND VENTILATION GAS, DAY 1

GEMINI EXTRAVEHICULAR SUIT

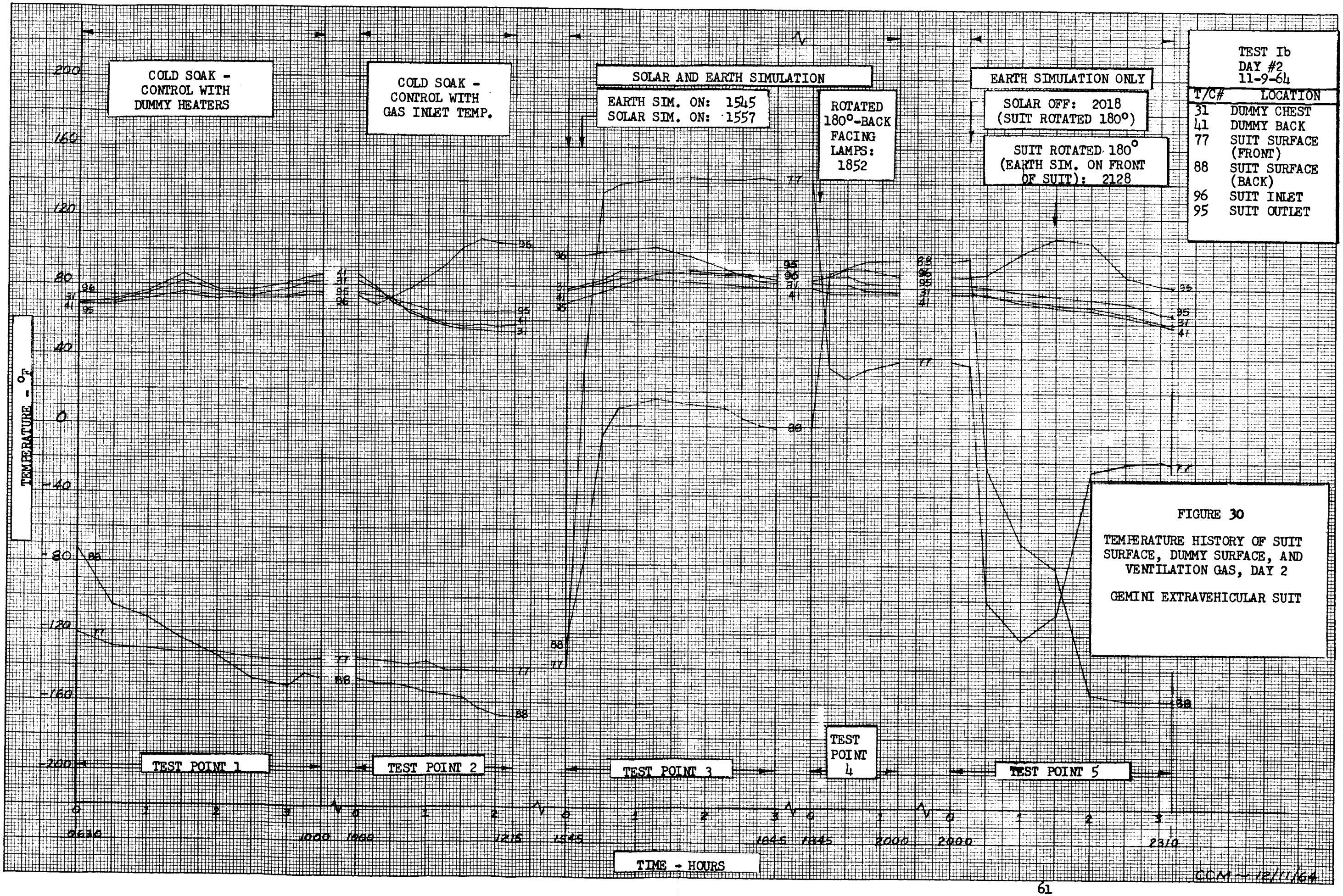


FIGURE 30

TEMPERATURE HISTORY OF SUIT SURFACE, DUMMY SURFACE, AND VENTILATION GAS, DAY 2

GEMINI EXTRAVEHICULAR SUIT

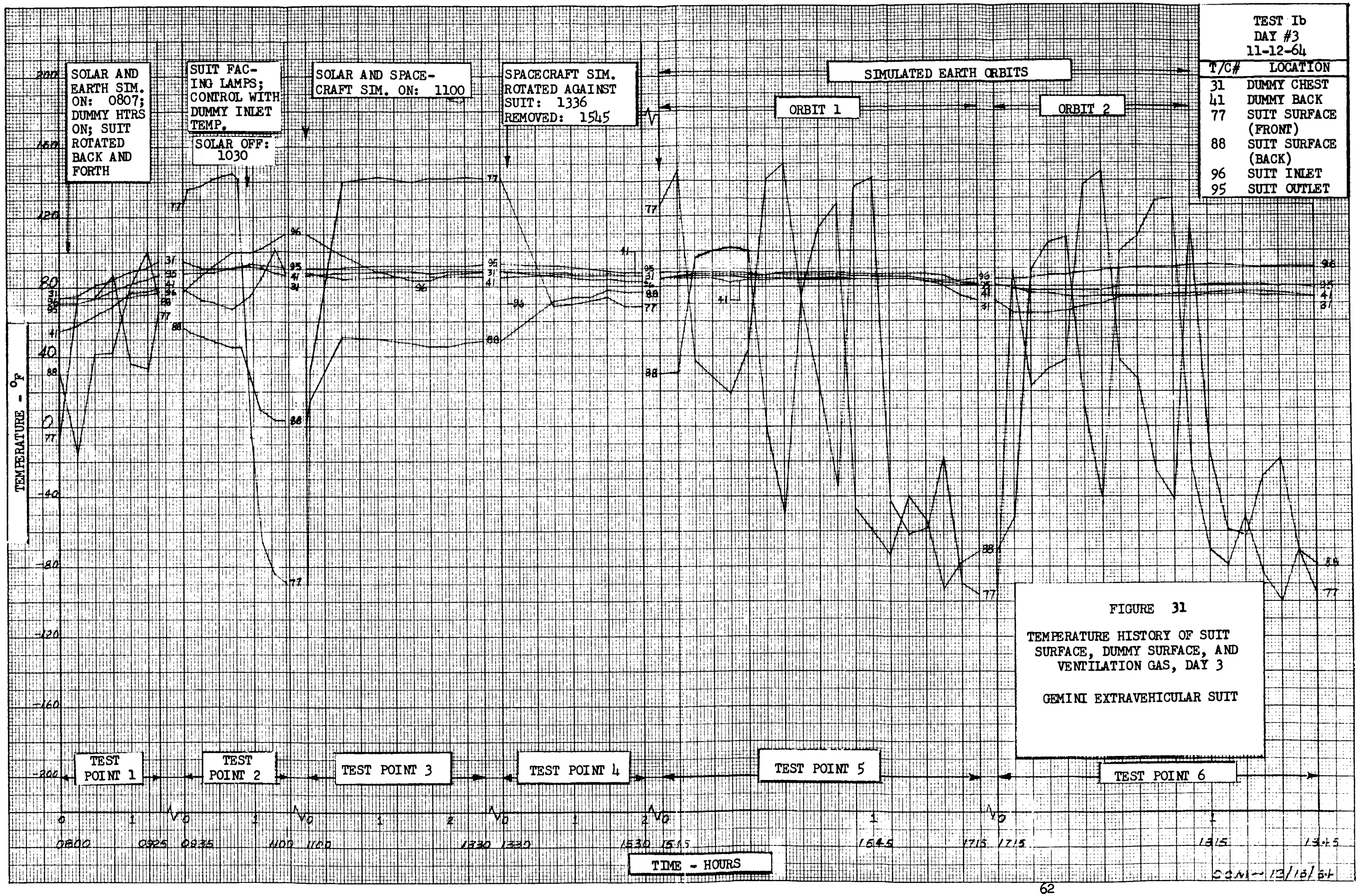


FIGURE 31

TEMPERATURE HISTORY OF SUIT SURFACE, DUMMY SURFACE, AND VENTILATION GAS, DAY 3

GEMINI EXTRAVEHICULAR SUIT

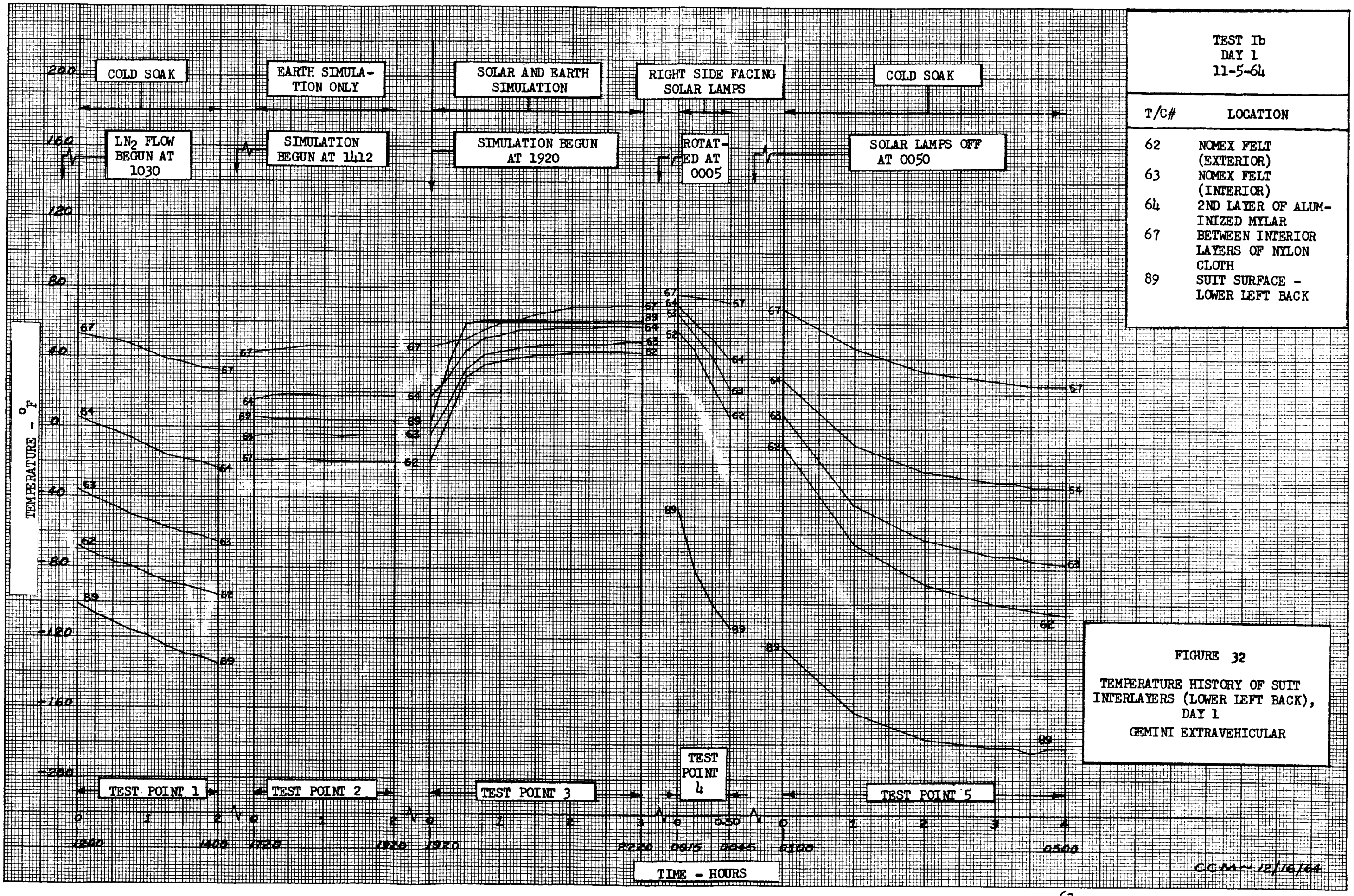


FIGURE 32

TEMPERATURE HISTORY OF SUIT INTERLAYERS (LOWER LEFT BACK), DAY 1

GEMINI EXTRAVEHICULAR

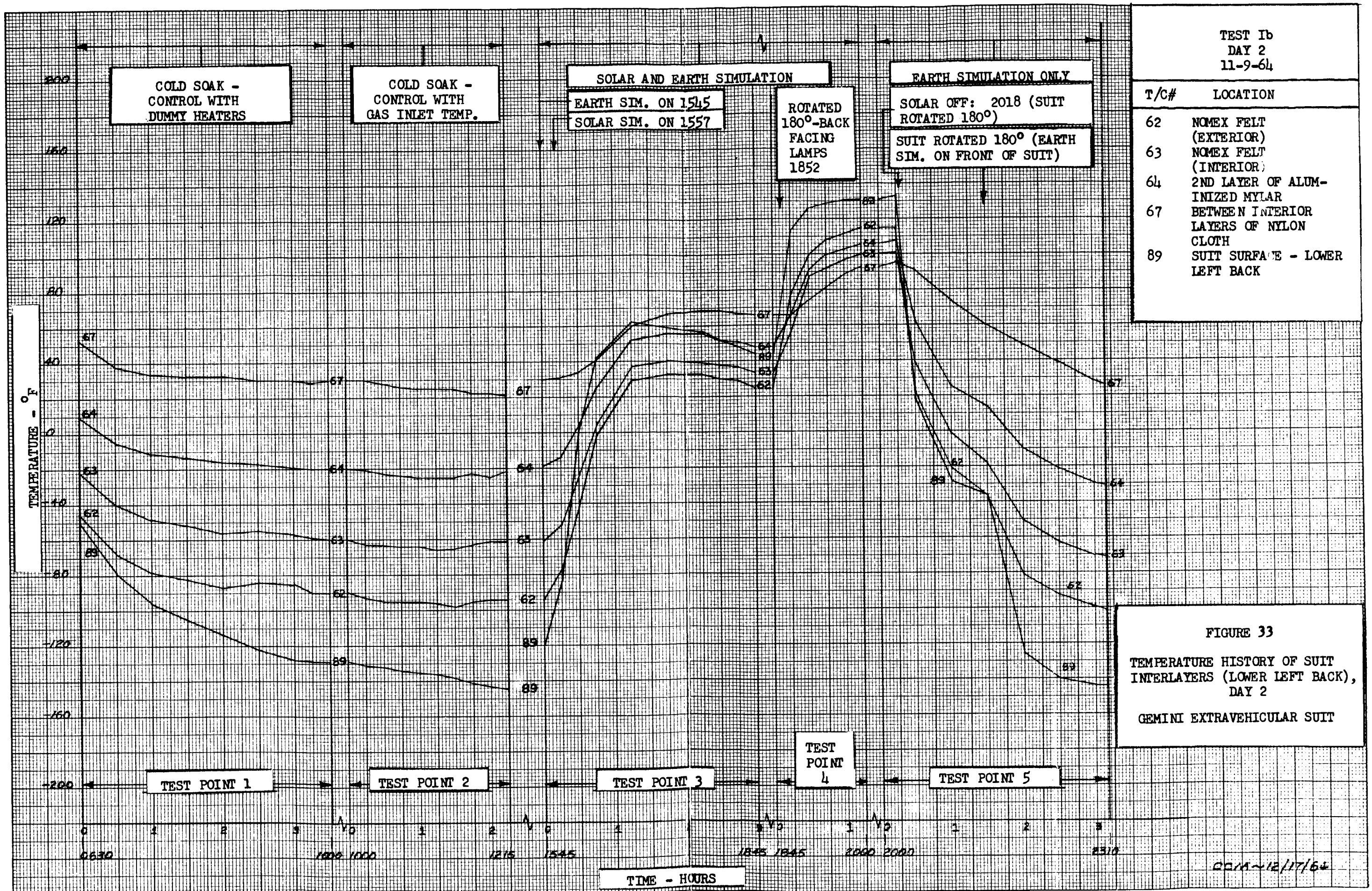


FIGURE 33

TEMPERATURE HISTORY OF SUIT INTERLAYERS (LOWER LEFT BACK), DAY 2

GEMINI EXTRAVEHICULAR SUIT

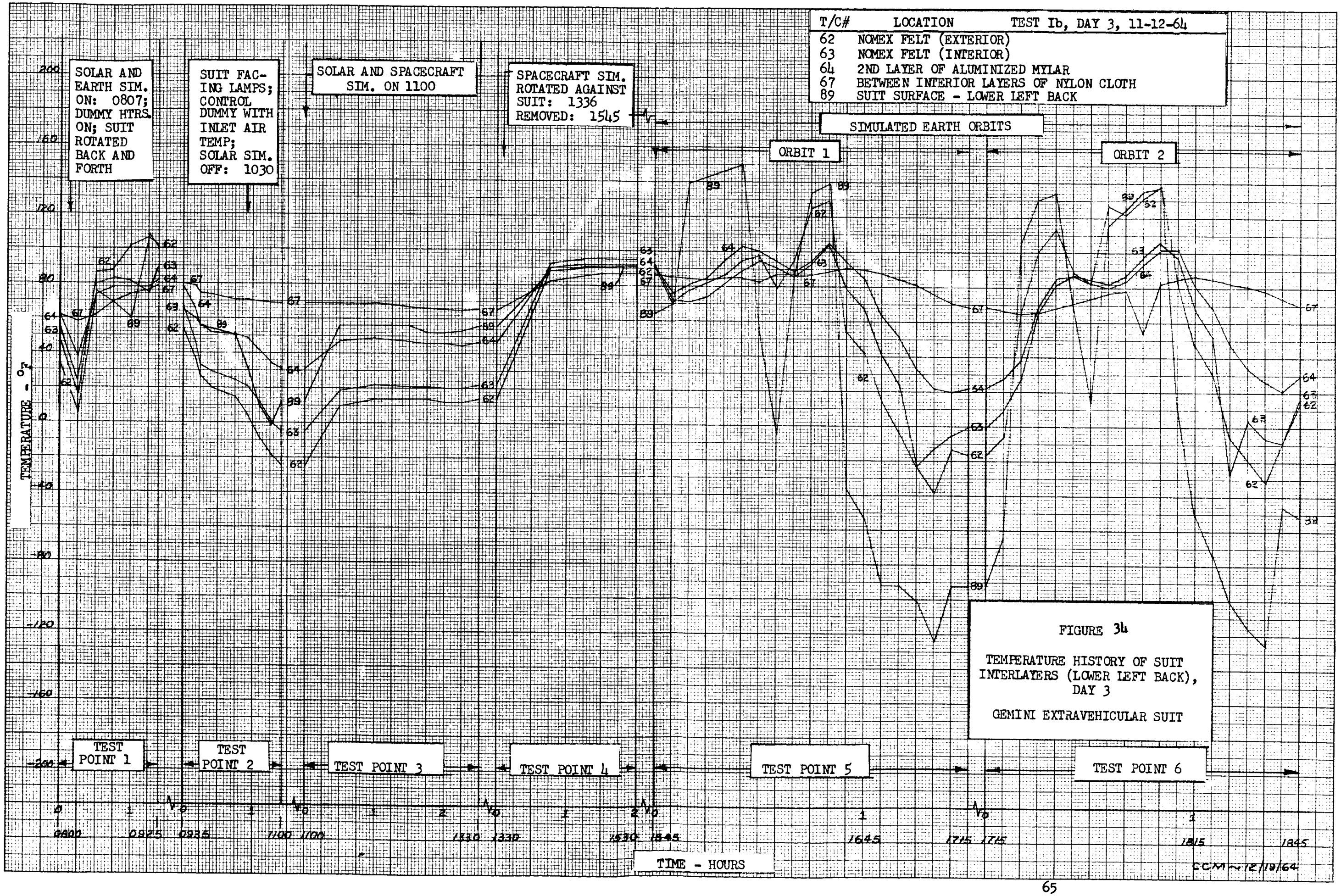


FIGURE 34

TEMPERATURE HISTORY OF SUIT INTERLAYERS (LOWER LEFT BACK), DAY 3

GEMINI EXTRAVEHICULAR SUIT

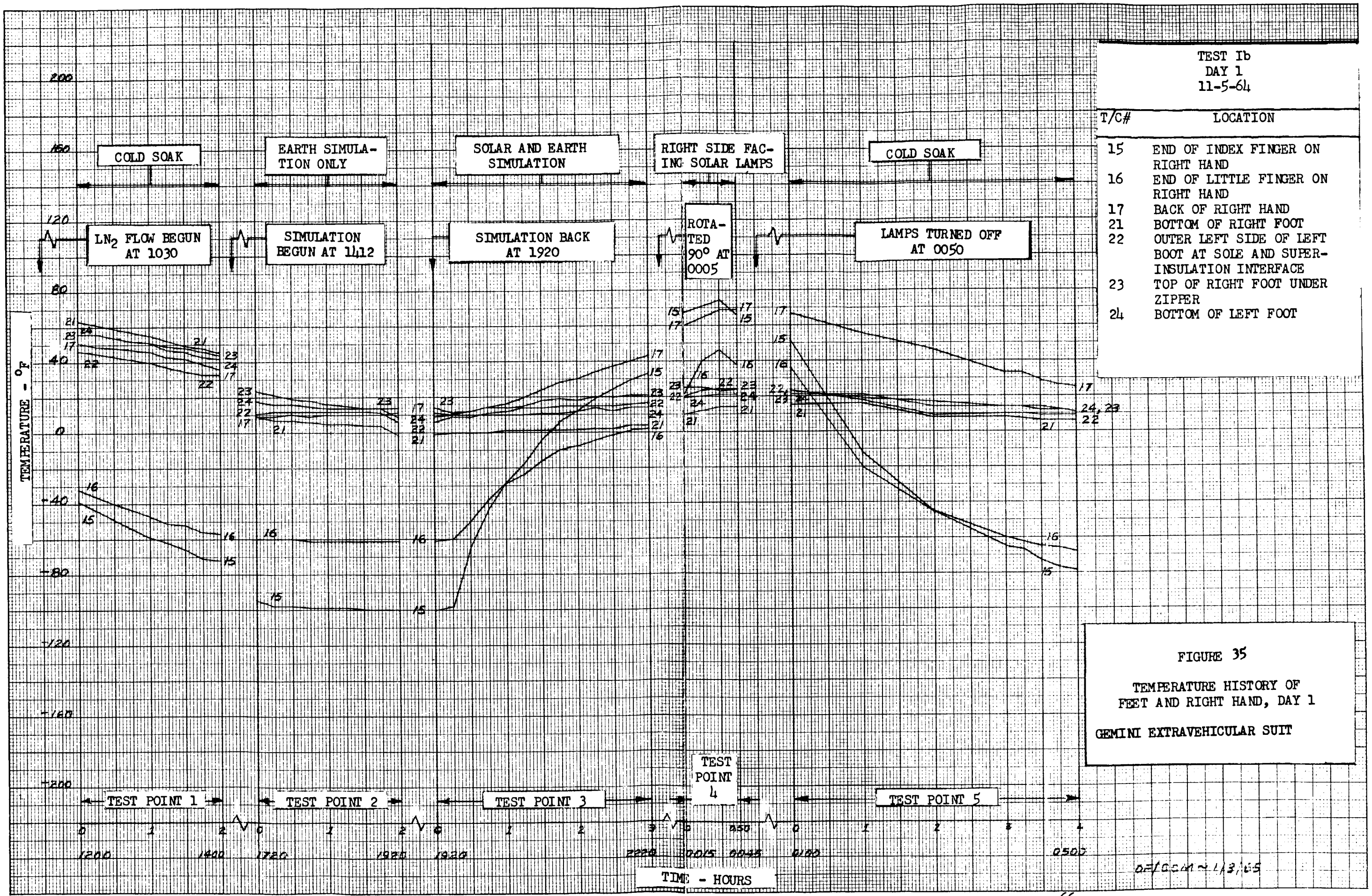


FIGURE 35

TEMPERATURE HISTORY OF FEET AND RIGHT HAND, DAY 1

GEMINI EXTRAVEHICULAR SUIT

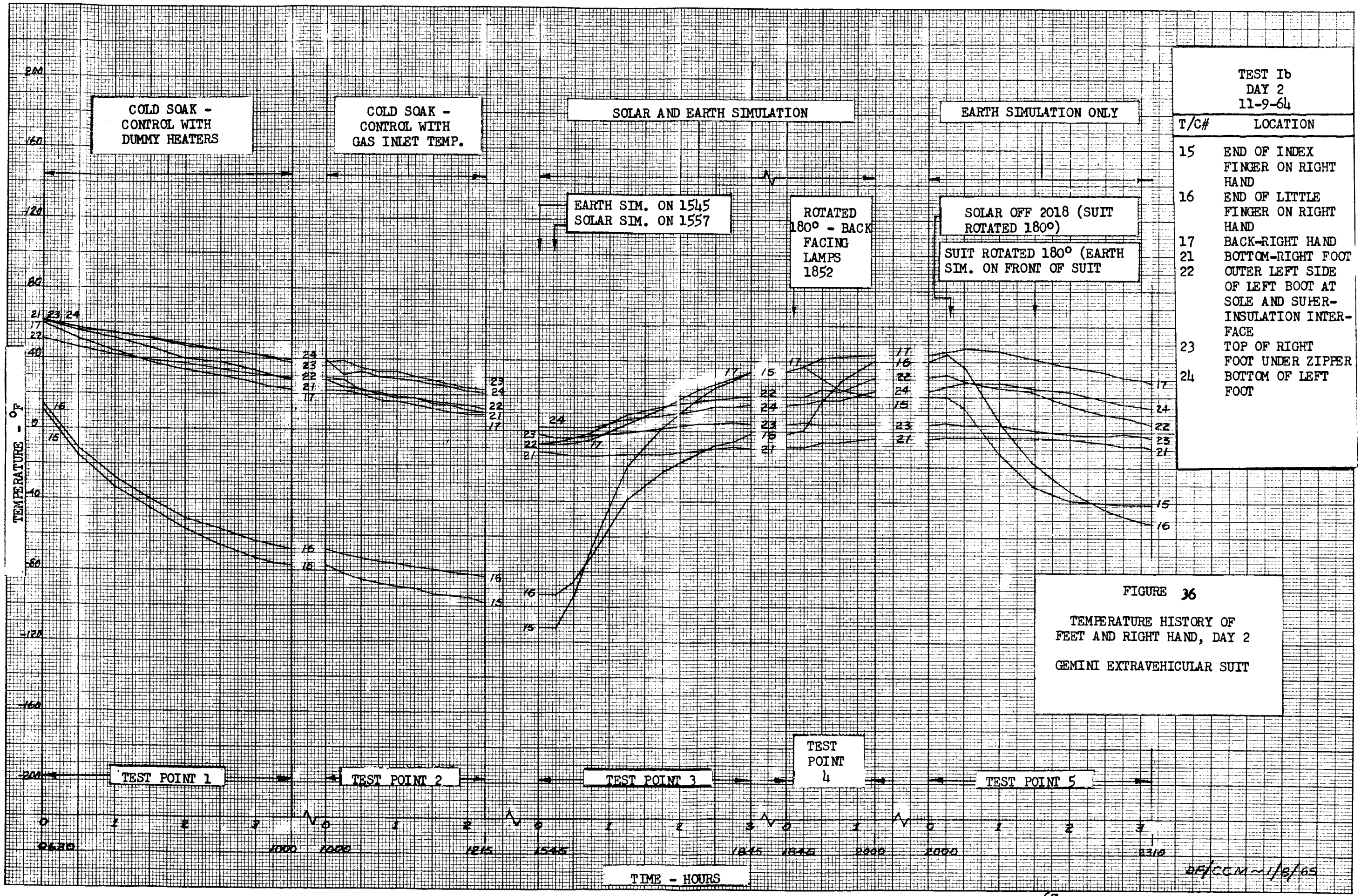


FIGURE 36

TEMPERATURE HISTORY OF FEET AND RIGHT HAND, DAY 2

GEMINI EXTRAVEHICULAR SUIT

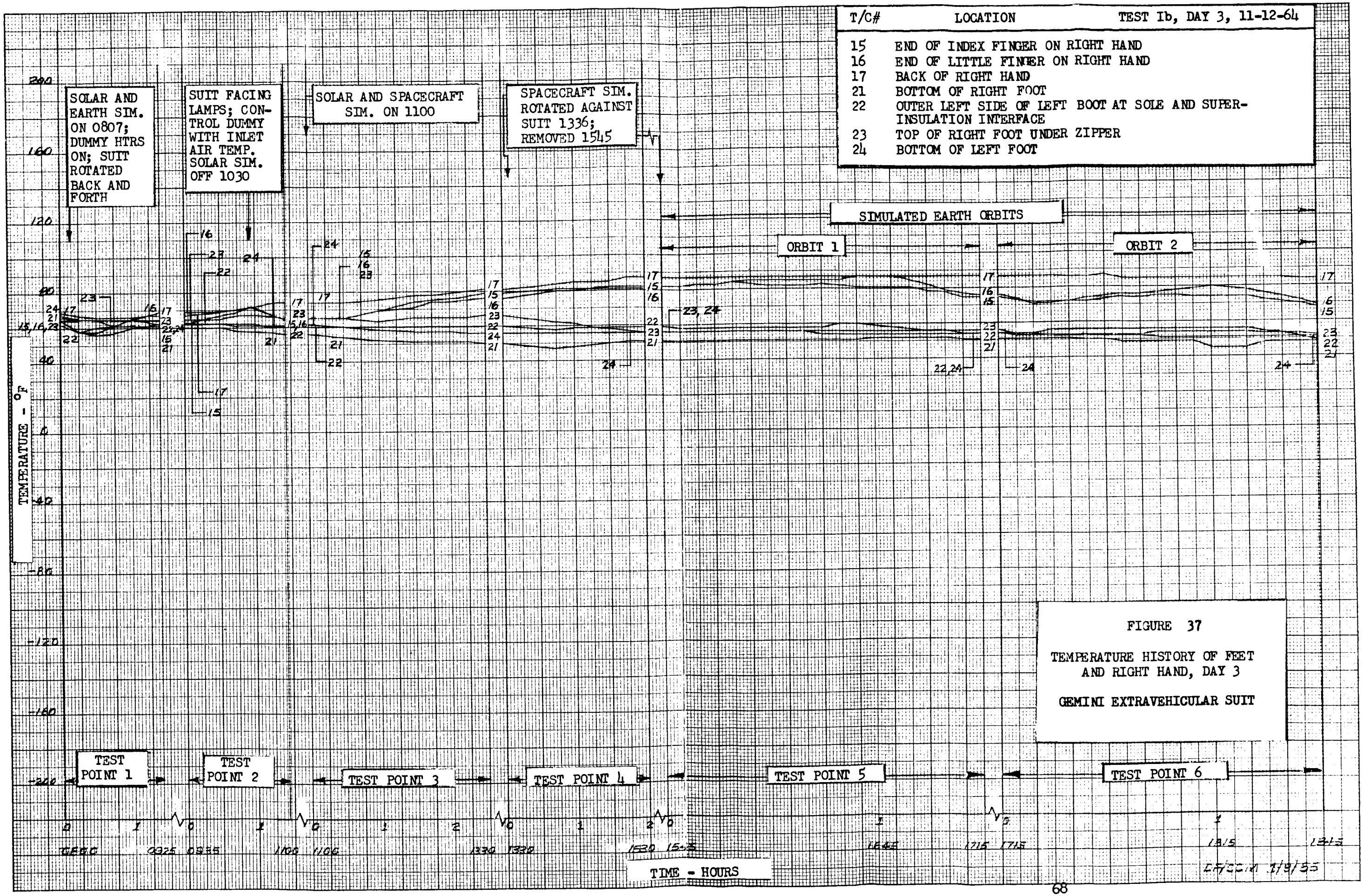


FIGURE 37

TEMPERATURE HISTORY OF FEET AND RIGHT HAND, DAY 3

GEMINI EXTRAVEHICULAR SUIT

TABLE IV

COMPARISON OF MEASURED SUIT SURFACE TEMPERATURES AND CALCULATED VALUES FOR A 200 NAUTICAL MILE EARTH ORBIT.

TEMPERATURE	(1) MEASURED °F	(2) CALCULATED °F
Suit surface temperature facing the sun	145	133**
Suit surface temperature facing the earth (sun side)	61	67**
Suit surface temperature facing the earth (dark side)	4	-20
Suit surface temperature facing deep space	-184	-180*

(1) Upper right chest and lower left back

(2) $\epsilon = 0.57$, $\alpha_{solar} = 0.273$ and flat plate view factors

* Based on a total heat loss of 150 BTU/Hr. and an area of 25 ft^2

** Subsolar Point

Figures 32 through 34 show the temperature history of various suit layers in the lower left back area during the experiment. The effectiveness of the superinsulation is demonstrated in these figures. For example, on Day No. 1 from the end of test point No. 3 to the end of test point No. 5, the suit surface temperature decreased 243°F (from 61°F to -182°F) while the temperature of the interior mylon layers next to the pressure garment decreased by approximately 45°F from 70°F to 25°F. During the entire experiment the temperature of the interior nylon layers did not exceed +100°F or drop below 20°F. In general, the interlayer temperature variation shown in these figures is as would be expected; that is, during cold soak, the temperatures follow a steadily decreasing pattern from the interior nylon layers to the outer surface of the suit. However, with the solar lamps on, the suit surface temperature rapidly increases to a value higher than the nomex felt, Test Point No. 3, Day No. 1, Figure 32. The same situation holds true for Test Point No. 3, Day No. 2, Figure 33. In these test points it appears that the nomex felt serves as a heat sink for the warmer interior layers and outer surface.

The excellent duplication of conditions through simulated orbits 1 and 2 is shown in Figure 34. Also this figure shows the temperature of the interior nylon layers varied from only approximately 65 to 90°F during the two orbits while the suit outer surface varied from +150°F to -126°F.

Suit inlet pressure, pressure in the helmet area and pressure drop did not vary appreciably during the three test days. An analysis of the data shows the following variations in these parameters during the experiment:

Suit inlet pressure - 3.77 - 4.46 psia

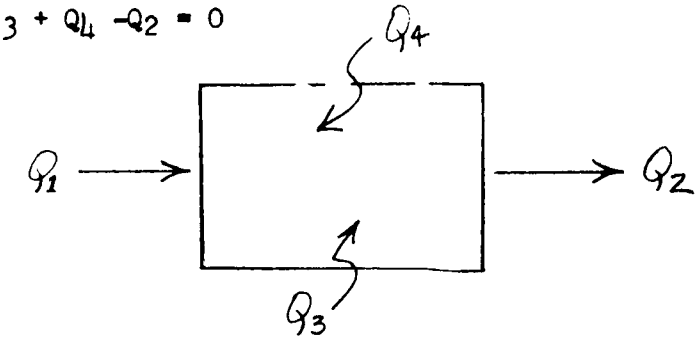
Suit pressure in helmet area - 3.80 - 4.40 psia

Suit pressure drop - .0812 - 0.115 psi

4.2.2 SUIT NET HEAT BALANCE

The heat loss out of the suit or heat leakage into the suit at steady state conditions can be determined by writing a heat balance for the suit as follows:

$$Q_1 + Q_3 + Q_4 - Q_2 = 0$$



Where

Q_1 = heat supplied by inlet gas, BTU/Hr.

Q_2 = heat removed by outlet gas, BTU/Hr.

Q_3 = heat transferred to ventilation gas from dummy, BTU/Hr.

Q_4 = heat leakage into or out of suit, BTU/Hr.

Then

$$Q_1 + Q_3 + Q_4 = Q_2$$

$$WC_p \ t_i + 3.413 \ P + Q_4 = WC_p \ t_o$$

$$Q_4 = WC_p \ (t_o - t_i) - 3.413 \ P$$

Where

W = gas weight flow rate, lb/hr.

C_p - specific heat at constant pressure of gas, BTU/lb °R.

t_o = outlet temperature of gas, °F.

t_i = inlet temperature of gas, °F.

P = dummy heater power, watts (1 watt = 3.413 BTU/hr).

Using the above equation heat leakage into or out of the suit may be calculated.

The heat loss for Test Point No. 5, Day #1 (Figure 29) based on conditions at the end of the test point can be calculated as follows:

$$Q = 13.7 \ (.2485) \ (74-67) - 3.413 \ (50)$$

$$Q = 24 - 170$$

$$Q = - 146 \text{ BTU/Hr.}$$

The minus sign indicates a heat loss out of the suit. The heat balance was set up so that a minus sign slways indicaves a heat loss while a plus sign indicates a heat gain (heat leakage into the suit). This value is with the hood covering the helmet and visor.

With the hood off and the dummy surface temperature controlled with the dummy heaters (Test Point No. 1, Day No. 2) the calculated heat loss is as follows:

$$Q = 13.6\ (2485)\ (76-74) - 3.413\ (87.5)$$

$$Q = -291 \text{ BTU/Hr.}$$

Analysis of the data shows at least 50 BTU/Hr. of this total heat loss can probably be attributed to the heat capacity of the dummy. Also Figure 30 shows the suit surface temperatures are still decreasing, indicating steady state conditions have not been achieved. A difference of only 10°F (-155° compared to -165°F) in average suit surface temperature can mean a difference of 27 BTU/Hr. in the total heat transfer rate from the suit to its environment. Therefore a more realistic value for the net heat loss from the suit, in this case, would be approximately 200 BTU/Hr.

Test Point No. 2, Day No. 2, Figure 30 is a cold soak condition with the hood off where the dummy heater power was zero and the dummy surface temperature was maintained by controlling the inlet gas temperature. The heat loss for this condition is

$$Q = 14.2\ (.2485)\ (65 - 104) - 3.413\ (0)$$

$$Q = -138 \text{ BTU/Hr.}$$

This heat loss is believed to be low because the dummy face temperature could not be maintained at 85°F when the inlet gas temperature was used to control the dummy surface temperature. In the two previous heat loss calculations the dummy face temperature was approximately 83°F but at the end of the above test point the face temperature was 27°F.

In a similar manner the net heat leakage into or out of the suit at other test points can be determined. Calculated heat leakage data are presented in Table V. These calculations show that the maximum heat loss out of the suit is 291 BTU/Hr, while the maximum heat leakage into the suit is 18 BTU/Hr. under the conditions imposed during this experiment.

For a heat loss of 146 BTU/Hr. from the suit, the over-all heat transfer coefficient or conductance, U, is

$$Q = UA\ \Delta t$$

$$U = \frac{146}{25\ 78 - (-165)}$$

$$U = 0.024\ \frac{\text{BTU}}{\text{hr. ft}^2\ {}^\circ\text{F}}$$

based on a suit surface area of 25 square feet, an average inner surface temperature of 78°F and an average suit surface temperature of -165°F. If the visor and helmet are assumed to contribute approximately 50 BTU/Hr. to the total heat loss and have an area of 2 square feet, the conductance for the suit alone is

TABLE V

CALCULATED NET SUIT

HEAT LEAKAGE

Test Day No.	Test Point No.	Test Point Description	Heat Leakage BTU/Hr.
1	5	Cold soak. Hood covering helmet and visor. Dummy surface temperature controlled with dummy heaters.	-146
2	1	Cold Soak. Hood off and two 20% transmittance visors installed. Dummy surface temperature controlled with dummy heaters.	-291
2	2	Cold soak. Hood off and two 20% transmittance visors installed. Dummy surface temperature controlled with inlet gas.	-138
1	3	Full simulation: Solar lamps on; earth simulator on. Suit facing lamps with hood covering helmet and visor.	-25
2	3	Full simulation. Suit facing lamps with hood off and two 20% transmittance visors installed.	+7
2	4	Full simulation. Back facing lamps. Hood off; two 20% transmittance visors installed.	-18
3	3	Full simulation. Suit facing lamps with clear visor. Simulated spacecraft (180°F) surface on right side of suit.	+14
3	4	Full simulation. Suit facing lamps with clear visor. Spacecraft surface (180°F) in contact with suit.	+18

(+) Indicates a net heat gain

(-) Indicates a net heat loss

$$U = \frac{96}{23[78 - (-165)]}$$

$$U = 0.0172 \text{ BTU/Hr. ft}^2\ ^{o}F$$

which agrees with previous test results, (Reference 6).

4.2.3 NET HEAT GAIN OR LOSS THROUGH VISOR

Comparing suit heat leakage values with the suit facing the lamps and the back facing the lamps, (Day No. 2, Table V) a change in heat leakage from +7 to -18 BTU/Hr. is observed. This variation would indicate the heat leakage through the two, 20% transmittance visors to be approximately 25 BTU/Hr. into the suit. Also Table V shows the suit net heat leakage with the hood "on" is -25 BTU/Hr. (Test Point No. 3, Day No. 1) while the suit net heat leakage with the hood "off" is +7 BTU/Hr. (Test Point No. 3, Day No. 2). This difference indicates a visor heat leakage of approximately 32 BTU/Hr. into the suit between the hood "on" and hood "off" conditions with the suit facing the lamps and full simulation (solar lamps on, earth simulator on) applied to the exterior of the suit.

Heat loss from the visor during the cold soak condition was impossible to determine from the over-all suit heat balance. However, the difference in power requirements for the heaters in the dummy head with the hood on and hood off gives an indication of the heat loss. The total power to the heaters in the dummy head at the end of Test Point No. 5, Day No. 1 (hood on), was 5 watts. At the end of Test Point No. 1, Day No. 2 (hood off, two 20% transmittance visors), the total power to the heaters in the head was 25 watts to maintain the same dummy face temperature. This 20 watt increase is equivalent to about 68 BTU/Hr. Part of this energy is transferred to the ventilation gas stream but the amount conducted through the visor and radiated from the outside surface can be calculated from the visor temperature. The temperature of the outside surface of the pressure visor at the end of Test Point No. 1, Day No. 2 was about 24 ^{o}F. Assuming the outer surface of the outside tinted visor is 24°F (actually it would be less) and an emittance of 0.9 for the plexiglass, the heat loss from the 71 square inch visor surface would be

$$q = \epsilon \sigma A T^4$$

$$= .9\ (.1713 \times 10^{-8})\ (.493)\ (484)^4$$

$$q = 42 \text{ BTU/Hr.}$$

This visor heat loss added to the -146 BTU/Hr. total heat loss calculated for test point No. 5, Day No. 1, (cold soak; hood on) would result in a total heat loss from the suit of

$$Q_{total} = -146 - (-42)$$

$$Q_{total} = -188 \text{ BTU/Hr.}$$

with the hood off and tinted visors installed. This value is in agreement with the -200 BTU/Hr. suggested in Paragraph 4.2.2 for Test Point No. 1, Day No. 2.

Therefore, these data indicate there is a net heat gain through visor of 30-40 BTU/Hr. when facing the sun and a net heat loss of 40-50 BTU/Hr. when facing deep space.

4.2.4 VISOR FROSTING

On Test Day No. 2 the humidity in the helmet was increased and a deflection in the oscillograph trace, indicating a decrease in light intensity to the photoelectric cell, was noted. The visor temperatures at this time were below 32°F and the deflection was possibly an indication of visor frosting. However, although the deflection occurs at approximately the same time as the increase in humidity, there is not always a good correlation between increases in humidity and deflections of the oscillograph trace. For a ventilation gas temperature of 85°F in the helmet area and a visor temperature below 32°F, the relative humidity in the helmet would have to be less than 14% for frosting not to occur. Relative humidity measurements as high as 95% in the helmet area were recorded during this phase of the test and although the data are not conclusive, visor frosting very likely did occur.

4.2.5 THERMAL ADEQUACY OF SUIT

Except for the hands and feet, the suit would appear to be thermally adequate. Figures 35 through 37 show the history of temperature measurements at various locations on the feet and right hand during the three test days. Temperatures near freezing or below were recorded for the feet and unheated hand on Days 1 and 2 with maximum thermal inputs to the suit from the solar lamps and earth simulator. Temperatures on the heated portions of both arms and legs were approximately the same as the torso temperatures at the various test points. Prior to Day No. 3 insulation was added to the bottom of the left foot and an insulated mitten was added to the right hand. The higher hand and feet temperatures recorded on the third test day were influenced by both the added insulation and the radiation from the simulated spacecraft surface. From the data it is not possible to determine the contribution of each. Temperatures on the right hand increased with an increase in temperature of the spacecraft surface, while temperatures on both feet remain relatively constant. The temperature on the bottom of the left foot is about 5-6°F higher than the bottom of the right foot; however, the bottom of the left foot was observed to be warmer than the right foot on previous days.

The 200-300 BTU/Hr. heat loss is larger than would be encountered in actual earth orbit since the suit will always be receiving the earth's thermal radiation. The slight heat leakage into the suit when facing the sun should not pose a severe problem for the environmental control system.

4.2.6 "HOT SPOTS" RESULTING FROM CONTACT WITH SPACECRAFT SURFACE

Contact with the 180°F simulated spacecraft surface did not produce a significant increase in dummy surface temperatures in the contact area. The total heat leakage into the suit may increase slightly (Table V, Test Point No. 4, Day No. 3) due to an increase in local suit surface temperatures but contact with the hot spacecraft surface did not create a "hot spot" in the sense of excessive temperatures on the interior of the suit.

Figure 38 shows the effect of mechanical loading on the apparent thermal conductivity of various numbers of aluminized layers in a vacuum. These data show that the apparent thermal conductivity of the layers increases abruptly (possibly by a factor of 100) with the initial application of load. However, after the load reaches about 2 psi the apparent thermal conductivity becomes practically independent of load and the maximum value attained is low indicating that radiation is still the predominant mode of heat transfer. Therefore, analysis of these data indicate that contact with a 180°F spacecraft surface should not produce a significant "hot spot" on the suit.

4.2.7 SUIT GAS LEAKAGE

Suit ventilation gas leakage was measured periodically during the three test days and varied between 140 and 190 cc/min. The Phillips gauges mounted external to the suit did not indicate the source of the leakage.

4.2.8 EFFECT OF COMPRESSION UNDER PARACHUTE HARNESS

During this series of tests the suit and dummy were partially supported by the parachute harness thereby imposing a greater compressive load under the harness straps than might ordinarily be experienced. Analysis of the data shows no significant difference in temperature between points on the dummy surface in the area of the straps and those on the underwear directly under the straps. The effect of harness compression on interlayer temperatures does not appear significant based on measurements in the upper left back area (under the harness) and the lower left back area (not under the harness). For example, Test Point No. 4, Day No. 2, with the back of the suit facing the solar lamps, the suit surface temperatures at the above locations are 132°F and 131°F respectively. The corresponding temperatures on the interior side of the nomex felt are 101°F and 100°F, while the temperatures on the exterior side of the second layer of aluminized mylar are 93°F and 106°F. Temperatures with the back of the suit facing the earth simulator do not agree as well because of the difference in view factor between the two locations and the earth simulator

Suit surface temperatures under the harness are generally higher than adjacent surface temperatures based on an analysis of measurements made in the right chest and upper right back areas. During the cold soak condition the suit surface under the harness may be as much as 50-60°F warmer than the adjacent suit surface, due to the insulating effect of the harness. When facing the solar lamps the surface under the strap is only about 10°F higher than the bare suit surface. This slight difference could be due to a higher absorptance for the harness material.

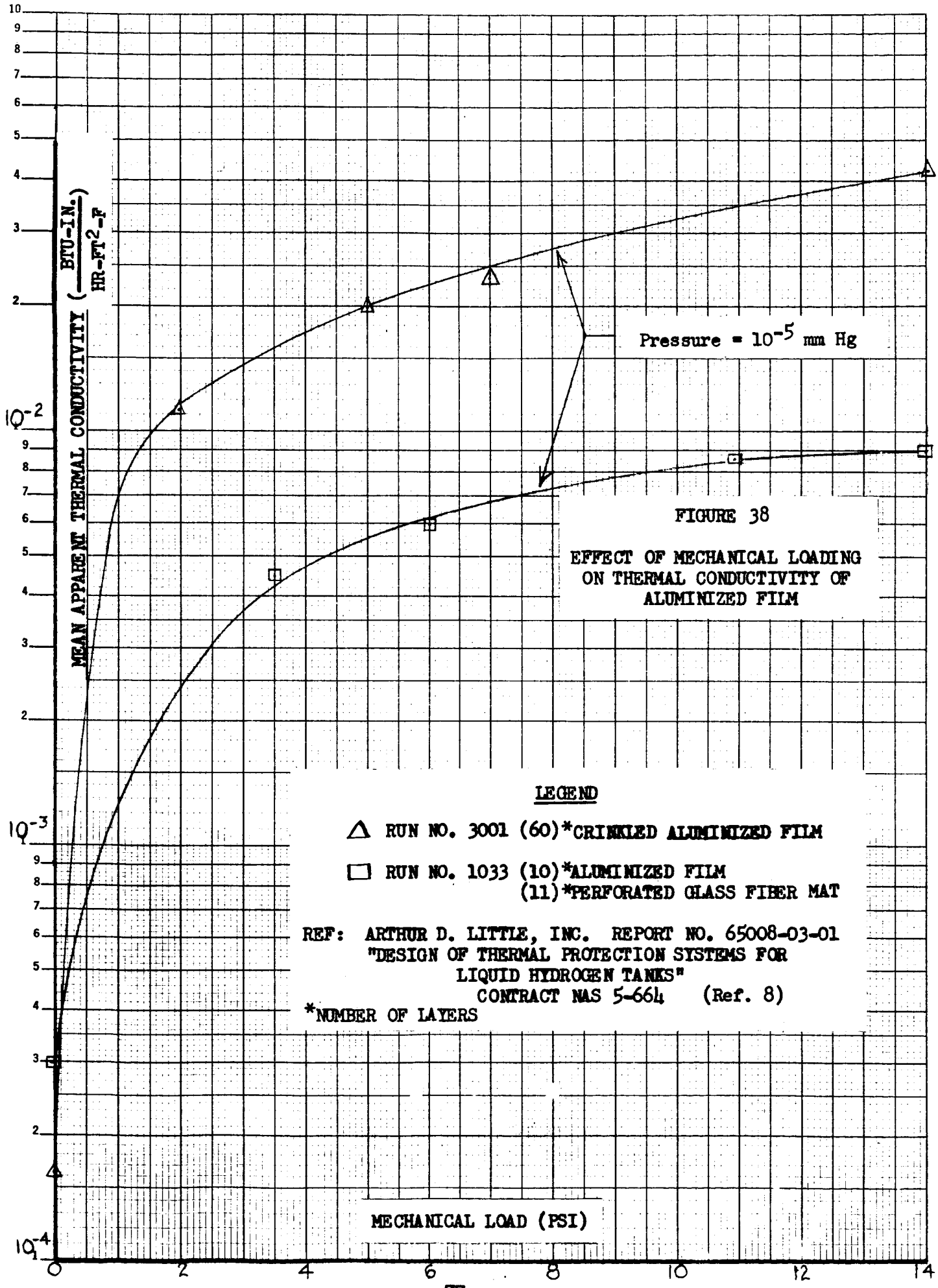


FIGURE 38

EFFECT OF MECHANICAL LOADING ON THERMAL CONDUCTIVITY OF ALUMINIZED FILM

K+E SEMI-LOGARITHMIC 46 5813
3 CYCLES X 140 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

5.0 CONCLUSIONS & RECOMMENDATIONS

Based on the results of this experiment the following is concluded with regard to the performance of the Gemini Extravehicular Suit under the test conditions imposed:

1. Suit surface temperatures should not exceed +200°F or be colder than -200°F during a near-earth orbit. Pressure in the helmet area is about 0.06 psi less than the suit inlet pressure (3.7 psia nominal). Total suit pressure drop is approximately 0.1 psi at 11.5 ACFM (3.7 psia, 70°F).

2. Maximum heat loss from the suit should not exceed 250 BTU/Hr. Maximum heat leakage into the suit is approximately 20 BTU/Hr.

3. Heat leakage through the visor is approximately 30-40 BTU/Hr. into the suit when facing the sun and about 40-50 BTU/Hr. out of the suit when facing deep space.

4. Visor frosting is possible when the visor faces deep space as visor surface temperature drops below the freezing point. When facing the sun, visor surface temperatures are approximately 90-100°F and condensation is not likely to occur.

5. The suit is thermally adequate except for the gloves and boots. Insulation should be added to these locations.

6. Contact with the 180°F simulated spacecraft surface did not produce "hot spots" on the interior of the suit.

7. Suit ventilation gas leakage should not exceed 200 cc/min.

8. Compression under the parachute harness does not result in "hot spots" on the interior of the suit.

APPENDIX A

TABULATED TEST DATA

TEST DAY NO. 1

HOOD COVERING HELMET

AND VISOR. SUIT SUPPORTED

FROM TIEDOWN CABLE.

PROTECTIVE GLOVE ON RIGHT HAND

TEST DAY NO. 1

TEST POINT NO. 1

COLD SOAK. DUMMY

SURFACE TEMPERATURE

CONTROLLED WITH DUMMY HEATERS.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 1 DATE 5 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1200	1215	1230	1245	1300	1315	1330	1345	1400		
001	127	125	125	118		125	111	126	126		
2	121	115	123	109	116	123	104		117		
3	94	92	89	84	78	74		67			
4	96	94	91	85	79	74	71	69	65		
5	75	74	72	70	67	65	62	61	60		
6	110	104	98	93	87		87	82	78		
7											
8	117	110	102	96	91	87	91	84	79		
9	107	108	108	106	104	134	102	100	98		
10	118	115	110	105	102	98	101	97	92		
11	98	98	96	94	91	87	85	83	80		
12	116	110	104	98	93		93	89	83		
13	84	84	83	81	79	75	74	74	70		
14	119	113	105	100	93	88	92	88	82		
15	-39	-44	-49	-54	-59	-62	-66	-71	-72		
16	-31	-36	-40	-43	-47	-51	-52	-56	-57		
17	51	49	48	47	46	43	42	39	36		
18	117	113	108	104	100		100	95	91		
19	113	111	108	104	101	108	98	95	91		
20	87	87	85	82	78	71	68	65	61		
21	53	51	49	47	45	42	39	38	35		
22	46	45	44	42	40	37	35	33	33		
23	56	56	54	52	51	49	48	46	44		
24	56	56	54	52	51	47	46	43	42		
25	119	112	104	97	91	87	92	87	80		
26	113	106	100	94	89	84	88	83	78		

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 1 DATE 5 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1200	1215	1230	1245	1300	1315	1330	1345	1400		
027	119	113	104	98	92	87	92	87	82		
28	114	108	100	95	89	84	88	83	78		
29	88	89	84	82	78	75	74	74	70		
30	130	123	114	105	98		95	89	82		
31	117	109	102	96	91	87	91	85	80		
32	117	110	104	98	93	88	91	87	82		
33	123	117	108	100	92	87	91	84	78		
34	126	119	110	102	95	88	93	87	79		
35	117	109	101	94	87	81	85	78	74		
36	119	114	109	105	101	98	101	97	92		
37	118	113	108	104	100	97	100	96	91		
38	118	110	101	93	86	79	82	75	69		
39	118	110	99	91	85	81	85	72	64		
40	121	114	106	97	90	84	88	79	73		
41	111	102	95	85	81	77	86	68	61		
42	125	117	108	100	94	89	95	87	82		
43	117	110	101	94	87	80	84	78	70		
44	80	79	78	74	71	69	67	65	62		
45	122	114	106	100	94	89	95	88	82		
46	118	114	109	105	101	97	100	96	92		
47	118	114	109	104	100	97	100	96	91		
48	123	114	105	98	91	85	89	83	75		
49	121	113	104	96	89	84	87	81	74		
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 1 DATE 5 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1200	1215	1230	1245	1300	1315	1330	1345	1400		
053											
54											
55											
56											
57	28	25	20	14	9	4	0	1	-5		
58											
59	78	74	68	61	56	51	49	47	42		
60											
61											
62	-68	-73	-77	-79	-84	-88	-90	-126	-95		
63	-36	-41	-45	-50	-53	-57	-60	-62	-65		
64	5	1	-2	-6	-11	-16	-18	-20	-23		
65											
66											
67	53	51	50	47	43	39	37	34	33		
68	-94	-95	-98	-101	-104		-110	-111	-112		
69	-67	-72	-76	-79	-84	-101	-93	-95	-98		
70	-66	-67	-68	-71	-73	-73	-77	-78	-78		
71	-119	-127	-131	-135	-140	-142	-148	-151	-154		
72	-72	-73	-76	-78	-81	-83	-85	-88	-90		
73	-68	-73	-77	-81	-85	-90	-93	-96	-101		
74	-157	-162	-166	-170	-177	-181	-183	-184	-188		
75	-175	-180	-183	-188	-194	-198	-202	-204	-206		
76	-151	-154	-156	-157	-162	-164	-167	-166	-170		
77	-122	-124	-126	-129	-130	-132	-135	-134	-137		
78	-135	-137	-138	-140	-142	-143	-144	-144	-148		

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 1 DATE 5 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1200	1215	1230	1245	1300	1315	1330	1345	1400		
079	-147	-149	-150	-153	-155	-157	-160	-160	-163		
80	-142	-144	-147	-150	-154	-156	-157	-157	-162		
81	-105	-106	-105	-103	-101	-105	-106	-106	-108		
82	-90	-79	-66	-60	-56	-63	-65	-64	-78		
83	-149	-151	-153	-155	-156	-160	-162	-163	-164		
84	-142	-144	-146	-149	-151	-154	-156	-157	-161		
85	-68	-82	-90	-96	-104	-111	-114	-119	-124		
86	-119	-124	-130	-137	-141	-148	-151	-156	-157		
87	-99	-105	-108	-113	-118	-135	-126	-129	-132		
88	-114	-119	-123	-126	-130	-135	-137	-140	-143		
89	-101	-107	-111	-116	-119	-125	-129	-131	-135		
90	-119	-124	-129	-132	-137	-141	-144	-149	-151		
91	-123	-129	-133	-136	-141	-144	-149	-151	-154		
92	-112	-137	-122	-128	-134	-137	-142	-144	-148		
93	-108	-114	-119	-124	-129	-134	-136	-137	-142		
94	91	91	91	89	87	84	82	81	78		
95	107	104	101	96	92	88	88	87	83		
96	78	76	75	74	74	71	70	70	70		
97	-95	-103	-109	-114	-118	-124	-129	-132	-136		
98	-96	-104	-109	-115	-119	-126	-130	-131	-136		
99											
100	-93	-101	-106	-112	-116	-121	-126	-130	-134		
101	-101	-111	-114	-119	-125	-129	-130	-138	-144		
102	-87	-95	-101	-107	-111		-119	-124	-130		
103											
104											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 1 DATE 5 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1200	1215	1230	1245	1300	1315	1330	1345	1400		
105											
106											
107											
108											
109						-280	-280	-286	-287		
110						-294	-294	-297	-292		
111						-308	-308	-309	-310		
112						-317	-318	-318	-320		
113						-300	-302	-300	-302		
114						-308	-309	-307	-307		
115	114	107	100	94	89	86	89	82	78		
116	121	114	108	101	96	92	96	91	84		
117	108	105	102	97	93	89	88	87	83		
118	107	104	101	96	93	89	88	87	82		
119											
120	88	87	85	82	79	76	75	74	71		
121	126	128	122	128	128	129	128	128	127		
122	104	104	100	97	93	89	87	87	83		
123	-88	-94	-98	-105	-111	-116	-117	-119	-124		
124	-137	-141	-141	-147	-149	-153	-155	-156	-157		
125	-150	-153	-154	-157	-161	-164	-168	-168	-170		
126	-108	-113	-117	-122	-126	-132	-136	-138	-143		
127											
128											
129											
130											

TEST DAY NO. 1

TEST POINT NO. 2

EARTH SIMULATION

(ONLY) ON BACK OF SUIT.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT 1b

TEST DAY NO. 1 TEST POINT NO 2 DATE 11-5-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1720	1735	1750	1805	1820	1835	1850	1905	1920		
1	110	111	113	113	115	111	110	110			
2	116	110	108	115	113	114	114	106	103		
3	61	62	62	62	61	61	60	60	57		
4	63	65	65	65	63	63	62	61	60		
5	51	52	53	53	54	54	54	54	52		
6	79	79	80	80	80	80	80	80	80		
7											
8	84	84	84	85	85	85	85	85	87		
9	83	83	83	83	83	83	84	84	84		
10	87	87	85	85	85	85	85	85	85		
11	77	78	80	80	80	80	80	80	80		
12	95	95	91	91	91	91	91	91	91		
13	63	65	66	65	66	66	66	66	66		
14	85	85	87	87	87	87	87	87	88		
15	- 95	-98	-98	-99	-99	-99	-100	-100	-100		
16	- 60	-60	-60	-61	-61	-61	-61	-61	-61		
17	9	9	10	9	10	10	10	10	11		
18	83	83	82	82	82	82	82	84	84		
19	81	81	81	81	82	82	82	82	82		
20	47	49	51	51	51	51	50	49	48		
21	9	7	7	6	5	5	4	4	-1		
22	11	12	12	12	12	12	12	11	6		
23	23	21	19	18	16	15	14	14	14		
24	17	16	16	15	14	14	14	14	9		
25	85	85	85	85	85	85	85	85	87		
26	82	82	83	83	82	83	83	83	84		

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT 1b

TEST DAY NO. 1 TEST POINT NO 2 DATE 11-5-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1720	1735	1750	1805	1820	1835	1850	1905	1920		
27	85	85	85	85	85	85	85	85	87		
28	82	82	83	82	82	83	83	82	84		
29	67	68	69	69	69	69	69	69	69		
30	97	95	91	90	88	87	87	85	85		
31	83	82	83	83	84		84	84	85		
32	83	84	84	85	85	85	85	85	85		
33	88	87	82	81	79	78	78	76	77		
34	93	91	88	86	85	84	83	82	82		
35	80	78	74	74	72	70	69	69	69		
36	87	85	84	84	84	84	84	84	85		
37	85	85	84	84	84	85	85	85	87		
38	81	81	82	83	85	82	84	86	86		
39	86	86	88	88	89	86	86	86	86		
40	87	86	82	80	79	77	76	75	76		
41	86	86	86	87	86	86	86	85	86		
42	87	87	88	88	88	88	88	88	89		
43	80	78	74	72	71	70	69	67	69		
44	59	60	60	60	60	60	60	60	61		
45	86	87	87	87	87	87	87	87	88		
46	87	85	85	85	85	85	85	85	87		
47	87	85	84	84	84	84	84	84	85		
48	87	88	88	88	88	87	87	88	88		
49	87	86	87	87	87	85	87	88	90		
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT 1b

TEST DAY NO. 1 TEST POINT NO 2 DATE 11-5-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1720	1735	1750	1805	1820	1835	1850	1905	1920		
53											
54											
55											
56											
57	21	24	24	24	25	24	24	24	24		
58											
59	54	56	56	56	56	56	56	56	56		
60											
61											
62	-19	-19	-18	-18	-19	-19	-19	-19	-19		
63	-5	-4	-4	-4	-4	-5	-4	-4	-4		
64	16	18	19	19	18	18	18	18	18		
65											
66											
67	43	44	45	46	46	46	46	46	46		
68	-116	-116	-116	-116	-116	-116	-117	-116	-116		
69	-24	-24	-23	-23	-23	-23	-23	-23	-23		
70	-82	-81	-81	-81	-81	-81	-81	-81	-81		
71	-30	-30	-30	-30	-31	-31	-31	-31	-31		
72	-94	-93	-93	-92	-92	-92	-92	-90	-90		
73	-28	-28	-26	-27	-27	-27	-27	-26	-27		
74	-156	-156	-156	-156	-156	-156	-156	-156	-156		
75	-174	-174	-173	-173	-174	-174	-174	-174	-174		
76	-170	-169	-168	-168	-168	-168	-168	-169	-168		
77	-137	-136	-135	-135	-134	-135	-135	-136	-135		
78	-149	-149	-149	-149	-147	-148	-149	-149	-149		

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO 2 DATE 11-5-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1720	1735	1750	1805	1820	1835	1850	1905	1920		
79	-166	-164	-164	-164	-162	-163	-164	-164	-164		
80	-162	-162	-161	-161	-161	-162	-162	-163	-162		
81	-116	-116	-116	-116	-116	-117	-117	-118	-118		
82	-103	-104	-104	-105	-105	-105	-106	-106	-106		
83	-161	-161	-160	-160	-160	-160	-160	-160	-160		
84	-149	-150	-149	-149	-149	-149	-149	-150	-149		
85											
86	-35	-35	-35	-35	-36	-36	-36	-36	-36		
87	-33	-31	-33	-33	-34	-34	-34	-34	-34		
88	-33	-33	-34	-33	-34	-34	-34	-35	-34		
89	6	5	5	5	4	4	4	4	4		
90	-29	-30	-29	-29	-30	-29	-30	-29	-31		
91	-38	-38	-39	-39	-40	-39	-39	-39	-40		
92	-24	-24	-25	-25	-25	-25	-26	-25	-26		
93	-31	-30	-30	-31	-33	-33	-33	-31	-31		
94	74	75	77	77	77	78	78	78	78		
95	74	76	77	77	78	78	78	78	76		
96	66	66	67	67	67	67	67	67	66		
97	58	57	57	56	56	56	56	56	56		
98	61	60	60	60	57	59	58	58	58		
99											
100	23	29	29	29	28	28	28	28	28		
101	72	70	71	66	69	71	69	68	70		
102	46	45	45	45	44	44	44	44	44		
103											
104											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO 2 DATE 11-5-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1720	1735	1750	1805	1820	1835	1850	1905	1920		
105											
106											
107											
108											
109	-273	-276	-276	-278	-285	-291	-288	-295	-294		
110	-282	-280	-281	-285	-291	-298	-298	-302	-303		
111		-301	-302	-307	-317						
112	-311	-308	-309	-313							
113	-297	-298	-295	-299	-299	-302	-302	-311	-313		
114	-301	-304	-302	-306	-312	-317	-317				
115	81	81	81	81	82	82	82	82	83		
116	86	86	87	87	88	88	87	87	88		
117	84	85	85	84	84	84	84	84	84		
118	84	85	84	84	84	84	83	83	84		
119											
120		69	69	69	69	69	69	69	69		
121	130	129	130	131	130	130	130	130	131		
122	71	74	74	75	75	75	75	75	74		
123	-18	-19	-19	-18	-19	-20	-19	-19	-19		
124	-155	-155	-155	-155	-154	-155	-154	-154	-155		
125	-169	-169	-168	-168	-167	-168	-168	-168	-169		
126	-20	-20	-20	-20	-21	-21	-21	-21	-21		
127											
128											
129											
130											

TEST DAY NO. 1

TEST POINT NO. 3

SOLAR SIMULATION ON

FRONT OF SUIT; EARTH

SIMULATION ON BACK.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO 3 DATE 5 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1920	1935	1950	2005	2020	2035	2050	2105	2120	2135	2150
1			118				129		118		121
2	103	114	110	118	110	113	111	121	115	113	113
3	57	58	65	68	71	75		78	79	79	80
4	60	61		69	72	75	78	79	79	79	80
5	52	54	61	70	75	79	83	85	85	87	87
6	80	80	83	87	88	89	88	88	87	87	87
7											
8	87	85	87	87	88	88	87	85	85	85	85
9	84	84	84	85	86	87	88	89	89	90	89
10	85	87	87	88	89	91	91	91	91	91	91
11	80	80	80	80	81	82	82	81	81	80	79
12	91	91	91	91	92	92	91	88	87	87	86
13	66	66	69	71	74	75	78	79	79	80	80
14	88	87	87	88	89	91	88	87	87	87	87
15	-100	-98	-66	-43	-29	-18	-4	6	12	19	24
16	-61	-60	-50	-38	-29	-23	-16	-10	-8	-4	-1
17	11	10	11	14	16	19	24	28	30	34	37
18	84	83	87	88	91	92	93	93	93	93	93
19	82	83	85	87	89	91	91	92	92	92	92
20	48	48	52	59	65	70	75	78	80	82	84
21	-1	0	0	0	1	1	1	1	1	2	2
22	6	9	9	11	12	14	14	15	15	15	15
23	14	11	12	14	14	15	18	19	18	20	20
24	9	10	10	10	10	10	11	11	12	14	12
25	87	86	87	90	91	91	91	89	88	88	88
26	84	83	84	85	87	87	87	85	85	85	85

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO 3 DATE 5 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2205	2220									
1	118	118									
2	121	114									
3	80	81									
4	81	81									
5	88	88									
6	87	88									
7											
8	85	85									
9	91	91									
10	91	91									
11	79	79									
12	87	87									
13	81	81									
14	87	87									
15	29	33									
16	1	2									
17	40	43									
18	94	93									
19	92	92									
20	85	85									
21	4	4									
22	16	17									
23	21	21									
24	14	14									
25	88	88									
26	85	85									

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Tb

TEST DAY NO. 1 TEST POINT NO 3 DATE 5 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1920	1935	1950	2005	2020	2035	2050	2105	2120	2135	2150
027	87	87	88	90	91	92	91	89	89	89	89
28	84	83	83	85	87	87	87	85	85	85	84
29	69	69	74	77	78	80	82	81	82	81	82
30	85	85	84	87	87	88	88	87	87	87	87
31	85	84	87	88	89	89	89	88	87	87	87
32	85	85	87	88	88	89	88	87	87	87	87
33	77	76	75	77	78	78	78	78	77	78	78
34	82	81	81	83	84	85	85	85	85	85	85
35	69	69	69	70	72	73	73	74	74	74	74
36	85	85	87	89	91	92	92	93	93	93	93
37	87	85	86	89	91	91	91	91	91	91	91
38	86	87	85	86	89	91	90	89	88	86	86
39	86	86	86	88	89	91	89	86	84	83	84
40	76	75	75	76	76	77	77	75	74	74	74
41	86	88	88	89	90	90	88	88	85	84	85
42	89	89	89	90	91	91	89	87	87	87	87
43	69	67	67	69	70	71	71	70	70	70	71
44	61	62	69	74	74	78	78	78	78	78	78
45	88	88	88	89	90	91	88	87	87	86	87
46	87	87	87	88	89	91	91	90	90	90	90
47	85	85	85	87	88	89	91	90	90	90	90
48	88	87	87	88	88	89	88	84	84	82	81
49	90	90	89	91	92	92	91	88	88	87	87
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO 3 DATE 5 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2205	2220									
027	89	88									
28	85	84									
29	82	82									
30	87	87									
31	87	87									
32	87	87									
33	78	78									
34	85	85									
35	74	75									
36	93	93									
37	91	91									
38	86	85									
39	82	81									
40	74	75									
41	84	84									
42	87	87									
43	71	72									
44	78	78									
45	87	87									
46	90	90									
47	90	91									
48	81	80									
49	85	85									
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO 3 DATE 5 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1920	1935	1950	2005	2020	2035	2050	2105	2120	2135	2150
053											
54											
55											
56											
57	24	28	35	40	43	46	47	47	47	47	47
58											
59	56	56	60	62	65	66	67	67	67	67	67
60											
61											
62	-19	5	29	36	38	40	42	42	43	43	43
63	-4	14	34	42	44	46	47	48	48	48	48
64	18	29	44	51	53	56	56	57	57	57	58
65											
66											
67	46	49	51	56	60	62	65	67	69	69	69
68	-116	65	134	146	150	154	157	157	157	158	159
69	-23	-6	11	16	18	18	20	20	20	20	20
70	-81	53	135	146	148	150	152	152	152	153	153
71	-31	9	25	29	29	30	30	29	29	30	29
72	-90	-10	104	131	140	145	148	150	150	150	151
73	-27	-16	1	10	12	14	14	15	15	15	15
74	-156	-34	-8	-5	-5	-5	-5	-6	-6	-6	-6
75	-174	-95	-71	-66	-65	-65	-65	-65	-65	-65	-67
76	-168	34	80	84	85	85	85	83	82	83	83
77	-135	94	138	140	142	142	143	142	142	143	143
78	-149	115	180	184	185	186	186	184	184	185	184

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO 3 DATE 5 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2205	2220									
053											
54											
55											
56											
57	48	47									
58											
59	67	67									
60											
61											
62	43	43									
63	49	49									
64	58	58									
65											
66											
67	70	70									
68	158	160									
69	20	20									
70	153	153									
71	29	29									
72	152	151									
73	15	15									
74	-7	-6									
75	-66	-66									
76	82	83									
77	142	145									
78	184	185									

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO 3 DATE 5 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1920	1935	1950	2005	2020	2035	2050	2105	2120	2135	2150
079	-164	96	162	169	171	173	174	173	173	174	173
80	-162	57	110	113	115	115	117	115	115	116	116
81	-118	94	144	150	153	154	157	156	156	158	158
82	-106	71	125	131	134	136	138	138	138	139	139
83	-160	124	169	170	172	173	174	173	172	173	173
84	-149	111	157	162	165	166	168	166	166	167	167
85				138	-130	-101	-73	-57	-47	-39	-30
86	-36	0	23	25	25	26	28	27	27	27	27
87	-34	0	23	28	28	30	30	30	30	30	30
88	-34	-8	9	9	9	9	9	7	6	6	6
89	4	38	60	61	61	61	61	61	61	61	61
90	-31	1	23	28	28	29	28	29	28	29	28
91	-40	-4	15	19	20	20	20	20	19	20	19
92	-26	5	25	29	30	30	30	30	30	30	29
93	-31	0	19	23	24	24	23	24	23	22	22
94	78	78	78	78	78	79	79	80	80	79	79
95	76	78	81	84	87	88	89	89	89	90	91
96	66	67	70	72	74	74	76	77	78	78	79
97	56	71	81	79	78	78	78	78	78	78	78
98	58	69	74	72	71	72	70	71	72	71	71
99											
100	28	42	60	63	65	66	66	66	66	66	66
101	70	70	61	57	58	60	57	59	60	57	59
102	44	71			92	93	92	92		92	91
103											
104											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO 3 DATE 5 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2205	2220									
079	173	174									
80	114	117									
81	157	158									
82	139	140									
83	172	174									
84	166	168									
85	-25	-21									
86	28	28									
87	30	30									
88	6	6									
89	61	61									
90	28	28									
91	19	20									
92	29	29									
93	22	22									
94	79	79									
95	91	91									
96	79	82									
97	78	77									
98	71	70									
99											
100	66	66									
101	60	58									
102	92	91									
103											
104											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO 3 DATE 5 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1920	1935	1950	2005	2020	2035	2050	2105	2120	2135	2150
105											
106											
107											
108											
109	-294	-277	-277	-272	-279	-278	-272	-286	-290	-292	-290
110	-303	-290	-290	-290	-290		-288	-299	-302	-306	-302
111		-312	-311	-308	-308	-308	-307				
112		-319	-318	-312	-315	-313	-313				
113	-313	-300	-300	-302	-302	-295	-300		-308	-310	-303
114		-309	-313	-313	-313	-313	-313				
115	83	78	84	86	88	88	87	86	85	85	85
116	88	88	88	89	90	91	88	88	87	88	87
117	84	84	84	85	85	85	87	85	84	84	84
118	84	83	83	85	85	85	87	85	84	84	84
119											
120	69	69	74	78	79	81	82	82	82	82	82
121	131	131	129	129	130	129	87	87	130	129	129
122	74	75	78	82	85	87	89	90	91	91	91
123	-19	15	37	40	40	42	42	40	40	40	39
124	-155	142	178	181	182	182	186	184	182	183	182
125	-169	74	118	123	126	128	130	131	130	132	132
126	-21	20	39	42	42	43	43	42	42	43	42
127											
128											
129											
130											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO 3 DATE 5 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2205	2220									
105											
106											
107											
108											
109	-290	-294									
110	-307	-302									
111											
112											
113	-307	-310									
114											
115	85	86									
116	87	87									
117	83	83									
118	84	83									
119											
120	82	82									
121	129	129									
122	91	91									
123	39	39									
124	181	184									
125	131	134									
126	42	42									
127											
128											
129											
130											

TEST DAY NO. 1

TEST POINT NO. 4

SOLAR SIMULATION ON

RIGHT SIDE OF SUIT; EARTH

SIMULATION ON LEFT SIDE.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT D6

TEST DAY NO. 1 TEST POINT NO. 4 DATE 5 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0015	0025	0035	0045							
001	123		123	129							
2	111	122		108							
3	85	84	83	82							
4	85	84	83	83							
5	87	84	80	79							
6	87	85	84	85							
7											
8	85	85	84	85							
9	92	92		92							
10	91	91	91	92							
11	79		78	78							
12	87	86	85	87							
13	82	82	81	81							
14	87	87	85	87							
15	67		74	66							
16	20	40		48							
17	60		69	69							
18	95	94	93	93							
19	91	90	88	88							
20	85	81	75	74							
21	10	12	14	14							
22	20	23	24	24							
23	25	25	23	24							
24	19	20	21	21							
25	88	87	86	87.							
26	85		83	85							

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 4 DATE 5 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0015	0025	0035	0045							
027	89		87	88							
28	85	85	84	85							
29	82	81	80	80							
30	91	91	91	93							
31	88	87	87	87							
32	87	86	85	87							
33	80	81	80	82							
34	89	91	91	93							
35	78	78	77	80							
36	96	94	93	94							
37	91	91	89	91							
38	86	88	86	89							
39	79	81	77	80							
40	77	79	77	80							
41	82	85	84	85							
42	87	87	87	88							
43	76	76	75	78							
44	78	75	74	74							
45	87	87	85	87							
46	91	89	88	89							
47	91	91	91	92							
48	78	78	77	79							
49	85	85	87	88							
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 4 DATE 5 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0015	0025	0035	0045							
053											
54											
55											
56											
57	56	48	43	39							
58											
59	71	68	65	65							
60											
61											
62	57	45	24	7							
63	66	53	40	23							
64	70	60	51	39							
65											
66											
67	76	75	74	71							
68	60	-1	-28	-40							
69	31		4	-10							
70		131	77	18							
71	-39	-46	-118	-143							
72	36	102	77	37							
73	-7	1	-5	-28							
74	116	129	-52	-110							
75	121	140	-50	-109							
76	60	43	-75	-116							
77	57	39	-70	-106							
78	70	5	-57	-92							

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 4 DATE 5 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0015	0025	0035	0045							
079	21	-56	-77	-93							
80	-1	-22	-49	-67							
81	86	54	-18	-49							
82	92	35	18	-10							
83	78	59	-68	-111							
84	100	88	-39	-82							
85	94	80	81	78							
86	28	24	-8	-28							
87	24	20	-10	-30							
88	-3	-3	-101	-124							
89	-45	-82	-100	-114							
90	-45	-66	-96	-111							
91	-35	-41	-116	-141							
92	-43	-60	-83	-99							
93	-60	-77	-108	-124							
94	79	78	77	77							
95	91	91	91	90							
96	79	80	80	80							
97	82	81	60	42							
98	77	77	60	44							
99											
100			59	40							
101	62	52	39	47							
102	98	100	72	51							
103											
104											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT T6

TEST DAY NO. 1 TEST POINT NO. 4 DATE 5 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0015	0025	0035	0045							
105											
106											
107											
108											
109	-292	-282	-282	-282							
110	-307	-296	-294	-290							
111		-316		-312							
112			-320	-320							
113	-319	-309	-310	-311							
114		318									
115	86	85	85	86							
116	87	88	87	88							
117	83	84	84	84							
118	84	84	84	84							
119											
120	83	81	80	80							
121	126	129	129	129							
122	94	94	94	94							
123	-35	-59	-81	-94							
124	111	97	-50	-105							
125	113	101	-65	-108							
126	-9	-24	-93	-116							
127											
128											
129											
130											

TEST DAY NO. 1

TEST POINT NO. 5

COLD SOAK. DUMMY

SURFACE TEMPERATURE CONTROLLED

WITH DUMMY HEATERS.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 5 DATE 12-4-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0100	0200	0300	0400	0415	0430	0445	0500			
1	118	113	110	114	109	110	110	114			
2	107	103	100	104		69		108			
3	80	69	61	60	59	57	56	56			
4	81	71	61	61	61	59	58	57			
5	76	63	56	54	54	53	52	52			
6	85	82	84	77	77	77	75	75			
7											
8	86	85	83	79	79	78	78	77			
9	92	90	87	85	85	83	83	82			
10	93	89	87	83	83	82	81	80			
11	79	80	78	75	75	74	74	74			
12	88	89	87	85	85	83	82	82			
13	80	74	69	66	66	65	65	65			
14	87	87	84	82	81	80	80	79			
15	51	-12	-46	-65	-67	-73	-77	-79			
16	36	-20	-46	-60		-65	-66	-68			
17	67	56	45	33	33	28	27	25			
18	94	89	85	82	82	81	80	79			
19	88	87	84	81	81	80	79	79			
20	72	63	56	53	53	51	51	49			
21	15	16	8	8	7	6	6	6			
22	23	18	9	10	10	9	9	9			
23	23	19	17	14	14	12	12	11			
24	21	21	14	14	14	14	12	11			
25	88	87	84	81	81	80	80	79			
26	85	83	82	78	78	76	76	75			
27	88	87	85	82	81	80	80	80			
28	85	83	82	78	77	76	75	74			
29	80	74	71	67	67	66	66	65			
30	95	92	88	84	83	81	80	80			

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 5 DATE 12-4-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0100	0200	0300	0400	0415	0430	0445	0500			
31	88	87	85	80	80	79	78	78			
32	87	87	85	81	81	80	79	78			
33	83	85	82	79	79	78	76	75			
34	94	91	85	81	80	78	78	76			
35	80	80	78	74	74	71	70	69			
36	94	90	87	84	83	82	82	81			
37	90	89	87	84	84	83	82	82			
38	89	84	81	77	77	75	74	73			
39	81	82	80	77	77	77	76	75			
40	82	84	82	78	77	76	75	74			
41	86	85	83	81	81	80	80	79			
42	89	88	87	83	82	81	81	80			
43	79	79	78	72	71	70	69	68			
44	74	68	62	60	60	58	58	57			
45	88	88	85	82	82	81	80	80			
46	90	89	87								
47	92	89	85	82	82	81	80	79			
48	80	81	80	77	76	75	74	74			
49	89	87	82	78	78	76	75	74			
50											
51											
52											
53											
54											
55											
56											
57	34	9	-4	-10	-10	-13	-13	-14			
58											
59	62	51	42	39	39	38	35	35			
60											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 5 DATE 12-4-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0100	0200	0300	0400	0415	0430	0445	0500			
61											
62	-9	-66	-89	-100	-101	-103	-105	-106			
63	8	-43	-63	-72	-72	-75	-76	-77			
64	28	-9	-24	-30	-30	-33	-33	-34			
65											
66											
67	68	46	33	28	26	25	25	25			
68	-51	-87	-101	-111	-111	-114	-115	-116			
69	-22	-70	-90	-102	-103	-106	-108	-108			
70	-20	-71	-76	-79	-81	-81	-81	-82			
71	-157	-188	-195	-198	-200	-201	-201	-203			
72	0	-74	-87	-93	-93	-94	-95	-95			
73	-51	-98	-112	-119	-119	-122	-123	-123			
74	-135	-164	-173	-177	-177	-180	-181	-181			
75	-138	-175	-183	-189	-189	-190	-191	-191			
76	-140	-177	-186	-190	-190	-191	-191	-191			
77	-124	-146	-150	-153	-153	-154	-154	-153			
78	-114	-150	-160	-164	-164	-166	-167	-167			
79	-108	-150	-166	-174	-174	-176	-177	-177			
80	-84	-132	-150	-159	-160	-162	-163	-164			
81	-67	-101	-114	-120	-119	-123	-124	-125			
82	-31	-73	-92	-101	-103	-106	-108	-109			
83	-134	-161	-168	-170	-170	-172	-173	-174			
84	-106	-147	-159	-164	-164	-166	-167	-168			
85	65	-10	-59	-87	-89	-96	-100	-104			
86	-47	-118	-148	-164	-166	-170	-172	-174			
87	-48	-105	-128	-140	-141	-144	-146	-147			
88	-137	-162	-170	-174	-175	-177	-176	-176			
89	-125	-162	-177	-181	-181	-185	-184	-184			
90	-124	-167	-183	-190	-191	-193	-194	-195			

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 5 DATE 12-4-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0100	0200	0300	0400	0415	0430	0445	0500			
91	-155	-167	-190	-193	-194	-196	-195	-196			
92	-114	-156	-173	-181	-181	-184	-186	-186			
93	-136	-163	-173	-177	-177	-179	-180	-181			
94	77	78	75	73	72	71	70	70			
95	89	84	79	76	76	74	74	74			
96	79	74	67	69	69	67	67	67			
97	21	-70	-110	-132	-133	-140	-144	-147			
98	23	-70	-111	-133	-135	-142	-144	-148			
99											
100	20	-65	-105	-128	-129	-137	-138	-143			
101	9	-76	-116	-136	-140	-144	-149	-151			
102	26	-61	-101	-125	-126		-137	-140			
103											
104											
105											
106											
107											
108											
109	-280	-281	-282	-277	-279	-281	-280	-279			
110	-292	-292	-292	-292	-290	-290	-290	-292			
111	-310	-308	-309	-305	-305	-307	-307	-307			
112	-319	-318	-316	-311	-312	-312	-316	-316			
113	-311	-308	-302	-298	-299	-300	-301	-297			
114		-318	-308	-307	-308	-309	-309	-302			
115	86	84	83	79	78	77	77	76			
116	88	88	87	83	83	82	81	81			
117	85	85	83	81	80	79	78	78			
118	85	85	83	80	80	79	78	78			
119											
120	79	75	71	68	68	67	66	65			

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 1 TEST POINT NO. 5 DATE 12-4-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0100	0200	0300	0400	0415	0430	0445	0500			
121	129	129	129	123	129	128	121	129			
122	93	86	80	76	76	74	74	74			
123	-106	-138	-150	-154	-156	-151	-156	-151			
124	-138	-155	-160	-162	-162	-164	-163	-164			
125	-134	-173	-181	-184	-184	-186	-187	-187			
126	-132	-167	-177	-183	-183	-183	-186	-187			
127											
128											
129											
130											

SUIT FLOW SYSTEM
GEMINI EXTRAVEHICULAR SUIT
EXPERIMENT Ib

TEST DAY NO. 1 DATE: 11-5-64 to 11-6-64

	ROTAMETER			VOLOFLOW							
TIME	PRESSURE PSIA	TEMP °F	FLOW SCFM*	SUIT OUTLET PRESS. PSIA	TEMP °F	FLOW ACFM	SUIT LEAKAGE CC/MIN				
1130	14.7	70	3.04	3.74	95	11.7					
1200			3.08	3.78	89	11.5					
1230			3.10	3.78	81	11.3					
1300			3.11	3.72	70	11.2					
1330			3.12	3.73	68	11.15					
1400			3.13	3.74	66	11.15	142				
1500			2.90	3.75	69	10.35					
1530			2.96	3.75	69	10.50					
1600			2.97	3.78	67	10.35					
1630			2.97	3.78	66	10.4					
1700			2.95	3.74	70	10.6					
1730			2.96	3.76	69	10.5					
1800			2.96	3.75	67	10.5					
1830			2.98	3.74	68	10.6					
1900			2.99	3.74	69	10.6					
1930			2.93	3.73	70	10.5	140				
2000			2.99	3.74	68	10.6					
2030			3.00	3.76	68	10.5					
2100			3.01	3.73	68	10.6					
2135											
2200			3.10	3.78	69	10.8					
2230			3.04	3.70	69	10.8	140				
2300			3.00	3.76	69	10.5					
2330			3.04	3.76	68	10.5					
0030			3.05	3.78	69	10.5					
0100	14.7	70	3.05	3.74	69	10.7					

* Air - 14.7 psia, 70°F

SUIT FLOW SYSTEM
GEMINI EXTRAVEHICULAR SUIT
EXPERIMENT Ib

TEST DAY NO. 1 DATE: 11-5-64 to 11-6-64

	ROTAMETER			VOLOFLOW							
TIME	PRESSURE PSIA	TEMP °F	FLOW SCFM*	SUIT OUTLET PRESS. PSIA	TEMP °F	FLOW ACFM	SUIT LEAKAGE CC/MIN				
0130	14.7	70	3.04	3.75	68	10.5					
0200			3.06	3.77	67	10.5					
0230			3.06	3.75	67	10.7					
0315			3.05	3.8	63	10.5					
0345			3.05	3.75	67	10.55					
0415			3.04	3.75	67	10.55					
0445			3.04	3.76	67	10.55					
0500	14.7	70	3.04	3.77	67	10.55	150				

* Air - 14.7 psia, 70°F

THERMAL DUMMY HEATER POWER
GEMINI EXTRAVEHICULAR SUIT TEST
EXPERIMENT Ib

TEST DAY NO. 1 DATE: 11-5-64 to 11-6-64

POWER-WATTS

TIME	VOLTS	TORSO	HEAD	LEFT ARM	RIGHT ARM	LEFT THIGH	RIGHT THIGH	LEFT LEG	RIGHT LEG	TOTAL	
0945	60	60	20	20	20	25	25	12	12	194	
1015	60	55	18	19	19	25	25	12	10	183	
1050	60	58	19	19	19	24	24	11	11	185	
1115	60	58	19	20	19	24	24	11	11	186	
1130	60	58	20	20	20	23	23	11	10	185	
1145	40	30	10	10	10	10	10	5	5	90	
1210	0	0	0	0	0	0	0	0	0	0	
1245	0	0	0	0	0	0	0	0	0	0	
1318	40	30	10	10	10	10	10	5	5	90	
1332	0	0	0	0	0	0	0	0	0	0	
1540	36	20	15	15	15	15	15	5	5	105	
1550	36	20	10	10	5	5	5	5	5	65	
	36	25	15	10	5	5	5	5	5	75	
1620	36	23	13	12	12	8	10	10	10	98	
1640	36	25	15	15	15	9	10	10	10	109	
1700	36	25	15	12	12	8	8	5	5	90	
1710	36	20	8	6	6	6	6	6	6	64	
1800	37	20	8	6	6	6	6	6	6	64	
1820	37	20	8	6	6	6	6	4	4	60	
1900	37	20	8	6	6	6	6	4	4	60	
2025	37	15	5	5	5	5	5	4	4	48	
2040	37	15	5	5	5	6	5	4	4	49	
2040	20	6	2	2	2	2	2	2	2	20	
2115	20	6	2	2	2	0	0	2	2	16	
0045	37	15	5	5	5	5	5	4	4	48	
0500		15	5	5	5	5	5	5	5	50	

TEST DAY NO. 2

HOOD OFF. TWO 20%

TRANSMITTANCE VISORS

INSTALLED. SUIT SUPPORTED

FROM TIEDOWN CABLE. PROTECTIVE

GLOVE ON RIGHT HAND.

TEST DAY NO. 2

TEST POINT NO. 1

COLD SOAK. DUMMY SURFACE

TEMPERATURE CONTROLLED WITH

DUMMY HEATERS.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 1 DATE 9 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0630	0700	0730	0800	0830	0900	0930	0945	1000		
001	96	93	-	87	18	85	88	85	88		
2	86	88	85	69	83	74	83	89	87		
3	60	56	58	65	63	60	57	57	57		
4	60	58	61	66	65	61	60	60	60		
5	65	57	57	58	58	57	57	58	59		
6	74	74	78	84	79	78	81	84	85		
7											
8	70	70	101	81	75	74	76	79	80		
9	69	69	72	77	77	77	76	76	76		
10	70	71	78	85	79	77	75	76	76		
11	4	-10	-12	-8	-14	-18	-18	-18	-15		
12	65	71	84	95	70	72	77	83	83		
13	43	34	33	33	30	30	29	29	30		
14	74	75	80	87	82	80	84	87	87		
15	10	-15	-33	-45	-57	-66	-73	-76	-77		
16	14	-11	-28	-40	-51	-57	-64	-66	-68		
17	60	51	44	38	33	30	26	24	23		
18	69	70	77	84	79	78	76	76	76		
19	69	70	76	84	81	79	78	78	78		
20	65	62	62	65	65	65	65	65	65		
21	61	56	51	46	40	38	33	30	28		
22	51	46	42	39	37	34	31	30	29		
23	61	56	54	51	47	45	42	40	38		
24	61	57	54	51	48	45	42	40	39		
25	74	76	81	88	82	81	85	88	89		
26	71	71	76	82	77	76	78	81	82		

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 1 DATE 9 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0630	0700	0730	0800	0830	0900	0930	0945	1000		
027	74	78	82	89	83	82	85	88	89		
28	69	67	71	78	72	70	74	75	76		
29	39	30	30	34	26	25	25	28	28		
30	70	78	87	98	87	83	83	84	83		
31	70	70	75	82	76	74	78	81	82		
32	74	74	78	87	79	78	82	84	85		
33	76	82	92	95	87	85	87	88	89		
34	70	75	85	95	82	80	79	88	80		
35	75	80	89	92	85	83	85	87	87		
36	69	74	80	86	80	78	77	78	78		
37	70	74	81	89	83	81	79	80	80		
38	67	77	91	99	86	81	82	83	86		
39	69	81	95	103	88	82	85	86	86		
40	73	81	90	94	85	82	84	86	88		
41	69	71	76	86	77	77	81	84	86		
42	74	74	81	89	81	79	85	88	88		
43	74	80	89	93	85	83	84	87	87		
44	34	30	30	34	26	25	26	26	26		
45	74	78	82	89	83	82	87	88	89		
46	69	71	79	88	81	79	78	78	78		
47	67	70	78	85	79	76	75	75	76		
48	74	84	100	108	93	87	88	91	91		
49	69	80	93	102	88	83	85	87	87		
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 1 DATE 20 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0630	0700	0730	0800	0830	0900	0930	0945	1000		
053											
54											
55											
56											
57	28	11	4	2	-1	-4	-6	-6	-5		
58											
59	56	47	45	46	43	40	40	42	42		
60											
61											
62	-46	-68	-78	-82	-87	-84	-85	-70	-90		
63	-21	-40	--49	-52	-56	-55	-57	-59	-60		
64	10	-5	-11	-13	-16	-17	-19	-20	-20		
65											
66											
67	53	38	34	33	33	30	30	29	30		
68	-73	-87	-92	-95	-96	-105	-106	-105	-105		
69	-39	-63	-73	-79	-85	-87	-90	-93	-94		
70	-63	-76	-78	-76	-76	-76	-77	-77	-79		
71	-73	-102	-117	-131	-143	-164	-170	-161	-164		
72	-52	-68	-77	-79	-81	-82	-83	-84	-84		
73	-31	-57	-77	-83	-90	-99	-105	-104	-105		
74	-149	-162	-167	-170	-173	-171	-173	-180	-180		
75	-170	-183	-191	-195	-196	-195	-196	-203	-204		
76	-144	-155	-160	-161	-160	-164	-167	-167	-168		
77	-121	-129	-130	-132	-132	-135	-136	-136	-135		
78	-123	-131	-134	-137	-138	-147	-149	-143	-143		

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 1 DATE 20 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0630	0700	0730	0800	0830	0900	0930	0945	1000		
079	-142	-154	-156	-157	-157	-166	-168	-166	-166		
80	-147	-154	-155	-156	-157	-164	-166	-163	-164		
81	-99	-106	-107	-108	-111	-111	-112	-114	-114		
82	-72	-77	-79	-83	-85	-93	-94	-93	-93		
83	-151	-157	-160	-161	-161	-164	-166	-168	-167		
84	-138	-149	-153	-154	-156	-160	-162	-163	-163		
85	100	75	51	32	12	8	-4	-18	-23		
86	-95	-120	-132	-134	-142	-135	-140	-151	-151		
87	-79	-106	-110	-111	-118	-113	-118	-124	-125		
88	-73	-105	-112	-124	-134	-147	-151	-144	-147		
89	-50	-79	-96	-105	-114	-122	-128	-129	-129		
90	-68	-96	-110	-119	-129	-137	-143	-142	-144		
91	-79	-106	-119	-134	-144	-162	-167	-159	-162		
92	-73	-96	-105	-111	-121	-127	-132	-132	-132		
93	-77	-99	-110	-120	-130	-144	-150	-144	-144		
94	0	-16	-20	-20	-26	-31	-31	-31	-30		
95	69	69	72	76	75	74	74	76	76		
96	73	74	74	74	72	73	73	74	74		
97	-36	-71	-90	-105	-118	-126	-132	-136	-138		
98	-36	-72	-90	-99	-118	-126	-132	-136	-140		
99	-45	-73	-94	-106	-119	-127	-134	-136	-141		
100	-36	-68	-89	-102	-116	-124	-132	-135	-138		
101	-35	-67	-87	-102	-115	-123	-130	-135	-138		
102	-30	-63	-82	-96	-110	-118	-126	-129	-132		
103											
104											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 1 DATE 20 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0630	0700	0730	0800	0830	0900	0930	0945	1000		
105											
106											
107											
108											
109	-321	-320	-328	-288	-292	-294	-292	-292	-290		
110	-323	-328	-330	-302	-302	-304	-303	-304	-301		
111	*	*	*	-317	-317	-317	-317	-317	-315		
112	*	*	*	-320	-320	-320	-319	-320	-318		
113	*	*	*	-315	-315	-312	-312	-312	-309		
114	*	*	*	*	*	*	*	*	-310		
115	69	69	74	81	74	73	77	74	80		
116	74	76	81	88	83	82	85	88	88		
117	91	91	90	91	90	92	91	92	91		
118	93	91	92	92	91	91	91	92	93		
119											
120	33	28	28	33	23	22	25	25	24		
121	129	129	130	131	130	131	131	128	131		
122	129	125	126	126	124	127	127	126	127		
123	-61	-79	-90	-94	-105	-118	-122	-118	-118		
124	-145	-154	-155	-153	-153	-154	-156	-157	-156		
125	-141	-153	-157	-156	-156	-157	-161	-162	-162		
126	-66	-94	-108	-120	-130	-147	-154	-149	-150		
127	73	71	71	71	71	71	72	72	73		
128	69	69	70	76	75	73	73	75	77		
129											
130											

TEST DAY NO. 2

TEST POINT NO. 2

COLD SOAK. DUMMY SURFACE

TEMPERATURE CONTROLLED

WITH INLET GAS.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 2 DATE 11-9-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1015	1030	1045	1100	1115	1130	1145	1200	1215		
1	81	79	80	83	81	85	83	88	94		
2	75	71	78	65	80		84	81	80		
3	54	52	49	46	44	42	42	40	40		
4	54	54	51	48	46	44	43	42	42		
5	56	54	51	51	56	58	62	65	66		
6	84	74	69	68	70	71	74	74	74		
7											
8	79	69	63	59	57	56	56	56	56		
9	75	74	74	72	70	69	66	65	64		
10	74	71	69	66	65	62	60	58	57		
11	-16	- 21	-28	-34	-38	-40	-41	-44	-44		
12	67	52	42	36	32	29	28	27	27		
13	28	24	20	20	19	20	21	23	23		
14	82	75	70	66	65	65	65	65	65		
15	-82	-85	-87	-89	-90	-93	-94	-95	-98		
16	-71	-73	-75	-76	-78	-79	-81	-82	-83		
17	22	20	17	16	14	12	10	9	9		
18	74	71	69	67	65	63	61	60	58		
19	75	74	71	70	69	67	66	65	65		
20	63	62	61	60	60	58	58	57	57		
21	24	23	20	18	18	15	14	11	10		
22	28	22	21	19	18	16	15	14	12		
23	39	35	33	33	30	28	26	24	23		
24	31	33	30	29	28	26	25	24	21		
25	83	75	70	67	66	67	69	69	69		
26	78	69	66	63	6;	6;	65	65	65		

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 2 DATE 11-9-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1015	1030	1045	1100	1115	1130	1145	1200	1215		
27	84	78	71	69	67	67	69	69	69		
28	78	65	60	56	53	52	52	52	52		
29	25	-217	12	9	9	8	9	9	9		
30	78	73	68	63	60	57	56	53	52		
31	79	70	65	61	58	57	58	57	58		
32	81	74	68	65	63	62	62	63	63		
33	85	82	77	74	74	74	74	74	74		
34	75	69	65	60	56	53	51	49	48		
35	83	79	75	74	72	71	71	70	71		
36	75	74	70	67	65	65	62	60	60		
37	78	74	72	70	69	68	67	65	65		
38	77	70	64	58	53	48	44	39	32		
39	80	71	64	59	54	50	45	41	39		
40	84	79	75	73	72	71	71	72	70		
41	77	7[illegible]	64	60	57	55	55	54	54		
42	81	74	67	62	60	57	56	56	56		
43	83	78	75	72	70	69	69	68	68		
44	24	19	14	9	6	5	5	4	5		
45	82	76	70	67	65	65	65	65	65		
46	74	74	70	67	66	65	62	60	59		
47	74	70	67	65	63	61	59	57	56		
48	81	74	67	61	56	52	47	44	42		
49	78	71	65	60	54	49	44	40	37		
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 2 DATE 11-9-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1015	1030	1045	1100	1115	1130	1145	1200	1215		
53											
54											
55'											
56											
57	-8	-9	-13	-14	-16	-18	-18	-18	-18		
58											
59	40	38	34	33	31	31	33	33	33		
60											
61											
62	-93	-95	-95	-95	-96	-98	-95	-94	-94		
63	-63	-63	-64	-64	-66	-65	-63	-61	-61		
64	-21	-23	-24	-25	-25	-25	-23	-25	-22		
65											
66											
67	30	28	26	25	25	25	28	28	29		
68	-105	-106	-108	-107	-110	-108	-111	-111	-113		
69	-95	-96	-99	-101	-102	-104	-104	-105	-106		
70	-79	-79	-81	-82	-82	-82	-84	-83	-83		
71	-166	-168	-170	-173	-174	-177	-186	-189	-190		
72	-183	-85	-86	-86	-87	-87	-85	-85	-85		
73	-106	-108	-108	-111	-112	-114	-117	-120	-121		
74	-181	-182	-182	-183	-186	-187	-182	-181	-181		
75	-206	-206	-209	-210	-212	-212	-205	-205	-203		
76	-168	-169	-170	-167	-170	-170	-176	-177	-176		
77	-136	-137	-138	-137	-141	-141	-142	-142	-142		
78	-144	-144	-148	-144	-149	-148	-151	-153	-153		

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 2 DATE 11-9-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1015	1030	1045	1100	1115	1130	1145	1200	1215		
79	-166	-166	-168	-164	-169	-168	-174	-175	-175		
80	-164	-164	-167	-164	-168	-168	-173	-174	-173		
81	-114	-114	-114	-107	-112	-112	-111	-111	-110		
82	-93	-92	-92	-88	-109	-87	-90	-90	-90		
83	-168	-169	-170	-169	-170	-172	-173	-174	-174		
84	-164	-166	-168	-168	-168	-170	-170	-173	-173		
85	-27	-30	-31	-31	-30	-28	-22	-19	-18		
86	-153	-156	-156	-156	-160	-166	-157	-157	-158		
87	-127	-130	-130	-131	-131	-137	-132	-134	-134		
88	-149	-149	-151	-154	-155	-157	-164	-167	-168		
89	-131	-132	-134	-135	-136	-138	-141	-143	-144		
90	-144	-148	-149	-151	-153	-157	-160	-163	-164		
91	-164	-164	-168	-170	-170	-174	-181	-184	-187		
92	-135	-138	-141	-144	-144	-149	-151	-154	-154		
93	-147	-150	-153	-156	-156	-160	-168	-172	-173		
94	-31	-36	-41	-45	-47	-50	-52	-54	-54		
95	74	71	69	66	65	65	65	65	65		
96	69	74	78	85	92	102	107	105	104		
97	-142	-142	-147	-149	-150	-153	0154	-156	-157		
98	-143	-144	-147	-149	-151	-153	-155	-156	-158		
99	-144	-147	-149	-151	-151	-154	-156	-157	-159		
100	-141	-144	-147	-149	-151	-153	-155	-156	-158		
101	-141	-144	-146	-149	-150	-153	-154	-156	-157		
102	-137	-138	-142	-144	-146	-148	-150	-151	-153		
103											
104											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 2 DATE 11-9-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1015	1030	1045	1100	1115	1130	1145	1200	1215		
105											
106											
107											
108											
109	-288	-292	-290	-290	-288	-288	-287	-287	-290		
110	-299	-302	-302	-302	-302	-302	-302	-300	-301		
111	-313	-316	-312	-313	-312	-315	-312	-312	-316		
112	-318	-318	-315	-317	-317	-317	-317	-318	-318		
113	-309	-308	-306	-309	-307	-308	-307	-307			
114	-310	-319	-309	-309	-309	-309	-309	-310	-309		
115	77	68	63	59	57	56	57	57	57		
116	82	78	72	69	67	65	65	65	65		
117	92	90	89	89	92	89	92	89	88		
118	91	92	93	91	90	91	91	91	91		
119											
120	20	14	10	7	6	5	6	6	6		
121	130	128		131	131	131	131	134	136		
122	129	126	129	124	126	127	128	131			
123	-122	-123	-128	-130	-132	-135	-141	-144	-146		
124	-160	-160	-162	-162	-163	-164	-163	-164	-166		
125	-164	-164	-164	-164	-167	-168	-170	-170	-170		
126	-151	-153	-155	-157	-160	-162	-168	-173	-174		
127	69	71	76	84	90	101	105	104	103		
128	73	71	67	64	64	64	64	64	63		
129											
130											

TEST DAY NO. 2

TEST POINT NO. 3

SOLAR SIMULATION ON

FRONT OF SUIT; EARTH

SIMULATION ON BACK.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 3 DATE 11-20-64

TEMPERATURE °F

Chan. No.	TIME OF DAY									
	1545	1600	1615	1630	1700	1730	1800	1815	1830	1845
1										
2		87				115	119			
3	40	42	49	57	72	75	75	75	75	
4	42	45	51	60	74	75	76	76	75	75
5	67	68	72	80	95	97	95	93	92	91
6	88	89	91	95	95	92	89	88	87	87
7										
8	78	80	82	86	86	85	84	84	82	80
9	56	57	60	63	69	71	74	74	75	75
10	57	61	65	70	73	73	74	74	74	74
11	-25	-21	-8	6	25	23	21	19	18	18
12	70	72	75	79	71	65	65	63	62	62
13	31	35	51	61	79	84	84	83	83	82
14	83	85	87	89	88	85	84	83	82	82
15	-112	-112	-94	-67	-20	2	18	25	29	34
16	-93	-93	-86	-71	-39	-23	-13	-8	-6	-1
17	-8	-8	-7	-5	4	13	23		30	34
18	54	57	62	70	74	74	74	75	75	75
19	58	61	66	71	77	77	76	75	75	75
20	63	65	68	74	88	95	97	98	98	98
21	-12	-13	-14	-14	-13	-13	-11	-10	-9	-10
22	-8	-7	-4	-1	9	14	17	18	19	20
23	-2	-4	-4	-3	-1	2	4	4	5	4
24	2	2	2	2	7	9	12	14	14	15
25	89	90	93	96	93	91	89	87	87	85
26	82	83	86	89	88	87	85	83	83	82
27	88	90	93	96	94	91	89	87	87	87
28	74	75	78	82	84	83	82	82	80	79
29	24	27	51	74	92	94	94	93	93	93
30	65	71	78	85	85	81	79	79	78	78

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 3 DATE 11-20-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1545	1600	1615	1630	1700	1730	1800	1815	1830	1845	
31	79	81	84	89	89	88	87	87	84	83	
32	84	85	88	92	91	88	87	87	84	84	
33	90	94	95	96	95	92	91	91	89	88	
34	58	65	72	79	79	77	76	76	76	76	
35	87	90	91	93	92	91	90	91	89	88	
36	58	61	66	74	75	75	75	76	76	76	
37	61	65	71	76	77	76	76	76	76	75	
38	36	46	58	69	67	59	55	53	52	50	
39	44	53	63	79	66	57	51	49	46	45	
40	86	89	90	91	92	90	88	86	86	85	
41	78	80	82	85	85	83	82	81	81	80	
42	83	84	85	90	86	84	83	83	82	80	
43	85	89	89	91	90	88	88	87	87	87	
44	22	25	46	68	89	92	92	92	92	92	
45	85	87	88	91	87	85	84	82	82	82	
46	56	60	64	69	71	70	71	71	71	71	
47	54	58	62	69	71	70	71	71	71	74	
48	50	60	71	81	71	60	53	51	49	47	
49	40	50	62	74	67	58	54	52	51	51	
50											
51											
52											
53											
54											
55											
56											
57	-8		-8	23	46	51	52	52	51	48	
58											
59	43	45	49	55	68	71	71	70	69	69	
60											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 3 DATE 11-20-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1545	1600	1615	1630	1700	1730	1800	1815	1830	1845	
61											
62	-94	-77	-41	-2	29	33	33	30	29	25	
63	-61	-52	-24	5	37	40	39	38	37	33	
64	-19	-14	4	25	52	56	56	52	51	48	
65											
66											
67	30	31	34	41	60	67	69	69	57	66	
68	-105	1	133	147	159	162	161	162	162	162	
69	-93	-69	-24	11	33	34	33	30	28	24	
70	-89	-74	1	43	71	74	74	74	74	74	
71	-139	078	5	25	37	35	33	28	25	21	
72	-83	-60	72	121	148	152				152	
73	-103	-89	-43	-12	16	19	18	16	14	1	
74	-189	-106	-54	-26	-18	-19	-20	-21	-20	-23	
75	-213	-146	-89	-65	-56	-56	-57	-60	-60	-61	
76	-176	-6	101	108	109	104	100	100	101	100	
77	-139	40	134	139	142	143	142	142	143	142	
78	-141	27	167	177	180	180	178	178	178		
79	-166	-2	165	173	180	181	179	181	182	181	
80	-162	-64	116	108	110	111	109	110	110	109	
81	-118	50	119	171	178	180	180	182	182	181	
82	-92	56	157	160	164	166	166	169	169	168	
83	-177	81	158	163	167	168	166	169	169	166	
84	-174	-57	4	26	33	33	34	34	33	32	
85	-85	-149	-260	-270	-210	-162					
86	-147	-90	-27	15	26	23	21	18	14	10	
87	-123	-79	-25	11	25	24	24	19	15	14	
88	-126	-77	-6	10	16	13	11	5	1	-1	
89	-119	-83	1	42	62	59	57	52	48	44	
90	-132	78	-6	24	40	38	37	33	28	25	

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 3 DATE 11-20-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1545	1600	1615	1630	1700	1730	1800	1815	1830	1845	
91	-141	-83	-1	16	27	25	24	19	15	11	
92	-127	-76	-6	23	34	31	29	24	20	18	
93	-134	-80	-7	13	24	21	19	15	11	9	
94	-33	-22	1	21	41	40	38	37	33	29	
95	71	74	77	81	88	89	88	88	87	87	
96	98	98	100	101	103	98	91	87	87	85	
97	-82	-3	81	103	97	89	87	74	65	60	
98	-81	-6	74	97	89	81	78	65	56	51	
99	-24	50	105	103	91	87	85	65	56	56	
100	-105	-50	24	54	68	66	65	57	52	48	
101	-99	-40	34	62	73	70	69	60	52	48	
102	-93	-25	68	98	107	103	101	91	85	82	
103											
104											
105											
106											
107											
108											
109	-294	-290	-288	-288	-288	-286	-290	-290	-288	-289	
110		-286	-287	-292	-298	-294	-297	-299	-299	-294	
111	-317	-317	-314	-316	-316	-315	-318	-319	-317	-318	
112	-320	-319	-316	-318	-319	-319	-319	-318	-319	-320	
113	-309	-306	-302	-305	-315	-308	-306	-308	-305	-308	
114	-312	-310	-309	-309	-309	-309	-310	-310	-312	-312	
115	79	81	85	89	88	87	85	84	82	81	
116	83	85	87	89	87	85	84	82	82	81	
117	93	95	97	98	91	99	102	101	101	101	
118	96	97	97	99	103		101	101	101	108	
119											
120	22	24	58	81	98	100	100	100	100	100	

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 3 DATE 11-20-64

TEMPERATURE °F

Chan. No.	TIME OF DAY									
	1545	1600	1615	1630	1700	1730	1800	1815	1830	1845
121	133	131	134	134	136	139	138	136	136	134
122	129		128	131	137	140	136	138	136	135
123	-117	-62	8	32	43	40	39	33	30	28
124	-172	84	161	173	177	177	177	178	178	178
125	-172	25	132	148	153	153	153	154	154	154
126	-129	-64	19	40	49	46	44	39	34	33
127	94	94	95	96	101	97	91	86	86	
128	68	70	73	77	87	88	88	86	86	86
129										
130										

TEST DAY NO. 2

TEST POINT NO. 4

SOLAR SIMULATION ON BACK

OF SUIT; EARTH SIMULATION

ON FRONT.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 4 DATE 11-20-64

TEMPERATURE °F

Chan. No.	TIME OF DAY									
	1845	1855	1900	1905	1910	1915	1930	1940	1950	2000
1	114	114		118			117	115	119	114
2		126	104	108	119	108	108		122	
3		75	74	74	74	74	73	74	73	73
4	75	75	75	75	75	75	74	75	75	74
5	91	91	91	89	88	87	83	82	81	79
6	87	87	85	85	84	84	83	83	83	82
7										
8	80	79	79	80	80	80	80	81	81	80
9	75	75	75	76	75	76	75	76	77	77
10	74	74	74	74	74	75	75	78	78	78
11	18	24	34	42	51	53	60	63	65	66
12	62	62	62	63	65	65	65	65	65	65
13	82	82	78	76	74	73	69	66	66	64
14	82	82	80	80	80	82	82	82	82	82
15	34	37	37	34	33	30	24	23	21	20
16	-1	-1	1	6	14	18	28	32	37	40
17	34	38	37	38	39	42	43	42	44	44
18	75	75	75	75	75	74	74	74	74	74
19	75	75	74	74	74	73	73	74	74	74
20	98	98	97	97	95	95	91	89	89	87
21	-9	-9	-9	-8	-6	-6	-6	-6	-5	-4
22	20	20	20	23	23	24	23	23	29	31
23	4	5	5	5	5	4	4	4	4	4
24	15	16	16	16	18	18	18	20	23	23
25	85	84	83	84	83	83	82	82	82	81
26	82	82	81	82	82	82	82	83	83	83
27	87	85	84	84	83	83	82	82	82	82
28	79	79	78	79	79	79	79	80	80	80
29	93	91	87	81	74	71	65	62	61	61
30	78	78	78	79	78	78	78	77	76	76

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 4 DATE 11-20-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1845	1855	1900	1905	1910	1915	1930	1940	1950	2000	
31	83	83	82	82	82	82	79	79	78	78	
32	84	83	82	83	82	82	82	80	80	79	
33	88	88	88	88	88	89	89	87	89	87	
34	76	75	75	75	75	75	74	75	75	74	
35	88	88	88	88	88	88	88	88	88	88	
36	76	78	78	76	75	75	75	76	75	75	
37	75	78	75	75	74	74	74	75	76	76	
38	50	50	50	50	50	50	50	48	48	49	
39	45	45	45	44	45	44	41	43	43	45	
40	85	85	103	85	85	86	86	85	85	86	
41	70	77	77	77	77	77	77	77	77	77	
42	80	80	79	79	79	79	79	79	79	79	
43	87	87	87	87	87	87	87	87	88	87	
44	92	91	87	82	75	74	65	61	60	58	
45	82	80	80	80	79	82	82	81	82	81	
46	71	71	71	71	71	74	74	74	78	74	
47	74	74	74	74	74	74	74	74	75	75	
48	47	46	47	46	46	46	46	46	46	46	
49	51	51	49	51	51	51	51	52	51	51	
50											
51											
52											
53											
54											
55											
56											
57	48	51	57	66	74	79	91	95	98	101	
58											
59	69	69	69	71	74	78	87	88	91	93	
60											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 4 DATE 11-20-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1845	1855	1900	1905	1910	1915	1930	1940	1950	2000	
61											
62	25	60	78	88	96	100	108	111	113	115	
63	33	42	56	69	80	87	92	96	98	100	
64	48	53	65	78	87	91	100	102	104	106	
65											
66											
67	66	66	66	69	71	74	82	87	91	93	
68	161	78	60	48	42	37	33	31	33	33	
69	24	76	97	109	117	121	126	129	131	132	
70	74	70	61	53	46	42	39	39	39	40	
71	21	91	100	101	104	104	104	105	106	107	
72	152	135	113	94	78	70	60	56	56	56	
73	1	33	57	75	87	93	101	104	106	108	
74	-23	-85	-95	-98		-100	-100	-98	-95	-95	
75	-61	-77	-82	-83	-85	-85	-84	-85	-84	-83	
76	100	49	39	35	33	33	37	37	39	42	
77	142	47	34	29	29	28	33	33	37	38	
78	146	78	51	42	37	37	37	39	42	44	
79	181	75	56	47	43	42	42	44	46	48	
80	109	11	-1		-10	-10	-11	-11	-9	-1	
81	181	74	60	54	51	51	47	47	48	49	
82	168	100	83	76	74	70	69	69	69	70	
83	166	28	9	1	-1	-1	0	1	4	5	
84	33	9	9	7	9	9	9	10	11	11	
85	-83	-204				-206	-197	-189	-183	-179	
86	10	27	29	32	33	34	37	39	40	41	
87	14	121	134	139	142	143	146	146	146	147	
88	-1	82	88	91	92	92	95	95	95	96	
89	44	88	113	121	125	126	129	131	131	131	
90	25	70	78	82	83	83	87	87	87	88	

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 4 DATE 11-20-64

TEMPERATURE °F

Chan. No.	TIME OF DAY									
	1845	1855	1900	1905	1910	1915	1930	1940	1950	2000
91	11	106	113	114	117	117	118	118	118	119
92	18	33	38	40	42	42	43	44	45	46
93	9	138	146	149	150	150	153	153	154	154
94	29	51	58	65	70	74	80	83	84	85
95	87	87	87	87	85	87	83	83	83	82
96	85	87	87	88	88	91	91	90	89	87
97	60	65	69	68	74	77	85	89	95	98
98	51	51	51	51	56	60	66	72	78	81
99	56	51	46	52	62	65	69	74	80	82
100	48	46	46	44	46	46	51	54	57	60
101	48	51	51	51	56	56	62	69	70	74
102	82	87	91	92	97	100	108	113	117	118
103										
104										
105										
106										
107										
108										
109	[illegible]	-288	-290	-287	[illegible]	[illegible]	-289	[illegible]	-287	-288
110	-294	-299	-300	-296	-292	-292	-296	-292	-295	-298
111	-318	-320	-317	-318	-317	-319	-319	-318	-317	-317
112	-320	-320	-320	-320	-318	-320	-320	-320	-320	-320
113	-308	-309	-305	-307	-302	-302	-307	-302	-307	-313
114	-310	-308	-308	-310	-305	-308	-308	-308	-308	-316
115	81	82	81	81	79	79	78	77	77	76
116	81	80	80	80	82	82	81	82	82	82
117	101	102	104	102	100	104	99	100	102	102
118	108	102	101	104	100	100	100	105	101	104
119										
120	100	95	88	82	78	74	69	65	62	62

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 4 DATE 11-20-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1845	1855	1900	1905	1910	1915	1930	1940	1950	2000	
121	165	162	165	165	165	165	166	167	165	165	
122	165	165	166	166	166	166	165	165	166	166	
123	24	177	189	194	198	197	100	199	200	201	
124	178	23	4	-10	-14	-5	-14	-11	-10	-9	
125	154	46	34	29	28	28	28	29	32	34	
126	33	139	146	152	154	154	159	160	161	162	
127	169	86	86	88	89	91	91	90	88	86	
128	86	86	86	115	115	82	82	82	82	82	
129											
130											

TEST DAY NO. 2

TEST POINT NO. 5

EARTH SIMULATION (ONLY)

ON FRONT OF SUIT.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 5 DATE 9 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2015	2020	2030	2100	2128	2137	2200	2230	2240	2245	2300
001	117	110				108	97	74	87		
2	108	111	106	91	104	91	85	90	96		
3	74	74	71	63	58	58	56	52	51	50	48
4	75	74	74	65	60	60	57	54	53	51	49
5	79	78	76	71	72	74	76	74	74	70	67
6	82	82	81	80	82	83	83	78	76	74	71
7											
8	81	80	78	74	71	70	70	65	65	62	60
9	78	78	78	76	74	74	71	69	69	67	65
10	78	78	78	75	71	69	66	63	62	61	60
11	67	52	30	+1	-11	-19	-30	-36	-36	-36	-38
12	65	65	62	53	46	44	39	38	37	37	35
13	63	61	56	42	37	38	42	39	38	37	35
14	82	82	82	79	78	77	75	71	70	68	65
15	20	20	14	-13	-31	-36	-39	-40	-41	-41	-41
16	44	45	37	5	-17	-21	-34	-44	-46	-48	-51
17	46	47	47	46	42	42	37	34	33	31	30
18	74	74	74	71	69	67	65	61	61	60	57
19	74	75	74	74	70	70	69	65	65	62	61
20	85	84	83	68	74	71	70	70	70	70	69
21	-3	-3	-3	-3	-3	-3	-4	-6	-6	-8	-8
22	33	33	29	25	23	20	15	10	9	9	6
23	5	5	4	4	1	0	-1	-2	-1	-1	-2
24	26	26	28	28	25	24	23	18	18	16	15
25	81	80	80	78	79	79	79	75	74	71	69
26	83	83	82	79	78	78	76	71	69	66	65

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 5 DATE 9 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2310										
001	87										
2	92										
3	47										
4	48										
5	66										
6	70										
7											
8	58										
9	65										
10	58										
11	-39										
12	34										
13	34										
14	65										
15	-41										
16	-52										
17	28										
18	56										
19	60										
20	69										
21	-9										
22	4										
23	-3										
24	14										
25	69										
26	65										

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 5 DATE 9 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2015	2020	2030	2100	2128	2137	2200	2230	2240	2250	2300
027	82	81	80	79	79	80	79	75	74	71	69
28	79	79	78	72	69	67	65	62	61	60	57
29	60	59	51	33	25	25	29	33	33	30	29
30	76	75	75	73	69	69	67	65	62	61	60
31	78	78	76	74	71	70	70	66	65	63	61
32	79	79	78	76	75	74	74	71	69	67	65
33	87	87	87	85	84	84	83	80	79	78	76
34	74	74	74	70	67	66	65	60	60	58	56
35	88	88	87	85	82	82	81	78	78	78	75
36	76	76	76	74	70	69	67	65	63	61	60
37	76	76	76	74	70	74	70	67	66	65	62
38	49	49	48	44	37	36		25	-24	23	20
39	45	45	43	40	36	36	34	29	28	27	25
40	86	86	85	84	82	82	82	77	77	76	74
41	77	77	77	72	69	69	68	64	64	61	60
42	79	79	78	74	71	71	69	66	65	65	61
43	88	87	87	83	80	79	78	76	76	75	74
44	57	56	51	33	24	24	28	29	30	29	28
45	81	81	80	78	77	77	75	72	70	69	66
46	76	76	75	72	69	67	65	61	61	60	57
47	76	76	75	71	68	67	65	60	60	57	56
48	46	46	46	42	39	37	34	30	29	28	25
49	51	51	49	44	38	37	30	25	25	22	19
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT 1b

TEST DAY NO. 2 TEST POINT NO. 5 DATE 9 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2310										
027	69										
28	56										
29	28										
30	58										
31	60										
32	65										
33	75										
34	56										
35	75										
36	58										
37	61										
38	19										
39	24										
40	73										
41	58										
42	60										
43	74										
44	28										
45	65										
46	56										
47	56										
48	25										
49	18										
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT 1b

TEST DAY NO. 2 TEST POINT NO. 5 DATE 9 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2015	2020	2030	2100	2128	2137	2200	2230	2240	2250	2300
053											
54											
55											
56											
57	104	100	78	46	30	25	10	-1	-3	-5	-9
58											
59	95	95	89	70	61	58	52	43	42	38	35
60											
61											
62	117	57	21	-21	-36	-59	-81	-93	-95	-97	-99
63	101	79	39	-1	-18	-29	-51	-63	-65	-68	-70
64	108	93	62	25	14	6	-10	-21	-23	-26	-29
65											
66											
67	96	96	91	74	60	56	49	39	37	33	28
68	30	-11	-40	-68	-76	-33	-11	-5	-5	-4	-4
69	134	61	24	-15	-26	-61	-81	-90	-92		-85
70	42	18	-20	-60	-71	-60	-47	-43	-43	-41	-41
71	108	18	-12	-60	-68	-154	-164	-174	-175	-176	-177
72	56	46	9	-43	-60	-47	-19	-7	-6	-5	-4
73	110	76	36	-19	-39	-57	-147	-101	-101	-106	-108
74	-95	-111	-135	-160	-162	-170	-170	-170	-170	-170	-169
75	-83	-119	-151	-183	-183	-196	-196	-195	-196	-195	-195
76	39	-72	-113	-143	-134	-60	-41	-34		-31	-31
77	35	-67	-101	-123	-108	-42	-25	-20	-18	-18	-19
78	42	-36	-93	-126	-119	-36	-10	-2	-1	0	-1

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO. 5 DATE 9 November 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2310										
053											
54											
55											
56											
57	-10										
58											
59	34										
60											
61											
62	-101										
63	-71										
64	-39										
65											
66											
67	26										
68	-5										
69	-96										
70	-43										
71	-176										
72	-4										
73	-108										
74	-168										
75	-194										
76	-35										
77	-21										
78	-3										

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 5 DATE 23 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2015	2020	2030	2100	2128	2137	2200	2230	2240	2250	2300
079	46	-51	-107	-142	-140	-40	-14	-5	-4	-3	-3
80	-4	-93	-132	-153	-142	-57	-39	-33	-30	-30	-30
81	47	-34	-68	-92	-90	-61	-49	-45	-44	-44	-44
82	69	1	-41	-67	-65	-14	4	9	9	9	9
83	4	-95	-135	-157	-144	-83	-67	-61	-61	-60	-60
84	14	-87	-126	-151	-154	-151	-151	-150	-150	-150	-151
85											
86	42	-34	-40	-68	-82	-154	-166	-174	-174	-174	-174
87	136	4	-25	-57	-68	-124	-138	-141	-141	-142	-142
88	97	4	-23	-66	-81	-141	-154	-157	-157	-157	-157
89	131	57	19	-28	-36	-87	-126	-140	-141	-143	-144
90		14	-10	-52	-73	-138	-157	-163	-163	-164	-164
91	120	7	-25	-68	-88	-157	-170	-173	-177	-174	-174
92	46	-5	-22	-59	-73	-140	-156	-159	-160	-160	-160
93	156	9	-26	-68	-87	-148	-153	-162	-162	-163	-163
94	87	56	37	5	-11	-25	-41	-47		-48	-49
95	82	81	81	78	76	75	74	72	70	69	66
96	85	85	88	100	109	111	106	87	85	82	82
97	88	65	46	-4	35	48	63	60	71	71	70
98	69	60	45	-4	37	51	66	73	74	74	74
99	56	51	42	-20	66	69	74	79	80	79	78
100	56	46	33	-10	7	16	29	35	37	38	38
101	67	56	37	-6	15	25	38	45	46	47	47
102	142	78	51	-1	33	33	46	54	56	56	56
103											
104											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 5 DATE 23 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2310										
079	-5										
80	-34										
81	-45										
82	7										
83	-61										
84	-151										
85											
86	-174										
87	-142										
88	-157										
89	-144										
90	-164										
91	-174										
92	-160										
93	-162										
94	-49										
95	65										
96	81										
97	59										
98	61										
99	39										
100	33										
101	39										
102	46										
103											
104											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 5 DATE 23 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2015	2020	2030	2100	2128	2137	2200	2230	2240	2250	2300
105											
106											
107											
108											
109	-288	-288	-288	-291	-291	-287	-307	-319	-318		-312
110	-302	-300	-298	-311	-289	-287	-310	-320	-320		
111	-319	-318	-318	-320	-317	-312					
112						-318					
113	-320	-318	-316	-311	-310	-307					
114	-318	-318	-320	-316	-312	-310					
115	75	75	74	71	70	70	69	65	60	62	60
116	82	82	81	79	78	78	76	72	71	69	67
117	100	100	102	100	87	95	96	95	97	96	96
118	106	104	104	99	100	101	97	98	98	98	98
119											
120	61	60	51	30	23	24	29	33	33	31	30
121	135	136	135	134	134	134	134	134	134	134	134
122	134	134	132	131	134	134	131	130	132	131	131
123	-101	25	-13	-56	-68	-123	-137	-140	-141	-141	-142
124	-11	-93	-134	-154	-142	-96	-83	-77	-66	-76	
125	31	-73	-112	-141	-124	-74	-55	-48	-47	-47	-46
126		33	0	-50	-67	-126	-153	-160	-162	-162	-163
127	85	85	88	98	108	110	106	86		82	81
128		81	81	77	76	75	75	71	69	68	66
129											
130											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 2 TEST POINT NO 5 DATE 23 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	2310										
105											
106											
107											
108											
109	-300										
110	-317										
111											
112											
113	-311										
114											
115	60										
116	66										
117	95										
118	95										
119											
120	29										
121	132										
122	127										
123											
124	-77										
125	-49										
126	-162										
127	80										
128	64										
129											
130											

SUIT FLOW SYSTEM
GEMINI EXTRAVEHICULAR SUIT
EXPERIMENT Ib

TEST DAY NO. 2 DATE: 11-9-64

	ROTAMETER			VOLOFLOW							
TIME	PRESSURE PSIA	TEMP °F	FLOW SCFM*	SUIT OUTLET PRESS. PSIA	TEMP °F	FLOW ACFM	SUIT LEAKAGE CC/MIN				
0630	14.7	70	3.21	3.7	75	11.7					
0700			-	3.8	75	11.75					
0730			-	3.7	75	11.6					
0800			-	3.7	75	11.5					
0830			-	3.65	77	11.45					
0900			-	3.7	77	11.45					
0930			-	3.7	77	11.4					
1000			-	3.7	77	11.4	160				
1030			3.03	3.6	82	11.45					
1100			3.12	3.6	115	10.8					
1130			3.12	3.7	132	10.7					
1200			3.14	3.7	131	10.55					
1230			3.16	3.7	129	10.35	190				
1300			3.21	3.7	129	10.75					
1330			3.03	3.7	130	10.75					
1400			3.03	3.7	131	10.75					
1430			2.98	3.7	131	10.75					
1500			3.03	3.7	131	10.75					
1530			3.02	3.7	130	10.75					
1600			3.02	3.7	131	10.75					
1630			3.02	3.7	130	10.75					
1700			3.07	3.7	115	11.0					
1730			3.07	3.7	92	11.2					
1800			3.03	3.7	79	11.45					
1830			3.02	3.7	78	11.45					
1900	14.7	70	3.06	3.7	100	11.10					

* Air - 14.7 psia, 70°F

SUIT FLOW SYSTEM
GEMINI EXTRAVEHICULAR SUIT
EXPERIMENT Ib

TEST DAY NO. 2 DATE: 11-9-64

	ROTAMETER			VOLOFLOW							
TIME	PRESSURE PSIA	TEMP °F	FLOW SCFM*	SUIT OUTLET PRESS. PSIA	TEMP °F	FLOW ACFM	SUIT LEAKAGE CC/MIN				
1930	14.7	70	3.12	3.7	96	11.1					
2000			3.31	3.75	83	11.3					
2030			3.11	3.7	96	11.3					
2100			3.06	3.64	124	10.9					
2130			3.14	3.7	133	12.2					
2200			3.23	3.8	112	12.2					
2230			3.16	3.7	80	12.8					
2300	14.7	70	3.16	3.7	96	12.6	140				

THERMAL DUMMY HEATER POWER
GEMINI EXTRAVEHICULAR SUIT TEST
EXPERIMENT Ib

TEST DAY NO. 2 DATE: 11-9-64

POWER-WATTS

TIME	VOLTS	TORSO	HEAD	LEFT ARM	RIGHT ARM	LEFT THIGH	RIGHT THIGH	LEFT LEG	RIGHT LEG	TOTAL	
0605	20	5	3.5	2	2	2	2	2	2	20.5	
0615	30	10	7	3	3	3	3	3	3	35	
0630	37	15	15	5	5	5	5	5	5	60	
0650	37	18	20	7	8	7	7	7	7	81	
0700	37	21	28	9	4	9	9	7	7	131	
0720	44	30	34	14	14	15	15	13	11	146	
0740	43	35	38	10	18	20	17	11	14	163	
0750	43	35	38	7	12	12	12	7	7	130	
0755	43	25	22	5	5	10	10	5	5	87	
0805	36	17.5	11	3	3	5	5	3	3	50.5	
0815	30	15	10	2	2	2	2	2	2	37	
0820	30	15	13	2	2	2	2	2	2	40	
0830	30	15	15	2	3	2	2	2	2	43	
0845	34	17	22	3.5	4	3	3	2.5	2.5	57.5	
0850	34	20	22	5	5	3	3	2.5	2.5	63	
0900	34	25	22	5	5	3	3	4	4	71	
0920	34	30	22	5	5	3	3	4	4	71	
0925	40	35	30	6	6	4	4	5.5	5	95.5	
0935	40	30	30	6	6	4	4	5.5	5	90.5	
0945	40	30	25	6	6	4	5	5.5	5	86.5	
1000	40	30	25	6	6	4	6	5.5	5	87.5	
1010	0	0	0	0	0	0	0	0	0	0	
1415	30	30	25	6	6	4	6	5.5	5	87.5	
1425	40	40	32.5	9	8.5	6	9	7.5	7	119.5	
1445	36	40	32.5	9	8.5	6	9	7.5	7	119.5	
1455											

THERMAL DUMMY HEATER POWER
GEMINI EXTRAVEHICULAR SUIT TEST
EXPERIMENT Ib

TEST DAY NO. 2 DATE: 11-9-64

POWER-WATTS

TIME	VOLTS	TORSO	HEAD	LEFT ARM	RIGHT ARM	LEFT THIGH	RIGHT THIGH	LEFT LEG	RIGHT LEG	TOTAL	
1545		31	16.5	10	10	9	9	9	9	103.5	
1610		31	16.5	10	12.5	12.5	12.5	12.5	12.5	120	
1620		31	16.5	10	12.5	12.5	12.5	12.5	12.5	120	
1635		29	21	5	12.5	12.5	16	12.5	12.5	121	
1639		0	0	0	0	0	0	0	0	0	

TEST DAY NO. 3

SIMULATED SPACECRAFT

SURFACE INSTALLED. SUIT

SUPPORTED BY HELMET WITH

CLEAR VISOR EXPOSED. PROTECTIVE

GLOVE COVER (MITTEN) ON

RIGHT HAND. SUPER INSULATION

ADDED TO BOTTOM OF LEFT FOOT.

TEST DAY NO. 3

TEST POINT NO. 1

SOLAR SIMULATION ON;

EARTH SIMULATION ON.

SUIT ROTATED TO ACHIEVE

AN AVERAGE SUIT SURFACE TEMPERATURE

OF 75 ± 15°F. DUMMY

SURFACE TEMPERATURE CONTROLLED

WITH DUMMY HEATERS.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 1 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0800	0815	0830	0845	0900	0915	0925				
1		150	63				76				
2		60	62			71	74				
3	67	67	68	71	74	78	80				
4	67	67	69	72	75	78	82				
5	70	65	65	66	69	74	75				
6	74	74	78	82	85	87	91				
7											
8	74	75	82	87	89	93	95				
9	70	70	71	74	74	76	78				
10	70	71	74	77	80	82	85				
11	69	61	62	66	70	74	74				
12	71	69	69	74	76	79	82				
13	70	61	65	70	74	78	79				
14	74	75	81	87	89	92	95				
15	65	58	56	57	60	61	61				
16	65	58	57	61	65	67	69				
17	69	67	66	66	66	67	67				
18	70	70	74	76	79	82	84				
19	69	69	70	74	75	78	80				
20	74	73	74	74	76	79	82				
21	66	65	65	61	61	60	60				
22	62	58	60	61	61	61	62				
23	65	65	65	65	65	65	65				
24	67	65	65	65	65	63	62				
25	74	76	82	87	90	93	95				
26	74	75	80	84	88	91	93				

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 1 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0800	0815	0830	0845	0900	0915	0925				
27	74	74	79	84	87	91	92				
28	71	74	79	84	88	92	95				
29	60	49	56	65	66	69	72				
30	69	71	75	80	79	88	91				
31	74	75	81	85	89	92	95				
32	74	78	82	85	89	92	95				
33	76	79	82	87	88	91	95				
34	69	71	75	79	82	87	89				
35	78	80	83	87	90	92	95				
36	71	71	74	78	80	83	85				
37	70	71	74	75	78	79	82				
38	53	55	60	66	73	77	80				
39	50	55	61	67	75	78	80				
40	64	67	71	73	78	81	82				
41	55	59	64	69	77	78	80				
42	74		83	88	92	95	100				
43	77	79	83	87	90	92	95				
44	94	69	78	87	92	95	93				
45	-204	-204			108	-144	150				
46		69	-136	74	76	78	80				
47	69	69	74	76	79	82	84				
48	66	70	78	84	88	93	97				
49	67	69	76	82	87	92	96				
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 1 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0800	0815	0830	0845	0900	0915	0925				
53											
54											
55	110	162	194	199	164	166	186				
56											
57	56	52	58	65	69		76				
58											
59	60	61	65	71	75	78	82				
60											
61											
62	46	16	87	88	102	106	102				
63	54	24	80	83	81	75	88				
64	60	38	74	78	78	78	82				
65											
66											
67	61	58	61	70	74	76	79				
68	51	39	45	52	63	62	69				
69	46	30	58	60	61	68	71				
70	33	52	69	110	74	65	100				
71	22	-10	72	52	83	110	87				
72	46	20	46	74	82	74	85				
73	37	25	28	42	48	56	60				
74	14	-4	42	62	51	-26	9				
75	15	-24	-1	51	60	4	18				
76	-25	46	74	87	25	52	74				
77	-5	74	74	87	36	33	66				
78	11	65	71	89	38	56	74				

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 1 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0800	0815	0830	0845	0900	0915	0925				
79	-10	7	51	23	31	65	51				
80	-10	10	53	47	42	60	53				
81	-6	104	92	108	30	56					
82	20	43	87	78	74	67	91				
83	-52	113	105	110	28	38	69				
84	-4	100	98		56	65	100				
85	113	134	56	44	-4	-21	4				
86	28	-10	71	65	71	108	113				
87	19	-3	70	60	70	104	101				
88	31	-16	42	43	80	100	75				
89	34	5	76	69	60	108	101				
90	18	-13	47	47	56	98	80				
91	14	-14	56	51	77	115	88				
92	18	-13	70	60	82	158	127				
93	19	-6	74	60	74		130				
94	69	56	57	60	60	65	65				
95	71	71	74	78	82	84	87				
96	74	74	74	74	75	76	78				
97	56	23	80	117	117	113	113				
98	56	18	69	113	111	104	104				
99	37	12	104	121	113	110	109				
100	53	18	52	87	92	93	92				
101	56	20	49	84	87	87	85				
102	56	33		114	119	118	117				
103	46	41	41	44	46	46	48				
104	46	41	44	46	49	49	50				

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 1 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0800	0815	0830	0845	0900	0915	0925				
105											
106											
107											
108											
109	-41										
110											
111											
112											
113	-26										
114	-16	-233									
115	74	74	79	84	88	91	93				
116	71	75	80	85	88	91	93				
117	92	92	92	92	92	92	93				
118	92	92	92	92	93	93	93				
119											
120	44	47	53	61	57	61	69				
121	72	71	72	74	74	76	78				
122	69	70	72	75	79	83	85				
123	28	5	116	85	82	117	129				
124	-46	127	108	138	82	30	122				
125	-10	62	82	102	51	41	100				
126		-6	85	80	85	146	87				
127		68	68	69	71	71	72				
128	68	67	69	73	77	78	82				
129											
130											

TEST DAY NO. 3

TEST POINT NO. 2

SOLAR SIMULATION ON

FRONT OF SUIT; EARTH

SIMULATION ON BACK.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 2 DATE 28 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0935	0940	0950	1000	1015	1020	1030	1040	1050	1100	
001											
2	74	74	74	75	78	80	82	79		69	
3	82	82	83	84	85	85	87	87	87	87	
4	82	83	84	84	85	87	87	87	87	87	
5	76	78	81	85	91	92	96	95	91	87	
6	91	89	89	91	92	93	95	92	91	88	
7											
8	95	94	91	91	88	88	88	89	88	88	
9	78	79	79	80	81	82	82	82	83	82	
10	87	85	84	84	84	83	84	84	84	83	
11	75	76	78	79	83	85	87	80	74	70	
12	82	82	78	77	75	75	75	74	70	66	
13	82	87	89	91	95	96	95	82	71	65	
14	95	92	91	89	89	89	91	91	91	91	
15	62	62	65	65	69	69	72	71	67	65	
16	69	69	69	69	69	70	71	71	67	65	
17	67	67	68	69	69	70	71	72	74	74	
18	85	85	85	85	87	85	87	87	85	83	
19	81	81	82	83	84	84	85	87	85	83	
20	83	85	88	91	95	96	100	100	98	95	
21	60	60	60	60	60	58	58	57	57	56	
22	63	62	62	62	62	62	62	61	60	60	
23	65	65	65	65	66	67	67	67	66	65	
24	62	62	62	62	61	61	61	61	61	61	
25	95	93	91	91	91	91	92	91	89	88	
26	93	91	90	89	91	91	91	91	91	91	

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 2 DATE 28 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0935	0940	0950	1000	1015	1020	1030	1040	1050	1100	
027	92	91	91	91	92	92	93	92	91	89	
28	95	93	91	91	89	88	89	89	88	88	
29	83	88	88	89	91	91	76	48	83	33	
30	91	91	88	87	91	87	88	88	88	87	
31	95	93	91	91	91	91	92	91	88	87	
32	95	93	91	91	91	91	91	91	88	87	
33	94	93	92	91	92	93	93	94	93	92	
34	89	88	87	87	87	87	87	87	87	87	
35	95	93	92	83	92	92	93	93	92	91	
36	87	85	85	85	85	85	87	87	85	84	
37	82	82	82	83	84	84	85	85	85	84	
38	80	77	75	73	72	80	81	86	84	82	
39	80	77	73	71	68	71	73	82	81	80	
40	82	77	77	77	77	85	86	91	91	91	
41	79	77	73	71	68	72	75	85	101	88	
42	97		91		88	88	88	88	88	88	
43	95	93	91	91	89	89	91	91	89	80	
44	100	106	108	109	110	110	97	69	56	51	
45										-31	
46	37			79		79			80	79	
47	85	92	82	82	82	82	82	82	82	82	
48	96	93	89	87	84	83	82	81	79	78	
49	96	93	91	88	87	85	84	83	82	82	
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 2 DATE 28 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	0935	0940	0950	1000	1015	1020	1030	1040	1050	1100	
053											
54											
55	129	140	141	144	148	150		-60	-75	-79	
56											
57	78		71	69	65	65	61	60	56	53	
58											
59	84	83	82	79	78	76	75	74	74	72	
60											
61											
62	54	38	25	20	16	15	5	-9	-19	-24	
63	65	46	33	29	25	25	21	12	0	-5	
64	78	66	56	52	51	51	49	42	34	31	
65											
66											
67	80	79	75	74	71	71	71	70	69	69	
68	108	129	145	148	142	140	121	62	28	9	
69	62	56	48	43	38	37	33	24	16	14	
70	65	51	45	51	61	63	44	15	-9	-21	
71	65	60	56	52	49	49	28	9	-1	-1	
72	92	106	120	127	47	135	35	65	19	-1	
73	61	61	60	58	56	56	56	51	45	39	
74	25	-30	34	-14	-10	-15	-51	-67	-73	-73	
75	4	4	2	37	43	28	-25	-47	-57	-57	
76	134	142	146	146		143	0	-62	-85	-96	
77	128	136	138	142	144	142	-6	-66	-84	-89	
78	140	146	139	136	134	134	42	-53	-90	-101	

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 2 DATE 28 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY									
	0935	0940	0950	1000	1015	1020	1030	1040	1050	1100
079	144	131	125	121	119	119	29	-54	-87	-101
80	136	143	146	147	148	148	-19	-95	-119	-129
81	82	51	56	70	78	79	20	-29	-50	-57
82	102	92	87	82	78	78	104	44	18	5
83	125	117	117	118	117	118	-15	-90	-111	-118
84	108	115	118	115	115	114	51	-16	-47	-57
85	10	14	14	14	14	14	31	47	47	35
86	1	-8	-11	-13	-15	-16	-35	-56	-67	-68
87	16	9	4	-1	-1	-1	-21	9	-52	-54
88	57	54	51	49	46	46	28	10	4	4
89	65	60	56	54	52	51	-31	9	-1	12
90	37	33	28	25	23	21	2	-18	-26	-28
91	45	39	36	34	33	31	9	-11	-20	-19
92	39	33	28	25	23	22	2	-18	-28	-26
93	51	44	40	39	37	35	14	-6	-15	-15
94	65	65	62	61	60	60	58	56	51	48
95	88	88	88	89	91	92	93	93	91	91
96	78	80	87	93	100	100	100	102	106	110
97	108	105	101	98	95	95	84	63	67	76
98	98	95	89	87	85	85	82	66	69	78
99	104	100	98	97	85	96	85	65	91	78
100	88	85	82	80	77	76	70	54	47	48
101	82	80	76	74	70	69	65	51	51	53
102	110	108	104	101	96	95	84	62	60	61
103	49	50	50	53	55	56	55	74	73	77
104	50	50	52	54	55	58	58	76	73	77

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 2 DATE 28 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY									
	0935	0940	0950	1000	1015	1020	1030	1040	1050	1100
105										
106										
107										
108										
109										
110										
111										
112										
113										
114										
115	92	91	89	89	89	90	90	89	86	84
116	93	91	89	88	88	88	89	89	93	89
117	93	93	93	93	93	93	93	93	93	93
118	93	93	93	93	93	93	93	93	93	92
119										
120	83	87	87	87	87	87	44	24	14	10
121	78	79	82	87	95	97	91	101	104	104
122	87	88	89	91	92	93	95	95	93	92
123	62	52	48	46	43	42	20	0	-10	-
124	166	174	176	174	177	174	-9	-78	-	-105
125	125	132	136	144	147	146	0	-55	-77	-85
126	85	80	-	74	70	71	43	22	14	14
127	73	73	77	86	91	95	97	101	105	108
128	82	82	82	82	85	90	90	92	91	90
129										
130										

TEST DAY NO. 3

TEST POINT NO. 3

SOLAR SIMULATION ON

FRONT OF SUIT; EARTH SIMULATION

ON BACK; SPACECRAFT SIMULATION

ON RIGHT SIDE.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO. 3 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1100	1130	1200	1230	1245	1300	1315	1330			
1		87	-65				-5				
2	69	76	79	78	78	78	79	79			
3	87	85	87	87	87	87	88	88			
4	87	87	87	87	87	88	88	88			
5	87	91	95	95	95	95	95	91			
6	88	91	91	91	89	89	89	91			
7											
8	88	87	87	87	87	85	85	87			
9	83	83	83	84	85	85	85	87			
10	83	82	83	84	84	85	85	85			
11	69	81	82	82	81	81	82	83			
12	65	42	69	71	72	74	73	75			
13	65	89	93	95	94	95	95	95			
14	90	89	88	87	87	87	87	87			
15	65	65	69	74	75	76	77	79			
16	65	65	69	71	74	74	75	76			
17	74	74	75	78	78	79	80	81			
18	83	84	85	87	87	87	87	88			
19	83	83	84	85	85	85	85	85			
20	95	94	100	102	104	104	104	105			
21	56	54	52	51	51	51	51	50			
22	60	60	60	60	60	60	60	60			
23	65	65	63	65	65	65	65	66			
24	61	60	58	57	57	57	56	56			
25	88	90	91	89	89	89	89	90			
26	91	90	88	87	87	87	87	87			
27	89	91	91	91	89	89	90	90			
28	87	87	87	87	87	87	87	87			
29	33	83	87	86	88	89	89	90			
30	87	87	87	87	88	88	88	88			

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO. 3 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1100	1130	1200	1230	1245	1300	1315	1330			
31	87	88	89	89	88	89	89	89			
32	87	88	89	89	88	88	89	89			
33	92	91	91	91	91	91	91	91			
34	87	85	91	87	87	87	88	88			
35	91	91	91	91	91	91	92	92			
36	84	84	85	87	87	87	87	88			
37	83	85	85	87	85	85	87	87			
38	82	77	77	79	80	80	80	81			
39	80	75	75	75	75	74	74	75			
40	91	90	90		240	240	323	90			
41	86	85	86	86	86	86	86	86			
42	87	87	87	87	87	87	87	87			
43	106	87	88	88	89	89	89	89			
44	51	104	107	108	108	108	104	107			
45											
46	79						82	81			
47	83	80	81	82	82	83	83	84			
48	78	74	74	74	74	74	74	73			
49	80	76	75	76	78	77	78	78			
50											
51											
52											
53											
54											
55	-6	150	153	151	152	152		152			
56											
57	52	51	51	52	52	52	52	52			
58											
59	71	69	69	69	69	69	69	69			
60											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO. 3 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1100	1130	1200	1230	1245	1300	1315	1330			
61											
62	-21	10	14	14	14	12	12	14			
63	-5	19	22	21	21	20	20	22			
64	31	47	49	47	46	46	45	47			
65											
66											
67	67	69	69	67				66			
68	25	154	161	160	161	161	160	160			
69	12	20	23	23	23	21	20	20			
70	-20	44	51	51	51	51	62	56			
71	9	53	54	52	51	50	51	53			
72	-4	127	134	134	134	134	136	134			
73	39	43	48	46	51	51	52	52			
74	-66	-29	-29	-30	-31	-33	-5	-29			
75	-46	7	9	5	4	4	44	7			
76	36	153	156	154	154	154	158	154			
77	33	140	143	140	142	142	143	142			
78	4	162	166	165	165	165	165	165			
79	31	178	182	180	181	181	181	181			
80	21	146	150	147	148	148	148	148			
81	-38	65	69	69	69	69	88	70			
82	105	88	89	89	74	72	72	72			
83	76	180	184	180	181	181	181	181			
84		111	113	113	113	113	113	113			
85	19	-46	-41	-34	-28	-25	-137	-25			
86	-57	-15	-15	-16	-18	-18	-17	-16			
87	-44	-3	-1	-3	-4	-4	-3	-1			
88	15	51	50	48	46	46	48	49			
89	12	56	56	56	52	52	53	56			
90	-17	23	24	23	21	21	22	23			

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 3 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1100	1130	1200	1230	1245	1300	1315	1330			
91	-6	34	34	33	33	31	33	33			
92	-16	24	24	23	22	21	23	24			
93	-3	37	37	35	34	34	36	37			
94	48	51	53	56	56	57	57	58			
95	91	91	92	92	92	92	92	93			
96	110	98	89	84	84	87	88	89			
97	78	109	104	101	98	97	102	104			
98	76	98	91	89	87	85	91	92			
99	79	106	100	98	95	95	106	101			
100	48	79	79	78	76	75	78	79			
101	49	78	75	74	71	69	74	74			
102	66	108	106	104	101	100	103	104			
103	84	201			169			180			
104	83	203	190	175	168	163	184	181			
105											
106											
107											
108											
109	-99	-99	-99	-98	-99	-99	-96	-96			
110	-101	-106	-108	-106	-108	-106	-103	-104			
111	-111	-112	-112	-112	-114	-112	-111	-111			
112	-111	-112	-112	-112	-112	-111	-109	-109			
113	-110	-111	-111	-111	-111	-110	-107	-108			
114	-106	-108	-108	-109	-108	-109	-107	-108			
115	84	86	87	87	87	87	87	88			
116	89	88	88	87	87	87	87	87			
117	93	92	93	93	93	93	93	95			
118	93	92	93	93	93	93	94	95			
119											
120	48	82	87	87	87	87	88	88			

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 3 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1100	1130	1200	1230	1245	1300	1315	1330			
121	105	104	98	92	91	91	92	94			
122	91	92	93	95	95	94	95	95			
123	4	42	43	42	42	40	42	42			
124	90	174	177	174		174		174			
125	58	142	146	143	144	143	148	146			
126	37	76	76	74	74	72	74	75			
127	108	99	92	86	85	86	88	91			
128	90	91	91	91	91	91	91	92			
129											
130											

TEST DAY NO. 3

TEST POINT NO. 4

SOLAR SIMULATION

ON FRONT OF SUIT; EARTH

SIMULATION ON BACK.

ROTATED SIMULATED HOT

SPACECRAFT SURFACE AGAINST

RIGHT SIDE OF SUIT.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 4 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1330	1415	1430	1445	1500	1515	1530				
1		81				80					
2	79	81	81	80	80	80	-124				
3	88	90	91	90	91	91	91				
4	88	90	91	91	91	91	91				
5	96	88	85	82	81	80	79				
6	91	87	85	84	83	83	82				
7											
8	87	87	87	87	86	85	85				
9	87	87	87	87	87	87	86				
10	85	87	87	87	87	87	87				
11	83	86	85	85	85	84	84				
12	75	78	79	81	81	82	83				
13	95	87	85	85	85	84	84				
14	87	88	88	87	87	87	87				
15	79	81	81	81	82	82	82				
16	76	80	80	81	81	81	81				
17	81	84	85	85	85	87	87				
18	88	87	87	87	87	87	87				
19	85	84	83	82	82	81	81				
20	105	94	89	85	81	79	77				
21	50	47	48	49	50	51	51				
22	60	58	59	59	59	59	59				
23	66	62	61	59	58	57	56				
24	56	56	56	56	56	56	57				
25	90	87	86	85	85	84	84				
26	87	87	87	87	86	85	85				

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 4 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1330	1415	1430	1445	1500	1515	1530				
27	90	90	87	87	86	85	85				
28	87	88	88	88	88	88	87				
29	90	65	63	63	63	63	63				
30	88	91	91	92	92	92	92				
31	89	88	87	87	87	86	86				
32	89	87	87	85	85	85	84				
33	92	91	89	88	87	87	85				
34	88	91	91	91	92	92	93				
35	92	91	90	88	87	87	85				
36	88	87	87	87	87	87	87				
37	87	85	84	83	82	82	82				
38	81	82	82	81	81	80	79				
39	75	74	73	73	72	71	71				
40	90	90		87	77	85	84				
41	87	87	87	86	86	86	86				
42	87	87	87	87	87	87	87				
43	89	89	89	88	87	85	85				
44	107	75	74	65	65	65	65				
45	77	60									
46	81	-	82	81		80	80				
47	84	85	85	85	85	85	85				
48	73	73	74	72	71	70	70				
49	78	79	79	79	79	78	78				
50											
61											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 4 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1330	1415	1430	1445	1500	1515	1530				
53											
54											
55	152	67		68	68	64					
56											
57	52	65	65	67	69	69	69				
58											
59	69	74	75	75	76	76	76				
60											
61											
62	14	88	89	91	91	91	91				
63	22	92	94	95	95	95	95				
64	47	90	91	92	92	92	92				
65											
66											
67	66	82			87	87	87				
68	44	12	6	2	1	0	-2				
69	23	49	51	54	56	56	57				
70	56	106		107	106	104	103				
71	53	56	57	57	57	56	56				
72	134	129	129	129	129	128	127				
73	52	56	58	61	63	65	66				
74	-29	139	140	142	143	139	140				
75	7	142	143	146	146	143	143				
76	37	47	47	48	47	44	44				
77	142	69	70	72	74	69	69				
78	49	43	43	44	43	40	40				

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 4 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1330	1415	1430	1445	1500	1515	1530				
79	67	-71	-73	-76	-77	-78	-79				
80	148	-75	-76	-76	-76	-76	-77				
81	70	5	3	2	0	-2	2				
82	114	61	56	54	51	48	47				
83	67	81	82	84	74	80	80				
84	113	148			142	41					
85	-25	-162	-179	-195							
86	-16	69	69	70	70	70	69				
87	-1	61	62	63	65	63	63				
88	49	72	74	74	78	77	77				
89	56	88	89	90	91	91	91				
90	23	21	21	22	23	22	21				
91	33	29	29	30	30	28	28				
92	24	24	24	25	25	25	23				
93	37	25	25	25	25	24	24				
94	58	71	73	76	78	79	80				
95	93	92	91	90	89	88	88				
96	89	86	85	84	84	83	83				
97	104	97	98	98	99	99	98				
98	92	97	98	98	98	98	98				
99	101	102	104	103	104	104	103				
100	79	85	87	87	87	88	87				
101	75	93	95	95	97	97	96				
102	104	114	116	116	117	117	117				
103	180	184	248	181		174	176				
104	181	183	178	179	177	173	174				

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 4 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1330	1415	1430	1445	1500	1515	1530				
105											
106											
107											
108											
109	-292	-296	-297	-297	-298	-297	-299				
110	-306	-309	-309	-309	-309	-309	-309				
111	-320										
112	-315	-320	-320								
113	-313	-316	-316	-316	-316	-316	-316				
114	-313	-316	-316	-315	-315	-313	-316				
115	88	87	86	85	85	85	84				
116	87	87	87	87	87	86	85				
117	95	95	94	94	94	94	94				
118	95	95	94	94	94	94	94				
119											
120	88	37	37	37	37	37	36				
121	94	92	90	88	86	85	85				
122	95	95	92	91	90	89	88				
123	42	42	42	42	42	42	41				
124	60	140	140	142	143	139	139				
125	146	95	95	98	97	94	93				
126	75	161	161	161	163	162	161				
127	91	86	85	84	84	83	83				
128	92	91	89	88	87	86	86				
129											
130											

TEST DAY NO. 3

TEST POINT NO. 5

SIMULATED ORBIT. SOLAR

SIMULATION ON FOR 60

MINUTES; OFF FOR 30 MINUTES.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 5 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1530	1545	1550	1555	1600	1605	1610	1615	1620	1625	1630
1			82					80	81	83	79
2		79	79	80	80	81	81	79	76	76	80
3	91	91	91	91	91	91	91	91	91	91	91
4	91	91	91	91	91	91	91	91	91	91	91
5	79	79	79	80	80	81	81	81	81	82	82
6	82	82	83	84	84	84	84	84	84	85	85
7											
8	85	85	85	85	85	85	85	85	87	87	87
9	86	86	87	87	87	87	86	86	86	86	86
10	87	87	87	87	87	87	87	87	88	88	87
11	84	84	82	81	80	79	79	78	79	79	79
12	83	83	84	83	83	83	82	82	82	82	80
13	84	84	87	84	83	81	78	81	84	87	80
14	87	85	85	85	85	85	86	86	87	87	87
15	82	82	82	83	83	84	83	82	82	82	83
16	81	82	82	83	83	84	85	85	85	85	85
17	87	87	87	87	87	87	87	87	87	87	87
18	87	87	87	87	87	87	87	87	87	87	87
19	81	81	80	80	80	80	81	81	81	81	81
20	77	75	75	75	76	76	78	78	78	79	81
21	51	51	51	51	51	51	51	51	51	51	51
22	59	59	58	58	58	58	58	58	58	58	58
23	56	56	56	56	56	56	56	56	56	56	56
24	56	56	56	56	56	56	56	56	56	56	54
25	84	84	84	85	85	85	85	85	85	85	85
26	85	85	85	85	85	85	86	87	87	87	87

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 5 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1635	1640	1645	1650	1655	1700	1705	1710	1715		
1	75	78	79	76	74						
2	81	76	75	73	70	67	64	61	61		
3	91	91	91	90	91	90	89	88	88		
4	91	91	91	91	91	90	89	88	88		
5	82	81	81	80	80	79	77	69	67		
6	84	83	83	84	83	82	81	58	58		
7											
8	87	87	87	87	87	85	84	83	83		
9	86	86	86	86	86	86	86	87	87		
10	87	87	88	88	87	87	86	85	85		
11	77	76	76	74	71	68	65	61	60		
12	80	80	80	78	77	74	70	67	66		
13	74	78	80	77	74	67	65	60	56		
14	87	87	87	87	87	86	85	85	84		
15	82	81	81	81	81	79	78	75	75		
16	85	87	87	87	85	82	79	77	76		
17	87	87	87	87	87	87	87	87	87		
18	87	87	87	87	87	87	85	85	84		
19	81	81	81	82	82	82	81	80	79		
20	82	82	82	83	84	85	84	83	83		
21	51	51	52	52	52	52	52	51	51		
22	60	60	59	58	57	56	56	54	54		
23	56	56	56	56	56	56	56	56	56		
24	54	54	54	54	54	54	54	54	54		
25	85	84	84	84	84	83	82	80	68		
26	87	87	87	87	87	85	85	83	83		

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 5 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1530	1545	1550	1555	1600	1605	1610	1615	1620	1625	1630
27	85	85	85	85	87	87	85	85	85	86	87
28	87	87	87	87	87	87	87	87	87	87	87
29	63	63	81	76	74	70	66	75	80	80	58
30		93	92	92	92	92	92	92	92	91	91
31	86	85	86	87	87	87	85	85	85	85	85
32	84	84	85	85	85	85	84	84	85	85	85
33	85	93	85	85	85	85	85	85	85	85	85
34	93	93	92	92	92	92	92	92	92	91	91
35	85	85	85	85	85	85	85	85	85	85	87
36	87	86	87	87	87	87	87	87	87	87	87
37	82	81	81	82	82	81	82	82	82	82	87
38	79	79	79	79	78	77	79	78	77	77	79
39	71	90	61	70	69	70	70	70	95	71	71
40	85	84	84	84	83	84	84	84	84	84	85
41	86	85	85	85	85	82	84	84	85	84	84
42	87	85	85	85	85	85	85	85	85	85	85
43	85	84	84	84	84	84	84	84	85	85	85
44	65	69	74	75	75	76	65	75	88	91	69
45											
46	80						80				
47	85	85	85	85	85	85	85	87	87	85	85
48	70	70	69	69	70	70	70	71	71	71	71
49	78	78	78	78	78	78	78	79	78	78	78
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 5 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1635	1640	1645	1650	1655	1700	1705	1710	1715		
27	85	85	85	85	85	84	84	80	78		
28	87	87	87	87	87	85	85	84	84		
29	48	71	77	56	49	42	42	37	36		
30	91	91	91	91	90	90	89	89	88		
31	85	84	84	84	84	83	81	75	72		
32	84	84	84	84	84	83	82	70	68		
33	85	85	85	85	87	87	87	85	85		
34	91	91	91	91	91	91	90	89	89		
35	87	87	87	87	87	87	87	87	87		
36	87	87	87	87	87	87	86	85	85		
37	83	83	83	83	84	83	83	78	78		
38	78	78	79	79	78	77	77	76	75		
39	71	72	72	72	72	72	70	69	69		
40	85	85	85	85	85	85	85	85	85		
41	84	84	84	84	84	83	82	81	81		
42	85	85	85	85	85	85	84	84	83		
43	85	85	85	86	85	85	85	85	85		
44	60	87	96	88	80	67	59	56	58		
45											
46		82			82	81	81	80	-123		
47	86	87	87	86	85	85	84	83	82		
48	71	72	72	72	72	71	70	70	69		
49	78	79	79	78	78	76	75	74	74		
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO5 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1530	1545	1550	1555	1600	1605	1610	1615	1620	1625	1630
53											
54											
55		110			64	58	57	145	151	80	5
56											
57	69	69	69	69	69	72	77	79	81	80	82
58											
59	76	76	76	76	76	77	78	80	81	82	83
60											
61											
62	91		71	78	-121	87	95	98	79	95	123
63	95	92	72	71	74	82	89	95	91	86	93
64	92	91	77	81	85	95	103	100	95	89	95
65											
66											
67	87	87	85	85	84	84	85	83	87	87	87
68	-2	16	80	69	66	62	44	88	113	108	62
69	57	55	54	68	74	84	95	90	79	78	96
70	103	149		119	101	79	88	101	137	132	100
71	56	45	47	127	131	135	138	23	-38	83	131
72	126	126	138	123	111	90	78	89	110	123	102
73	66	66	62	62	65	69	77	80	78	74	72
74	140	75	31	-41	-49	-56	-30	-13	4	16	20
75	143	77	38	3	0	-5	16	10	0	48	56
76	44	123	147	64	57	51	63	143	150	70	23
77	69	126	146	37	28	19	44	141	150	72	23
78	40	102	145	77	67	57	31	142	165	90	-5

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 5 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1635	1640	1656	1650	1655	1700	1705	1710	1715		
53											
54											
55	24	143	147	26	24	22	95	51	134		
56											
57	86	88	87	83	79	74	68	63	62		
58											
59	84	87	87	87	85	83	80	77	75		
60											
61											
62	129	54	43	14	-3	-23	-38	-13	-16		
63	104	78	68	40	24	-23	-13	-5	-1		
64	105	94	85	63	51	33	22	20	22		
65											
66											
67	89	91	90	88	85	82	76	71	69		
68	38	51	170	74	56	38	20	12	22		
69	106	85	78	58	47	38	24	26	24		
70	51	100	105	122	40	10	29	-4	-4		
71	145	-94	-71	-94	-59	-60	-128	-77	-65		
72	69	79	99	77	52	25	18	7	1		
73	80	85	83	74	68	61	51	42	39		
74	31	-14	-15	-59	-15	-10	-30	-76	-86		
75	68	-15	-19	-56	-5	-4	-34	-77	-90		
76	-41	139	144	-36	-63	-58	-26	-95	-99		
77	-34	137	142	-43	-81	-98	-16	-89	-96		
78	-54	144	158	11	-29	-59	-60	-79	-77		

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 5 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1530	1545	1550	1555	1600	1605	1610	1615	1620	1625	1630
79	-79	48	118	69	66	63	20	158	166	70	-14
80	-83	56		65	62	60	9	125	143	44	-31
81		130	181	65	56	47	86	143	123	111	69
82	47	112	155	96	90		78	175	150	117	67
83	85	150	174	40	31	23	42	173	179	65	2
84	150	111	136	74	66	58	30	100	119	66	-2
85											
86	69	139	43	112	116		124	77	51	115	136
87	63	54	47	118	122	126	131	72	43	104	134
88	77	30	31	96	100	102	101	-1	-49	78	114
89	91	65	70	139	143	146	150	56	-5	89	136
90	21	31	37	119	123	128	132	33	-17	88	119
91	28	33	38	134	139	142	143	12	-33	108	143
92	24	34	39	168	173	177	178	34	-17	138	176
93	24	40	46	154	159	163	165	28	-21	129	167
94	80	80	78	81	82	83	85	80	76	76	80
95	88	88	88	88	88	88	88	87	88	88	88
96	83	85	86	87	87	87	87	87	87	87	87
97	98	100	99	100	100	98	99	100	98	94	89
98	98	98	94	94	94	91	111	117	104	93	81
99	103	105	103	100	100	92	89	90	71	56	45
100	87	90	86	86	87	85	100	105	90		63
101	96	92	84	80	78	75	90	93	87	82	76
102	117	117	111	113	113	113	87	82	91	95	95
103	176	176	254	180	177	245		316	162	160	159
104	174	174	175	178	176	165	164	161	159	155	155

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 5 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1635	1640	1645	1650	1655	1700	1705	1710	1715		
79	-55	165	175	11	-22	-52	-52	-70	-62		
80	-69		156	9	-33	-57	-51	-59	-44		
81	7	123	134	-5	-28	-31	5	-51			
82	38	175	180	60	37	20	17	0	4		
83	-61	172	176	-59	-90	-93	-54	-122			
84	-33	91	100	15	-33	-71	-72	-61	-37		
85	-203	45	60	80	44	55	91	63			
86	137	-7	-18	-56	-90	-111	-119	-40	-48		
87	136	-1	-13	-48	-76	-95	-106	-47	-52		
88	127	-47	-59	-73	-40	-53	-93	-77	-71		
89	139	-36	-53	-92	-92	-101	-124	-92	-92		
90	128	-49	-63	-96	-88	-103	-137	-93	-93		
91	156	-56	-72	-97	-59	-75	-127	-76	-71		
92	181	49	-66	-101	-90	-105	-137	-87	-87		
93	176	-47	-65	-94	-68	-81	-124	-71	-67		
94	84	75	73	67	64	59	54	50	49		
95	88	87	87	87	87	87	86	82	81		
96	86	85	85	85	85	84	83	83	84		
97	74	72	72	67	67	64	65	66	68		
98	69	69	69	67	66	65	67	67	69		
99	75	62	83	71	79	71	73	70	71		
100	56	52	52	47	44	41	39		38		
101	63	57	56	51	48	46	46	45	47		
102	77	71	69	62	59	56	56	55	58		
103	314		165	159	155	150	144	143	147		
104	160	161	160	155	151	145	139	138	131		

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 5 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1530	1545	1550	1555	1600	1605	1610	1615	1620	1625	1630
105											
106											
107											
108											
109	-299	-299	-299	-295	-306						
110	-309	-309	-309	-307	-320						
111											
112											
113	-316	-317	-317	-311							
114	-316	-316	-316	-311							
115	84	84	85	85	85	84	84	84	84	84	84
116	85	85	85	85	85	85	85	85	85	85	85
117	94	94	94	94	94	94	94	94	94	94	94
118	94	94	94	94	94	94	94	94	94	94	94
119											
120	36	65	67	65	63	56	56	79	84	53	34
121	85	85	85	86	86	87	87	87	87	87	87
122	88	88	88	88	88	88	88	88	88	88	88
123	41	51	100	177	184	189	142		5	154	201
124	139	185	138	23	10		78	185	195	72	14
125	93	147	118	43	35	34	79	150	160	74	33
126	161	71	118	192	196	207	140	26	-23	150	187
127	83	84	85	85	86	86	86	86	86	86	86
128	86	86	86	86	86	86	86	86	86	86	87
129											
130											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 5 DATE 11-12-64

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1635	1640	1645	1650	1655	1700	1705	1710	1715		
105											
106											
107											
108											
109											
110											
111											
112											
113											
114											
115	83	82	83	83	81	81	80	73	71		
116	85	85	85	89	85	85	85	84	84		
117	94	94	94	94	94	94	95	95	95		
118	94	94	94	94	94	94	95	95	94		
119											
120	28	81	85	40	31	28	25	20	39		
121	87	87	87	87	87	86	85	84	84		
122	88	88	88	88	88	88	87	85	84		
123	207	-10	-11	-71	-87	-90	-98		-57		
124	-41	186	226	-51	-95	-90	-35	-108	41		
125	-21	142	148	-35	-52	-38	-11	-83	26		
126	200	-18	-36	-65	-40	-48	-94	-75	-63		
127	86	85	85		84	84	83	82			
128	86	86	86	86	86	85	85	80	79		
129											
130											

TEST DAY NO. 3

TEST POINT NO. 6

SIMULATED ORBIT. SOLAR

SIMULATION ON FOR 60

MINUTES; OFF FOR 30 MINUTES.

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 6 DATE 30 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1715	1720	1725	1730	1735	1740	1745	1750	1755	1800	1805
001				57					68	67	67
2	61	58	60	62	63	62	61	65	66	69	71
3	88	87	87	86	85	85	85	84	84	84	84
4	88	87	87	85	85	85	85	85	85	84	84
5	67	62	61	60	60	61	62	68	69	70	71
6	58	58	62	66	67	69	71	75	76	76	76
7											
8	83	81	80	78	78	78	78	78	78	78	78
9	87	85	85	85	85	84	84	84	83	83	83
10	85	84	83	82	81	82	82	82	81	82	82
11	60	61	61	60	60	61	63	67	68	68	68
12	66	63	62	61	62	63	65	65	65	68	66
13	56	59	58	56	56	61	65	68	66	63	61
14	84	82	82	80	79	79	79	79	79	79	80
15	75	73	72	72	72	72	73	74	74	75	75
16	76	74	71	71	72	74	75	76	76	77	78
17	87	87	87	87	86	86	87	85	85	85	85
18	84	82	82	81	81	81	81	82	82	82	82
19	79	78	76	75	74	74	74	74	74	74	74
20	83	82	82	81	81	80	80	82	82	83	84
21	51	51	51	51	51	50	50	49	49	49	49
22	54	54	54	56	56	56	56	56	56	56	56
23	56	54	54	53	53	53	53	53	53	54	54
24	54	53	53	53	53	53	52	52	52	51	51
25	68	65	65	66	67	69	70	73	74	74	
26	83	81	80	79	79	79	79	80	80	80	81

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 6 DATE 30 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1810	1815	1820	1825	1830	1835	1840	1845			
001		73	69	67		65	63				
2	70	66	65	63	62	61	59	57			
3	85	85	84	85	84	84	84	83			
4	85	85	85	85	84	84	84	83			
5	72	72	74	74	73	72	71	69			
6	77	78	78	78	78	78	77	76			
7											
8	78	79	80	80	80	79	79	78			
9	83	83	83	83	83	83	82	82			
10	82	82	82	82	82	81	81	80			
11	69	69	66	65	63	62	61	57			
12	67	69	68	66	65	63	61	58			
13	62	67	65	60	58	57	56	51			
14	80	80	81	81	81	81	81	80			
15	74	74	74	74	72	71	70	68			
16	79	80	79	78	76	74	72	69			
17	85	85	85	85	85	85	84	84			
18	82	82	82	82	82	81	80	79			
19	74	74	74	74	74	74	74	73			
20	84	84	84	85	85	84	84	82			
21	49	45	45	45	48	48	48	48			
22	56	56	54	53	51	51	51	49			
23	54	54	54	54	53	53	53	52			
24	51	51	51	51	51	51	51	51			
25	75	76	77	77	77	77	76	76			
26	81	82	82	82	82	82	81	81			

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 6 DATE 30 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1715	1720	1725	1730	1735	1740	1745	1750	1755	1800	1805
027	78	75	74	74	74	74	74	77	78	78	78
28	84	82	81	78	78	77	77	77	78	77	78
29	36	56	56	54	51	67	73	60	53	46	40
30	88	88	87	87	68	85	85	85	84	84	84
31	72	65	65	65	66	69	70	74	74	74	74
32	68	65	62	61	61	65	66	71	72	74	74
33	85	85	85	84	84	84	84	84	84	85	85
34	89	88	88	87	87	87	85	85	85	85	84
35	87	85	85	85	85	85	85	85	85	85	87
36	85	83	82	82	82	82	82	82	82	83	82
37	78	77	76	74	74	74	75	77	78	78	78
38	75	73	73	72	72	71	72		73	73	73
39	69	67	66	64	63	62	62	61	61	61	60
40	85	84	84	244	83	83	83	84	84	84	84
41	81	79	77	76	75	74	75	75	75	75	76
42	83	82	80	79	78	77	76	76	76	76	76
43	85	84	84	84	84	84	84	85	85	85	85
44	58	70	67	65	60	76	86	79	72	65	60
45											
46		79	79	78	78	78	78			78	78
47	82	81	81	81	81	81	81	80	80	80	81
48	69	69	67	66	65	65	65	62	62	61	61
49	74	73	72	72	73	73	73	71	71	70	72
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 6 DATE 30 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1810	1815	1820	1825	1830	1835	1840	1845			
027	78	78	79	79	79	78	78	78			
28	78	78	78	79	79	78	78	77			
29	53	60	45	37	37	38	35	29			
30	84	84	84	84	84	84	84	83			
31	74	75	75	76	75	75	74	74			
32	74	76	77	77	76	76	76	75			
33	85	85	86	86	87	87	87	86			
34	85	85	85	84	84	84	84	83			
35	87	87	87	87	87	87	87	87			
36	83	82	82	82	81	81	81	80			
37	78	78	78	78	78	78	78	78			
38	73	73	73	73	73	72	71	70			
39	60	60	60	59	59	59	58	57			
40	85	85	85	85	85	85	85	169			
41	76	76	77	77	77	76	77	76			
42	76	77	78	78	78	78	78	77			
43	85	85	85	85	87	85	85	85			
44	71	82	74	61	56	53	48	43			
45											
46	78	78	78	78	77	77	76	75			
47	81	81	81	81	80	79	79	78			
48	61	61	60	60	58	58	57	56			
49	73	74	72	72	71	70	69	69			
50											
51											
52											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 6 DATE 30 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1715	1720	1725	1730	1735	1740	1745	1750	1755	1800	1805
053											
054											
55	134		45	39	39	143	149	40	55	99	114
56											
57	62	59	58	61	65	70	71	72	74	75	78
58											
59	75	74	70	69	70	71	73	74	75	76	78
60											
61											
62	-16	-6	63	101	113	89	83	127	122	131	138
63	-1	9	28	66	82	87	84	82	87	98	106
64	22	28	38	69	85	87	83	80	84	94	102
65											
66											
67	69		65	66			74	77	78	54	82
68	12	29	33	33	27	90	113	89	75	54	39
69	24	22	45	72	83	78	74	78	84	93	100
70	-4	124	93	85	89	66	81	99	92	69	48
71	-65	-38	109	136	126	16	-36	117	123	146	148
72	1	48	65	56	57	80	99	113	104	85	62
73	39	31	28	33	40	49	49	44	45	51	59
74	-86	114	-46	-52	-45	-51	-36	23	24	37	33
75	-90	87	-20	-15		-22	-19	54	56	70	67
76	-99	83	42	46	51	143	147	36	25	-31	-51
77	-96	89	23	33	38	138	145	38	28	-25	-41
78	-77	90	44	20	9	142	159	35	9	-34	-57

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 6 DATE 30 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1810	1815	1820	1825	1830	1835	1840	1845			
053											
54											
55	118	64	110	122	100	90	62	44			
56											
57	82	81	79	74	70	66	63	60			
58											
59	78	81	81	80	79	78	76	73			
60											
61											
62	82	47	31	-6		-31	-261*	14			
63	97	67	52	-22	4	-7	-9	15			
64	102	81	68	48	36	26	21	29			
65											
66											
67	85	87	85	83	81	78	74	70			
68	72	79	56	34	25	19	-228*	-1			
69	91	70	60	42	33	25	30	33			
70	55	39	22	7	10	19	7	-13			
71	-17	-82	-94	-67	-109	-132	-84	-73			
72	56	78	56	29	18	16	12	-6			
73	66	65	60	52	47	41	34	26			
74		-65	-70	0	-29	-35	-68	-72			
75	-17	-55	-64	9	-26	-35	-53	-62			
76	123	-14	-57	-72	-36	-26	-78	-106			
77	117	-13	-58	-62	-28	-19	-71	-95			
78	102	31	-23	-61	-62	-62	-85	-105			

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 6 DATE 30 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1715	1720	1725	1730	1735	1740	1745	1750	1755	1800	1805
079	-62	-28	24	9	-2	160	174	20	-1	-36	-54
80	-44	9	30	9	1	135	144	-2	-20	-53	-67
81		97	48	70	80	79	118	76	68	16	-2
82	4	79	65	60	56	183	189	84	70	46	31
83		108	19	21	25	174	178		4	-54	-72
84	-37	131	46	13	3	94		22	5	-22	-36
85											
86	-48	-10	118	135	138	68	60	131	94	141	145
87	-52	-18	111	131	134	65	49	123	129	138	139
88	-71	-52	90	105	108	11	-43	100	108	129	130
89	-92	-65	106	130	134	67	16	116	125	135	138
90	-93	-63	97	113	117	37	-7	105	111	126	128
91	-71	-36	121	135	136	12	-33	129	136	157	158
92	-87	-55	156	173	174	39	-6	162	169	182	182
93	-67	-33	148	164	166	31	-16	155	162	178	181
94	49	48	54	60	63	62	59	62	65		71
95	81	79	78	78	78	78	78	80	80	80	80
96	84	84	85	87	87	88	89	90	91	91	91
97	68	94	97	100	99	100	100	100	100	89	76
98	69	90	87	100	113	120	114	97	95	84	74
99	71	72	78	86	85	86	103	66	65	74	69
100	38	52	58	74	88	100	94	71	68	63	58
101	47	73	69	75	84	89	87	82	81	74	64
102	58	86	95	90	79	71	80	98	100	87	76
103	147	155	157	160		161			164		167
104	131	151	152	155	156	156	165	163	162	162	166

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 6 DATE 30 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1810	1815	1820	1825	1830	1835	1840	1845			
079	133	24	-19	-50	-49	-50	-81	-101			
80	133	5	-24	-57	-48	-46	-103	-114			
81	40	7	-27	-39	-7	4	-41	-64			
82	162	77	39	18	14	14	0	-13			
83	155	-23	-81	-99	-64	-54	-107	-130			
84	66	29	-9	-65	-70	-71	-71	-71			
85			77	47	80	90	62				
86	29	-3		-101	-114	-122	-11	4			
87	33	-5	-25	-87	-99	-108	-22	-11			
88	-21	-70	-79	-51	-84	-99	-71	-79			
89	9	-51	-73	-101	-116	-126	-46	-52			
90	-15	-61	-82	-99	-126	-140	-59	-63			
91	-21	-81	-93	-68	-113	-133	-77	-67			
92	-5	-65	-85	-101	-129	-142	-56	-56			
93	-7	-68	-85	-77	-112	-128	-63	-55			
94	67	61	57	53	48	46	46	43			
95	80	81	81	81	81	80	80	79			
96	92	92	92	91	91	91	91	91			
97	69	63	62	61	62	65	65	67			
98	66	61	61	61	62	65	66	68			
99	66	65	69	69	69	71	70	73			
100	51	44	41	38		46	37	37			
101	60	49	46	44	44	44	45	45			
102	68	61	59	56	55	55	55	56			
103	326	184	183	179	175	172	169	171			
104	176	183	182	177	173	169	166	168			

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 6 DATE 30 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1715	1720	1725	1730	1735	1740	1745	1750	1755	1800	1805
105											
106											
107											
108											
109							-299	-296	-296	-296	-296
110							-310	-308	-308	-309	-310
111											
112								-320	-320		
113								-316	-316	-317	-317
114								-313	-313	-312	-313
115	71	66	65	65	66	68	69	72	72	73	74
116	84	83	82	81	80	79	79	79	79	79	79
117	95	94	94	93	94	94	93	94	94	94	93
118	94	94	94	94	94	94	93	94	94	93	93
119											
120	39	43	45	39	38	74	78	38	33	25	23
121	84	84	84	84	84	85	86	88	88	88	89
122	84	82	80	79	78	78	78	79	79	80	80
123	-57	-23	177	202	205	60	14	186	197	211	213
124	41	154	15	25	32	299	186	35	23	-36	-56
125	26	114	30	49	56	140	150	53	45	-13	-29
126	-63	-41	198	177	182	30	-24		173	196	199
127		83	84	85	85		88	90	90	91	91
128	79	77	77	76	76	77	77	80	80	80	80
129											
130											

GEMINI EXTRAVEHICULAR SUIT TEST

EXPERIMENT Ib

TEST DAY NO. 3 TEST POINT NO 6 DATE 30 Nov. 1964

TEMPERATURE °F

Chan. No.	TIME OF DAY										
	1810	1815	1820	1825	1830	1835	1840	1845			
105											
106											
107											
108											
109	-296	-298	-298	-299	-301	-304	-301	-301			
110	-310	-313	-313	-316	-314	-313	-315	-313			
111											
112											
113	-317	-318	-318				-319	319			
114	-313	-313	-317	-318	-318	-319	-319	-320			
115	73	74	74	74	74	74	73	72			
116	79	80	80	80	81	81	80	80			
117	93	94	93	93	93	93	93	93			
118	93	93	93	93	93	93	93	93			
119											
120	69	38	29	21	22	22	14	10			
121	89	90	90	91	90	90	90	89			
122	80	80	81	81	81	81	80	80			
123	38	-36	-60	-72	-89	-101	-56	-46			
124		-14	-68	-79	-47	-36	-87	-117			
125	119	-11	-49	-53	-20	-11	-65	-90			
126	12	-52	-70	-47	-56	-99	-82	-85			
127	91	91	91	91	91	91	173	90			
128	80	81	81	81	80	80	79	79			
129											
130											

SUIT FLOW SYSTEM
GEMINI EXTRAVEHICULAR SUIT
EXPERIMENT Ib

TEST DAY NO. 3 DATE: 11-12-64

	ROTAMETER			VOLOFLOW							
TIME	PRESSURE PSIA	TEMP °F	FLOW SCFM*	SUIT OUTLET PRESS. PSIA	TEMP °F	FLOW ACFM	SUIT LEAKAGE CC/MIN				
0800	14.7	70	3.12	3.70	74	10.0					
0830			3.11	3.69	75	12.4					
0900			3.11	3.70	77	13.2					
0930			3.11	3.70	82	12.7					
1000			3.11	3.75	101	17.0					
1030			3.13	3.70	107	17.0					
1100			3.13	3.74	111	21.1					
1130			3.17	3.65	101	20.5					
1200			3.13	3.68	85	17.0					
1230			3.11	3.69	78	14.7					
1300			3.11	3.70	90	16.0					
1330			3.14	3.75	93	16.7					
1430			3.16	3.70	80	13.8					
1500			3.16	3.75	79	11.7					
1530			3.16	3.70	90	15.8	143				
1600			3.16	3.70	90	16.0					
1630			3.16	3.69	83	16.7					
1700			3.14	3.68	80	16.4	180				
1730			3.14	3.70	97	17.1					
1800			3.14	3.65	105	19.4					
1830	14.7	70	3.14	3.70	100	17.3					

THERMAL DUMMY HEATER POWER
GEMINI EXTRAVEHICULAR SUIT TEST
EXPERIMENT Ib

TEST DAY NO. 3 DATE: 11-12-64

POWER-WATTS

TIME	VOLTS	TORSO	HEAD	LEFT ARM	RIGHT ARM	LEFT THIGH	RIGHT THIGH	LEFT LEG	RIGHT LEG	TOTAL	
0700										<10	
0745	15									10	
0800	25	11	9	4	4	2	2	2	2	36	
0810	37	24.5	21	5	5	3.5	5	4	4	72	
0845	37	19	21	5	5	3	5	4	4	66	
0930	0	0	0	0	0	0	0	0	0	0	
1845	0	0	0	0	0	0	0	0	0	0	

APPENDIX B

INSTRUMENTATION ACCURACIES

APPENDIX B

INSTRUMENTATION MEASUREMENT ACCURACIES

I. Thermocouple Temperature Measurements.

Experiment I-b specimen temperatures were measured by forty gauge copper-constantan thermocouples. Paragraph 3.4.1 describes the thermocouple attachments and signal recording methods.

Sources of error in temperature measurements on Experiment I-b arise from:

(a) Thermocouple errors due to copper and constantan wire impurities.

(b) Reference junction temperature errors.

(c) Recorder errors.

(d) Millivolt-temperature conversion errors.

(e) Differences in junction temperatures and the temperature of the materials to which the thermocouples were attached.

The accuracy of the thermocouple wire (used for this test) is stated by the manufacturer to be $\pm 1\frac{1}{2}$°F in the temperature range between -75°F and +200°F. At +200°F, a copper-constantan thermocouple has a thermoelectric power of 26 microvolts/°F. Since the thermoelectric power decreases with temperature, the maximum error in this range will be at +200°F and is equal to 39 microvolts. This is the voltage error contributed by the thermocouple wire in this temperature range.

The manufacturer of the 150°F reference junction used (Pace model BRJR13A-48TP) specifies the following tolerances for the junction: ±0.1°F accuracy, ±0.1°F stability, ±0.1°F uniformity (between multipoint junctions), and ±0.25°F stability in ambient temperatures of -30°F to +120°F. On the basis of 26 microvolts/°F for thermoelectric power, the total RMS error of the reference junction can be calculated to be:

$$\sqrt{(2.6)^2 + (2.6)^2 + (2.6)^2 + (6.5)^2} = 7.9 \text{ microvolts}$$

The Cubic Corporation specifies the following accuracies for the model A-85 A-C pre-amplifier used in the recording system:

- Gain accuracy can be set to ± 0.01%

- Gain stability is ± 0.1%.

- Noise level: ± 2 microvolts referred to input.

- Drift: $\pm$ 2 microvolts per 500 hours of operation at constant ambient temperature, referred to input.

The voltage error of the pre-amplifier due to the noise level and drift voltages is $\sqrt{8}$ microvolts. The voltage error contributed by the gain accuracy and stability and the basic digital voltmeter accuracy of .01% can be shown to be negligible in the RMS summing procedure. These errors are made further insignificant due to the digital voltmeter resolution of $\pm$ 1 digit. Since the last digit read on the meter was in units of 0.01 volts, this results in an error at least 10 times larger than the instrument basic accuracy. Thus the instrument resolution error is 0.01 volts divided by the gain factor of 1,000 which results in an error of 10 microvolts.

An additional error of approximately $\pm 0.5^{\circ}F$ or 13 microvolts was incurred as a result of reading the standard temperature conversion charts to the nearest degree.

It can be seen that the significant errors of the thermocouple wire and recording system and their magnitudes are as follows:

Thermocouple Wire	$\pm$39 microvolts
Reference Junction	$\pm$7.9 microvolts
Voltmeter Pre-amplifier	$\pm \sqrt{8}$ microvolts
Digital Voltmeter	$\pm$ 10 microvolts
Millivolt-temperature Conversion Table Interpolation	$\pm$13 microvolts

The total RMS sum of these errors is 43.2 microvolts which corresponds to the following temperature errors (exclusive of thermocouple attachment errors):

$\pm 1.7^{\circ}F$ in range of -75° to $+200^{\circ}F$

$\pm 3.1^{\circ}F$ in range of -150° to $-75^{\circ}F$

Thermocouple attachment techniques are a potential source of error. The thermocouples must be attached such that the junction temperature is the same as the temperature of the material to which they are attached. Thus, it is heat transfer considerations that result in thermocouple junction temperature errors, and therefore, signal errors. Forty gauge thermocouple wire (0.003 in. diameter) and the attachment precautions described in paragraph 3.6.1 were used during Experiment I-b to reduce temperature measurement errors attributable to thermocouple mounting techniques.

The thermocouples on the HT-1 outside surface of the suit and those on the NRC-2 insulation are most subject to attachment errors. The thermocouples on the HT-1 fabric are subject to error for the following reasons:

(a) The emissive properties of the painted thermocouple do not match those of the HT-1. Because the thermocouple absorbs and emits at a different rate, there is a tendency for the junction temperature to be higher or lower than that of the HT-1.

(b) The lateral conductance of the HT-1 fabric is relatively low. The low thermal conductance of the HT-1 aids in permitting incident radiation (e.g. simulated solar radiation) to perturb the junction temperature as discussed above.

While tests were not performed to evaluate the accuracy of suit surface thermocouples during Experiment I-b, it is believed that no gross errors were incurred by the effects discussed above. The discussion of paragraph 4.2.1 shows that measured suit surface temperatures were approximately as expected (on the basis of test solar and albedo flux calibration). Also, undocumented results of a comparative evaluation of similar thermocouple attachments performed during contract NAS 9-1163 indicated that the attachment techniques employed during Experiment I-b do not result in large errors under simulated solar irradiation. The same comparative evaluation also revealed that attachment errors were probably nil during suit cold soak tests.

II. Suit Pressure Measurement Accuracies.

The suit inlet gas pressure, helmet pressure, and the pressure drop across the suit (inlet to outlet gas pressure) were measured by a system of pressure sensors described in paragraph 3.6.1. The following error analysis of these measurements is based on data from the manufacturer of the sensors.

The suit helmet pressure and the suit inlet pressure accuracies are the same since the sensors and method of readout are identical. A root-mean-square sum of the performance characteristics of the sensors is given as an example. The manufacturer specified the following:

Maximum combined non-linearity and hysterises	.75% FS (Full Scale)
Repeatability	0.10% FS
Temperature Drift	2% FS/100°F
Temperature effect on sensitivity	1% FS/100°F

When the temperature is within 10°F of the calibration temperature, a value for the errors is 0.79% of full scale or .079 psi for the 10 psi full scale gauge.

The resolution of the recording oscillograph (Figure 20) is approximately 0.235 MV (.05 in) with a non-linearity of 1%. The oscillograph gives an error of .235 MV (resolution) and .24 MV (non-linearity). In this case, the .235 MV is equal to .09 psi and the RMS sum of the three figures is:

$$\sqrt{[(7.9)^2 + 9^2 + 9^2] \times 10^{-2}\ \mathrm{PSI}^2} = 0.15\ \mathrm{PSI}$$

The probable accuracy is then ± 0.15 PSI (1.5% of full scale).

A similar method was used on the suit pressure drop sensor and the resultant probable accuracy is ± .01 psi (2% of full scale).

III. Suit Gas Flow Accuracy.

The flowmeter used to measure suit gas flow rate was calibrated against a Brooks flowmeter which was accurate to 1% of indicated flow. The flowmeter used during the test was mounted in the flow system where the inlet pressure was ambient pressure. Thus, no pressure corrections were required.

The accuracy of the flowmeter measurements is ±3% for the conditions of use.

IV. Suit Leakage Accuracy.

Suit leakage rate measurements are described in paragraph 3.4.1 On the basis of data supplied by the flowmeter, the accuracy of the instrument as used is 2%. The readability of the instrument is approximately 0.5% resulting in an overall accuracy of +0.1% to -4.1%. When a standard flowmeter gas correction (for N_2) is applied, the accuracy is ± 2.1%.

The ionization gauges described in paragraph 3.6.1 were utilized during Experiment I-b to indicate the general area of the origin of suit leaks. The manufacturers calibrations were used for the gauges since a qualitative indication was sufficient to indicate the area of the leaks. The accuracy of the gauges is estimated to be on the order of ±15% of the indicated reading.

V. Relative Humidity and Visor Frosting.

The humidity measuring system (paragraph 3.6.1) was calibrated with a Blue M. Electric Co. Model VP100 relative humidity chamber whose accuracy is 2%. The probable accuracy of the measurements made in this test are ±10%, based upon linearity, calibration accuracy, and the method of indication.

The lamp-photo-cell visor frosting indicating system served only to give a qualitative indication so it was not quantitatively calibrated against any standard.

VI. Energy Into Visor.

The thermopile utilized for this measurement (paragraph 3.6.1) was calibrated by the Eppley Laboratories against a U.S. Bureau of Standards Class A standard. The Eppley Laboratory calibration for this instrument was used for test I-b.

APPENDIX C

VIEW FACTOR CALCULATIONS

CALCULATION OF VIEW FACTOR BETWEEN TEST PLANE

AND EARTH SIMULATOR

Diagram of approximate geometric configurations existing within the SES:

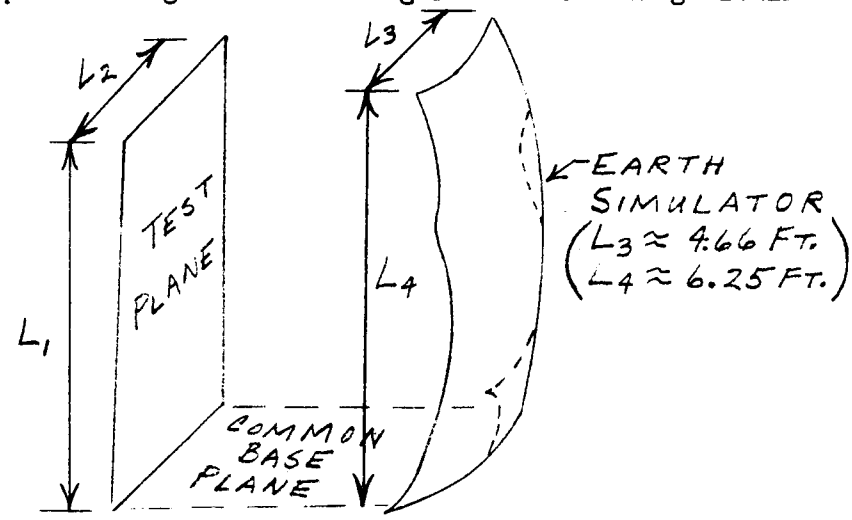


Figure C-1

Diagram of Geometric Configuration in SES

Assuming the simplest geometrical configuration available, that of an ellipse (See WADD TN 60-145), to represent the thermal dummy, the following relationships were utilized:

(a) major diameter: 15.5 in. (1.29 Ft)

(b) minor diameter: 8.9 in. (0.74 Ft)

(c) height: 60.1 in. (5.75 Ft)

(d) total surface area: 20.6 Ft^2

(e) total projected area: 10.3 Ft^2

(f) dimensions of test plane rectangle representing thermal dummy: height: 5.75 Ft (L_1); width: 1.79 Ft (L_2)

Assuming that the thermal dummy and the earth simulator can be replaced by their respective projected areas, it is now necessary to find the resulting view factor between them. The method used herein may be found in ASD Technical Report 60-119, Part I. For two parallel planes in the most general position, the following dimensions are defined with respect to Figure C-2:

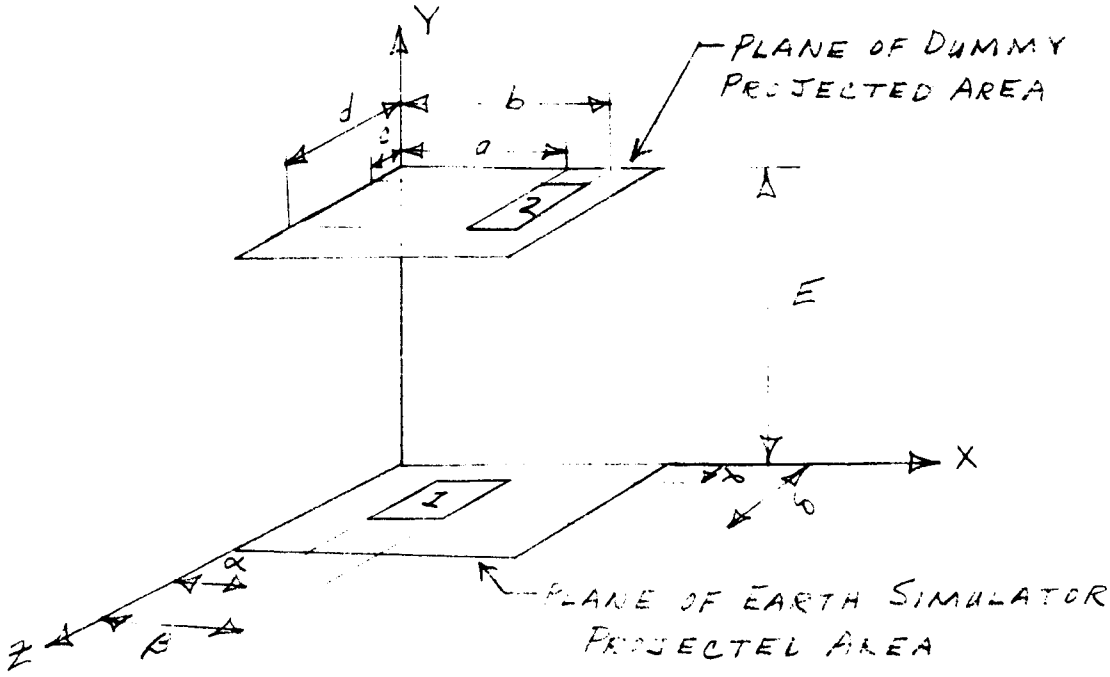


Figure C-2

Definition of Dimensions for Two Parallel Planes

For the particular case in question, the following relationships exist:

$$(1)\quad \begin{cases} \alpha = 0 \\ \gamma = 0 \\ c = 0 \end{cases}$$

$$(2)\quad \begin{cases} \beta = 4.66 \text{ Ft} \\ \delta = 6.25 \text{ Ft} \\ d = 5.75 \text{ Ft} \\ b = 3.73 \text{ Ft} \\ a = 1.94 \text{ Ft} \end{cases}$$

In general the following relationship exists (See Figure C-2):

$$(3)\quad F_{12} = \frac{1}{\pi A_1} \; f_1(\beta-b, \delta-c) - f_1(\beta-a, \delta-c) + f_1(\alpha-a, \delta-c)$$

$$- f_1(\alpha-b, \delta-c) + f_1(\alpha-b, \gamma-c)$$

$$- f_1(\alpha-a, \gamma-c) + f_1(\beta-a, \gamma-c) - f_1(\beta-b, \gamma-c)$$

$$+ f_1(\beta-b, \gamma-d) - f_1(\beta-a, \gamma-d) + f_1(\alpha-a, \gamma-d)$$

$$- f_1(\alpha-b, \gamma-d) + f_1(\alpha-b, \delta-d) - f_1(\alpha-a, \delta-d)$$

$$+ f_1(\beta-a, \delta-d) - f_1(\beta-b, \delta-d) \quad ,$$

Where

$$(4)\quad f_1(\nu, \xi) = \frac{1}{2}\left[E\nu \tan^{-1}\left(\frac{\nu}{E}\right) - \xi\sqrt{E^2+\nu^2}\,\tan^{-1}\left(\frac{\xi}{\sqrt{E^2+\nu^2}}\right)\right.$$

$$\left. - \nu\sqrt{E^2+\xi^2}\,\tan^{-1}\left(\frac{\nu}{\sqrt{E^2+\xi^2}}\right) + \frac{E^2}{2}\ln\left(\frac{E^2+\nu^2+\xi^2}{E^2+\xi^2}\right)\right]$$

The following definitions are now in order:

$$(5)\quad \begin{cases} f_1(\beta-b, \delta-c) = f(\nu_1, \xi_1) \\ f_1(\beta-a, \delta-c) = f(\nu_2, \xi_2) \\ f_1(\alpha-a, \delta-c) = f(\nu_3, \xi_3) \\ f_1(\alpha-b, \delta-c) = f(\nu_4, \xi_4) \\ f_1(\alpha-b, \gamma-c) = f(\nu_5, \xi_5) \\ f_1(\alpha-a, \gamma-c) = f(\nu_6, \xi_6) \\ f_1(\beta-a, \gamma-c) = f(\nu_7, \xi_7) \\ f_1(\beta-b, \gamma-c) = f(\nu_8, \xi_8) \end{cases}$$

$$
\begin{cases}
f_1\ (\beta-b,\ \gamma-d) = f\ (\nu_9, \xi_9) \\
f_1\ (\beta-a,\ \gamma-d) = f\ (\nu_{10}, \xi_{10}) \\
f_1\ (\alpha-a,\ \gamma-d) = f\ (\nu_{11}, \xi_{11}) \\
f_1\ (\alpha-b,\ \gamma-d) = f\ (\nu_{12}, \xi_{12}) \\
f_1\ (\alpha-b,\ \delta-d) = f\ (\nu_{13}, \xi_{13}) \\
f_1\ (\alpha-a,\ \delta-d) = f\ (\nu_{14}, \xi_{14}) \\
f_1\ (\beta-a,\ \delta-d) = f\ (\nu_{15}, \xi_{15}) \\
f_1\ (\beta-b,\ \delta-d) = f\ (\nu_{16}, \xi_{16})
\end{cases}
$$

$$
(6)\begin{cases}
f\ (\nu_1, \xi_1) = f\ [(4.66 - 3.73), (6.25 - 0)] = f\ (0.93,\ 6.25) \\
f\ (\nu_2, \xi_2) = f\ [(4.66 - 1.94), (6.25 - 0)] = f\ (2.72,\ 6.25) \\
f\ (\nu_3, \xi_3) = f\ [(0 - 1.94),\ (6.25 - 0)] = f\ (-1.94,\ 6.25) \\
f\ (\nu_4, \xi_4) = f\ [(0 - 3.73),\ (6.25 - 0)] = f\ (-3.73,\ 6.25) \\
f\ (\nu_5, \xi_5) = f\ [(0 - 3.73),\ (0 - 0)] = f\ (-3.73,\ 0) \\
f\ (\nu_6, \xi_6) = f\ [(0 - 1.94),\ (0 - 0)] = f\ (-1.94,\ 0) \\
f\ (\nu_7, \xi_7) = f\ [(4.66 - 1.94),\ (0 - 0)] = f\ (2.72,\ 0) \\
f\ (\nu_8, \xi_8) = f\ [(4.66 - 3.73),\ (0 - 0)] = f\ (0.83,\ 0) \\
f\ (\nu_9, \xi_9) = f\ [(4.66 - 3.73),\ (0 - 5.75)] = f\ (0.93,\ -5.75) \\
f\ (\nu_{10}, \xi_{10}) = f\ [(4.66 - 1.94),\ (0 - 5.75)] = f\ (2.72,\ -5.75) \\
f\ (\nu_{11}, \xi_{11}) = f\ [(0 - 1.94),\ (0 - 5.75)] = f\ (-1.94,\ -5.75) \\
f\ (\nu_{12}, \xi_{12}) = f\ [(0 - 3.73),\ (0 - 5.75)] = f\ (-3.73,\ -5.75) \\
f\ (\nu_{13}, \xi_{13}) = f\ [(0 - 3.73),\ (6.25 - 5.75)] = f\ (-3.73,\ 0.50) \\
f\ (\nu_{14}, \xi_{14}) = f\ [(0 - 1.94),\ (6.24 - 5.75)] = f\ (-1.94,\ 0.50) \\
f\ (\nu_{15}, \xi_{15}) = f\ [(4.66 - 1.94),\ 6.25 - 5.75)] = f\ (2.72,\ 0.50) \\
f\ (\nu_{16}, \xi_{16}) = f\ [(4.66 - 3.73),\ (6.25 - 5.75)] = f\ (0.93,\ 0.50)
\end{cases}
$$

Each of the terms given in equation (6) is evaluated by substituting the respective numbers into equation (3). Due to the fact that all the calculations are not only similar in nature, but also very tedious, only the first will be spelled out in detail. The others are omitted, with only the results called out. Thus,

(7) $f(\nu_1, \xi_1) = f(0.93, 6.25)$

$$= \tfrac{1}{2}\Big[(3)(0.93)\tan^{-1}\left(\frac{0.93}{3}\right) - (6.25)\sqrt{(3)^2+(0.93)^2}\,\tan^{-1}\left(\frac{6.25}{\sqrt{(3)^2+(0.93)^2}}\right)$$

$$-(0.93)\sqrt{(3)^2+(6.25)^2}\,\tan^{-1}\left(\frac{0.93}{\sqrt{(3)^2+(6.25)^2}}\right) + \frac{(3)^2}{2\ \ln}\left(\frac{(3)^2+(0.93)^2+(6.25)^2}{(3)^2+(6.25)^2}\right)\Big]$$

$$= \tfrac{1}{2}\Big[(2.79)\tan^{-1}(0.31) - (6.25)\sqrt{9.865}\,\tan^{-1}\left(\frac{6.25}{\sqrt{9.865}}\right)$$

$$-(0.93)\sqrt{48.0}\,\tan^{-1}\left(\frac{0.93}{\sqrt{48.0}}\right) + (4.5)\ \ln\left(\frac{48.865}{48.0}\right)\Big]$$

$$= \tfrac{1}{2}\Big[(2.79)(0.292) - (19.6)(1.09) - 6.45(0.0194) + (4.5)(0.0188)\Big]$$

$$= \tfrac{1}{2}\Big[0.815 - 21.7 - 0.125 + 0.0845\Big]$$

$$= \tfrac{1}{2}(-20.9)$$

(8) $f_1(\nu_1, \xi_1) = -10.45$

Similarly,

$f_1(\nu_2, \xi_2) = -12.88$

$f_1(\nu_3, \xi_3) = -11.69$

$f_1(\nu_4, \xi_4) = -28.96$

$f_1(\nu_5, \xi_5) = +2.10$

$f_1(\nu_6, \xi_6) = +0.86$

$f_1(\nu_7, \xi_7) = +1.46$

(9) $f_1(\nu_8, \xi_8) = +0.1347$

$f_1\ (\nu_9, \xi_9) = -0.988$

$f_1\ (\nu_{10}, \xi_{10}) = -10.98$

$f_1\ (\nu_{11}, \xi_{11}) = -10.12$

$f_1\ (\nu_{12}, \xi_{12}) = -12.84$

$f_1\ (\nu_{13}, \xi_{13}) = +1.94$

$f_1\ (\nu_{14}, \xi_{14}) = +0.643$

$f_1\ (\nu_{15}, \xi_{15}) = +0.055$

$f_1\ (\nu_{16}, \xi_{16}) = +0.065$

To arrive at the form factor between the earth simulator and the thermal dummy, it is necessary to substitute the values of $f_1\ (\nu n, \xi n)$ obtained in equations (8) and (9) into equation (4).

Thus:

$$(10)\quad F_{12} = \frac{1}{\pi A_1}\Big[(-10.45) - (-12.78) + (-11.74) - (-28.96) + (2.10) - (0.86) + (1.46) - (0.1347) + -9.88) - (-10.98) + (-10.12) - (-12.84) + (1.94) - (0.643) + (0.055) - (0.065)\Big]$$

$$= \frac{1}{\pi A_1}\ (71.215 - 44.4277)$$

$$= \frac{(26.79)}{\pi(6.25)\ (4.66)}$$

$$(11)\quad F_{12} = 0.286,$$

Where F_{12} is the view factor from the earth simulator to the thermal dummy. By the reciprocity theorem ($A_1\ F_{12} = A_2\ F_{21}$) the reciprocal view factor can be obtained; that is, the view factor from the thermal dummy to the earth simulator. Hence,

$$(12)\quad F_{21} = \frac{(6.25)\ (4.66)\ (0.286)}{(10.3)} = 0.809$$

REFERENCES

1. Drummond, A. J., "Examination of Spectral Energy Distribution of Mercury-Xenon Lamps," The Eppley Laboratory, Inc., 27 June 1962.

2. Stevenson, J. A. and Grafton, J. C., "Radiation Heat Transfer Analysis for Space Vehicles," ASD TR 61-119, Part I. Space and Information Systems Division, North American Aviation, Inc., December 1961.

3. Mouritsen, T. E., "Test Plan, Gemini Extravehicular Suit Performance and Thermal Response Test, Exp. Ib," Report 00.520, LTV Astronautics Division, 18 October 1964.

4. Johnson, E. S., "The Solar Constant," U. S. Naval Research Laboratory, Journal of Meteorology, Vol. II, No. 6, December 1954.

5. Poradek, J. C., "Measurement of Solar Reflectance and Transmittance on HT-1 Nylon and on Dacron Noncoated Fabrics," Report No. MSC-IN-64-EC 41-3, December 3, 1963 to January 15, 1964.

6. Hnilicka, M. P., "Engineering Aspects of Heat Transfer in Multilayer Reflective Insulation and Performance of NRC-2 Insulation," Paper Presented at 1959 Cryogenic Engineering Conference, University of California at Berkley, September 2-4, 1959.

7. Goodnight, F. H., "Thermal Tests of a Prototype Gemini Extravehicular System," Report No. 00.478, LTV Astronautics Division, 6 August 1964.

8. "Design of Thermal Protection Systems for Liquid Hydrogen Tanks," Report No. 65008-03-01, Contract NAS 5-664, Arthur D. Little, Inc.