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USER'S MANUAL

FOR

A COMPUTER PROGRAM FOR THE EMULATION/SIMULATION OF A SPACE STATION ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM

(ESCM)

BY

HAMILTON STANDARD

DIVISION OF UNITED TECHNOLOGIES CORPORATION

WINDSOR LOCKS, CONNECTICUT

PREPARED UNDER CONTRACT NO. NAS 1-17397

FOR

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

LANGLEY RESERACH CENTER

HAMPTON, VIRGINIA

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ABSTRACT

This manual describes how to use the Emulation/Simulation Computer Model, ESCM. Based on G189A, ESCM computes the transient performance of a Space Station atmospheric revitalization subsystem (ARS) with CO_2 removal provided by a solid amine water desorbed subsystem called SAWD. Many performance parameters are computed some of which are cabin CO_2 partial pressure, relative humidity, temperature, O_2 partial pressure, and dew point. The program allows the user to simulate various possible combinations of man loading, metabolic profiles, cabin volumes and certain hypothesized failures that could occur.

FOREWARD

This User's Manual has been prepared by Hamilton Standard, Division of United Technologies Corporation for the National Aeronautics and Space Administration's Langley Research Center in accordance with Contract NAS 1-17397, "Development of an Emulation/Simulation Computer Model of a Space Station Environmental Control and Life Support System (ECLSS)". This manual describes the use of the computer model.

Appreciation is expressed to the Technical Monitors Messrs. John B. Hall, Jr. and Lawrence F. Rowell of the NASA Langley Research Center for their guidance and advice.

This manual was prepared by Mr. James L. Yanosy, Program Engineer. The program was conducted under the direction of Mr. Harlan Brose, Program Manager and Mr. Albert Boehm, Assistant Program Manager. Special thanks is given to Mr. Gordon Allen for his contributions to the development of the analytical model of the Solid Amine Water Desorbed process. Thanks are also extended to Messrs. Raymond Trusch and Edward O'Connor for their assistance and technical advice.

Table of Contents

List Of Tables

List Of Figures

1.0 INTRODUCTION

1.1 Background

ESCM is a computer model which was developed to demonstrate the utility of a major portion of the Emulation/Simulation, Sizing, and Technology Assessment Program (ESSTAP). See Reference 1. ESSTAP is a concept for software tools that will support the total engineering process of the Space Station beginning with concept definition and continuing on through mission operations. The interaction of the software tools with the design and operational phases of a flight system is shown in Figure 1. The philosophy of this software concept is to have the analysis software for each step in the design process precede development of hardware in order to provide the greatest design and cost benefits.

Of the many systems in the Space Station, the Environmental Control and Life Support System (ECLSS) was selected to demonstrate the utility of the ESSTAP concept because of its complexity (number of components and dynamic operational capability), availability of operational data for checkout, and growth potential. The ESCM program was targeted to evaluate and demonstrate the benefits of phases 2 through 4 software. For this purpose, an evaluation of the six major ECLSS functions was performed as published in the program document "ESCM-EM-02". As a result of this study, a subgroup of the Air Revitalization Subsystem (ARS) shown in Figure 2 was selected for modelling because of its dynamic complexity, growth potential, design tool utility, and the independent nature of the ARS compared to other subsystems.

The resulting ESCM model has been used to demonstrate the use of a computer program in the design, development, and test of applicable development hardware. Specifically, through the use of the program, design hardware and software can be verified, Failure Mode and Effect Analysis (FMEA) can be assisted, and test planning can be technically improved.

1.2 Computer Program Overview

The ESCM Computer Program consists of five parts, as shown in Figure 3. Like a generalized heat transfer program, ESCM uses the G189A framework to set up the input data, uses the G189A subroutine library for models of many of the components, and lastly, uses the G189A executive routines to take the input data and component subroutines and compute the solution. However, particular to the ESCM program are: (1) the GPOLY1 and GPOLY2 subroutines which

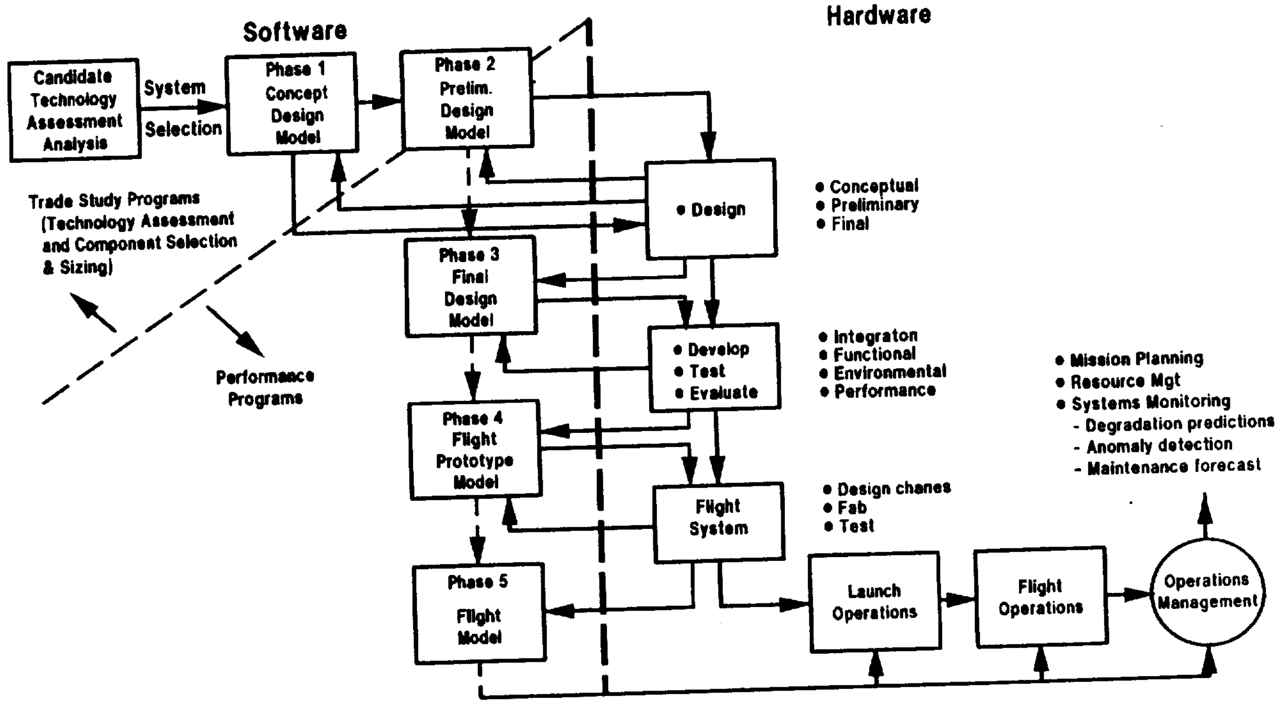

Figure 1

Application Of Software Tools To The Design And Operational Phases Of A Flight System

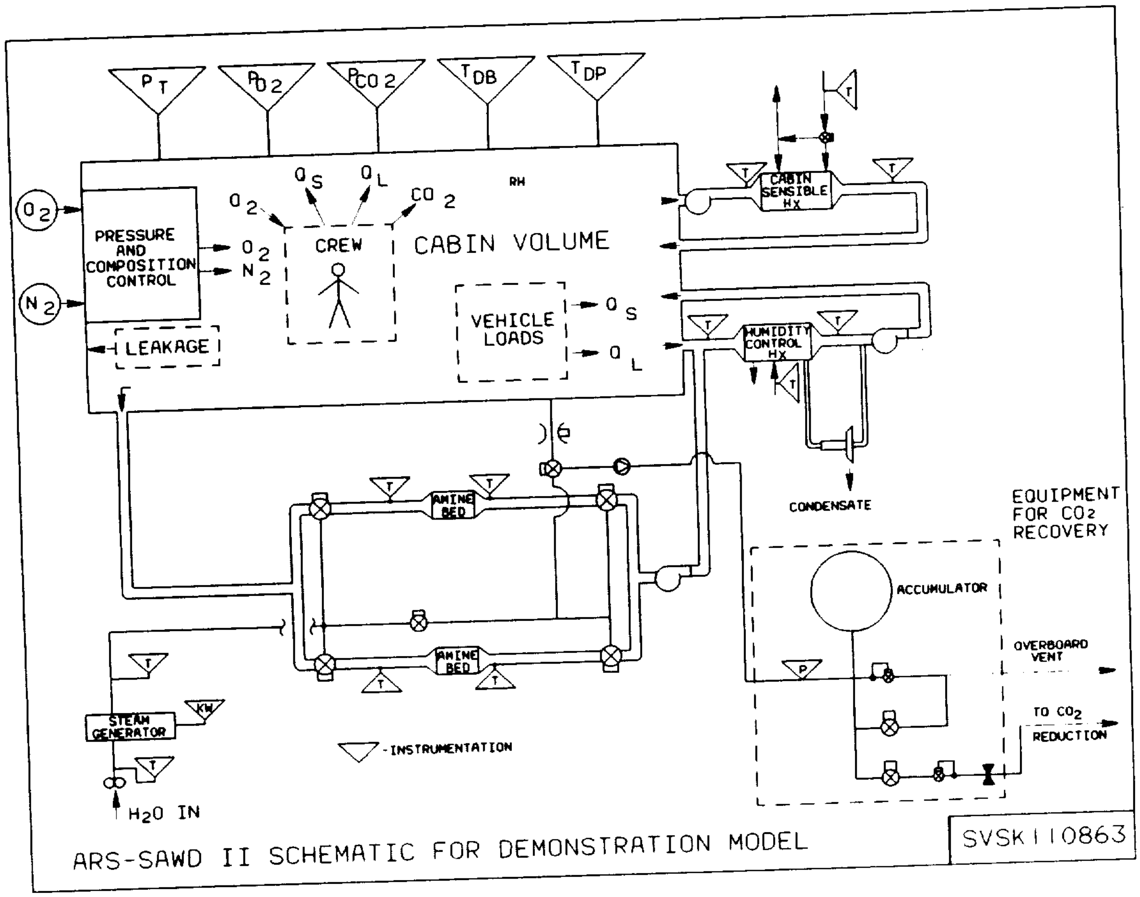

Figure 2

ARS - SAWD II Schematic For Demonstration Model

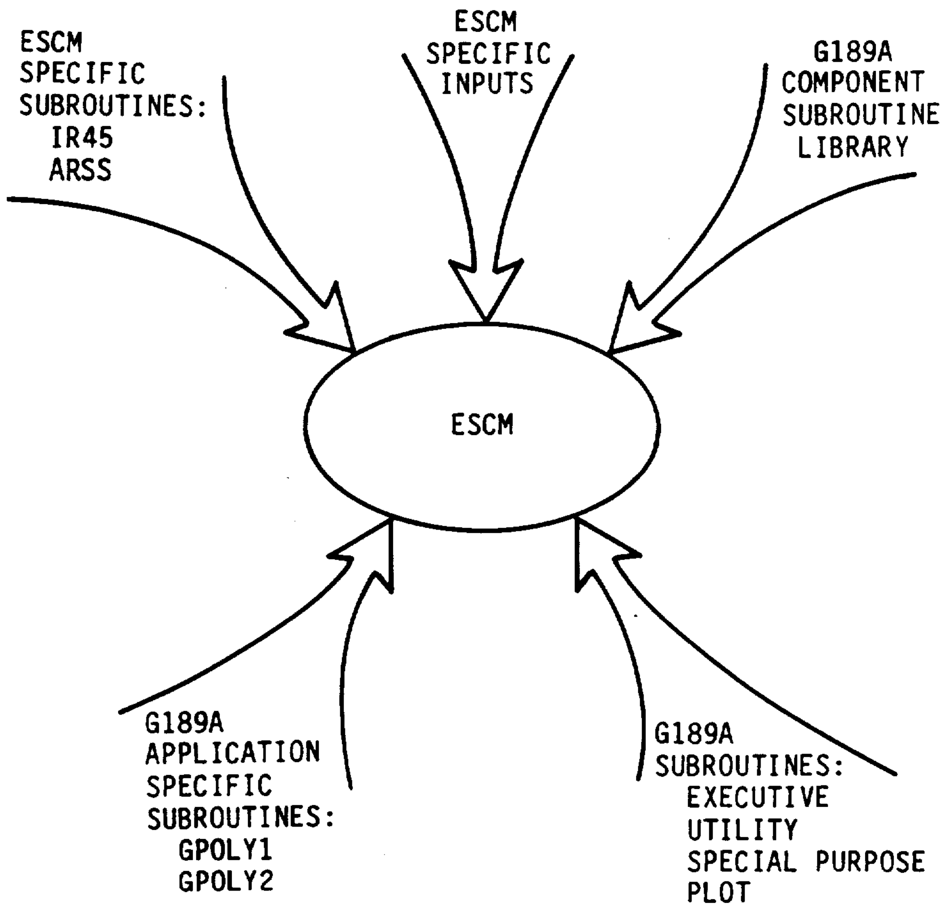

Figure 3
Overview Of ESCM Computer Program

1.2 Computer Program Overview (Continued)

define the control logic for the ARS subgroup, (2) the newly developed component subroutine for the Solid Amine Water Desorbed (SAWD) bed, (3) the ARS subroutine which provides computer generated schematics of the ARS subgroup with important performance parameters and tabular printoff to a terminal screen for interactive operation, and (4) the input data file which defines the ARS subgroup for G189A and which contains many performance constants and input parameters.

ESCM starts with input data which defines the ARS subgroup components and plumbing and combines this data with various program options. Typical input parameters are:

(1) Number of men
(2) Cabin volume
(3) Cabin temperature
(4) Equipment heat load
(5) Cabin leakage
(6) Metabolic profiles

ESCM then solves each of the components in turn per the sequence specified by the user. After all components have been solved for a particular time step, typical performance parameters are displayed to the screen and a schematic of the ARS subgroup is saved for a hardcopy printoff. Of course, the user may select the frequency of printoff. Typical computed performance parameters are:

(1) Cabin CO_2 mmHg
(2) Cabin O_2 Partial pressure
(3) Cabin relative humidity
(4) Cabin temperature
(5) Cabin total pressure

After the display to the screen, the time step is incremented, GPOLY1 is solved, all the component subroutines are solved again per the specified sequence, GPOLY2 is solved, and lastly ARS subroutine is invoked to display and save important performance parameters. The process is repeated until the time specified by the user is reached.

2.0 DESCRIPTION OF HARDWARE AND MODEL

ESCM is a computer program which emulates/simulates a Space Station Environmental Control and Life Support System (ECLSS). To demonstrate its utility only a portion of the ECLSS had to be modeled. The portion modeled is a subgroup of the ARS and is shown in Figure 2. This section will provide a description of the system to be modeled and give a description of the ESCM computer program.

2.1 Description of System to be Modeled

As stated above, the system modeled is a subgroup of the ~~atmospheric~~ revitalization subsystem. The major elements are the cabin, the crew, a sensible heat exchanger, a humidity control heat exchanger, fans, a SAWD carbon dioxide removal system, and a two gas controller.

The cabin is a volume of user specified size which houses the crew, two gas controller, and certain user specified vehicle loads representative of test equipment. The user may also specify air leakage out of the cabin.

The crew of user specified size and metabolic loading breathes in oxygen from the cabin air and releases carbon dioxide and water vapor. The crew also gives off sensible heat to the cabin air.

Cabin air is drawn off by one fan to pass the air through a heat exchanger which removes sensible heat from the air. In the heat exchanger, the air gives off its heat to coolant water which enters the heat exchanger at a user specified temperature. The cabin air temperature controller will control the flow of water to maintain the desired cabin air temperature. The heat exchanger is a plate-fin type similar to that on the Shuttle.

Another fan is used to draw air from the cabin to send it in turn to a humidity control heat exchanger. Air in this heat exchanger loses its heat to coolant water which enters the heat exchanger at a user specified flow and temperature. Water vapor in the air is condensed in this heat exchanger. A portion of the main air stream with condensed vapor is sent to a water separator where the condensed vapor is removed. This humidity control heat exchanger also receives air flow directly from the SAWD carbon dioxide removal system. Thus the effect of any moisture from the SAWD system on cabin relative humidity is lessened.

The last fan draws air from the cabin for use by the SAWD carbon dioxide removal system. This carbon dioxide removal system contains two amine beds, solenoid valves, an accumulator, a water pump, steam generator, a controller, and necessary plumbing and instrumentation. In general, the system operates to remove carbon dioxide continuously by alternately absorbing and desorbing each bed. The sequence of operation is shown in Table 1 for the startup cycle and the first full cycle. At startup, bed #2 desorbs while bed #1 is on standby. Initial flow from the desorbing bed #2 flows to the cabin until the flow reaches 0.01 cfm as detected by the flow sensor. Then, the flow is directed to an accumulator. Pressure builds in the accumulator until 24 psia is reached. At this pressure, flow is permitted to leave at a controlled rate to a carbon dioxide reduction process. If pressure builds beyond 30 psia, carbon dioxide is dumped overboard to lower the pressure below 30 psia. During desorb, the pressure in the accumulator back pressures the desorbing bed. A check valve prevents any back flow from the accumulator to the beds.

Table 1
SAWD Operation From Startup

	Bed #1	Bed #2	Fan	Steam	Desorb Flow To Cabin Or Accumulator	Event To Switch To Next Stop
Startup Cycle	---	Desorb	Off	On	Cabin	Flow Sensor $\geq$ 0.01 cfm
	---	Desorb	Off	On	Accumulator	Bed #2 exit temp $\geq$ 180°F
	---	Bleed to #1	Off	Off	---	Time in bleed = 120 sec.
	---	Energy Trans	On	Off	---	Time in E.T. = 300 sec or Bed #1 exit temp $\geq$ 130°F
Cycle #1	Desorb	Absorb	On	On	Cabin	Flow Sensor $\geq$ 0.01 cfm
	Desorb	Absorb	On	On	Accumulator	Bed #1 exit temp $\geq$ 180°F
	Standby	Absorb	On	Off	---	Absorb time reaches tab = f(Cabin RH)
	Bleed to #2	---	Off	Off	---	Bleed time = 120 sec
	Energy Trans	---	On	Off	---	E.T. time = 300 sec or Bed #2 exit temp $\geq$ 130°F
	Absorb	Desorb	On	On	Cabin	Flow Sensor $\geq$ 0.01 cfm
	Absorb	Desorb	On	On	Accumulator	Bed #2 exit temp $\geq$ 180°F
	Absorb	Standby	On	Off	---	Absorb time reaches tab = f(Cabin RH)

2.1 Description of System to be Modeled (Continued)

Desorbing in bed #2 continues until its exit temperature reaches 180°F. At that point, fan flow and steam flow cease and the pressure in bed #2 slowly bleeds to bed #1 for 120 seconds. Then, the fan starts flowing cabin air through bed #2 to bed #1 and then back to the cabin. As the air passes through bed #2 it pushes the steam in bed #2 ahead to bed #1 and thereby heats bed #1. This energy transfer continues for five minutes or until the bed #1 exit temperature reaches 130°F, whichever occurs first.

After energy transfer is completed, steam begins to flow to bed #1 to desorb it while valve positions are changed to direct air flow exiting bed #2 back to the cabin. Desorbing continues in bed #1 with any flow directed back to the cabin until the flow reaches 0.01 cfm. Then, the desorb flow is directed to the accumulator. The process continues as described previously but with bed #1 desorbing and bed #2 absorbing. Absorbing in bed #2 continues for a time which is determined directly from the average cabin relative humidity measured during the past desorption of bed #2. The time for successive absorption cycles is determined from the average cabin relative humidity measured during the previous absorption cycle. The beds then alternate through this absorbing-desorbing sequence as directed by the SAWD controller.

Air from the SAWD system enters the humidity control heat exchanger where any moisture is removed. The air returning to the cabin from the SAWD system now has less carbon dioxide.

Cabin air total pressure and oxygen partial pressure are controlled by a two gas controller patterned after that used by the Space Shuttle. It admits oxygen and nitrogen as required to maintain the total pressure at 14.7 psia and the oxygen partial pressure at 3.09 to 3.23 psia. Details of the control logic are shown in Table 2. The opening and closing curves are input by the user as part of the input table data. See Section 4.0.

2.2 Description of Model

The previously described system is modeled for use in the ESCM computer program as shown in Figure 4. Since ESCM uses G189A as a basis, the Figure 4 schematic is set up in G189A format. Therefore, each component is given a number, and the entering and exit flow paths are given a letter P or S to designate the path into or out of the component as primary or secondary.

Table 3 identifies the component subroutine used for each component and also presents the G189A subroutine number. All components are labelled in Figure 4 except those indicated by a small circle or small square. If the small circle has two flows entering and one leaving, the component is a mixer. It simply mixes the two entering flows. If the small circle has one entering flow and two leaving, the component is a splitter. It splits the entering flow into the two paths per a user provided split ratio. Of course, all the

Table 2

Controller Logic For 14.5 psi Shuttle Two Gas Controller

Condition					Action			
Initial Oxygen Valve Status	Initial Nitrogen Valve Status	Last Valve Opened	PT (psia)	PO_2 (psia)	Oxygen Valve Status	Nitrogen Valve Status	O_2 Flow Per Opening Or Closing Curve	N_2 Flow Per Opening Or Closing Curve
N/A	N/A	N/A	≥ 14.819	---	Closed	Closed	---	---
N/A	N/A	N/A	≥ 14.813	≥ 3.23	Closed	Closed	---	---
Closed	N/A	N/A	<14.819	<3.09	Open	Closed	Opening	---
Open	N/A	N/A	<14.819	<3.09	Open[1]	Closed	Closing[1]	---
Closed	N/A	Oxygen	<14.819	$3.09 \leq PO_2 < 3.23$	Open	Closed	Opening	---
Open	N/A	Oxygen	<14.819	$3.09 \leq PO_2 < 3.23$	Open[1]	Closed	Closing[1]	---
N/A	Closed	Nitrogen	<14.819	$3.09 \leq PO_2 < 3.23$	Closed	Open	---	Opening
N/A	Open	Nitrogen	<14.819	$3.09 \leq PO_2 < 3.23$	Closed	Open[1]	---	Closing[1]
N/A	Closed	N/A	<14.813	≥ 3.23	Closed	Open	---	Opening
N/A	Open	N/A	<14.813	≥ 3.23	Closed	Open[1]	---	Closing[1]

1 When flow calculated by closing curve = 0.0, valve closes.

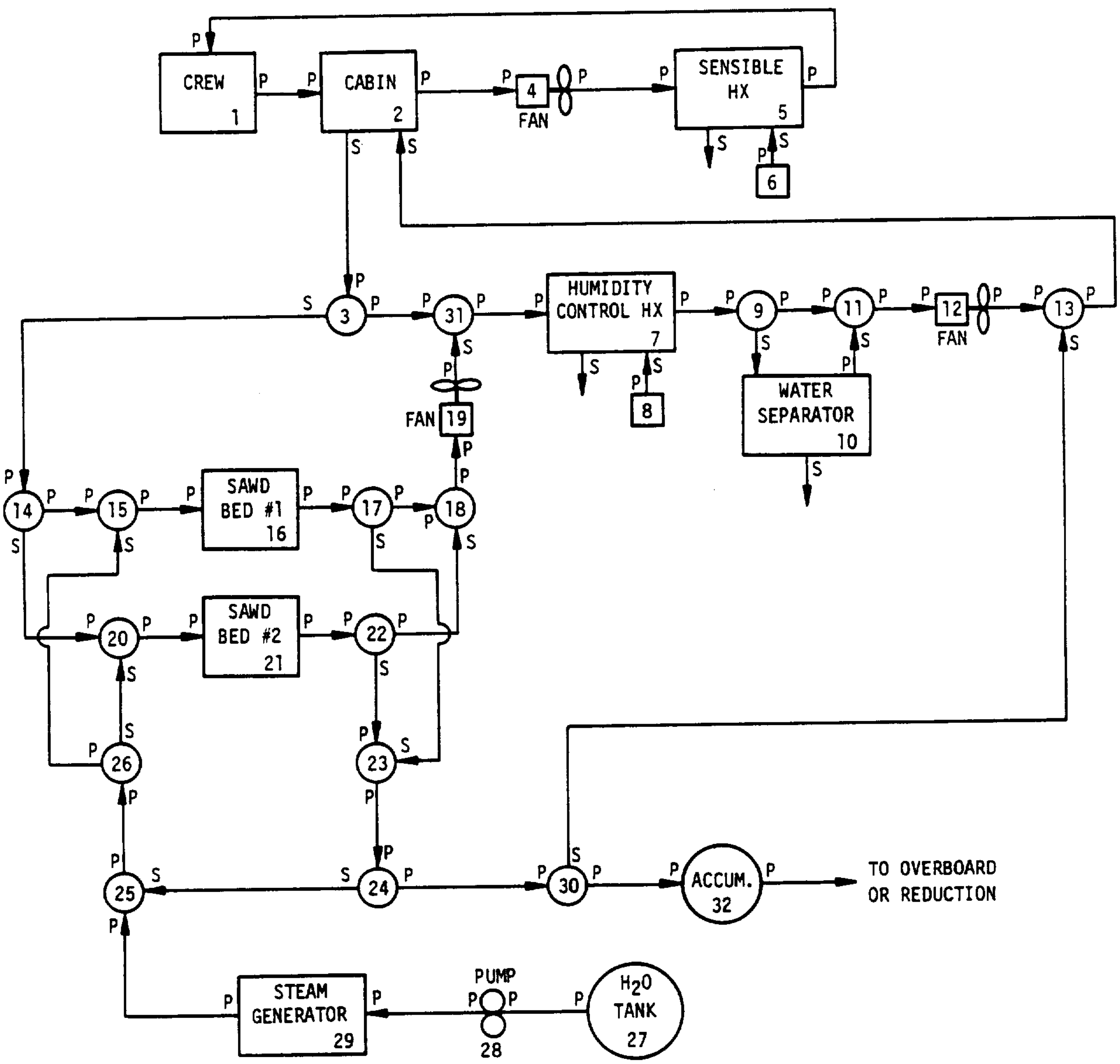

Figure 4

ARS - SAWD II Schematic As Modeled In The ESCM

Table 3

ESCM Component Number - Subroutine Cross Reference Table

Component No.	Component Description	Subroutine Name	Subroutine No.
1	Crew in cabin	SUITS	2
2	Cabin	CABIN	1
3	Split to humidity control HX or SAWD	SPLIT	10
4	Cabin Sensible HX fan	FAN	23
5	Cabin sensible HX	ANYHX	4
6	Cabin sensible HX cooling fluid boundary	ALTCOM	49
7	Cabin condensing HX	ANYHX	4
8	Condensing HX cooling fluid boundary	ALTCOM	49
9	Split to water separator or bypass	SPLIT	10
10	Water separator	ALTCOM	49
11	Mix water separator and bypass	GASMIX	6
12	Condensing HX fan	FAN	23
13	Mix SAWD and condensing HX flows	GASMIX	6
14	Split to SAWD bed #1 or #2	SPLIT	10
15	Mix steam or cabin air to bed #1	GASMIX	6
16	SAWD bed #1	IR45	73
17	Split to cond. HX or CO2 recovery	SPLIT	10
18	Mix bed #1 and bed #2 flows	GASMIX	6
19	SAWD fan	FAN	23
20	Mix steam or cabin air to bed #2	GASMIX	6
21	SAWD bed #2	IR45	73
22	Split to cond. HX or CO2 recovery	SPLIT	10
23	Mix bed #1 and bed #2 exit gases	GASMIX	6
24	Split to preheat or CO2 accumulator	SPLIT	10
25	Mix steam generator and preheat streams	GASMIX	6
26	Split to SAWD bed #1 or #2	SPLIT	10
27	Water supply tank	TANKG	30
28	Water supply pump	PUMP	22
29	Steam generator	SMGEN	27
30	Split desorbed gas to cabin or CO2 accumulator	SPLIT	10
31	Mix cabin air and SAWD air	GASMIX	6
32	Carbon dioxide accumulator tank	TANKG	30

2.2 Description of Model (Continued)

entering flow could be directed to take one of the exiting flow paths. Splitters and mixers are used to represent valve functions. The small square components are alternate components and simply provide boundary condition water flows and temperatures to the two heat exchangers.

3.0 DESCRIPTION OF ESCM COMPUTER PROGRAM

The total ESCM program consists of eight entities:

- G189A executive subroutines
- G189A utility subroutines
- G189A special purpose subroutines
- G189A plot subroutines
- G189A component subroutines
- G189A application specific subroutines GPOLY1 and GPOLY2
- G189A subroutine additions for ESCM: IR45, ARSS
- G189A input specific for ESCM

While a detailed discussion of the sequence of operation G189A can be found in Reference 3 for the interested user, a brief description is presented here and shown in Figure 5.

(1) At the start of execution, the G189 executive subroutines process the input data by allocating the data storage space and dynamically loading the integer and floating point data into a large single array; the K and V array.

(2) After the input data is processed, a printoff of the component initial values and the solution path is generated.

(3) From the input solution path, the executive subroutines retrieve and unpack from the large single array the first component's integer instruction data; and the executive subroutines retrieve from the large single array and store into small working arrays the component floating point data.

(4) Thermophysical property data (specific heat, molecular weight, thermal conductivity, and viscosity) for the component source streams are evaluated using G189A utility subroutines.

(5) A transfer to the user coded subroutine GPOLY1 is made to allow data modifications or logic changes to be incorporated prior to component solution.

(6) The executive routines then transfer computer operation to the proper subroutine for the component.

(7) Following component solution, a transfer to the user coded subroutine GPOLY2 is made to allow data modifications or logic charges after component solution.

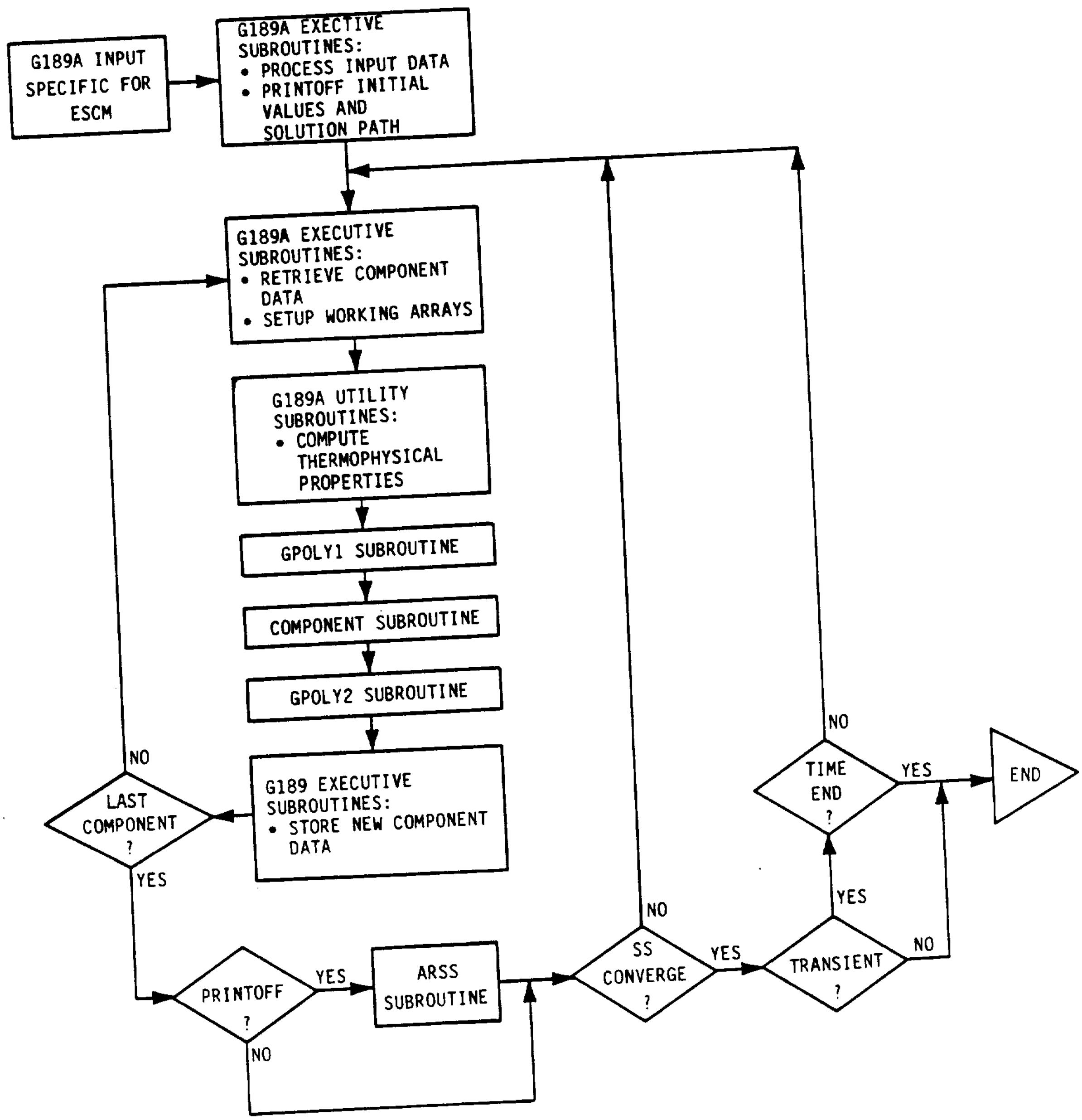

Figure 5
Flow Chart Of ESCM Computer Program Operation

(8) The new component status and data are returned to the large single array.

(9) Steps (3) through (8) are repeated for each component in the solution path.

(10) A printoff of the ARS subgroup schematic is made by subroutine ARSS for every steady state pass and after every user specified number of time steps in transient runs.

(11) Steps (3) through (10) are repeated until a steady state solution is achieved; then, if specified, a transient begins and will end at the user specified time.

The following sections present a description of the seven entities previously mentioned.

3.1 G189A Executive Subroutines

The executive subroutines consist of the master control block subroutine ECLST and the input editor subroutines: IEDIT, CASDAT, BASDAT, MERGEC, KVREAD, TABLRD, SCRUP, ENKODE/DEKODE, IVBLOK, ULOSE, UWIN, and DBLOCK.

The main program is called X189#A and simply transfers operation to the master control block subroutine ECLST.

Complete descriptions of these subroutines can be found in Reference 3.

3.2 G189A Utility Subroutines

Utility subroutines are those subroutines which are general enough in form and application that they could be used by a number of subroutines. The utility subroutines used by ESCM are presented in Table 4; a complete description of these subroutines can be found in Reference 3.

3.3 G189A Special Purpose Subroutines

Special purpose subroutines are lower level subroutines which are generally called by either the executive subroutines or by a component subroutine. These subroutines were created for one particular purpose and are not general enough to be classified as a Utility Subroutine. The special purpose routines used by ESCM are presented in Table 5; a complete description of these subroutines can be found in Reference 3.

3.4 G189A Component Subroutines

Each particular type of component in an Environmental Control and Life Support System is simulated by a component subroutine. The G189A component subroutines used by ESCM are presented in Table 6, a complete description of these subroutines can be found in Reference 3.

Table 4

G189A Utility Subroutines

Subroutine Name	Description
ABRPRT	A, B, and R Array Printout
CYCLE	Cycle Displacement Time
ELAPSE	Central Processor and Peripheral Processor Elapsed Times
ESTIM	Reestimator for Iterative Calculations
FLØARY	Selects and Stores Component Flow Data into 19 Member Flow Array
FLØSUM	Sums Constituent Flows to Obtain Total Flows within a 19 Member Flow Array
HBALNC	Computes Adiabatic Mixture Conditions for a 19 Member Flow Array
HF	Computes Specific Enthalpy of Liquid Water
HG	Computes Specific Enthalpy of Water Vapor
KK	Locates and Returns Value Stored in Specified Component K Array Reference Location
LK	Calculates and Returns K Array Address of Specified Component K Array Reference Location
LV	Calculates and Returns V Array Address of Specified Component V Array Reference Location
PRØP	Calculates Thermo-Physical Property Data for a 19 Member Flow Array
PRTIME	Accesses and Prints Computer Clock Time
PSAT	Determines Water Vapor Pressure at a Specified Temperature
QSURR	Determines Heat Loss to the Surroundings for a Component
RH	Calculates Relative Humidity and Dew Point of a 19 Member Flow Array
SHELL	Unpacks Modular K Array Data

Table 4 (Continued)

G189A Utility Subroutines

Subroutine None	Description
SK	Stores Integer Data into a Specified Component K Array Reference Location
STØPIT	Places End-of-File Mark on Output Tape (Normal Run Termination Subroutine)
SV	Stores Floating Point Data into a Specified Component V Array Reference Location
TAPEIT	Used to Dump D/V Array Data onto File
TSAT	Determine Saturation Temperature of Water Vapor at a Specified Pressure
VALUE	Table Interpolation Function
VARPRT	Labelled Printout of all Components' K and V Array Data
VDATPT	Component's V Array Data Printout
VV	Locates and Returns Value Stored in Specified Component V Array Reference Location
WASP	Calculates Thermodynamic and Transport Properties of Water and Steam

Table 5

G189A Special Purpose Subroutines

Subroutine None	Description
ALFRED	Error Mode Output Format
CØMSØL	Component Subroutine Selector
CØ2CP	Computes Effective Specific Heat for Precipitation of Carbon Dioxide in a Heat Exchanger
EFFCP	Effective Specific Heat for Heat Exchanger Calculations
HXPER	Steady State Heat Exchanger Performance
VLH2Ø	Calculates Equilibrium Pressure of Water Vapor on IR-45 Solid Amine Resin

Table 6

G189A Component Subroutines

Subroutine None	Description
ALTCØM	Alternate Component
ANYHX	Compact Heat Exchanger
CABIN	Cabin or Compartment
DUCT	Length of Gas Circuit Ducting
FAN	Fan, Blower, or Compressor
GASMIX	Gas Mix
LIQMIX	Liquid Mix
PUMP	Pump
SMGEN	Steam Generator
SPLIT	Generalized Split
SUITS	Crewmen in Suits or Cabin
TANKG	Storage Tank
VACPMP	Vacuum Pump

3.5 G189A Plot Subroutines

Two subroutines are used to save data for use by a separate plotting routine. These subroutines are MAINPL and PLEDIT both of which are described in Reference 3.

3.6 GPOLY1 and GPOLY2 for ESCM

GPOLY1 and GPOLY2 are coded for the ESCM application to make data modifications, logic changes, and solution path changes. GPOLY1 is executed before the component subroutine while GPOLY2 is executed after the component subroutine.

Both GPOLY subroutines are setup in the same manner. The standard construction is:

```
IF (N .NE. 3) GO TO 399
      .
      .
      .
      .
399 CONTINUE
```

N is the component number which is about to be or just was analyzed. This construction causes logic to be performed only for the component presently being analyzed. A construction of this type is written for each component where desired by the user.

3.6.1 GPOLY1

The GPOLY1 subroutine in ESCM essentially simulates the control functions required for the ARS subgroup modelled. These control functions are:

(1) control of oxygen and nitrogen addition to maintain desired levels of oxygen partial pressure and cabin total pressure.

(2) control of cooling flow to sensible heat exchanger to maintain desired cabin temperature.

(3) control cycling and total operation of SAWD carbon dioxide removal system.

The following are input once at the first execution of GPOLY1:

DTIME	= Time step, seconds
VV(2,184)	= Printoff frequency, time steps per printoff
VV(16,93)	= Total weight of foam in bed #1, lbm
VV(16,94)	= Specific heat of foam in bed #1, Btu/lbm-F
VV(16,79)	= Total canister thermal mass in bed #1, lbm
VV(16,84)	= Specific heat of canister in bed #1, Btu/lbm-F
VV(16,78)	= Total dry resin weight in bed #1, lbm
VV(16,66)	= Specific heat of dry resin in bed #1, Btu/lbm-F

3.6.1 GPOLY1 (Continued)

The following are input and output from GPOLY1 before solution of component number 1 (the crew):

Input:

TIME	= Time in transient, seconds
VV(2,104)	= Cabin temperature, °F

Output:

R(66)	= Crew total sensible heat, Btu/hr
R(67)	= Crew total latent heat, Btu/hr
R(82)	= Crew total metabolic rate, Btu/hr

The following are input and output from GPOLY1 before the solution of component number 2 (the cabin):

Input:

STEADY	= Logical variable denoting if steady state calculations are now being performed or not.
KSYSPAS	= Integer variable which counts the number of passes of the computer program through the solution of all the components.
IFREQ	= The number of computer passes to be performed per printoff using ARSS subroutine.
DTIME	= Current time step, seconds.
R(4)	= Total pressure of flow leaving cabin via the primary flow path.
R(94)	= Cabin partial pressure of oxygen, psia.
R(180)	= Flag denoting whether oxygen or nitrogen was last gas admitted through two gas controller. 1 = nitrogen, 0 = oxygen.

Output:

R(165)	= Flow oxygen into cabin, lb/hr
R(166)	= Flow of nitrogen into cabin, lb/hr

The following are input to and output from GPOLY1 before the solution of component number 3 (Splitter for flow from cabin):

3.6.1 GPOLY1 (Continued)

Input:

STEADY = Logical variable denoting if steady state calculations are now being performed or not.

KSYPAS = Integer variable which counts the number of passes of the computer program through the solution of all the components.

VV(19,1) = Total gas flow through SAWD fan, lb/hr.

VV(24,1) = Total flow to splitter from SAWD beds, lb/hr. Flow goes to other bed or to CO_2 accumulator.

VV(12,1) = Total flow (lb/hr) through cabin condenser heat exchanger fan.

VV(10,67) = Condensate removed (lb/hr) in cabin condenser heat exchanger.

Output:

R(65) = Splitting ratio in splitter (ratio of flow to SAWD to total secondary flow from cabin).

The following are input to and output from GPOLY1 before the solution of component number 5 (main cabin sensible heat exchanger):

Input:

STEADY = Logical variable denoting if steady state calculations are now being performed or not.

KSYPAS = Integer variable which counts the number of passes of the computer program through the solution of all the components.

VV(2,104) = Main cabin gas mixture temperature, °F

VV(2,87) = Main cabin gas design temperature, °F

Output:

B(1) = Cooling flow to sensible heat exchanger, lbm/hr

The following are input to and output from GPOLY1 before the solution of component number 7 (humidity control heat exchanger):

Input:

A(1) = Total primary (gas) flow into humidity control heat exchanger.

R(72) = Effective specific heat (Cp) of gas flow into humidity control heat exchanger, Btu/lb-°F

B(1) = Water cooling flow into humidity control heat exchanger, lbm/hr

CPA = Specific heat of total air flow entering the humidity control heat exchanger, Btu/lbm-°F

3.6.1 GPOLY1 (Continued)

Output:

R(66) = Calculated overall heat transfer coefficient of humidity control heat exchanger, Btu/hr-°F

The following are input to and output from GPOLY1 before the solution of component number 10 (water separator for cabin condenser heat exchanger).

Input:

A(7) = Condensable entrained liquid flow, lb/hr
A(1) = Total primary flow into water separator, lb/hr
A(5) = Non-condensables flow into water separator, lb/hr
A(8) = Non-condensables specific heat, Btu/lb-°F
A(6) = Condensable vapor flow into water separator, lb/hr
CPONV = Specific heat of condensable vapor flow into separator, Btu/lb-°F

Output:

R(67) = Condensable entrained liquid flow, lb/hr
A(1) = Total flow into water separator after removal of entrained liquid, lbm/hr
CPA = Specific heat of total flow into water separator, Btu/lbm-°F
R(65) = Power added to water separator, Btu/hr
A(7) = New entrained liquid flow which is set to 0.0 lb/hr.

The following are input to and output from GPOLY1 before the solution of component number 14 (splitter for gas flow from main cabin to SAWD bed #1 or SAWD bed #2). This section of GPOLY1 is where all the control logic for the operation of the SAWD carbon dioxide removal system is performed.

Input:

STEADY = Logical variable denoting if steady state calculations are now being performed or not.
TIMEMX = Length of time the transient case is to run, seconds.
TIME = Length of time into transient, seconds.
DTIME = Time step between interations, seconds.
RHAVG = Average relative humidity (decimal form) in cabin during absorption cycle.
TABOLD = Length of absorption cycle before present iteration, seconds.
VV(2,89) = Cabin gas relative humidity (decimal form).
VV(21,2) = Temperature of flow exiting SAWD bed #2, °F
VV(21,85) = Exit temp. from SAWD bed to end desorption, °F.

3.6.1 GPOLY1 (Continued)

Input:

VV(2,183)	= SAWD absorption cycle time curve multiplication factor.
KK(21,16)	= Absorb/desorb flag for SAWD bed #2 (0=absorb, 1=desorb)
TBSET	= Length of time during which the bed which just finished desorbing bleeds its pressure to the other bed, seconds.
TEXCHG	= Maximum length of time (seconds) during which the bed which just finished desorbing will transfer energy to the other bed if the other bed does not reach a set temperature.
KK(16,16)	= Absorb/desorb flag for SAWD bed #1 (0=absorb, 1=desorb)
TPEND	= Temperature of SAWD bed receiving energy at which energy transfer from the other SAWD bed is terminated, °F.
VV(16,2)	= Temperature exiting SAWD bed #1,°F
A(1)	= Total flow into splitter (splitter for flow to beds), lb/hr.
RHOA	= Density of gas flowing from cabin to beds, lb/ft^3.
VV(2,20)	= Total secondary flow from cabin to humidity control splitter, lb/hr.
V(IS+I)	= This statement denotes various portions of the cabin secondary flow. The flows that are calculated (lb/hr) include: oxygen, diluent = nitrogen, carbon dioxide, trace contaminant flow.
V(IS+6)	= Condensable vapor secondary flow from cabin, lb/hr.
V(IS+7)	= Condensable entrained liquid flow from cabin secondary flow, lb/hr.

Output:

A(I)	= Separate flows of oxygen, nitrogen, carbon dioxide and trace contaminants to SAWD bed splitter, lb/hr.
WSTM	= Flow of steam needed for a particular desorption cycle, lb/hr.
CFM	= Flow through SAWD bed fan, ft^3/min.
A(1)	= Total flow to humidity control splitter from cabin, lb/hr.
VV(14,65)	= Ratio of secondary exit flow to inlet flow for splitter #14.
VV(17,65)	= Ratio of secondary exit flow to inlet flow for splitter #17.
VV(22,65)	= Ratio of secondary exit flow to inlet flow for splitter #22.
VV(24,65)	= Ratio of secondary exit flow to inlet flow for splitter #24.

3.6.1 GPOLY1 (Continued)

VV(26,65) = Ratio of secondary exit flow to inlet flow for splitter #26.

VV(30,65) = Ratio of secondary exit flow to inlet flow for splitter #30.

KK(17,8) = Number of component to be solved after component #17.

KK(22,8) = Number of component to be solved after component #22.

KK(24,8) = Number of component to be solved after component #24.

KK(26,8) = Number of component to be solved after component #26.

KK(29,8) = Number of component to be solved after component #29.

The following are input to and output from GPOLY1 before the solution of component 15 (gas mixer - steam or cabin gas to SAWD bed #1 inlet):

Input:

BLEED = Flag is true if SAWD cycle is in pressure bleed phase.

KK(16,16) = Absorb/desorb flag for SAWD bed #1 (0=absorb, 1=desorb).

Output:

B(I) = Secondary side inlet flows which are set equal to zero during bed #1 pressure bleed down to bed #2.

The following are input to and output from GPOLY1 before the solution of component 16 (SAWD bed #1). Here is calculated the pressure decay in bed #1 during its pressure bleed to bed #2.

Input:

KK(16,16) = Absorb/desorb flag for SAWD bed #1 (0=absorb, 1=desorb).

VV(3,23) = Outlet pressure from humidity control splitter on secondary side (to beds), psia.

KK(16,19) = Number of SAWD bed segments used in calculations in SAWD bed #1.

V(IV+J) = Void volume of segment "j" in SAWD bed #1, ft^3

R(4) = Outlet pressure at bed #1 for bleeddown, psia

R(2) = Temperature of fluid exiting bed #1, °F

R(5) = Non-condensable flow from bed #1, lb/hr

R(6) = Condensable vapor flow from bed #1, lb/hr

R(9) = Molecular weight of non-condensables, lb/mol.

3.6.1 GPOLY1 (Continued)

Output:

PNEW = Inlet pressure to SAWD bed #1, psia

The following are input to and output from GPOLY1 before the solution of component number 20 (gas mixer - steam or cabin gas to SAWD bed #2 inlet):

Input:

BLEED = Flag is true if SAWD cycle is in pressure bleed phase.

KK(21,16) = Absorb/desorb flag for SAWD bed #2 (0=absorb, 1=desorb).

Output:

B(I) = Secondary side inlet flows which are set equal to zero during bed #2 pressure bleed down to bed #1.

The following are input to and output from GPOLY1 before the solution of component number 21 (SAWD bed #2). Here is calculated the pressure decay in bed #2 during its pressure bleed to bed #1.

Input:

KK(21,16) = Absorb/desorb flag for SAWD bed #2 (0=absorb, 1=desorb).

KK(21,19) = Number of SAWD bed segments used in calculations in SAWD bed #2.

V(IV+J) = Void volume of segment "j" in SAWD bed #2, ft^3

VV(3,23) = Outlet pressure from humidity control splitter on secondary side (to beds), psia.

R(4) = Outlet pressure at bed #2 for bleeddown, psia

R(2) = Temperature of fluid exiting bed #2, psia

R(5) = Non-condensable flow from bed #2, lb/hr

R(6) = Condensable vapor flow from bed #2, lb/hr

R(9) = Molecular weight of non-condensables, lb/mol.

Output:

PNEW = Inlet pressure to SAWD bed #2, psia.

The following are input to and output from GPOLY1 before the solution of component 25 (mixer of flows from steam generator and from a SAWD bed during energy transfer). Here the secondary side inlet flow (i.e., the flow which would come from a SAWD bed during energy transfer or bleed) is set equal to zero whenever the SAWD is not in the energy transfer or bleed portions of its cycle.

3.6.1 GPOLY1 (Continued)

Input:

PREHET = Flag is true if SAWD is in energy transfer portion of its cycle.
BLEED = Flag is true if SAWD is in bleed portion of its cycle.

Output:

B(I) = Flows into secondary side of mixer.

The following are input to and output from GPOLY1 before the solution of component 27 (water supply tank for steam generator). Here is calculated the water flow to be used for desorbing a SAWD bed.

Input:

VV(2,105) = Cabin gas mixture total pressure, psia
VV(32,72) = Pressure in carbon dioxide accumulator, psia
VV(30,65) = Split ratio in component 30 (splitter for flow to CO_2 accumulator or to cabin).
STEADY = Logical variable denoting if steady state calculations are now being performed or not.
R(100) = Steam flow, pph.
KK(16,16) = Absorb/desorb flag for SAWD bed #1 (0=absorb, 1=desorb)
VV(16,2) = Temp exiting SAWD bed #1, °F
VV(16,85) = Exit temperature to end desorption, °F
KK(21,16) = Absorb/desorb flag for SAWD bed #2 (0=absorb, 1=desorb).
BLEED = Flag is true if SAWD is in bleed portion of cycle.
PREHET = Flag is true if SAWD is in energy transfer portion of cycle.
VV(21,2) = Temp exiting SAWD bed #2, °F
VV(21,85) = Exit temperature to end desorption, °F

Output:

R(1) = Total flow from water tank, lb/hr

The following are input to and output from GPOLY1 before the solution of component 30 (splitter for desorbed gas - to cabin or CO_2 accumulator). Here is the control logic to simulate the flow sensor sensing flow and to direct the desorbed flow to the accumulator when the flow reaches the setpoint.

3.6.1 GPOLY1 (Continued)

Input:

RHOA	= Density of flow to splitter, lbm/ft^3
A(1)	= Total flow to splitter, lb/hr
KK(16,16)	= Absorb/desorb flag for SAWD bed #1 (0=absorb, 1=desorb).
KK(21,16)	= Absorb/desorb flag for SAWD bed #2 (0=absorb, 1=desorb).

Output:

R(65)	= Split ratio in splitter which is ratio of flow directed to cabin to total entering flow.

The following are input to and output from GPOLY1 before the solution of component 32 (CO_2 accumulator tank). Here is the logic to determine the flow leaving the accumulator depending on whether the flow is to go overboard or to another system for reduction of the carbon dioxide.

Input:

STEADY	= Logical variable denoting if steady state calculations are now being performed or not.
R(72)	= Pressure in accumulator, psia.
KK(32,16)	= Carbon dioxide delivery (0=overboard, 1=CO_2 reduction).
A(1)	= Total flow to CO_2 accumulator, lb/hr
R(71)	= CO_2 accumulator tank volume, ft^3
R(70)	= CO_2 temperature, °F

Output:

R(1)	= Total flow out of CO_2 accumulator, lb/hr

3.6.2 GPOLY2

The GPOLY2 subroutine in ESCM performs several calculations to tally the rate of change in oxygen, carbon dioxide, and water vapor in the cabin, to compute the water and carbon dioxide loadings in both SAWD beds, and lastly to tally with time the total water used for SAWD bed desorption, and the total condensate removed from the cabin air.

Input and output from the GPOLY2 subroutine are made through the R and K arrays of the G189A framework. All transfer of data in and out of the subroutine is performed in the appropriate COMMON blocks.

3.6.2 GPOLY2 (Continued)

The following are input and output from GPOLY2 after component 1 (crew) is analyzed:

Input:

KK(21,16)	= SAWD bed #2 absorb/desorb flag: 0=absorb, 1=desorb.
VV(16,72)	= Total SAWD bed #1 CO_2 absorption rate, lbm/hr.
VV(16,73)	= Total SAWD bed #1 H_2O evaporation rate, lbm/hr.
VV(24,65)	= SAWD exit flow control valve 1.0 = flow goes to opposite bed for energy transfer; 0.0 = flow goes to accumulator. See Figure 4.
VV(21,72)	= Total SAWD bed #2 CO_2 absorption rate, lbm/hr.
VV(21,73)	= Total SAWD bed #2 water evaporation rate, lbm/hr.
R(70)	= Total crew water vapor generation rate, lbm/hr
VV(10,67)	= Rate of condensate removal from cabin, lbm/hr
R(68)	= Total crew oxygen usage rate, lbm/hr
R(69)	= Total crew carbon dioxide generation rate, lbm/hr

Output:

VV(2,137)	= Net water vapor flow into cabin, lbm/hr
VV(2,175)	= Net oxygen addition rate to cabin, lbm/hr
VV(2,177)	= Net carbon dioxide addition rate to cabin, lbm/hr

The following are input and output for GPOLY2 after component 16 (bed #1) or 21 (bed #2) are analyzed. Here bed loadings are calculated, and during steady state, the proper air temperature and mass flows of vapor and entrained liquid are computed.

Input:

R(78)	= Total dry bed #1/#2 resin weight, lbm
R(80)	= Total water in bed #1/#2 resin, lbm
R(81)	= Total carbon dioxide in bed #1/#2 resin, lbm
A(2)	= Bed #1 or bed #2 inlet flow temperature, °F
A(5)	= Bed #1 or bed #2 inlet non-condensable flow, lbm/hr
A(6)	= Bed #1 or bed #2 inlet water vapor flow, lbm/hr
A(7)	= Bed #1 or bed #2 inlet entrained liquid flow, lbm/hr
A(8)	= Specific heat of non-condensable flow entering bed #1 or bed #2, Btu/lbm-°F
STEADY	= Logical variable denoting if steady state calculations are now being performed or not.

3.6.2 GPOLY2 (Continued)

Output:

R(82) = Total bed #1 or bed #2 water loading, lbm/lbm
R(83) = Total bed #1 or bed #2 carbon dioxide loading, lbm/lbm of dry resin.
R(2) = Bed #1/#2 exit flow temperature, °F
R(6) = Bed #1/#2 exit water vapor flow, lbm/hr
R(7) = Bed #1/#2 exit entrained liquid flow, lbm/hr

Note: Variables R(2), R(6), and R(7) are output only during steady state calculations.

The following are input to and output from GPOLY2 after component 27 (the water supply tank) is analyzed.

Input:

R(1) = Total flow exiting water supply tank, lbm/hr
R(98) = Previous total water used from tank, lbm
R(99) = Previous total water added to tank, lbm
DTIME = Current time step, seconds
STEADY = Logical variable denoting if steady state calculations are now being performed or not.
VV(10,67) = Rate of condensate removal from cabin, (i.e., rate of water added to tank), lb/hr

Output:

R(98) = Updated total water used from tank, lbm
R(98) = Updated total water added to tank, lbm

No error messages are generated by GPOLY2. Lower level functions and subroutines used by GPOLY2 are:

VV KK HG HF HBLANC

3.7 ARSS Subroutine

The ARSS subroutine generates a schematic of the modeled atmospheric revitalization subsystem with performance information such as flow, temperature, and heat load printed near each component. Also printed are total crew loadings and cabin conditions. This subroutine is called from sburoutine ECLST; but whether ARSS is called or not in ECLST is specified by the user through the printoff frequency input variable IFREQ which is equal to VV(2,184). Figure 6 shows a sample schematic generated by ESCM in the ARSS subroutine.

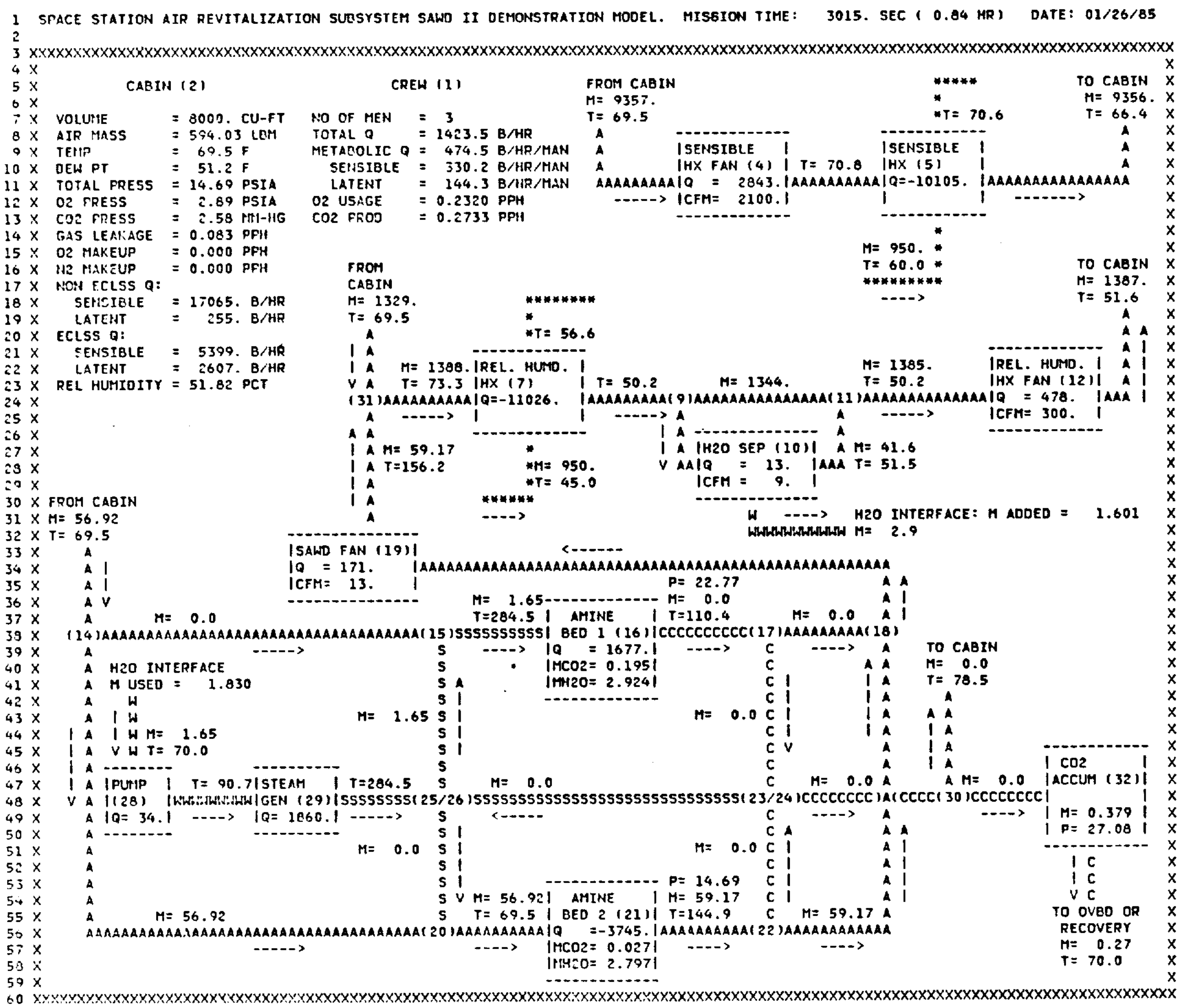

Figure 6

Sample Schematic Generated By ESCM

3.7 ARSS Subroutine (Continued)

The following are input into Subroutine ARSS and output from it with no manipulations performed on them except those with asterisks. Those with 1 asterisk are manipulated before they are output. The manipulations are noted below. Those with 2 asterisks are input but not output.

IDATE	= Date of transient run (input and output).
TIME	= Time into transient, seconds (input and output).

The following inputs/outputs relate to the crew (component 1):

VV(1,65)	= Total metabolic heat from crew, Btu/hr
V(IV+2)	= Sensible heat per crewman, Btu/hr
V(IV+3)	= Latent heat per crewman, Btu/hr
V(IV+4)	= Total oxygen use rate, lb/hr
V(IV+5)	= Total CO_2 generation rate, lb/hr
KK(1,16)	= Number of crewmen

The following inputs/outputs relate to the main cabin:

VV(2,1)	= Total flow out of cabin to sensible heat exchanger fan, lb/hr
V(IP+2)	= Temperature of flow exiting cabin and flowing to fan, lb/hr
V(IV+2)	= Equipment, lighting and miscellaneous heat load added to cabin gas, Btu/hr
*V(IV+25)	= Cabin gas relative humidity, decimal form. This is multipled by 100 to put it in percent form before it is output.
V(IV+30)	= Cabin gas oxygen presure, psia
V(IV+34)	= Cabin gas dew point, °F
V(IV+36)	= Cabin gas carbon dioxide pressure, mmHg
V(IV+39)	= Cabin gas mixture total mass, lbs
V(IV+40)	= Cabin gas mixture temperature, °F
V(IV+42)	= Cabin gas mixture total presure, psia
V(IV+58)	= Outboard leakage rate, lb/hr
**V(IV+64)	= Water vapor addition rate, lb/hr
**V(IV+72)	= Net non-condensable flow into cabin, lb/hr
V(IVT+1)	= Cabin free volume, ft^3
V(IVEX+6)	= Diluent addition rate, lb/hr
V(IVEX+7)	= Carbon dioxide addition rate, lb/hr

3.7 ARSS Subroutine (Continued)

The following inputs/outputs relate to the splitter (component 3) for flow from the cabin:

VV(3,1) = Total flow from splitter (3) to gas mixer (31) then to humidity control heat exchanger, lb/hr
V(IP+2) = Fluid temperature exiting splitter primary side (3), °F
V(IS+1) = Total flow from splitter (3) to SAWD beds, lb/hr
V(IS+2) = Fluid temperature exiting splitter (3) to SAWD beds, °F

The following inputs/outputs relate to the main cabin sensible heat exchanger fan (component 4):

VV(4,2) = Temperature of fluid exiting main cabin sensible heat exchanger fan, °F
V(IV+1) = Heat added to gas stream at fan, Btu/hr
V(IV+12) = Cabin fan volumetric flow rate, cfm

The following inputs/outputs relate to the sensible heat exchanger (component 5):

VV(5,1) = Total flow from sensible heat exchanger (5) (primary side - gas side), lb/hr
V(IP+2) = Temperature of gas exiting sensible heat exchanger (primary side), °F
V(IS+2) = Temperature of fluid exiting sensible heat exchanger (secondary side), °F
V(IV+1) = Heat transferred across heat exchanger between secondary and primary sides, Btu/hr
VV(6,1) = Coolant flow to cabin sensible heat exchanger (5), lb/hr
VV(6,2) = Temperature of coolant to cabin sensible heat exchanger, °F

The following inputs/outputs relate to the main cabin condensing heat exchanger (component 7, also known as humidity control heat exchanger):

VV(7,2) = Temperature (°F) of fluid exiting main cabin condensing heat exchanger 7 (humidity control heat exchanger), °F
V(IS+2) = Temperature (°F) of fluid exiting main cabin condensing heat exchanger 7, secondary or coolant side.
V(IV+1) = Heat transferred across condensing heat exchanger 7, Btu/hr
VV(8,1) = Coolant flow to main cabin condensing heat exchanger 7, lb/hr
VV(8,2) = Temperature of coolant to cabin condensing heat exchanger, °F

3.7 ARSS Subroutine (Continued)

The following inputs/outputs relate to the splitter (component 9) for flow exiting the condensing heat exchanger:

VV(9,1)	= Total flow exiting splitter (9) and flowing to gas mixer (11), lb/hr

The following inputs/outputs relate to the water separator (component 10):

VV(10,1)	= Total flow from water separator (10) to gas mixer (11), lb/hr
V(IP+2)	= Temperature of fluid exiting water separator (10) and going to gas mixer (11), °F
V(IV+1)	= Heat added, Btu/hr
V(IV+3)	= Condensate removed in water separator, lb/hr

The following inputs/outputs relate to the gas mixer (component 11) for flow to condenser heat exchanger fan:

VV(11,1)	= Total flow from gas mixer (11) to condenser heat exchanger fan (12), lb/hr
VV(IP+2)	= Temperature of fluid flowing from gas mixer (11) to condenser heat exchanger fan, °F

The following inputs/outputs relate to the condenser heat exchanger fan:

VV(12,1)	= Total flow exiting condenser heat exchanger fan (12), lb/hr
V(IP+2)	= Temperature of fluid flowing from condenser heat exchanger fan, °F
V(IV+1)	= Total heat added to gas stream, Btu/hr
V(IV+12)	= Volumetric flow through fan (12), cfm

The following inputs/outputs relate to the splitter (component 14) for flow to SAWD beds:

VV(14,1)	= Total flow to SAWD bed #1 from splitter (14), lb/hr
V(IS+1)	= Total flow to SAWD bed #2 from splitter (14), lb/hr
V(IV+1)	= Split ratio in splitter (14) for flow to SAWD beds.

The following inputs/outputs relate to the gas mixer (component 15) for flow to SAWD bed #1:

VV(15,1)	= Total flow to SAWD bed #1 from gas mixer (15), lb/hr
V(IP+2)	= Temperature of fluid exiting gas mixer (15) and going to SAWD bed #1, °F

3.7 ARSS Subroutine (Continued)

The following inputs/outputs relate to SAWD bed #1 (component 16):

VV(16,1)	= Total flow exiting SAWD bed #1, lb/hr
V(IP+2)	= Temperature of fluid exiting SAWD bed #1, °F
V(IP+4)	= Outlet pressure at SAWD bed #1, psia
V(IV+6)	= Gas stream total sensible heat change in bed #1, Btu/hr
**KK(16,16)	= Absorb/desorb flag (0=absorb, 1=desorb).
**V(IV+9)	= Total water evaporation/condensation rate (pph)
V(IV+16)	= Total water in SAWD bed #1 at start of transient, lbs
V(IV+17)	= Total CO_2 in SAWD bed #1 at start of transient, lbs

The following inputs/outputs relate to the splitter (component 17) for flow from SAWD bed #1:

VV(17,1)	= Total flow exiting splitter (17) which goes to the condenser heat exchanger, lb/hr
V(IS+1)	= Total flow exiting splitter (17) which goes to CO_2 recovery, lb/hr
V(IV+1)	= Split ratio in splitter (17).

The following inputs/outputs relate to the SAWD bed fan (component 19):

VV(19,1)	= Total flow through SAWD bed fan (19), lbm/hr
V(IP+2)	= Temperature of flow exiting SAWD bed fan, °F
V(IV+1)	= Total heat added to gas stream, Btu/hr
V(IV+12)	= SAWD bed fan volumetric flow rate, cfm

The following inputs/outputs relate to the gas mixer (component 20) for flow to SAWD bed #2:

VV(20,1)	= Total flow from gas mixer (20) which sends steam or cabin gas to SAWD bed #2 inlet, lb/hr
V(IV+2)	= Temperature of flow from gas mixer (20), °F

The following inputs/outputs relate to SAWD bed #2 (component 21):

VV(21,1)	= Total flow exiting SAWD bed #2, lb/hr
V(IP+2)	= Temperature of fluid exiting SAWD bed #2, °F
V(IP+4)	= SAWD bed #2 outlet pressure, psia
V(IV+6)	= Gas stream total sensible heat change, Btu/hr
**KK(21,16)	= Absorb/desorb flag (0=absorb, 1=desorb).
**V(IV+9)	= Total water evaporation/condensation rate, lb/hr
V(IV+16)	= Total water in SAWD bed #2 at start of transient, lbs
V(IV+17)	= Total CO_2 in SAWD bed #2 at start of transient, lbs

3.7 ARSS Subroutine (Continued)

The following inputs/outputs relate to the splitter (component 22) for flow from SAWD bed #2:

VV(22,1) = Total flow exiting splitter (22) which goes to condenser heat exchanger, lb/hr
V(IS+1) = Total flow exiting splitter (22) which goes to CO_2 recovery, lbm/hr
V(IV+1) = Split ratio in splitter (22)

The following inputs/outputs relate to the splitter (component 24) for flow from gas mixer (23):

VV(24,1) = Total flow exiting splitter (24) to CO_2 accumulator, lb/hr
V(IS+1) = Total flow exiting splitter (24) to gas mixer (25), lb/hr

The following inputs/outputs relate to the splitter (component 26) for flow from gas mixer (25):

VV(26,1) = Tota flow of steam from splitter (26) to SAWD bed #1, lb/hr
V(IS+1) = Total flow of steam from splitter (26) to SAWD bed #2, lb/hr

The following inputs/outputs relate to the water supply tank (component 27):

VV(27,1) = Total flow from water supply tank (27) to steam generator, lb/hr
V(IP+2) = Temperature of flow from water supply tank, °F
V(IEX+1) = Total water used, lb/hr
V(IEX+2) = Total water added, lb/hr

The following inputs/outputs relate to the water supply pump (component 28):

VV(28,2) = Temperature of water exiting water supply pump (28) for steam generator, °F
V(IV+1) = Total heat added to water in pump (28), Btu/hr

The following inputs/outputs relate to the steam generator (component 29):

VV(29,2) = Temperature of steam exiting steam generator (29) °F
*V(IV+4) = Electric energy required by steam generator, watts. It is multipled by 3.413 to convert it to Btu/hr before it becomes output.

3.7 ARSS Subroutine (Continued)

The following inputs/outputs relate to the splitter (component 30) for flow from gas mixer (24):

VV(30,1)	= Total flow exiting splitter (30) to CO_2 accumulator, lb/hr
V(IS+1)	= Total flow exiting splitter (30) to cabin, lb/hr
V(IS+2)	= Temperature of fluid exiting splitter (30) to cabin, °F
V(IV+1)	= Ratio of flow directed to cabin to total inlet flow in splitter (30).

The following inputs/outputs relate to the gas mixer (component 31) for flow to condensing heat exchanger (7):

VV(31,1)	= Total flow exiting gas mixer (31) to humidity control heat exchanger (7), lb/hr
V(IP+2)	= Temperature of fluid exiting gas mixer (31) to humidity control heat exchanger, °F

The following inputs/outputs relate to the CO_2 accumulator (component 32):

VV(32,1)	= Total flow exiting CO_2 accumulator (32) to overboard or CO_2 reduction, lb/hr
V(IP+2)	= Temperature of fluid exiting CO_2 accumulator, °F
V(IV+5)	= Total fluid weight in CO_2 accumulator, lbm
V(IV+8)	= CO_2 accumulator pressure, psia.

The following input relates to gas mixer (component 18):

**VV(18,6)	= Condensable vapor flow exiting gas mixer (18), lb/hr

The following input relates to the splitter (component 3) for flow from the cabin:

**VV(3,25)	= Condensable vapor flow exiting splitter (3) and flowing to SAWD system.

The following are output only of ARSS:

TIMEM	= Time into transient in minutes. It is calculated by dividing the input TIME (seconds) by 60.
TIMEH	= Time into transient in hours. It is calculated by dividing the input TIME (seconds) by 3600.
QMET	= Total metabolic heat per crewman, Btu/hr. It is the total of the input sensible and latent heats per crewman.

3.7 ARSS Subroutine (Continued)

QNELAT	= Latent heat added to cabin by non-ECLS and non-metabolic sources, ie, vehicle loads, Btu/hr.
V1076	= 9.0 = water separator power, Btu/hr
Q16	= Latent heat released due to condensation during desorption or sensible heat used for evaporation during absorption in SAWD bed #1, Btu/hr
Q21	= Latent heat released due to condensation during desorption or sensible heat used for evaporation during absorption in SAWD bed #2, Btu/hr
QESEN	= Total power required by ECLS components, Btu/hr
QELAT	= Total latent heat added to cabin from ECLS sources, i.e., the SAWD system, Btu/hr

The following are outputs which cause A's, C's or S's which represent air, carbon dioxide, and steam flows, respectively to be printed at the proper places and times on the output schematic:

L1	= Flow stream into SAWD bed #1
L2	= Flow stream out of SAWD bed #1 to splitter (17)
L3	= Flow stream between splitter (17) and gas mixer (23) which ultimately goes to bed #2, the cabin, or the CO_2 accumulator.
L4	= Flow stream into SAWD bed #2
L5	= Flow stream out of SAWD bed #2 to splitter (22)
L6	= Flow stream between splitter (22) and gas mixer (23) which ultimately goes to bed #1, the cabin, or the CO_2 accumulator.
L7	= Flow stream between splitter (24) and the CO_2 accumulator.
L8	= Flow stream between splitter (30) and the cabin.

3.8 IR45 Subroutines

This group of subroutines computes the transient performance of a SAWD canister which includes the inlet header, the bed, an exit header, and an exit temperature sensor. The bed itself can be divided into as many as five segments.

The computational sequence for subroutine IR45 is shown in Figure 7. At the start of the subroutine, values of resin weight, carbon dioxide weight, water weight, canister weight, void volume, and foam weight are computed for each segment of the bed. This is done only the first time that the IR45 subroutine is called in ESCM. If steady state analyses are to be done, subroutine STAEDY is called; if not, the program begins the transient IR45 analysis with a call to subroutine HEADER. In that subroutine, the mixed temperature and composition of the gases in the inlet header are computed. From there, the gases enter the first segment of the bed. Subroutine BALNCE performs a mass, energy, and pressure balance on the gas and

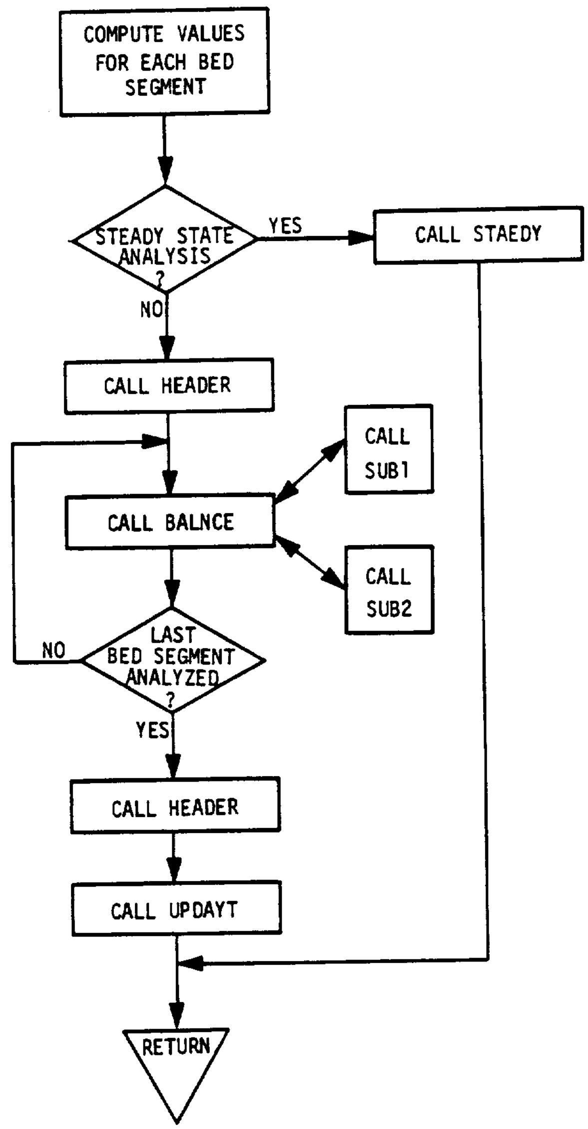

Figure 7
Subroutine IR45 Flow Diagram

3.8 IR45 Subroutines (Continued)

water and carbon dioxide loadings in the resin for a bed segment. BALNCE calls subroutine SUB1 to compute the sum of the enthalpies at any temperature for the entering or exiting gas, resident gas, resin, and canister metal; BALNCE calls SUB2 to compute the partial pressures of water and carbon dioxide in the bed voids, and to compute the rate constant for CO_2 loading. The temperature and composition of the gas leaving the first segment are computed in BALNCE. This subroutine is repeated for all segments. When all the segments have been analzyed, subroutine HEADER is called to compute the temperature and composition of the gas leaving the exit header. The last subroutine called is UPDAYT. There, the "R" array values are updated for the analyzed time step, and the effect of the temperature sensor time constant on sensed temperature is computed.

IR45 is the main subroutine which simulates a SAWD bed; the subroutine calls the other subroutines. Since IR45 is the main subroutine and represents the SAWD bed to the ESCM, only the input and output to this subroutine are pesented in the following.

A array data and R array data up to R(64) [R(1) to R(64)] are always the same. Only the component to which they refer changes.

A Array Data (Input/Output)

The A array [A(1) to A(19)] contains the primary source flow data (upstream component flow data which enters the primary side of the component being solved (SAWD bed #1 or #2 in the IR45 subroutine). The specific inputs for each array position may be found in the G189 Manual (Table 2-1, page 2-12).

R Array Data (Input/Output)

R array locations R(1) to R(19) contain the exit flow data for the primary side of the current component being solved (SAWD bed #1 or #2 in IR45). This is the same as the A array data except that it involves exit rather than source flaws. The specific inputs for R(1) to R(19) may be found in the G189 Manual (page 2-12 or 2-15).

R(20) to R(62) are not used in the IR45 subroutine. R(63) and R(64) are used. They are always the same as mentioned above. Only the component to which they refer changes (see page 2-19 of G189 Manual). In the IR45 subroutine they refer to SAWD bed #1 or #2.

R(63) = Exterior surface temperature (°F)
R(64) = Conductance between source (bed) and exterior (Btu/hr-°F)

3.8 IR45 Subroutines (Continued)

R(65) to R(95)

These are subroutine dependent data. Inputs to these positions depend upon the subroutine being used (in this case IR45). In IR45 the R(65) to R(95) refer to the following in the SAWD beds:

R(65)	= Heat of CO_2 reaction with resin bed (Btu/lb)
R(66)	= Specific heat of dry resin bed (Btu/lb-°F)
R(67)	= Density of dry resin bed (lb/ft^3)
R(68)	= Resin bed void volume fraction (ft^3/ft^3)
R(69)	= Time required to complete steam desorb (sec)
R(70)	= Gas stream total sensible heat change (Btu/hr)
R(71)	= Gas stream total latent heat change (Btu/hr)
R(72)	= Carbon dioxide absorption rate (lb/hr)
R(73)	= Water absorption rate (lb/hr)
R(74)	= Basepoint absorption/desorption rate (pph of CO_2/lb of dry resin/psi of CO_2 partial pressure difference).
R(75)	= Average steady state desorption steam rate (lb/hr)
R(76)	= Steady state carbon dioxide removal efficiency.
R(77)	= Average steady state bed temperature (°F)
R(78)	= Total dry resin bed weight (lbm)
R(79)	= Total canister weight (lbm)
R(80)	= Total water in bed (lbm)
R(81)	= Total carbon dioxide in bed (lbm)
R(82)	= Total bed water loading (lbm H_2O/lb bed)
R(83)	= Total bed carbon dioxide loading (lb CO_2/lb bed)
R(84)	= Specific heat of canister (Btu/lbm-°F)
R(85)	= Temperature to end desorption (°F)
R(86)	= Time at which absorption is to end (sec)
R(87)	= Outlet temperature time lag (sec)
R(88)	= Bed inlet dew point (°F)
R(89)	= Bed exit dew point (°F)
R(90)	= Bed inlet carbon dioxide partial pressure (mmHg)
R(91)	= Bed exit carbon dioxide partial pressure (mmHg)
R(92)	= Total bed exit flow (ft^3/min)
R(93)	= Total foam in bed (lbm)
R(94)	= Specific heat of foam (Btu/lbm-°F)
R(95) to R(99)	= are spare positions in the array.

The following R array positions are used for each segment that the SAWD beds are divided into for calculation purposes: In the following J=99+30*(k-1) and k=1 thru number of bed segments used.

R(J+I)	= Same as A(I) array
R(J+20)	= Segment k bed temperature (°F)
R(J+21)	= Segment k bed carbon dioxide weight (lbm)
R(J+22)	= Segment k bed water weight (lbm)
R(J+23)	= Segment k bed weight (lbm)

3.8 IR45 Subroutines (Continued)

R(J+24)	= Segment k canister weight (lbm)
R(J+25)	= Segment k void volume (ft^3)
R(J+26)	= Segment k carbon dioxide loading (lb CO_2/lb bed)
R(J+27)	= Segment k water loading (lb H_2O/lb bed)
R(J+28)	= Segment k foam weight (lbm)
R(J+29) and R(J+30)	= Spares.

4.0 PROGRAM USE

Instructions to access ESCM and to use the program are presented in this section. ESCM may be run interactively at a terminal or run by submitting batch jobs. Of course the job control language will vary from computer system to computer system. Also, several subroutines will be different from system to system. The job control language and subroutines described in section 4.1 apply to the IBM 3080 series computer with the MVS 3.8 Operating System. Section 4.2 describes how the ESCM program must be modified to operate on the LaRC PRIME computers under FORTRAN 77.

4.1 Operation Using Hamilton Standard's IBM 3080 Series Computer

To run ESCM, use the following sequence of steps:

(1) Access the desired command list:

(a) ESCMCN CNTL (to run batch job)
(b) ESCMCL CLIST (to run interactive)

(2) Access input data set: ESCM2B.DATA

(3) Make desired changes to ESCM2B.DATA

(4) For batch jobs, SUBMIT ESCMCN; for interactive jobs, EX ESCMCL.

4.1.1 Accessing Desired Job Control List

After logging onto the computer time sharing system, either ESCMCN or ESCMCL must be accessed from the library and brought into the User's file. The following are the commands to do this:

```
LC ESCMCN CNTL SO(G15UARL) RON
LGCL ESCMCL G15UARL RON
```

A listing of each is given in Appendix A. Input output files are allocated by these control lists; Table 7 presents these assignments. The program has been coded in such a fashion as to facilitate changes in I/O assignments to conform to individual computer installations. This was accomplished by using variable unit names

Table 7

ESCM I/O File Assignments For IBM Computer

FORTRAN Variable Unit Name	Current FORTRAN Logical Unit Number	File Type	Physical Unit Assignment	
NDA	1	Scratch	These four files may use Tape, Disk or Drum Units	Contains card images of all input data cards. Editing and processing take place from this file.
NDB	2	Scratch		Used during Basic Case in conjunction with NDC and NDB to process cards. At all other times, contains edited Basic Case K/V array.
NDC	3	Scratch		Used during Basic Case input operations with NDB to process K and V Component Data card images. Used to store processed SD-4060 plot data at conclusion of G189A case.
NDD	4	Scratch		Used during Basic Case with NDB to process Table Data card images. May be used for SD-4060 operations.
NDE	16	Output	Tape	Output file for G189A plot data to be processed by post Processor plot package (Section 10 of Reference 3).
NTIN	10	Input	Tape	Input file for the data tape.
NTØUT	11	Output	Tape	Output file for the data tape.
NSTUFF	31	Output	Card Punch	Used to punch card images of the edited simulation data.
---	20	Output	Terminal	Output to terminal screen.

4.1.1 Accessing Desired Job Control List (Continued)

in all FORTRAN I/O statements, eg, WRITE(NDA,30)K. The variable unit names are made available to the appropriate subprograms in the common block /FILES/. The numerical values for the variable unit names are set in the block data subroutine DBLOCK. For more information, see Reference 3. The only file that is not set up in the above fashion is file 20 which is only used in subroutine ARSS.

4.1.2 Input Data

Input to the program is made through the data set ESCM2B. To access this data set from Librarian, enter:

LG ESCM2B DATA SO(G15UARL)

A copy of ESCM2B is shown in Table 8. The input and values specified in Table 8 are the recommended values and set up for the ESCM application using G189A. The input follows that required for G189A; the user should refer to Reference 3 for more detailed information.

The input is divided into four groups of cards: case data, K and V component data, table data and plot data. The following sections briefly describe the input data required for each of these sections specific for the ESCM, the user again should refer to the G189A Manual, Reference 3, for a complete and general description of the input. For convenience, Figure 8 is provided to show the general input setup and the case data required.

4.1.2.1 Case Data Group

The case data group contains such data as necessary to specify the overall data storage arrangement, describe the model in general, and control the execution of the case. The group also contains fluid property data. Since the publication of Reference 3, an additional input has been added to this group, and it is the first record for the group.

	FORMAT	COLS
Record 1		
1) Type of printout desired:	I4	1-4

IOUT=0=print input data and input echo
IOUT=1=print input data only
IOUT=2= print input echo only
IOUT=3=print neither input data nor echo

Table 8
Input to ESCM

```
**** TSO FOREGROUND HARDCOPY **** 14:55:21 85030
DSNAME=TSOG156.ESCM2B.DATA

   0   0                PRINT INPUT DATA AND SCHEMATICS
       **** NAMELIST, BASIC CASE
TAPE
BASIC          1      50      13      2     YEA      NAY
CASE           ESCM: BASELINE, VOL=8000 FT-3, PCO2=2.5, .275 PPH AVG

 $CASE1
  KPTINV(1)= 1, KPTINV(2)= 5, KPTINV(3)= 10, KPTINV(4)=30,
  KCHOUT= 0, KPUNCH= 0, KPRNT= 0, KRUN= 1, KSTEDY= 0,
  MAXSLP= 4, MAXSSI= 15, MINSSI= 10, NOLIM=0,
  DTIME=15., START= 0.0, TIMEMX= 86400.,
  TMAX= 325.0, TMIN= 0.0, WTMAX= 1.6E6  $END

 $PROP1
  CP(1)=1.,    RHO(1)=62.4,   VISC(1)=2.42, WTM(1)=18.016,  XK(1)=0.34,
  CP(2)=0.2, RHO(2)=0.00045, VISC(2)=0.378, WTM(2)=44.01, XK(2)=0.0098,
  CPCONL=1., CPCONV=0.445,CPCO2=0.2, CPDIL=0.25, CPOXY=0.22, CPTC=0.2,
  GAMGAS=1.4,VISGAS=.44,WTMCON=18.016,WTMDIL=28.013,WTMTC=20.,
  XKGAS=0.146 $END

ID**   1      ARS DEMO MODEL FOR SAWD II GENERAL NOTES:
ID**   1  10 FLUID TYPE CODES --
ID**   1  11         1 = WATER
ID**   1  12         2 = CO2 GAS @ 70 F, 3 MM HG
ID**   1  90
ID**   1 100    CREW METABOLIC SIMULATION
KBAS   1      2  1          5 2                                    14     2
NSTR   1    0               1     NO TESTS, SS CALCS
VARY   1    2 50.0          TEMP (F)
VARY   1    3 14.7        4 PRESS (PSIA)
VARY   1    6     87.8      H2O VAPOR FLOW  (LB/HR)
VARY   1   10   2046.9      OXYGEN FLOW  (LB/HR)
VARY   1   11   7200.7      NITROGEN FLOW  (LB/HR)
VARY   1   12     46.7      CO2 FLOW  (LB/HR)
KARY   1   16          3    NUMBER OF CREWMEN
VARY   1   65               TOTAL METABOLIC HEAT - ALL CREWMEN (BTU/HR)
VARY   1   66 291.7         SENSIBLE HEAT PER CREWMAN (BTU/HR)
VARY   1   67 175.2         LATENT HEAT PER CREWMAN (BTU/HR)
VARY   1   68               TOTAL OXYGEN USE RATE (LB/HR)
VARY   1   69               TOTAL CO2 GENERATION RATE (LB/HR)
VARY   1   70               TOTAL H2O VAPOR GENERATION RATE (LB/HR)
VARY   1   75               INLET GAS RELATIVE HUMIDITY (DECIMAL)
VARY   1   76               INLET GAS DEW POINT (F)
VARY   1   77               OUTLET GAS RELATIVE HUMIDITY(DECIMAL)
VARY   1   78               OUTLET GAS DEW PONT (F)
VARY   1   82               TOTAL METABOLIC RATE PER CREWMAN (BTU/HR)
ID**   2      MAIN CABIN
KBAS   2      1 25          1 2              -13 2                3     2
NSTR   2     151011000            PRI P, 5 RESETS, SPECIFY NET FLOWS
VARY   2    2 70.           CABIN GAS MIXTURE: INITIAL TEMP (F)
VARY   2    3 14.7        4 TOTAL PRESSURE  (PSIA)
VARY   2    6     89.7      H2O VAPOR FLOW  (LB/HR)
VARY   2   10   2046.8      OXYGEN FLOW  (LB/HR)
VARY   2   11   7199.4      NITROGEN FLOW  (LB/HR)
VARY   2   12     46.3      CO2 FLOW  (LB/HR)
VARY   2   21 70.           CABIN GAS MIXTURE: INITIAL TEMP (F)
```

CASE GROUP DATA

START OF OF K AND V COMPONENT DATA

Table 8 (Continued)
Input to ESCM

CONTINUATION OF K AND V COMPONENT DATA

```
VARY  2  22 14.7      23 TOTAL PRESSURE  (PSIA)
VARY  2  25   13.00      H2O VAPOR FLOW  (LB/HR)
VARY  2  29  303.76      OXYGEN FLOW  (LB/HR)
VARY  2  30 1068.67      NITROGEN FLOW  (LB/HR)
VARY  2  31    9.45      CO2 FLOW  (LB/HR)
VARY  2  65              TOTAL HEAT ADDED TO CABIN GAS MIXTURE (BTU/HR)
VARY  2  66 17065.       CABIN HEAT LOAD  (BTU/HR) = 5 KW
VARY  2  71              HEAT LOSS DUE TO OUTBOARD LEAKAGE (BTU/HR)
VARY  2  72              HEAT GAIN DUE TO MASS ADDITIONS (BTU/HR)
VARY  2  73              HEAT REQ'D TO FLASH ENTRAINED H2O (BTU/HR)
VARY  2  74              FLASH EVAPORATION RATE OF ENTRAINED H2O (LB/HR)
VARY  2  87 70.0         CABIN GAS DESIGN TEMP  (F)   (4 MEN)
VARY  2  88 10.0         CABIN GAS DESIGN TEMP TOL (F)  (4 MEN)
VARY  2  89              CABIN GAS RELATIVE HUMIDITY (DECIMAL)
VARY  2  90 14.7         DESIGN TOTAL PRESSURE (PSIA)
VARY  2  91 0.5          DESIGN TOTAL PRESSURE TOL  (PSIA)
VARY  2  92 2.9          DESIGN OXYGEN PRESSURE  (PSIA)
VARY  2  93 0.5          DESIGN OXYGEN PRESSURE TOL (PSIA)
VARY  2  94              CABIN GAS OXYGEN PRESSURE (PSIA)
VARY  2  95              CABIN GAS NITROGEN PRESSURE (PSIA)
VARY  2  96 50.0         DESIGN DEW POINT (F)
VARY  2  97 30.0         DESIGN DEW POINT TOL (F)
VARY  2  98              CABIN GAS DEW POINT (F)
VARY  2  99 20.          MAX ALLOWABLE CO2 PRESSURE  (MM HG)
VARY  2 100              CABIN GAS CO2 PRESSURE  (MM HG)
VARY  2 101 250.         MAX ALLOWABLE TRACE CONTAMINANT LEVEL (PPM)
VARY  2 102              CABIN GAS TRACE CONTAMINANT LEVEL (PPM)
VARY  2 103              CABIN GAS MIXTURE, TOTAL MASS (LB)
VARY  2 104              CABIN GAS MIXTURE, TEMPERATURE (F)
VARY  2 105              CABIN GAS MIXTURE, TOTAL PRESSURE (PSIA)
VARY  2 107              CABIN GAS MIXTURE, NON-CONDESABLES MASS (LB)
VARY  2 108              CABIN GAS MIXTURE, H2O VAPOR MASS (LB)
VARY  2 109              CABIN GAS MIXTURE, ENTRAINED H2O MASS (LB)
VARY  2 110              CABIN GAS MIXTURE, NON-COND. SPECIFIC HEAT (BTU/LB-F
VARY  2 111              CABIN GAS MIXTURE, NON-COND. MOL WEIGHT (LB/MOL)
VARY  2 112              CABIN GAS MIXTURE, OXYGEN MASS (LB)
VARY  2 113              CABIN GAS MIXTURE, NITROGEN MASS (LB)
VARY  2 114              CABIN GAS MIXTURE, CO2 MASS (LB)
VARY  2 115              CABIN GAS MIXTURE, TRACE CONTAMINANTS MASS (LB)
VARY  2 122 0.0833       OUTBOARD LEAKAGE RATE (LB/HR)
VARY  2 123              NON-CONDENSABLES LEAKAGE RATE (LB/HR)
VARY  2 124              H2O VAPOR LEAKAGE RATE (LB/HR)
VARY  2 125              ENTRAINED H2O LEAKAGE RATE (LB/HR)
VARY  2 126              TOTAL MASS ADDITION RATE (LB/HR)
VARY  2 127              NON-COND. ADDITION RATE (LB/HR)
VARY  2 128 0.233        H2O VAPOR ADDITION RATE (LB/HR)
VARY  2 129 0.0          ENTRAINED H2O ADDITION RATE (LB/HR)
VARY  2 130              AVERAGE TEMPERATURE OF MASS ADDITIONS (F)
VARY  2 132 70.0         ADD COND VAPOR TEMP              (F)
VARY  2 135              NET TOTAL FLOW INTO CABIN (LB/HR)
VARY  2 136              NET NON-COND. FLOW INTO CABIN (LB/HR)
VARY  2 137              NET H2O VAPOR FLOW INTO CABIN - CALC IN GPOLY2
VARY  2 139 8000.        CABIN FREE VOL (FT3)
VARY  2 170 70.0         OXYGEN ADDITION TEMP (F)
VARY  2 171 70.0         NITROGEN ADDITION TEMP (F)
VARY  2 172 70.0         CO2 ADDITION TEMP (F)
VARY  2 173 70.0         TRACE CONTAMINANTS ADDITION TEMP (F)
VARY  2 174 70.0         SPECIAL FLOW NO. 1 ADDTION TEMP (F)
VARY  2 175              NET O2 ADDITION (LB/HR) - GPOLY2 CALC
VARY  2 176              NET N2 ADDITION (LB/HR) - GPOLY2 CALC
```

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Table 8 (Continued)
Input to ESCM

CONTINUATION OF K AND V COMPONENT DATA

```
VARY    2 177 0.0          NET CO2 ADDITION (LB/HR)
VARY    2 178 0.0          NET TRACE CONTAMINANTS ADDITION (LB/HR)
VARY    2 179 0.0          NET SPEC FLOW 1 ADDITION (LB/HR)
VARY    2 180 0.0          O2/N2 REG FLAG = 0.0 IF O2 USED LAST, = 1.0
VARY    2 181              MISSION TIME (SEC)
VARY    2 182              MISSION TIME (MIN)
VARY    2 183 1.0          SAWD ABSORB CYCLE TIME CURVE MULTIPLY FACTOR
VARY    2 184  8.0         PRINTOFF FREQUENCY, TIME STEPS PER PRINTOFF
ID**    3      SPLIT - MAIN CABIN HUMIDITY CONTROL HX OR TO SAWD-II        4    2
KBAS    3      10          -2 2                          2
NSTR    3
VARY    3  65 0.04866      SPLIT RATIO - GPOLY1 CALC
ID**    4      MAIN CABIN SENSIBLE HX FAN                                  5    2
KBAS    4      23           2 2
NSTR    4      1                  INPUT CFM & Q
VARY    4  76 2100.        CABIN FAN VOLUMETRIC FLOW RATE (CFM)
VARY    4  84 1.0          FAN ON/OFF SWITCH (1.0=ON,0.0=OFF)
VARY    4  91 833.         FAN HEAT ADDITION (WATTS)
ID**    5      MAIN CABIN SENSIBLE HX - SENSIBLE HEAT REMOVAL ONLY         1    2
KBAS    5      4            4 2                    -6 0   1
NSTR    5      2   0        1    COUNTERFLOW, PRI=GAS, SEC=LIQ, SS CALC
VARY    5  66 6240.        HX COUNTERFLOW UA (BTU/HR-F)
ID**    6      COOLING FLUID BOUNDARY COND - CABIN SENSIBLE HX                  2
KBAS    6      49      2          0   1
NSTR    6
VARY    6   1 1350.        COOLANT FLOW (LB/HR) -GPOLY1 CALC
VARY    6   2 60.0         COOLANT TEMP (F)
VARY    6   3 50.0       4 COOLANT PRESSURE (PSIA)
KARY    6  16          0   KPRNT VALUE AT START OF TRANSIENT (GPOLY1)
KARY    6  17          0   KCHOUT VALUE AT START OF TRANSIENT (GPOLY1)
ID**    7      MAIN CABIN CONDENSING HX                                    9    2
KBAS    7      4           31 2                    -8 0   1
NSTR    7      2   0        1    INPUT EFF, PRI=GAS, SEC=LIQ, SS CALCS
VARY    7  66 1000.        COUNTERFLOW HX UA (BTU/HR-F) _ GPOLY1 CALC
ID**    8      COOLING FLUID BOUNDARY COND - CABIN COND HX                      2
KBAS    8      49                 0   1
NSTR    8
VARY    8   1 950.         COOLANT FLOW (LB/HR)
VARY    8   2 45.0         COOLANT TEMP (F)
VARY    8   3 50.0       4 COOLANT PRESSURE (PSIA)
ID**    9      SPLIT - COND HX TO WATER SEPARATOR BYPASS, WATER SEPARATOR  10   2
KBAS    9      10  7        7 2                          2
NSTR    9      1                  SPECIFY INDIVIDUAL SPLIT RATIOS
VARY    9  66 0.03         SPLIT RATIO - COND VAPOR
VARY    9  67 1.00         SPLIT RATIO - COND LIQUID
VARY    9  68 0.03         SPLIT RATIO - OXYGEN
VARY    9  69 0.03         SPLIT RATIO - NITROGEN
VARY    9  70 0.03         SPLIT RATIO - CARBON DIOXIDE
VARY    9  71 0.03         SPLIT RATIO - TRACE CONTAMINANTS
VARY    9  72 0.03         SPLIT RATIO - SPECIAL FLOW #1
ID**   10      WATER SEPARATOR - CABIN COND HX                             11   2
KBAS   10      49  1       -9 2
NSTR   10      2                  CALC EXIT TMEP GIVEN Q
VARY   10  65              HEAT ADDED (BTU/HR) - GPOLY1 CALC
VARY   10  67              CONDENSATE REMOVED (LB/HR) - GPOLY1 CALC
ID**   11      GASMIX - COND HX WATER SEPARATOR, WATER SEPARATOR BYPASS    12   2
KBAS   11      6            9 2                    -10 2
NSTR   11
ID**   12      COND HX FAN                                                 13   2
KBAS   12      23          11 2
```

Table 8 (Continued)
Input to ESCM

```
                                       INPUT CFM & Q
NSTR  12     1
VARY  12   76 300.               CABIN FAN VOLUMETRIC FLOW RATE (CFM)
VARY  12   84 1.0                FAN ON/OFF SWITCH (1.0=ON,0.0=OFF)
VARY  12   91 140.               FAN HEAT ADDITION (WATTS)
ID**  13      GASMIX - SAWD-II AND COND HX FAN                                   2      2
KBAS  13      6             12 2                         30 2
NSTR  13
ID**  14      SPLIT - MAIN CABIN TO SAWD BED #1, SAWD BED #2                    27      2
KBAS  14      10            -3 2                               2
NSTR  14
VARY  14   65 0.0              SPLIT RATIO - GPOLY1 CALC
ID**  15      GASMIX - STEAM OR CABIN GAS TO SAWD BED #1 INLET                   16      2
KBAS  15      6             14 2                        -26 2
NSTR  15    2
ID**  16      SAWD BED #1 SIMULATION - ALTCOM                                    17      2
KBAS  16      73  0  0      15 2
NSTR  16
KARY  16   16           0      ABSORB/DESORB FLAG (0 = ABSORB, 1 = DESORB)
KARY  16   17          21      COMPLEMENTARY BED'S COMPONENT NO.
KARY  16   18           0      DESORBING FLOW REVERSAL FLAG: 1=YES, 0=NO
KARY  16   19           5      NUMBER OF BED SEGMENTS
KARY  16   20          15      DOWNSTREAM COMPONENT NUMBER
VARY  16   60 70.0             AMBIENT TEMPERATURE (F)
VARY  16   61 0.8              CAN-TO-AMBIENT KA/X (BTU/HR-F)
VARY  16   63 70.0             EXTERIOR SURFACE TEMPERATURE, (DEG-F)
VARY  16   64 0.800            CONDUCTANCE BETWEEN BED AND EXTERIOR, (BTU/HR-F)
VARY  16   65 1270.            HEAT OF CO2 REACTION WITH RESIN BED (BTU/LB)
VARY  16   66 0.314            SPECIFIC HEAT OF DRY IR45 RESIN, (BTU/LB-F)
VARY  16   67 32.70            DENSITY OF DRY RESIN BED, (PCF)
VARY  16   68 0.319            RESIN BED VOID VOLUME FRACTION
VARY  16   69 10.0             TIME REQUIRED TO COMPLETE STEAM DESORB (SEC)
VARY  16   70                  GAS STREAM TOTAL SENSIBLE HEAT CHANGE (BTU/HR)
VARY  16   71                  GAS STREAM TOTAL LATENT HEAT CHANGE (BTU/HR)
VARY  16   72                  TOTAL CO2 ABSORPTION(+)/DESORPTION(-) RATE (PPH)
VARY  16   73                  TOTAL H2O EVAPORATION(+)/CONDENSATION(-) RATE (PPH)
VARY  16   74 1.500            ABSORPTION/DESORPTION RATE (PPH OF CO2/LB-BED/PSI)
VARY  16   75 0.400            AVG. STEADY STATE DESORPTION STEAM RATE (PPH)
VARY  16   76 0.604            STEADY STATE CO2 REMOVAL EFFICIENCY
VARY  16   77 70.00            AVG. STEADY STATE BED TEMPERATURE, (DEG-F)
VARY  16   78 8.500            TOTAL DRY RESIN BED WEIGHT (LBM)
VARY  16   79 7.400            TOTAL CANISTER WEIGHT (LBM)
VARY  16   80 2.550            TOTAL WATER IN BED (LBM)
VARY  16   81 0.005            TOTAL CO2 IN BED (LBM)
VARY  16   82                  TOTAL BED H2O LOADING (LB H2O/LB BED)
VARY  16   83                  TOTAL BED CO2 LOADING (LB CO2/LB BED)
VARY  16   84 0.120            SPECIFIC HEAT OF CANISTER (BTU/LB-F)
VARY  16   85 180.0            EXIT TEMPERATURE TO END DESORPTION, DEG-F
VARY  16   86 2280.            TIME TO END ABSORPTION, SECONDS
VARY  16   87 240.             TIME LAG FOR OUTLET TEMPERATURE, SECONDS
VARY  16   88                  BED INLET DEW POINT, DEG-F
VARY  16   89                  BED EXIT DEW POINT, DEG-F
VARY  16   90                  BED INLET CO2 PARTIAL PRESSURE, MM-HG
VARY  16   91                  BED EXIT CO2 PARTIAL PRESSURE, MM-HG
VARY  16   92                  TOTAL BED EXIT FLOW, CFM
VARY  16   93 0.470            TOTAL WEIGHT OF FOAM IN BED, LBM
VARY  16   94 0.330            SPECIFIC HEAT OF FOAM BTU/LB-F
VARY  16   95 100000.          TIME TO BEGIN DEBUG PRINTOFF, SECONDS.
ID**  17      SPLIT - SAWD BED #1 TO COND HX OR CO2 RECOVERY                     20      2
KBAS  17      10            16 2                        2
NSTR  17
```

CONTINUATION OF K AND V COMPONENT DATA

Table 8 (Continued)
Input to ESCM

CONTINUATION OF K AND V COMPONENT DATA

```
VARY  17  65 0.0              SPLIT RATIO - GPOLY1 CALC
ID**  18      GASMIX - SAWD BED #1, SAWD BED #2
KBAS  18       6              17 2                -22 2                19    2
NSTR  18
ID**  19      SAWD BED FAN
KBAS  19      23              18 2                                     30    2
NSTR  19     003                       INPUT Q ONLY
VARY  19    2 70.             CABIN GAS MIXTURE: INITIAL TEMP (F)
VARY  19    3 14.7          4 TOTAL PRESSURE  (PSIA)
VARY  19    6  0.78           H2O VAPOR FLOW  (LB/HR)
VARY  19   10 20.55           OXYGEN FLOW  (LB/HR)
VARY  19   11 71.87           NITROGEN FLOW  (LB/HR)
VARY  19   12  0.30           CO2 FLOW  (LB/HR)
VARY  19   76 15.             CABIN FAN VOLUMETRIC FLOW RATE (CFM)
VARY  19   84 1.0             FAN ON/OFF SWITCH (1.0=ON,0.0=OFF)
VARY  19   91 50.             FAN HEAT ADDITION (WATTS)
ID**  20      GASMIX - STEAM OR CABIN GAS TO SAWD BED #2 INLET
KBAS  20       6            -14 2                  26 2                21    2
NSTR  20     2
ID**  21      SAWD BED #2 SIMULATION - ALTCOM
KBAS  21      73  0  0       20 2                                      22    2
NSTR  21
KARY  21   16           1     ABSORB/DESORB FLAG (0 = ABSORB, 1 = DESORB)
KARY  21   17          16     COMPLEMENTARY BED'S COMPONENT NO.
KARY  21   18           0     DESORBING FLOW REVERSAL FLAG: 1=YES, 0=NO
KARY  21   19           5     NUMBER OF BED SEGMENTS
KARY  21   20          20     DOWNSTREAM COMPONENT NUMBER
VARY  21   60 70.0            AMBIENT TEMPERATURE (F)
VARY  21   61 0.8             CAN-TO-AMBIENT KA/X (BTU/HR-F)
VARY  21   63 70.0            EXTERIOR SURFACE TEMPERATURE, (DEG-F)
VARY  21   64 0.800           CONDUCTANCE BETWEEN BED AND EXTERIOR, (BTU/HR-F)
VARY  21   65 1270.           HEAT OF CO2 REACTION WITH RESIN BED (BTU/LB)
VARY  21   66 0.314           SPECIFIC HEAT OF DRY IR45 RESIN, (BTU/LB-F)
VARY  21   67 32.70           DENSITY OF DRY RESIN BED, (PCF)
VARY  21   68 0.319           RESIN BED VOID VOLUME FRACTION
VARY  21   69 10.0            TIME REQUIRED TO COMPLETE STEAM DESORB (SEC)
VARY  21   70                 GAS STREAM TOTAL SENSIBLE HEAT CHANGE (BTU/HR)
VARY  21   71                 GAS STREAM TOTAL LATENT HEAT CHANGE (BTU/HR)
VARY  21   72                 TOTAL CO2 ABSORPTION(+)/DESORPTION(-) RATE (PPH)
VARY  21   73                 TOTAL H2O EVAPORATION(+)/CONDENSATION(-) RATE (PPH)
VARY  21   74 1.500           ABSORPTION/DESORPTION RATE (PPH OF CO2/LB-BED/PSI)
VARY  21   75 0.400           AVG. STEADY STATE DESORPTION STEAM RATE (PPH)
VARY  21   76 0.604           STEADY STATE CO2 REMOVAL EFFICIENCY
VARY  21   77 70.00           AVG. STEADY STATE BED TEMPERATURE, (DEG-F)
VARY  21   78 8.500           TOTAL DRY RESIN BED WEIGHT (LBM)
VARY  21   79 7.400           TOTAL CANISTER WEIGHT (LBM)
VARY  21   80 2.080           TOTAL WATER IN BED (LBM)
VARY  21   81 0.300           TOTAL CO2 IN BED (LBM)
VARY  21   82                 TOTAL BED H2O LOADING (LB H2O/LB BED)
VARY  21   83                 TOTAL BED CO2 LOADING (LB CO2/LB BED)
VARY  21   84 0.120           SPECIFIC HEAT OF CANISTER (BTU/LB-F)
VARY  21   85 180.0           EXIT TEMPERATURE TO END DESORPTION, DEG-F
VARY  21   86 2280.           TIME TO END ABSORPTION, SECONDS
VARY  21   87 240.            TIME LAG FOR OUTLET TEMPERATURE, SECONDS
VARY  21   88                 BED INLET DEW POINT, DEG-F
VARY  21   89                 BED EXIT DEW POINT, DEG-F
VARY  21   90                 BED INLET CO2 PARTIAL PRESSURE, MM-HG
VARY  21   91                 BED EXIT CO2 PARTIAL PRESSURE, MM-HG
VARY  21   92                 TOTAL BED EXIT FLOW, CFM
VARY  21   93 0.470           TOTAL WEIGHT OF FOAM IN BED, LBM
```

Table 8 (Continued)
Input to ESCM

```
VARY  21  94 0.330         SPECIFIC HEAT OF FOAM BTU/LB-F
VARY  21  95 100000.       TIME TO BEGIN DEBUG PRINTOFF, SECONDS.
ID**  22     SPLIT - SAWD BED #2 TO COND HX OR CO2 RECOVERY                 23    2
KBAS  22     10              21 2                          2
NSTR  22
VARY  22  65 1.0              SPLIT RATIO - GPOLY1 CALC
ID**  23     GASMIX - SAWD BED #1 EXIT GAS, SAWD BED #2 EXIT GAS            24    2
KBAS  23      6             -22 2                        17 2
NSTR  23
ID**  24     SPLIT - SAWD EXIT GAS TO PREHEAT OR TO CO2 ACCUMULATOR         18    2
KBAS  24     10              23 2                          2
NSTR  24
VARY  24  65 0.0              SPLIT RATIO - GPOLY1 CALC
ID**  25     GASMIX - STEAM GENERATOR AND PREHEAT STEAMS                    26    2
KBAS  25      6              29 2                        24 2
NSTR  25
ID**  26     SPLIT - STEAM TO SAWD BED #1 OR #2.                            15    2
KBAS  26     10              25 2                          2
NSTR  26
VARY  26  65 1.0              SPLIT RATIO - GPOLY1 CALC
ID**  27     H2O SUPPLY TANK FOR STEAM GENERATOR                            28    2
KBAS  27     30  3             0  1
NSTR  27    1101                    COMPUTE OUTLET FLOW IN GPOLY1
VARY  27   1 2.55             INITIAL H2O FLOW (LB/HR)
VARY  27  68 168.3            H2O TANK MAX CAPACITY (LB)
VARY  27  69 168.3            H2O TANK INITIAL FILL (LB)
VARY  27  70 70.0             H2O TEMPERATURE (F)
VARY  27  71                  TANK VOLUME (FT3)
VARY  27  72 30.0             TANK PRESSURE (PSIA)
VARY  27  98                  WATER USED FROM TANK (LB)
VARY  27  99                  WATER ADDED TO TANK (LB)
VARY  27 100 2.55             H2O FLOW (PPH)
ID**  28     H2O SUPPLY PUMP FOR STEAM GENERATOR                            29    2
KBAS  28     22              27 0  1
NSTR  28     0002                   INPUT PUMP HEAT ADDITION
VARY  28  79 1.0              PUMP ON/OFF FLAG (1.0=ON)
VARY  28  85 10.0             HEAT ADDITION (WATTS)
ID**  29     STEAM GENERATOR FOR SAWD BED DESORPTION                        25    2
KBAS  29     27              28 2
NSTR  29     1                      CALC ELEC ENERGY REQUIRED
VARY  29  66 40.0             DESIRED DEGREES OF SUPERHEAT (F)
VARY  29  67                  TEMP OF SATURATED STEAM (F)
VARY  29  68                  ELEC ENERGY REQUIRED (WATTS)
ID**  30     SPLIT - DESORBED GAS TO CABIN OR CO2 ACCUMULATOR.              32    2
KBAS  30     10              24 2                          2
NSTR  30
VARY  30  65 1.0              SPLIT RATIO - GPOLY1 CALC
ID**  31     GASMIX - CABIN AIR AND SAWD AIR TO HUMD CONTROL HX              7    2
KBAS  31      6               3 2                        -19 2
NSTR  31
ID**  32     CO2 ACCUMULATOR TANK                                           31    2
KBAS  32     30      1       30 2
NSTR  32     01000
KARY  32     16          1    CO2 DELIVERY; 0 = OVBD; 1 = CO2 REDUCTION.
VARY  32  70 70.              CO2 TEMPERATURE (F)
VARY  32  71 2.0              TANK VOLUME (FT3)
VARY  32  72 30.0             CO2 PRESSURE (PSIA)
VARY  32  80 0.4644           MASS OF CO2 IN TANK (LB)
TABL   1  1     2            16      0     LIN    LIN
TITL   1  2 CREWMAN METABOLIC RATE (BTU/HR) VS MISSION TIME (SEC)
```

END OF K AND V COMPONENT DATA

↕

START OF TABLE DATA

Table 8 (Continued)
Input to ESCM

CONTINUATION OF TABLE DATA

```
VALU    1 10 2I  .0          2700.       3600.       7200.       .1800E+05   .1980E+05
VALU    1 11 2D  450.0       450.0       520.0       650.0       650.0       450.0
VALU    1 12 2I  .2340E+05   .2520E+05   .3960E+05   .4140E+05   .4320E+05   .4680E+05
VALU    1 13 2D  450.0       650.0       650.0       520.0       450.0       450.0
VALU    1 14 2I  .5040E+05   .5400E+05   .5580E+05   .8640E+05
VALU    1 15 2D  390.0       520.0       300.0       300.0
TABL   10  1     2           3             LIN   STP
TITL   10  2 PRESSURE CONTROL SYSTEM OPERATION
TITL   10  3 PRESSURE MODE VS MISSION TIME (SEC)
TITL   10  4      =0  14.5 PSI CONTROLLER USED
TITL   10  5      =1  8.0 PSI CONTROLLER USED
VALU   10 10 2I  -8400.      15300.      427864.
VALU   10 11 2D   0.0         0.0         0.0
TABL   20  1     2           6             LIN   LIN
TITL   20  2  PRESSURE CONTROL SUBSYSTEM REGULATOR FLOWRATE CURVE
TITL   20  3 O2 OPENING FLOWS (FROM JULY 1980 PCS TESTING AT JSC)
TITL   20  4 O2 OPENING FLOWS VS TOTAL PRESSURE (PSIA)
VALU   20 10 2I      0.0       14.510      14.565      14.666      14.700      100.0
VALU   20 11 2D     10.0        10.0        0.85         0.2         0.0         0.0
TABL   21  1     2           6             LIN   LIN
TITL   21  2  PRESSURE CONTROL SUBSYSTEM REGULATOR FLOWRATE CURVE
TITL   21  3 O2 CLOSING FLOWS (FROM JULY 1980 PCS TESTING AT JSC)
TITL   21  3 O2 CLOSING FLOWS VS TOTAL PRESSURE (PSIA)
VALU   21 10 2I      0.0      14.605      14.672      14.745      14.819      100.0
VALU   21 11 2D     10.0        10.0         0.6        0.25         0.0         0.0
TABL   22  1     2           8             LIN   LIN
TITL   22  2  PRESSURE CONTROL SUBSYSTEM REGULATOR FLOWRATE CURVE
TITL   22  3 N2 OPENING FLOWS (FROM JULY 1980 PCS TESTING AT JSC)
TITL   22  4 N2 OPENING FLOWS VS TOTAL PRESSURE (PSIA)
VALU   22 10 2I      0.0      14.500      14.510      14.563      14.583      14.640
VALU   22 11 2D     67.0        67.0        25.0         7.0         1.0         0.5
VALU   22 12 2I   14.748       100.0
VALU   22 13 2D      0.0         0.0
TABL   23  1     2           8             LIN   LIN
TITL   23  2  PRESSURE CONTROL SUBSYSTEM REGULATOR FLOWRATE CURVE
TITL   23  3 N2 CLOSING FLOWS (FROM JULY 1980 PCS TESTING AT JSC)
TITL   21  3 N2 CLOSING FLOWS VS TOTAL PRESSURE (PSIA)
VALU   23 10 2I      0.0      14.590      14.625      14.658      14.680      14.748
VALU   23 11 2D     67.0        67.0        11.0         7.0         0.8         0.5
VALU   23 12 2I   14.813       100.0
VALU   23 13 2D      0.0         0.0
TABL   30  1     2          12       0     LIN   LIN
TITL   30  2 RELATIVE HUMIDITY (DECIMAL) VS ABSORPTION CYCLE DURATION (MIN)
TITL   30  3 FAN CHARACTERISTIC ADJUSTED - HSD REPORT SVHSER 8921
VALU   30 10 2I      .15         .25         .35         .45         .50         .55
VALU   30 11 2D    13.00       28.14       41.00       51.57       56.00       59.85
VALU   30 12 2I      .60         .70         .80         .85         .95        1.00
VALU   30 13 2D    63.14       68.00       70.57       70.99       71.01       71.01
TABL   31  1     2           7       0     LIN   LIN
TITL   31  2 SAWD FAN FLOW (CFM) VS ELAPSED TIME (SEC) DURING PREHEAT
TITL   31  3 ESTIMATED VALUES 1-9-85
VALU   31 10 2I  .0          60.         120.        180.        240.        300.
VALU   31 11 2D  1.90        1.90        3.50        4.90        5.90        6.70
VALU   31 12 2I  360.
VALU   31 13 2D  7.10
TABL   32  1     2          10       0     LIN   LIN
TITL   32  2 SAWD FAN FLOW (CFM) VS. ELAPSED ABSORPTION CYCLE TIME (SEC)
VALU   32 10 2I  .0          60.         120.        240.        360.        480.
VALU   32 11 2D  0.10        5.00        7.90        11.00       12.80       13.95
VALU   32 12 2I   600.        720.        900.        7200.
```

Table 8 (Continued)
Input to ESCM

```
VALU  32 13 2D  14.60      15.00       15.00       15.00
TABL  33  1   2            10      0    LIN   LIN
TITL  33  2 ABSORPTION CYCLE TIME (SEC) VS. SAWD FAN FLOW (CFM)
VALU  33 10 2I  0.10       5.00        7.90        11.00       12.80       13.95
VALU  33 11 2D  .0          60.         120.        240.        360.        480.
VALU  33 12 2I  14.60      15.0        15.0        15.0
VALU  33 13 2D   600.      720.         900.        7200.
TABL  41  1   2            16      0    LOG   LIN
TITL  41  2  MOLE FRACTION OF CO2 IN BED SEGMENT VERSUS LOADING.
VALU  41 10 2I         0.0        0.01        0.02        0.03        0.04        0.05
VALU  41 11 2D   .0000001   0.000052     0.00048      0.0019      0.0050      0.0105
VALU  41 12 2I       0.06       0.07       0.075      0.0600      0.0225       0.025
VALU  41 13 2D     0.0225      0.044       0.068      0.1100      0.1500       0.250
VALU  41 14 2I     0.0885      0.090       0.094         1.0
VALU  41 15 2D     0.5100      0.630       1.000         1.0
TABL  51  1   2            12      0    LIN   LIN
TITL  51  2  TEMPERATURE FACTOR ON CALCULATION OF EQUIL YCO2.
VALU  51 10 2I        55.        77.         90.        110.        130.        150.
VALU  51 11 2D       1.20       1.00       0.870       0.790       0.570      0.4400
VALU  51 12 2I       170.       190.       210.0        250.        270.        400.
VALU  51 13 2D     0.2750     0.1550       0.060      0.0300      0.0150      0.0001
TABL  61  1   2            12      0    LIN   LIN
TITL  61  2  WATER LOADING FACTOR ON CALCULATION OF EQUIL YCO2.
VALU  61 10 2I        0.0       0.09       0.105       0.125       0.157       0.175
VALU  61 11 2D      0.551      0.550       0.571       0.745       1.034       1.200
VALU  61 12 2I      0.200      0.225       0.250       0.275       0.300       1.000
VALU  61 13 2D      1.360      1.410       1.429       1.440       1.450       1.450
TABL  71  1   2            13      0    LIN   LIN
TITL  71  2  INFLUENCE OF RELATIVE HUMIDITY ON EQUILIBRIUM WATER LOADING
VALU  71 10 2I     -10.00      0.000       0.010       0.035       0.060       0.083
VALU  71 11 2D       0.00      0.000       0.100       0.200       0.300       0.400
VALU  71 12 2I      0.104      0.145       0.190       0.230       0.275       0.315
VALU  71 13 2D      0.500      0.600       0.700       0.800       0.900       1.000
VALU  71 14 2I      1.000                                                      0.315
VALU  71 15 2D      1.000                                                      1.000
```

END OF TABLE DATA

START OF PLOT DATA

```
PLOT0                               ESCM DEMONSTRATION MODEL
PLOT1       2 181                   MISSION TIME (SEC)
PLOT1       2 182                   MISSION TIME (MIN)
PLOT2       1  66                   CREWMAN SEN (BTU/HR)
PLOT2       1  67                   CREWMAN LAT (BTU/HR)
PLOT2       1  68                   O2 USE RATE (LB/HR)
PLOT2       1  69                   CO2 GEN RATE (LB/HR)
PLOT2       1  82                   CREWMAN MET (BTU/HR)
PLOT2       2  89                   REL HUMIDITY (DEC)
PLOT2       2  94                   O2 PRESSURE (PSIA)
PLOT2       2  95                   N2 PRESSURE (PSIA)
PLOT2       2  98                   DEW POINT TEMP (F)
PLOT2       2 100                   CO2 PRESS (MM HG)
PLOT2       2 104                   DRY BULB TEMP (F)
PLOT2       2 106                   TOTAL PRESS (PSIA)
PLOT2       2 165                   O2 MAKEUP (LB/HR)
PLOT2       2 166                   N2 MAKEUP (LB/HR)
PLOT2      15   6                   SA-1 H2O IN (LB/HR)
PLOT2      16   6                   SA-1 H2O OUT (LB/HR)
PLOT2      15  12                   SA-1 CO2 IN (LB/HR)
PLOT2      16  12                   SA-1 CO2 OUT (LB/HR)
PLOT2      16   2                   SA-1 EXIT TEMP (F)
PLOT2      16  82                   SA-1 H2O LOAD(LB/LB)
PLOT2      16  83                   SA-1 CO2 LOAD(LB/LB)
PLOT2      20   6                   SA-2 H2O IN (LB/HR)
```

Table 8 (Continued)
Input to ESCM

```
PLOT2      21   6        SA-2 H2O OUT (LB/HR)
PLOT2      20  12        SA-2 CO2 IN (LB/HR)
PLOT2      21  12        SA-2 CO2 OUT (LB/HR)
PLOT2      21   2        SA-2 EXIT TEMP (F)
PLOT2      21  82        SA-2 H2O LOAD(LB/LB)
PLOT2      21  83        SA-2 CO2 LOAD(LB/LB)
ENDC
ENDR
```

END OF
PLOT DATA

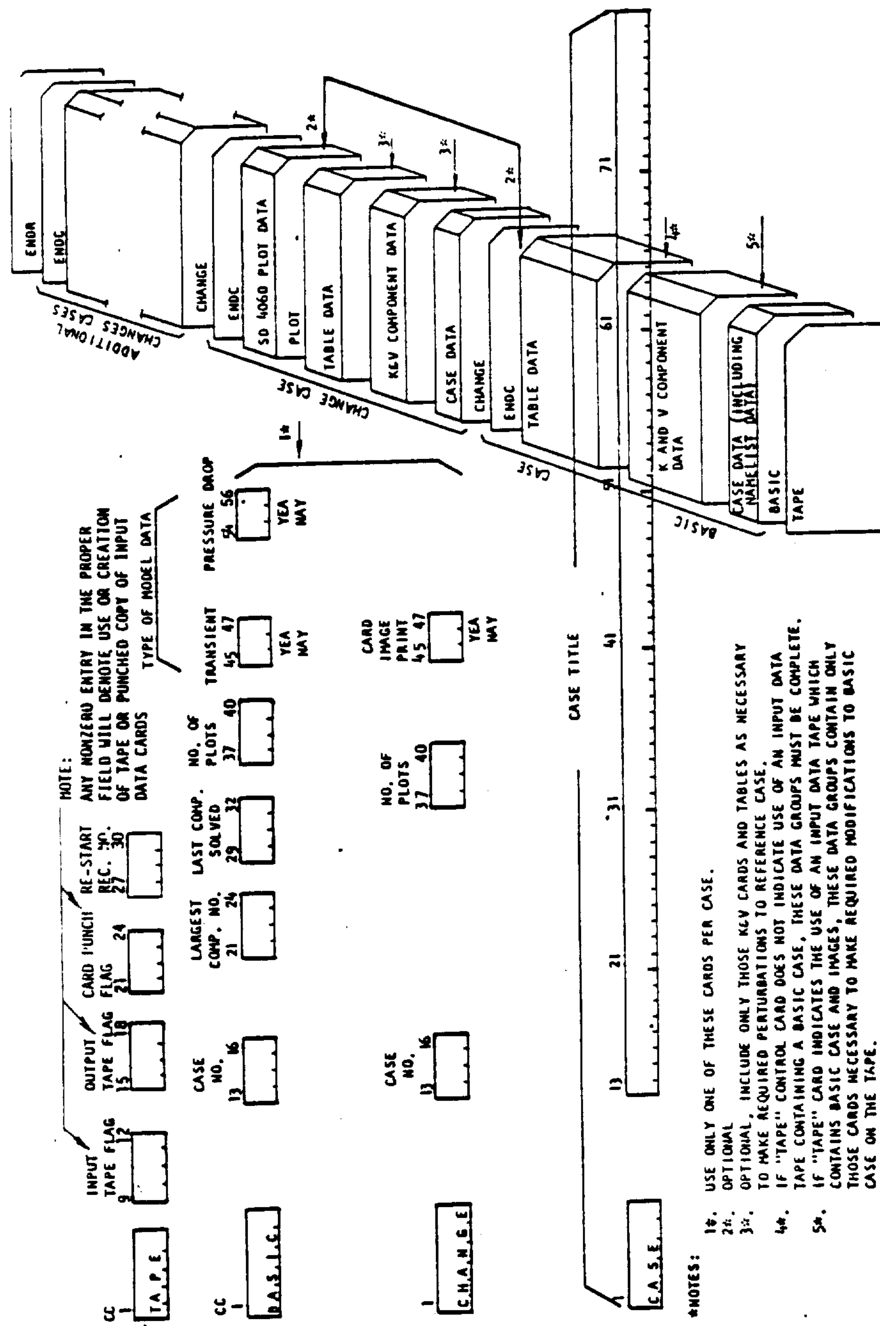


Figure 8
Input Setup And Case Data Loadsheet

4.1.2.1 Case Data Group (Continued)

Record 1	FORMAT	COLS
2) Print selection for Shuttle model using G189A. Not used by ESCM. Input a zero in column 8.	I4	5-8

IPRT=0=print phase instantaneous and average data
IPRT=1=print only instantaneous data
IPRT=2=delete all diagram printouts, do not print average data.

See Figure 8 for the setup of the TAPE, BASIC, and CASE lines of input.

In the case group data, the user need only change the maximum value of time in seconds ,TIMEMX, for a transient case. The time increment DTIME should not be changed; the value of 15 seconds has been selected to give the fastest running time while still giving the desired computational accuracy.

In the PROP1 NAMELIST, the special fluids array are:

1) liquid water at 70°F and 1 atmosphere
2) carbon dioxide gas at 70°F and 3 mmHg

The diluent is nitrogen and the condensable is water vapor.

4.1.2.2 K and V Component Data Group

The K and V component data group consists of all the data required to specify and describe each component. These data include the connection and option data entered in integer format and the numerical values entered in floating point format. The former are referred to as K array values while the latter are referred to as V array values.

Five different types of input are required for each component. These input are contained in the ID record, the KBAS record, the NSTR record, the KARY records, and the VARY records. The ID record specifies the component number given by the user and describes what the component is. For example in Figure 4, the ID # of the crew is 1. See Figure 9 for the ID** load sheet which gives the format for the entries required.

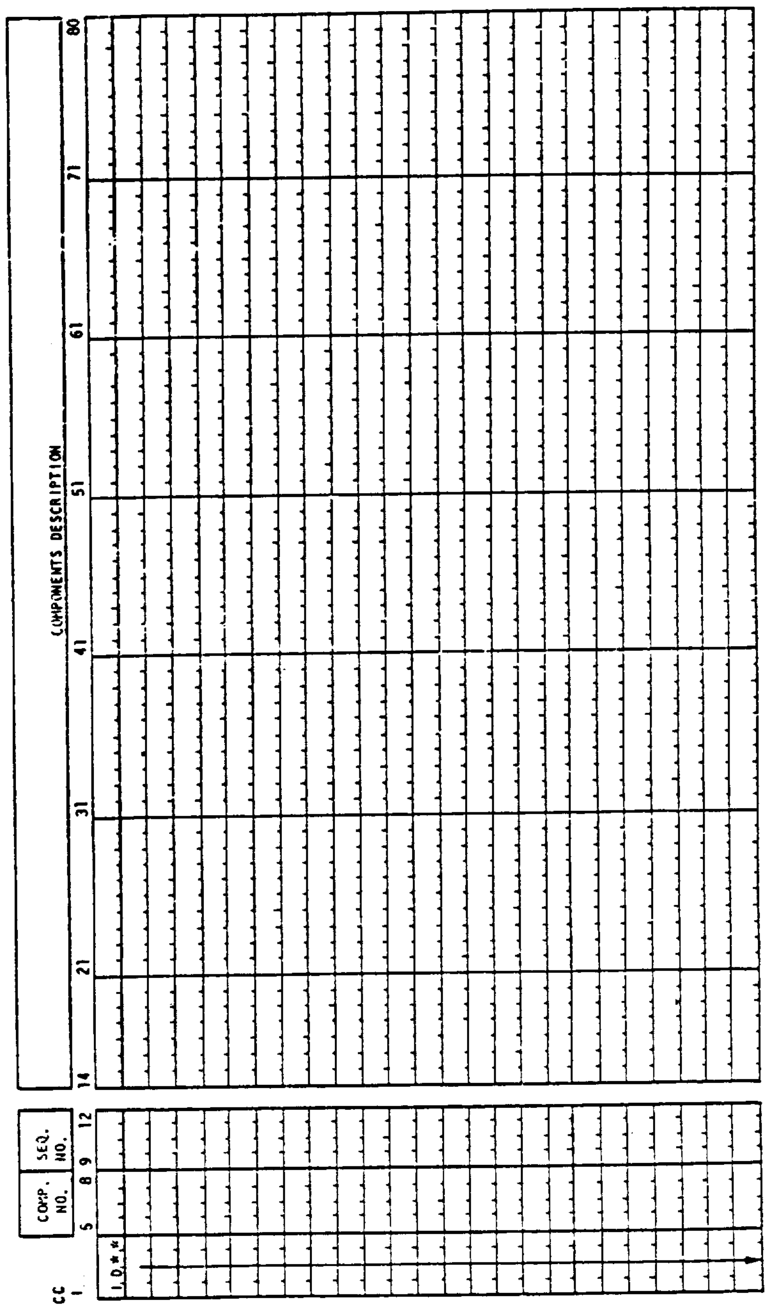


Figure 9
ID** Loadsheet

4.1.2.2 K and V Component Data Group (Continued)

The second record is the KBAS record. This input provides the basic input to describe how the components are connected together via fluid flow paths and also provides the solution sequence (i.e., the order in which each component is solved). The format for input to the KBAS record is shown in Figure 10. The input in Table 8 for the KBAS records are for the model shown in Figure 4 and are formatted per Figure 10.

The third record in the K and V component group data is the NSTR record. In this record are input the component specific instructions or options selected that are required by the component subroutine. See Figure 11 for the format. A description of the options are provided in Reference 3 for each subroutine. Also, NSTR(16) through NSTR(18) have general meanings applicable to all subroutines. These general meanings can be found in Chapter 6 of Reference 3.

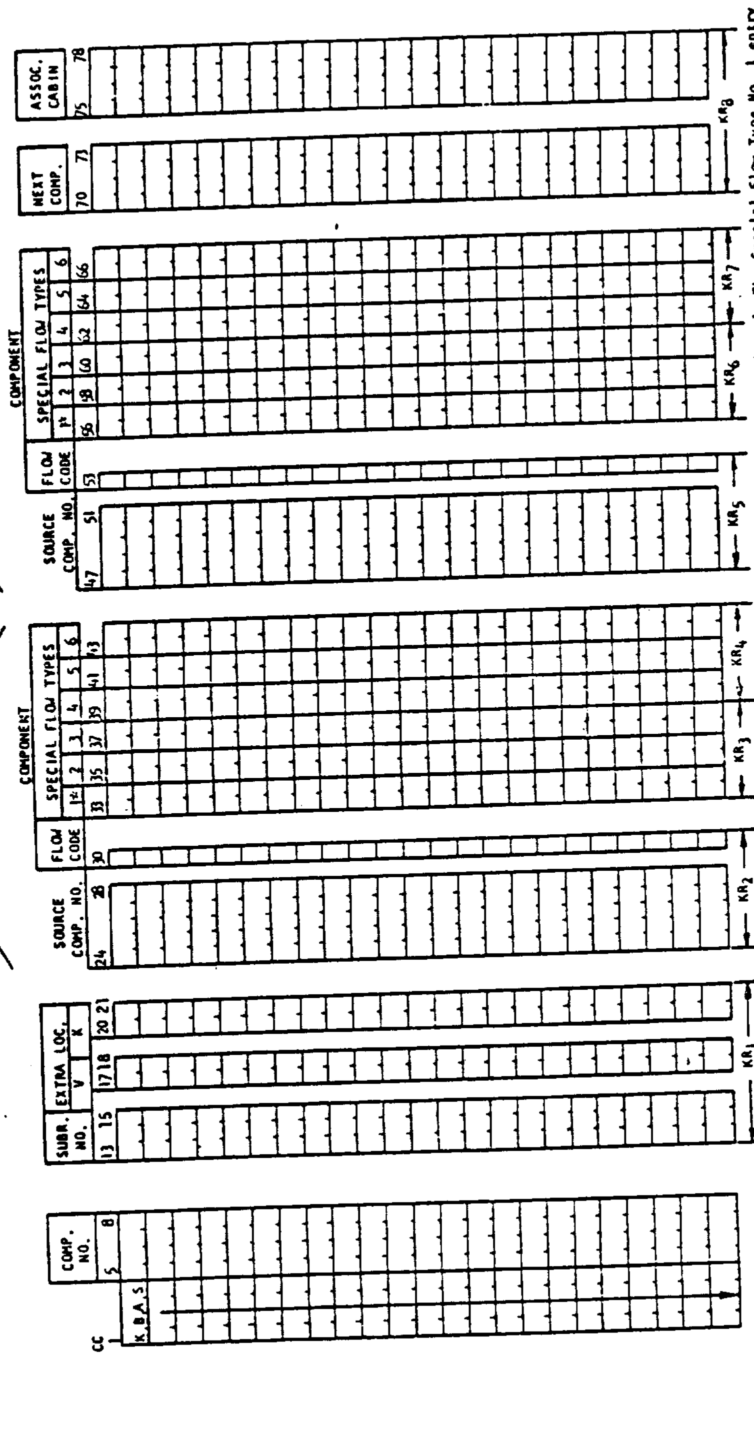
The fourth and fifth records to be provided are the KARY and VARY records. These input provide the initial values and constants for integer and floating point variables required for each component. The format for inputting these values is given in Figures 12 and 13 respectively for the KARY and VARY records.

All the input for the K and V component group data are constants and should not be changed by the user. The only input that may be changed without affecting the ESCM model and correlation are the following:

Item	Location
1) Number of crewmen	K(1,16)
2) Sensible heat per crewman	V(1,66)
3) Latent heat per crewman	V(1,67)
4) Cabin heat load	V(2,66)
5) Cabin free volume	V(2,139)
6) Printoff frequency	V(2,184)
7) Cabin gas design temperature	V(2,87)
8) Time to begin debug printoff	V(16,95)/V(21,95)
9) CO_2 delivery: 0=O_2 bed 1=CO_2 reduction	K(32,16)

Other parameters may of course be changed, but only by a user who understands the ESCM program and the implications of the change.

*As a convenience, the Special Flow Type No. 1 entry is also used to define the total flow stream property data for flow codes = 0 or 1 as described below:



* If Flow Code = 0; The Special Flow Type No. 1 entry defines the property data for the non-condensables flow. If Flow Code = 1; The Special Flow Type No. 1 entry defines the property data for the total liquid flow.

Figure 10
KBAS Loadsheet

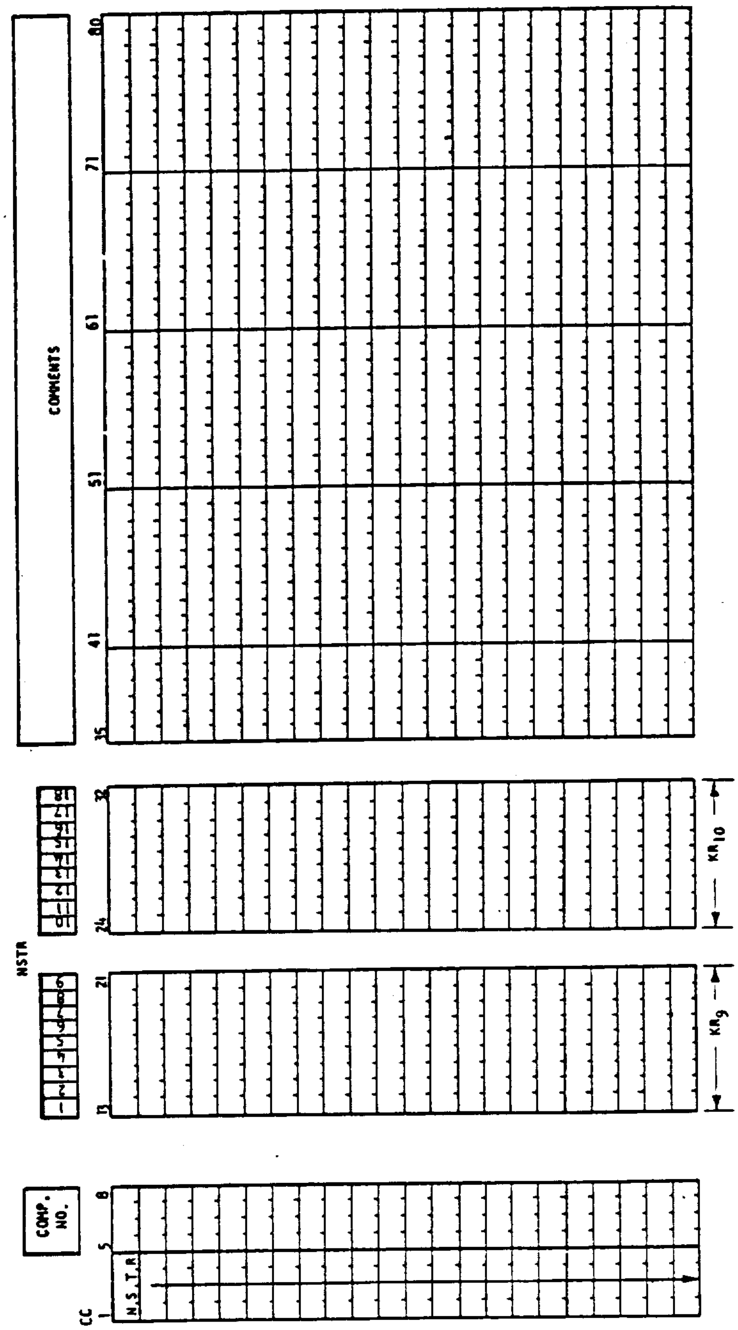


Figure 11
NSTR Loadsheet

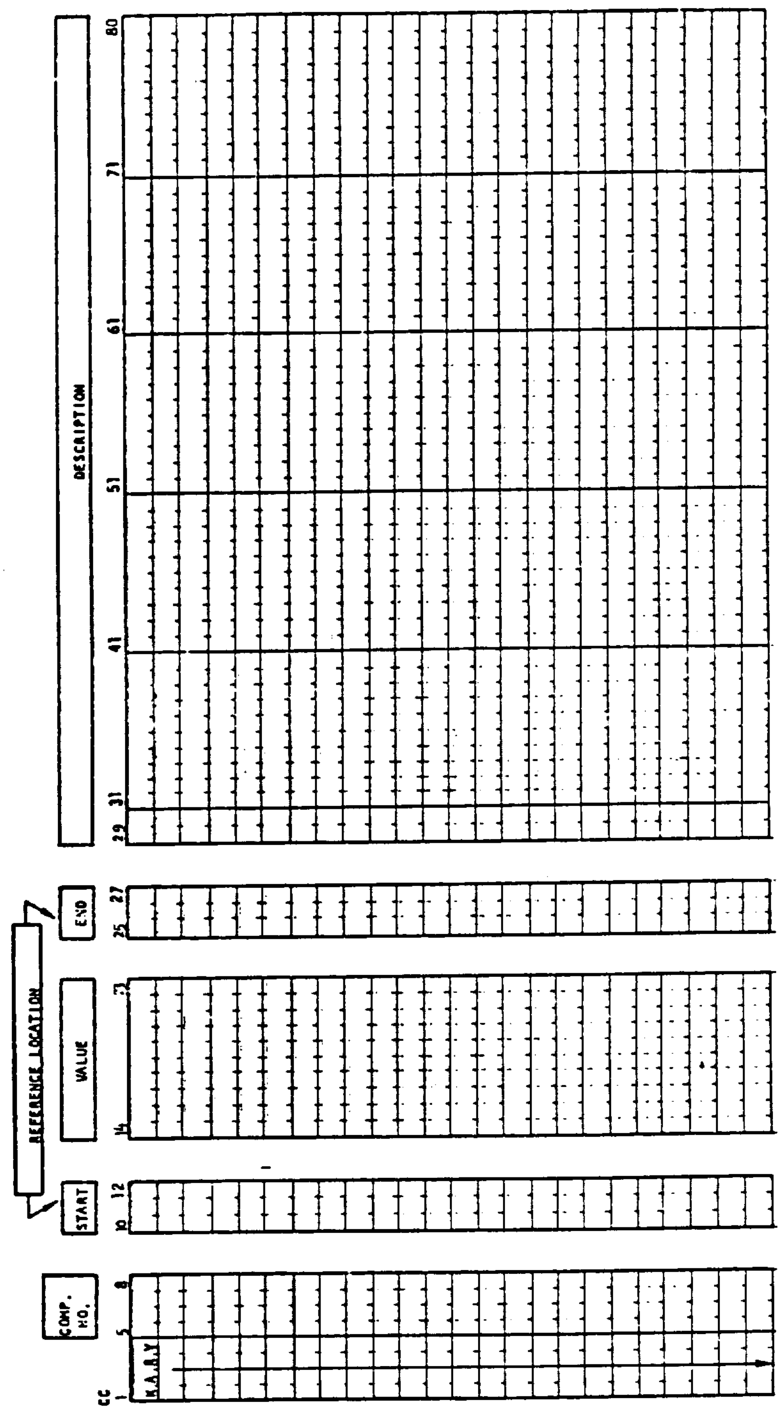


Figure 12
KARY Loadsheet

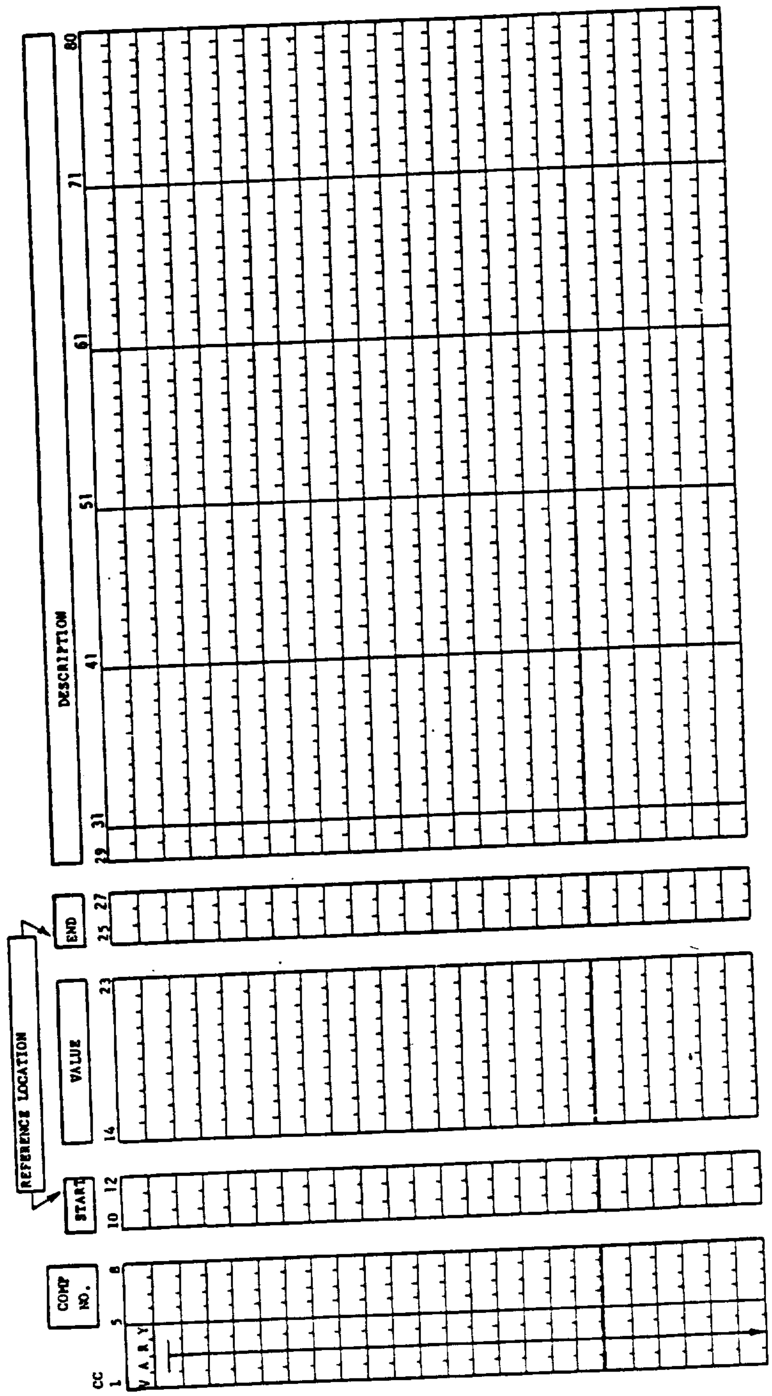


Figure 13
VARY Loadsheet

4.1.2.3 Table Data Group

The table data group contains all the tables or curves required for the ESCM program. These tables relate such variables as metabolic load as a function of time. These table data are not to be altered by the user except for crewman metabolic rate (Btu/hr) vs mission time (sec).

Of course other table data may be changed by the user but should only be done so by a user who understands the program and the implications of the change. The format to input table data is shown in Figure 14.

4.1.2.4 Plot Data Group

The plot data group of input specifies those variables which are to be saved for later use by a plotting program. The variables listed in Table 8 serve as a baseline group from which some can be deleted or others added as desired by the user. The format for each variable to be entered is shown in Figure 15.

4.2 Installation of HS ESCM Program at Langley Research Center

4.2.1 Introduction

The Hamilton Standard (HS) version of the ESCM program is executed at HS on IBM 3080 computers, and several modifications are needed to make it compatible with the Langley Research Center (LaRC) Prime 850 computer. These modifications involve substituting equivalent prime system functions (for example, date and central processor time) for the IBM calls and updating the program to the local FORTRAN 77. The procedure for making these changes to the program as delivered by HS is outlined below. All programs and procedure files are found in the directory SEB>LFR.DIR>EMSIM.DIR.

4.2.2 Program Delivery

HS will provide a nine-track magnetic tape with the program source code and input data at least. In addition, listings of the code and results of a sample simulation run will be needed to verify the correctness of program execution. This tape, with sufficient description of its block size, density, code (probably EBCDIC), word length, and number of files should be taken to the PRIME analyst who will dump the tape to a user directory.

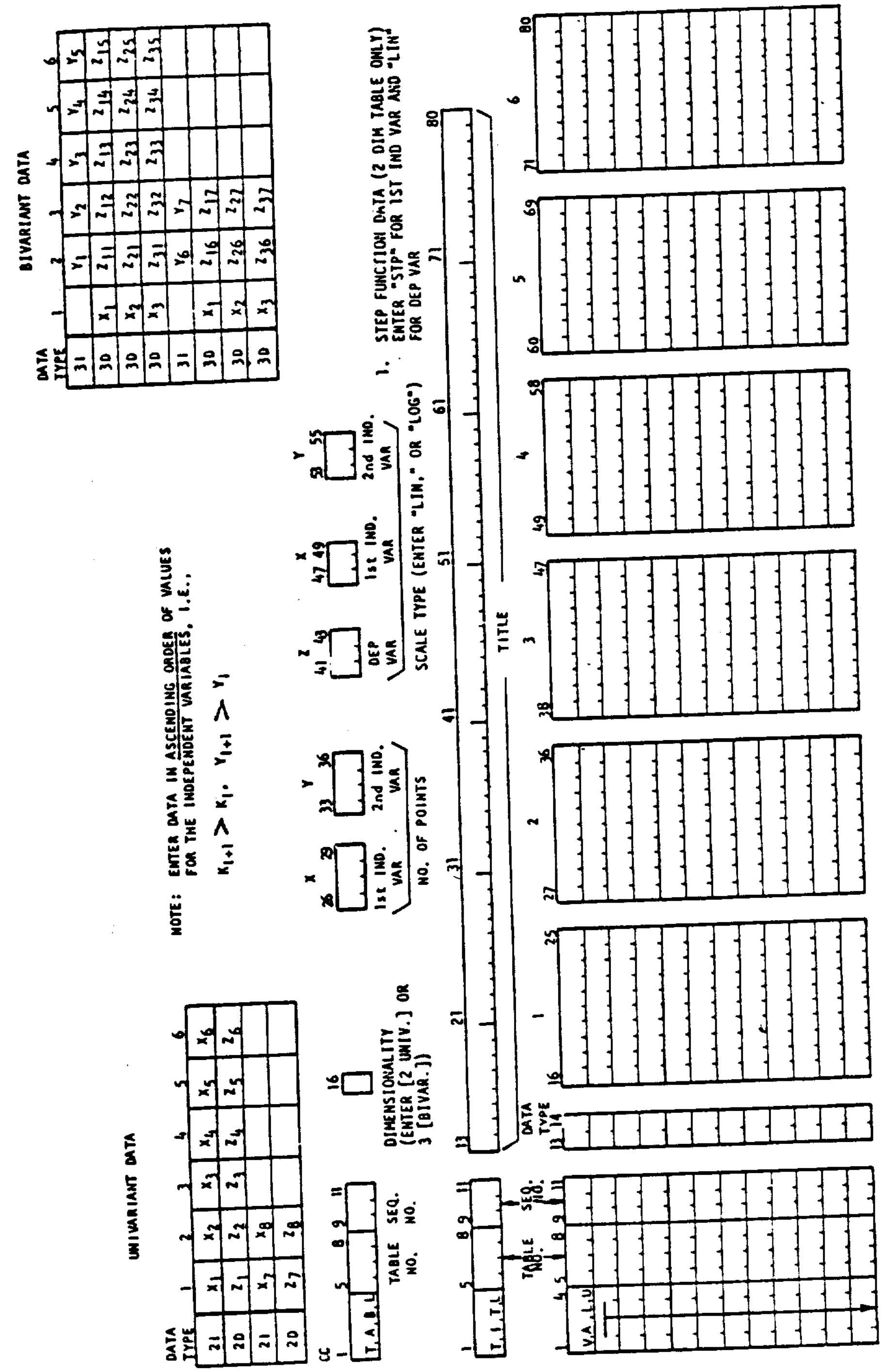


Figure 14

CURVE OR TABLE DATA Loadsheet

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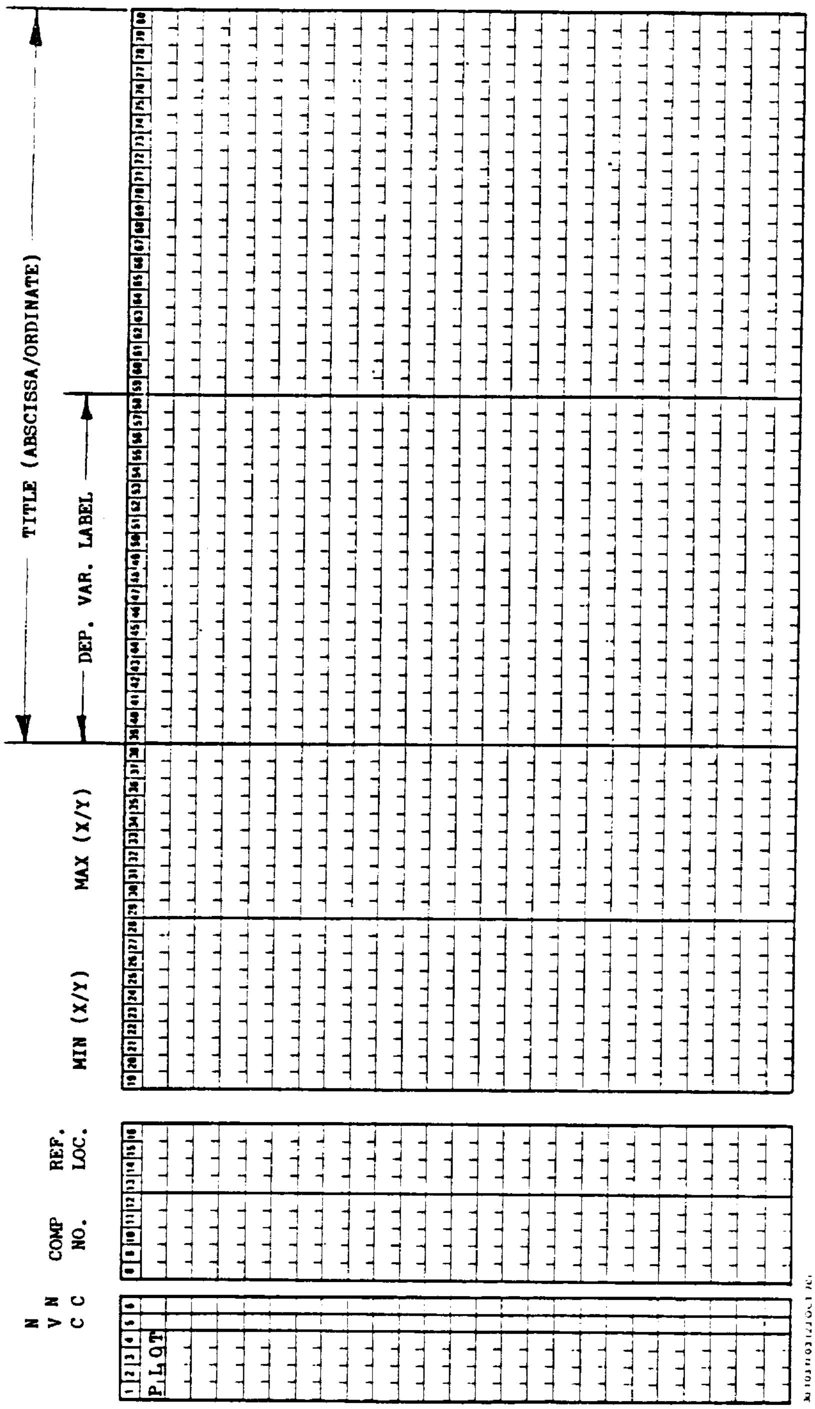

Figure 15
PLOT Data Loadsheet

4.2.3 Modification and Checkout

The five subprogram calls that must be satisfied in the ESCM program are: DATEJC, JOBTIM, CORE, RTIME, and ERASE. These subprograms are not delivered with the program in any form since they are IBM-system dependent. ERASE (called from ARSS) clears the interactive screen before data is to be displayed. This equivalent function has been provided by ERASE.F77 and assumes that the terminal is a Tektronix terminal. The library VLBTEK.L must also be loaded to satisfy entry points required by the LaRC subroutine. DATEJC (called from ECLST) provides the date on the format MM/DD/YY. The equivalent function has been provided by DATEJC. F77. These two subroutines should be added to the delivered source code for the ESCM program which is in the file ESCM.F77.

The three remaining functions are called from subroutines as follows: JOBTIM from ELAPSE, CORE from ENKODE (which has an entry DEKODE), and RTIME from PRTIME. In these cases the calling subroutines themselves (which are included in the delivered source code) are to be replaced by source code of the same name, i.e., ELAPSE.F77, ENKODE.F77, and PRTIME.77. These subroutines require that the prime library VAPPLB be loaded.

The procedure file needed to compile this modified source code is called ESCM.CMPL.CPL and is listed below. To execute it, simply do R ESCM.CMPL.

```
/* REPLACE SUBROUTINES ELAPSE, PRTIME, AND
/* ENKODE WITH THE LRC VERSIONS
/* ADD SUBROUTINES DATEJC AND ERASE

F77 ESCM.F77 - 64V - SILENT - DEBUG -XREF - LOUT
```

This will produce a compilation listing on file OUT with variable cross references. FORTRAN errors, if any are encountered, will appear in the listing except for warning (level 1) messages (which can be numerous). When all FORTRAN errors have been corrected, this procedure will produce a binary file ESCM.BIN which can be loaded by procedure ESCM.LOAD.CPL listed below. To execute it, simply do R ESCM.LOAD.

```
/* THIS LOADS THE ESCM BINARY AND LIBRARIES
SEG -LOAD
LO ESCM.BIN
LI VAPPLB
LI VLBTEK
LI
MAP LM Ø
SA
Q
```

4.2.3 Modification and Checkout (Continued)

This will produce a full load map on file LM which can be reviewed for unsatisfied entry points. If the load is complete, this will produce an absolute run file called ESCM.SEG. The program can be executed simply by SEG.ESCM. If errors are found, the same file can be run using the prime debugger by DBG.ESCM. Once all errors are corrected and an appropriate check case is verified, the -DEBUG option should be removed from the F77 command line in procedure ESCM.CMPL.CPL and both procedures re-executed to provide a more efficient run file.

4.2.4 File Usage

The ESCM program requires about a dozen files, several of which are site dependent and will not be used (on purpose) at LaRC. A summary table of the files is given below. These are defined by OPEN statements in program MAIN. File numbers are usually identified by integer variables which are usually set by DATA statements. Values for the LaRC prime version of ESCM are reflected in Table 9.

4.3 ESCM Output

Three forms of output are available with the ESCM program - output to the screen, hardcopy output, and plots.

Output to the screen is automatic and will occur at the printoff frequency specified by location V(2,184). For example, if the printoff frequency specified is 8.0 time steps per printoff, then a printoff will be made every 120 seconds when the recommended time step of 15 seconds is used. Values are printed in tabular form on the screen as a function of time. The values printed to the screen are:

1) Time of operation, minutes
2) Cabin temperature, °F
3) Cabin dew point temperature, °F
4) Cabin relative humidity, %
5) Cabin CO_2 partial pressure, mmHg
6) SAWD bed #1 CO_2 loading, % of dry amine wgt
8) SAWD bed #1 exit temperature, °F
9) SAWD bed #2 CO_2 loading, % of dry amine wgt
10) SAWD bed #2 H_2O loading, % of dry amine wgt
11) SAWD bed #2 exit temperature, °F

Table 9

ESCM I/O File Assignments For PRIME Computer

Integer Variable	File # Assigned	Where Assigned	Status	Comments
NDA	41	BLOCK DATA	Scratch	Restart file for multiple cases
NDB	42	BLOCK DATA	Scratch	(Also referred to as NOUT in MERGEC)
NDC	43	BLOCK DATA	Scratch	
NDD	44	BLOCK DATA	Scratch	
NDE	45	BLOCK DATA	Saved	Plot output for GPLOT program
NTIN	10	BLOCK DATA		Read basic case or restart data
NTOUT	11	BLOCK DATA		
NSTUFF	31	BLOCK DATA	Scratch	Card punch file
NOUT	=NDB	MERGEC	Scratch	(Used only in MERGEC)
NIN	=NDC or NDD	MERGEC	Scratch	(used only in MERGEC)
---	5			All input data
---	6		Saved	All output data & schematics
NTERM	1	ARSS		Special output to interactive terminal
---	15	ENKODE	Non-existent	Used for ENCODE/DECODE area
NTAPE	1234	STOPIT	Non-existent	Used by STOPIT to produce error
	30			Used by IEDIT for ?
NDISK				Used in KVREAD
N		Equivalenced to NDISK		Used in TABLRD

4.3 ESCM Output (Continued)

The hardcopy output is shown in Appendix B. It includes:

1) A mirror image of the input.

2) A more readable version of the entire input.

3) Schematic printouts of the requested printoff frequency. See Figure 6 or Appendix B.

4) Final values in the K and V arrays for all components at the end of the case.

5) A list of variables whose time varying data have been saved for use by a plotting program.

Plot output must be generated through the use of another program. At Hamilton Standard, plots are generated using the MERIAM program which will in turn generate a tape for use on the CALCOMP plotter. To generate plots, follow the following steps:

1) LG EPLOT CNTL SO(G15UARL) RON

2) LGEF GPLOT DATA G15UARL

Make changes to NAMELIST CASE as required. The definition of the variables in CASE and their type are given in Table 10. Note that ILRCD, NPPTS, TSTART, TEND and NCASE are printed out at the end of the ESCM run. Also make changes to the independent and dependent variable input which defines the plots to be made. Note that if no independent variable card is input, the default independent variable is mission time in hours. See Tables 11 and 12 for the setup for the indenpendent and dependent variable input respectively. A sample setup is shown in Appendix B under GPLOT.DATA.

3) SUB EPLOT

Execution of these steps will generate plots. A sample set of plots is shown in Appendix D.

4.4 Error Messages

Listing of error messages can be found in Reference 3 for G189A supplied subroutines. Subroutines written specific for ESCM are GPOLY1, GPOLY2, IR45, and ARSS. Of these subroutines, only IR45 has error messages. A listing of these error messages follows:

Table 10

NAMELIST CASE Variables To Make Plots

FORTRAN Format	FORTRAN Name	Definition
I	NCASE	G189 case number (Output by G189).
I	ILRCD	Length of plot tape records (Output by G189).
I	NPPTS	Number of tape time points written for the G189 case. (Output by G189).
E	TSTART	Plot start time (Seconds).
E	TEND	Plot end time (Seconds).
I	IPFREQ	Plot frequency flag. (Default value=1)
I	NUMCAS	Number of G189 tape cases flag. If more than one G189 case is on the input plot tape, set NUMCAS=1. If only one G189 case is on the plot tape, NUMCAS=0. (Refer to G189 Input Data Setup for further details.)
I	IFPLOT	Plot data table generation flag. Must be equal to 0 for the first plotting case. For succeeding plotting cases, set IFPLOT=1 if new plot data cards are not to be input.
I	IEND	End of run flag. IEND=0 If this is not the last plotting case to be executed. IEND=1 If this is the last plotting case to be executed.
I	IPLOT	Plot only option flag. IPLOT=0 Plot editing information will be input. IPLOT=1 Plot only. No plot editing information will be input. (IFPLOT,LOCREF,NVC)
I	IPRINT	Plot file print flag. IPRINT=0 No plot file time point history will be output. IPRINT=1 A plot file time point history (list of time points for which a plot data record has been written) will be output.

Table 11

Independent Variable Input To Make Plots

Card Name	Card Column	FORTRAN Format	FORTRAN Name	Definitions
PLOT	1-4			
	5	I1	NVC*	Variable type code. NVC=1 for the independent variable. If no independent variable card is input, the default independent variable is mission time (hours).
	13-16	I4	LOCREF*	Tape reference location for the independent variable. [Default independent variable is time (hrs), Tape Location 1.]
	19-28	E10.0	XMIN	Minimum value of the independent variable to be plotted (optional input).
	29-38	E10.0	XMAX	Maximum value of the independent variable to be plotted (optional input).
	39-80	7A6	XINTIT(7)	Abcissa title. This alphanumeric information will appear on the plot frame as the horizontal axis title.

* Do not input if IPLOT=1

Table 12

Dependent Variable Input To Make Plots

Card Name	Card Column	FORTRAN Format	FORTRAN Name	Definitions
PLOT	1-4			
	5	I1	NVC*	Variable type code. NVC=2 for the dependent variable(s).
	6	I1	NC**	Number of dependent variable curves to be plotted for a frame. Default value is 1 ($1 \leq NC \leq 6$).
	13-16	I4	LOCREF**	Tape reference location for the independent variable. A table of tape reference location vs. V-array location (component number, reference location) is printed by G189. (Do not input on this card if NC > 1. Refer to multivariable data cards.)
	19-28	E10.0	YMIN	Minimum value of the dependent variable(s) to be plotted (optional input).
	29-38	E10.0	YMAX	Maximum value of the dependent variable(s) to be plotted (optional input).
	39-80	7A6	YTITLE(7)	Ordinate title. This alphanumeric information will appear on the plot as the vertical axis title.

* Note: When using multivariable plots, the data value range of the dependent variables to be plotted on the frame should not differ significantly.

** Do not input if IPLOT=1

Multivariable plot Data Input

Card Name	Card Column	FORTRAN Format	FORTRAN Name	Definitions
PLOT	1-4			
	5	I1	NVC	Variable type code. NVC=2 for dependent variable.
	13-16	I4	LOCREF	Tape reference location for the ith dependent variable on a frame ($i \leq 6$).
	39-58	5A4	DVLAB(I)	Label for the ith dependent variable on a plot frame. The variable label and corresponding plot character information are printed at the bottom of the plot frame.

These cards are input only if NC > 1 and IPLOT=0. Do not input if IPLOT=1.

4.4 Error Messages (Continued)

Subroutine	Message
SUB2	Subroutine SUB2 called with a temperature below 55°F by component #____ Temperature = ___°F Time = _____.
SUB2	Subroutine SUB2 called with a temperature above 300°F by component #____ Temperature = ___°F Time = _____.

These two messages alert the user that the temperatures tried are outside the range of the correlation for the temperature effect on bed CO_2 loading.

Subroutine	Message
BALNCE	Subroutine IR45 called by component #____, segment _____. Heat balance did not converge after _____ iterations. The time is ____ seconds. Sum of the energies = _____. Temperature = _____. Vapor mass = ______.

This message alerts the user that convergence could not be achieved after XX interations when interating on the temperature in a SAWD bed segment to balance the energy equation. This message may occur from time to time throughout a case and usually is of no consequence. Typically, the temperature error by not reaching convergence is less than 0.5°F.

Lastly, although not an error, the user may request debug printoff to begin occurring at any desired time by specifying this time in location 95 in either SAWD bed input. The information printed is as follows:

Time	= Transient time, seconds
K	= Segment number
ICOUNT	= Iteration number
TBED	= Bed temperature, °F
TEMP	= Gas temperature, °F
TDEW	= Dew point temperature, °F
XLOAD	= equivalent CO_2 loading, fraction of dry amine weight in time step DTIME, lbm
INERTS	= Total inerts less CO_2 entering segment in time step DTIME, lb-moles
INERT	= Total inerts less CO_2 initially in segment void, lb-moles
PTOT	= Total pressure of gas in segment, psia
PIF	= Total pressure of gas in segment that would exist if all gas entering segment were allowed to stay, psia
PH20	= Equilibrium partial pressure of water, psia

4.4 Error Messages (Continued)

PCO2	= Equilibrium partial pressure of CO_2, psia
AE(I)	= Mass of gases exiting segment in time step DTIME, lbm
R2(I)	= Mass of gases resident in void volume at end of time step, lbm
B2(I)	= Mass of CO_2 in resin, H_2O in resin, and dry resin at end of time step, lbm
RATE	= CO_2 absorption/desorption rate, lb of CO_2 per lb of dry amine per psi difference between actual and equilibrium CO_2 pressure.
PCO21	= Initial partial rpessure of CO_2 from subroutine SUB2, psia
MCR1	= Initial calculation of mass of CO_2 absorbed using PCO21, lbm
MCR2	= Second calculation of mass of CO_2 absorbed after being limited to the masses of CO_2 actually present, lbm
MCO21	= Mass of CO_2 in gas entering plus resident after subtraction of amount absorbed MCR2, lbm
MCO2	= Mass of CO_2 in gas entering plus resident after absorption and after checks for pressure collapse and minimum CO_2 available to satisfy PCO_2, lbm
MH2O1	= Mass of H_2O in gas entering plus resident after evaporation or condensation but before pressure collapse check, lbm
MH2O2	= Mass of H_2O in gas entering plus resident after evaporation or condensation and after pressure collapse check, lbm
BURP	= Flag to indicate if bed temperature is at saturation temperature. T = true, F = false
PH2OIN	= Partial pressure of water vapor entering segment, psia
WTMAIN	= Molecular weight of gas mixture entering segment, lb/lb-mole
PCO2IN	= Partial pressure of CO_2 in gas entering segment, psia
PUSTRM	= Pressure upstream of segment, psia
PDSTRM	= Pressure downstream of segment, psia
QSUM	= Sum of all energies. When balanced QSUM = 0.0, Btu
HBEGIN	= Sum of energies in existing gas, entering gas, the bed, and tank at the beginning of the time step, Btu
HEND	= Sum of energies in existing gas, exiting gas, the bed, and tank at the end of the time step, Btu
HCO2	= Energy change due to absorption or desorption of CO_2, Btu
HH2O	= Energy change due to evaporation or condensation of water, Btu
HSTOR	= Energy change due to the change in stored energy within the segment, Btu

4.4 Error Messages (Continued)

MFG	= Mass of steam condensed if positive, otherwise mass of steam evaporated.
MCR	= Mass of CO_2 absorbed if positive, otherwise mass of CO_2 desorbed.
AI(I)	= Mass of gases entering segment in time step DTIME, lbm I=1=total I=2=total non-condensable I=3=water vapor I=4=oxygen I=5=nitrogen
R1(I)	= Mass of gases resident in void volume at start, lbm
B1(I)	= Initial masses of (1) CO_2 in resin (2) H_2O in resin (3) dry resin, lbm
AIN(1)	= Total mass of gas entering segment in time DTIME, lbm
AIN(5)	= Total non-condensables entering segment in time DTIME, lbm
AIN(6)	= Water vapor entering segment in time, DTIME, lbm
AIN(9)	= Molecular weight of non-condensable gases entering segment, lbm/lb-mole
AIN(12)	= Carbon dioxide gas entering segment in time DTIME, lbm

This information is printed for each segment of the specified SAWD bed and each iteration in every time step following the user specified time.

5.0 FORTRAN NAME - ANALYSIS SYMBOL CROSS REFERENCE

Table 13 is a cross reference list between the FORTRAN variable names used in the ESCM User's Manual and the analysis symbols used in the ESCM Model Description Document in Reference 4. Only those FORTRAN names that have a corresponding symbol in the Model Description Document are listed. In some instances, the general symbol is presented for a specific FORTRAN name because that same symbol is used throughout the Model Description Document (i.e., m_e = exiting mass flow, lbm/hr).

6.0 REFERENCES

(1) Blakely, Robert L. and Rowell, Lawrence F.; "Environmental Control and Life Support System Analysis Tools for the Space Station Era"; SAE Technical Paper Series 840956; Fourteenth Intersociety Conference on Environmental Systems, San Diego, California; July 16-19, 1984.

(2) Blakely, Robert "Contract NAS 1-17397, Development of an Emulation/Simulation Computer Model of a Space Station Environmental Control and Life Support System (ECLSS) Task 1 and Task 2 Results", ESCM-EM-02, December 12, 1983.

Table 13

FORTRAN Name - Analysis Symbol Cross Reference List

FORTRAN Name	Analysis Symbol	Description
CFM	cfm	Flow through fan, cfm
DTIME	Δt	Time step increment, seconds
KK(1,16)	N	Number of people in crew
R(1)	m_T	Total flow exiting a component, lbm/hr
R(2)	T	Temperature of fluid exiting a component, °F
R(3)	P_i	Pressure at component inlet, psia
R(4)	P_e	Pressure at component exit, psia
R(5)	$m_{nc}+m_{CO2}$	Total non-condensable flow, lbm/hr
R(6)	m_v	Vapor flow, lbm/hr
R(7)	m_l	Entrained liquid flow, lbm/hr
R(8)	c_p	Specific heat of non-condensables, Btu/lbm-°F
R(9)	M_w	Molecular weight of non-condensables, lb/lb-mole
R(10)	m_{O2}	Flow of oxygen, lbm/hr
R(11)	m_{N2}	Flow of nitrogen, lbm/hr
R(12)	m_{CO2}	Flow of carbon dioxide, lbm/hr
RHAVG	RH	Average relative humidity (decimal form) in cabin during absorption cycle
VV(1,66)	QSxN	Crew total sensible heat generated, Btu/hr
VV(1,67)	QLxN	Crew total latent heat generated, Btu/hr
VV(1,68)	WO2	Crew oxygen usage rate, lbm/hr
VV(1,69)	WCO2	Crew carbon dioxide generation rate, lbm/hr
VV(1,70)	WH2O	Crew water vapor generation rate, lbm/hr
VV(1,82)	QT	Crew total metabolic rate, Btu/hr
VV(2,4)	P_T	Cabin total pressure, psia
VV(2,87)	T_{set}	Main cabin gas design or setpoint temperature, °F
VV(2,94)	P_{O2}	Cabin partial pressure of oxygen, psia
VV(2,165)	m_{O2}	Flow of oxygen into cabin, lbm/hr
VV(2,166)	m_{N2}	Flow of nitrogen into cabin, lbm/hr

Table 13 (Continued)

FORTRAN Name - Analysis Symbol Cross Reference List

FORTRAN Name	Analysis Symbol	Description
VV(7,1)	m_a	Mass flow of air through humidity control heat exchanger, lbm/hr
VV(7,66)	UA	Calculated overall heat transfer coefficient of humidity control heat exchanger, Btu/hr-°F
VV(7,72)	$(C_p)_{eff}$	Effective specific heat of gas flow into humidity control heat exchanger, Btu/lbm-°F
VV(10,67)	m_l	Condensate removal rate in water separator, lbm/hr
VV(10,65)	Q	Power added to water separator, Btu/hr
VV(19,1)	$(m_T)_e$	Total gas flow exiting SAWD fan, lbm/hr
VV(32,71)	Vo	CO_2 accumulator tank volume, ft^3
VV(x,65)	SR	Split ratio for splitter "x"

The following apply to either SAWD bed:

FORTRAN Name	Analysis Symbol	Description
R(66)	C_r	Specific heat of dry resin bed, Btu/lbm-°F
R(67)	ρ_r	Density of dry resin bed, lbm/ft^3
R(74)	r_o	Basepoint absorption desorption rate (pph of CO_2/lb of dry resin/psi of CO_2 partial pressure difference)
R(78)	M_r	Total dry resin weight, lbm
R(79)	M_t	Total thermal mass of tank or canister around SAWD resin, lbm
R(82)	L_{H2O}	Total bed water loading
R(83)	L_{CO2}	Total bed carbon dioxide loading
R(84)	c_t	Specific heat of canister, Btu/lbm-°F
R(87)	τ	Outlet temperature sensor time constant, sec
R(93)	M_f	Total foam in bed, lbm
R(94)	c_f	Specific heat of foam, Btu/lbm-°F

6.0 REFERENCES (Continued)

(3) "G189A Generalied Environmental/Thermal Control and Life Support Systems Computer Program Manual"; McDonnell Douglas Corporation MDAC-G2444; September, 1971.

(4) Yanosy, J. "Model Description Document for a Computer Program of the Emulation/Simulation of a Space Station Environmental Control and Life Support System (ESCM)"; Hamilton Standard Report SVHSER 9504 for National Aeronautics and Space Administration Langley Research Center; NASA CR-181737, September 1988.

Appendix A

Job Control Lists For IBM

- ESCMCL
- ESCMCN

ESCMCL
JOB CONTROL LIST

```
CONTROL PROMPT NOMSG
N1: DELETE PLOTL.DATA
    DELETE OUTX.DATA
FREE FILE(FT01F001)
FREE FILE(FT02F001)
FREE FILE(FT03F001)
FREE FILE(FT04F001)
FREE FILE(FT05F001)
FREE FILE(FT06F001)
FREE FILE(FT10F001)
FREE FILE(FT11F001)
FREE FILE(FT16F001)
FREE FILE(FT20F001)
FREE ATTRLIST(A1 B2 C3 D4)
ATTRIB A1 BLKSIZE(844)  RECFM(V B)   LRECL(844)
ATTRIB B2 BLKSIZE(5000) RECFM(V B S) LRECL(5000)
ATTRIB C3 BLKSIZE(8404) RECFM(V B S) LRECL(8404)
ATTRIB D4 BLKSIZE(3990) RECFM(F B A) LRECL(133)
DELETE DD1
DELETE DD2
DELETE DD3
DELETE DD4
DELETE DDA
DELETE DDB
ALLOC DS(DD1) F(FT01F001) NEW SPACE(844,200)  BLOCK(844) +
        USING(A1)   CATALOG
ALLOC DS(DD2) F(FT02F001) NEW SPACE(200,200) BLOCK(5000)+
        USING(B2)   CATALOG
ALLOC DS(DD3) F(FT03F001) NEW SPACE(200,200) BLOCK(8404) +
        USING(C3)   CATALOG
ALLOC DS(DD4) F(FT04F001) NEW SPACE(200,200) BLOCK(8408) +
         USING(C3)   CATALOG
ALLOC DS(ESCM2C.DATA) F(FT05F001)
ALLOC DS(OUTX.DATA) F(FT06F001) NEW SPACE(200,200) BLOCK(3120) +
        USING(D4)   CATALOG
ALLOC DS(DDA) F(FT10F001) NEW SPACE(200,200) BLOCK(8408) +
        USING(C3)   CATALOG
ALLOC DS(DDB) F(FT11F001) NEW SPACE(200,200) BLOCK(8408) +
        USING(C3)   CATALOG
ALLOC DS(PLOTL.DATA) F(FT16F001) NEW SPACE(200,200) BLOCK(8408) +
      UNIT(TSOWRKB) USING(C3)   CATALOG
ALLOC DS(*)   F(FT20F001)
CALL 'ENG.G15.LM(G189L2C)'
END
```

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Appendix B

Files For Plotting

- EPLOT
- GPLOT

EPLOT.CNTL

```
//TSOG15PD      JOB  (X,8888,99,08,,,,01,,60,G189,15603,0100,E),
//              'J. YANOSY',NOTIFY-TSOG15P,
//              CLASS-E,MSGLEVEL-(1,1),MSGCLASS-8
//*
/*JOBPARM       LINES-15
/*ROUTE  PRINT LOCAL
//GO     EXEC  PGM-GPLOT,REGION-1024K
//STEPLIB  DD DSNAME-ENG.G15.LM,DISP-SHR
//FT01F001 DD UNIT-SYSDA,DISP-(NEW,DELETE),SPACE-(8408,(200,200)),
//          DCB-(RECFM-VBS,LRECL-8404,BLKSIZE-8408)
//FT02F001 DD UNIT-SYSDA,DISP-(NEW,DELETE),SPACE-(8408,(200,200)),
//          DCB-(RECFM-VBS,LRECL-8404,BLKSIZE-8408)
//FT04F001 DD UNIT-SYSDA,DISP-(NEW,DELETE),SPACE-(8408,(200,200)),
//          DCB-(RECFM-VBS,LRECL-8404,BLKSIZE-8408)
/*   SET UP TO RUN ESCM CHECKOUT MODEL DATA "ESM.DATA" NOW
//FT05F001 DD UNIT-TSOWRKB,DSN-TSOG15P.GPLOT.DATA,DISP-(OLD,KEEP)
//FT06F001 DD SYSOUT-A
//FT08F001 DD DSN-TSOG15P.TRES.DATA,UNIT-TSOWRKB,DISP-(NEW,CATLG),
//            DCB-(RECFM-FB,LRECL-80,BLKSIZE=3120),
//            SPACE-(3120,(200,200),RLSE)
//FT09F001 DD DSN-TSOG15P.BRES.CNTL,UNIT-TSOWRKB,DISP-(NEW,CATLG),
//            DCB-(RECFM-FB,LRECL-80,BLKSIZE-3120),
//            SPACE-(3120,(200,200),RLSE)
//FT16F001 DD DSN-TSOG15P.PLOT.DATA,UNIT-TSOWRKB,DISP-(OLD,KEEP),
//              DCB-(RECFM-VBS,LRECL-8404,BLKSIZE=8408),
//              SPACE-(8408,(200,200),RLSE)
/*
//PETE3    EXEC MPRES,MACH=B
//MPRS.ICML5      DD   DSN-TSOG15P.BRES.CNTL,DISP-(OLD,DELETE)
//MPRS.INDT9      DD   DSN=TSOG15P.TRES.DATA,DISP=(OLD,DELETE)
//*
```

Appendix C

Sample Problem Input and Output

This appendix contains an abridged output from the following sample problem. The principal input parameters are:

(1) Number of men = 3
(2) Cabin volume = 8,000 ft^3
(3) Cabin temperature = 70°F
(4) Equipment heat load = 17065 Btu/hr
(5) Cabin leakage = 0.08333 lbm/hr
(6) A variable metabolic load representative of a work, eat, sleep schedule

The output is abridged by showing only a representative number of output schematic printouts for the transient portion of the analysis.

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VARY	2	29	303.76	OXYGEN FLOW (LB/HR)
VARY	2	30	1063.67	NITROGEN FLOW (LB/HR)
VARY	2	31	9.45	CO2 FLOW (LB/HR)
VARY	2	65		TOTAL HEAT ADDED TO CABIN GAS/MIXTURE (BTU/HR)
VARY	2	66	17065.	CABIN HEAT LO'D (BTU/HR) = 5 KW
VARY	2	71		HEAT LOSS DUE TO OUTBOARD LEAKAGE (BTU/HR)
VARY	2	72		HEAT GAIN DUE TO MASS ADDITIONS (BTU/HR)
VARY	2	73		HEAT REQ'D TO FLASH ENTRAINED H2O (BTU/HR)
VARY	2	74		FLASH EVAPORATION RATE OF ENTRAINED H2O (LB/HR)
VARY	2	87	70.0	CABIN GAS DESIGN TEMP (F) (4 MEN)
VARY	2	88	10.0	CABIN GAS DESIGN TEMP TOL (F) (4 MEN)
VARY	2	89		CABIN GAS RELATIVE HUMIDITY (DECIMAL)
VARY	2	90	14.7	DESIGN TOTAL PRESSURE (PSIA)
VARY	2	91	0.5	DESIGN TOTAL PRESSURE TOL (PSIA)
VARY	2	92	2.9	DESIGN OXYGEN PRESSURE (PSIA)
VARY	2	93	0.5	DESIGN OXYGEN PRESSURE TOL (PSIA)
VARY	2	94		CABIN GAS OXYGEN PRESSURE (PSIA)
VARY	2	95		CABIN GAS NITROGEN PRESSURE (PSIA)
VARY	2	96	50.0	DESIGN DEW POINT (F)
VARY	2	97	30.0	DESIGN DEW POINT TOL (F)
VARY	2	98		CABIN GAS DEW POINT (F)
VARY	2	99	20.	MAX ALLOWABLE CO2 PRESSURE (MM HG)
VARY	2	100		CABIN GAS CO2 PRESSURE (MM HG)
VARY	2	101	250.	MAX ALLOWABLE TRACE CONTAMINANT LEVEL (PPM)
VARY	2	102		CABIN GAS TRACE CONTAMINANT LEVEL (PPM)
VARY	2	103		CABIN GAS MIXTURE, TOTAL MASS (LB)
VARY	2	104		CABIN GAS MIXTURE, TEMPERATURE (F)
VARY	2	105		CABIN GAS MIXTURE, TOTAL PRESSURE (PSIA)
VARY	2	107		CABIN GAS MIXTURE, NON-CONDESABLES MASS (LB)
VARY	2	108		CABIN GAS MIXTURE, H2O VAPOR MASS (LB)
VARY	2	109		CABIN GAS MIXTURE, ENTRAINED H2O MASS (LB)
VARY	2	110		CABIN GAS MIXTURE, NON-COND. SPECIFIC HEAT (BTU/LB-F
VARY	2	111		CABIN GAS MIXTURE, NON-COND. MOL WEIGHT (LB/MOL)
VARY	2	112		CABIN GAS MIXTURE, OXYGEN MASS (LB)
VARY	2	113		CABIN GAS MIXTURE, NITROGEN MASS (LB)
VARY	2	114		CABIN GAS MIXTURE, CO2 MASS (LB)
VARY	2	115		CABIN GAS MIXTURE, TRACE CONTAMINANTS MASS (LB)
VARY	2	122	0.0833	OUTBOARD LEAKAGE RATE (LB/HR)
VARY	2	123		NON-CONDENSABLES LEAKAGE RATE (LB/HR)
VARY	2	124		H2O VAPOR LEAKAGE RATE (LB/HR)
VARY	2	125		ENTRAINED H2O LEAKAGE RATE (LB/HR)
VARY	2	126		TOTAL MASS ADDITION RATE (LB/HR)
VARY	2	127		NON-COND. ADDITION RATE (LB/HR)
VARY	2	128	0.233	H2O VAPOR ADDITION RATE (LB/HR)
VARY	2	129	0.0	ENTRAINED H2O ADDITION RATE (LB/HR)
VARY	2	130		AVERAGE TEMPERATURE OF MASS ADDITIONS (F)
VARY	2	132	70.0	ADD COND VAPOR TEMP (F)
VARY	2	135		NET TOTAL FLOW INTO CABIN (LB/HR)
VARY	2	136		NET NON-COND. FLOW INTO CABIN (LB/HR)
VARY	2	137		NET H2O VAPOR FLOW INTO CABIN - CALC IN GPOLY2
VARY	2	139	8000.	CABIN FREE VOL (FT3)
VARY	2	170	70.0	OXYGEN ADDITION TEMP (F)
VARY	2	171	70.0	NITROGEN ADDITION TEMP (F)
VARY	2	172	70.0	CO2 ADDITION TEMP (F)
VARY	2	173	70.0	TRACE CONTAMINANTS ADDITION TEMP (F)
VARY	2	174	70.0	SPECIAL FLOW NO. 1 ADDTION TEMP (F)
VARY	2	175		NET O2 ADDITION (LB/HR) - GPOLY2 CALC
VARY	2	176		NET N2 ADDITION (LB/HR) - GPOLY2 CALC
VARY	2	177	0.0	NET CO2 ADDITION (LB/HR)
VARY	2	178	0.0	NET TRACE CONTAMINANTS ADDITION (LB/HR)

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VARY  12  84 1.0              FAN ON/OFF SWITCH (1.0=ON,0.0=OFF)
VARY  12  91 140.             FAN HEAT ADDITION (WATTS)
ID**  13     GASMIX - SAWD-II AND COND HX FAN                      2    2
KBAS  13      6          12 2              30 2
NSTR  13
ID**  14     SPLIT - MAIN CABIN TO SAWD BED #1, SAWD BED #2       27    2
KBAS  14     10          -3 2                  2
NSTR  14
VARY  14  65 0.0              SPLIT RATIO - GPOLY1 CALC
ID**  15     GASMIX - STEAM OR CABIN GAS TO SAWD BED #1 INLET     16    2
KBAS  15      6          14 2             -26 2
NSTR  15   2
ID**  16     SAWD BED #1 SIMULATION - ALTCOM                      17    2
KBAS  16     73  0  0    15 2
NSTR  16
KARY  16  16          0     ABSORB/DESORB FLAG (0 = ABSORB, 1 = DESORB)
KARY  16  17         21     COMPLEMENTARY BED'S COMPONENT NO.
KARY  16  18          0     DESORBING FLOW REVERSAL FLAG: 1=YES, 0=NO
KARY  16  19          5     NUMBER OF BED SEGMENTS
KARY  16  20         15     DOWNSTREAM COMPONENT NUMBER
VARY  16  60 70.0           AMBIENT TEMPERATURE (F)
VARY  16  61 0.8            CAN-TO-AMBIENT KA/X (BTU/HR-F)
VARY  16  63 70.0           EXTERIOR SURFACE TEMPERATURE, (DEG-F)
VARY  16  64 0.800          CONDUCTANCE BETWEEN BED AND EXTERIOR, (BTU/HR-F)
VARY  16  65 1270.          HEAT OF CO2 REACTION WITH RESIN BED (BTU/LB)
VARY  16  66 0.314          SPECIFIC HEAT OF DRY IR45 RESIN, (BTU/LB-F)
VARY  16  67 32.70          DENSITY OF DRY RESIN BED, (PCF)
VARY  16  68 0.319          RESIN BED VOID VOLUME FRACTION
VARY  16  69 10.0           TIME REQUIRED TO COMPLETE STEAM DESORB (SEC)
VARY  16  70                GAS STREAM TOTAL SENSIBLE HEAT CHANGE (BTU/HR)
VARY  16  71                GAS STREAM TOTAL LATENT HEAT CHANGE (BTU/HR)
VARY  16  72                TOTAL CO2 ABSORPTION(+)/DESORPTION(-) RATE (PPH)
VARY  16  73                TOTAL H2O EVAPORATION(+)/CONDENSATION(-) RATE (PPH)
VARY  16  74 1.500          ABSORPTION/DESORPTION RATE (PPH OF CO2/LB-BED/PSI)
VARY  16  75 0.400          AVG. STEADY STATE DESORPTION STEAM RATE (PPH)
VARY  16  76 0.604          STEADY STATE CO2 REMOVAL EFFICIENCY
VARY  16  77 70.00          AVG. STEADY STATE BED TEMPERATURE, (DEG-F)
VARY  16  78 8.500          TOTAL DRY RESIN BED WEIGHT (LBM)
VARY  16  79 7.400          TOTAL CANISTER WEIGHT (LBM)
VARY  16  80 2.550          TOTAL WATER IN BED (LBM)
VARY  16  81 0.005          TOTAL CO2 IN BED (LBM)
VARY  16  82                TOTAL BED H2O LOADING (LB H2O/LB BED)
VARY  16  83                TOTAL BED CO2 LOADING (LB CO2/LB BED)
VARY  16  84 0.120          SPECIFIC HEAT OF CANISTER (BTU/LB-F)
VARY  16  85 130.0          EXIT TEMPERATURE TO END DESORPTION, DEG-F
VARY  16  86 2280.          TIME TO END ABSORPTION, SECONDS
VARY  16  87 240.           TIME LAG FOR OUTLET TEMPERATURE, SECONDS
VARY  16  88                BED INLET DEW POINT, DEG-F
VARY  16  89                BED EXIT DEW POINT, DEG-F
VARY  16  90                BED INLET CO2 PARTIAL PRESSURE, MM-HG
VARY  16  91                BED EXIT CO2 PARTIAL PRESSURE, MM-HG
VARY  16  92                TOTAL BED EXIT FLOW, CFM
VARY  16  93 0.470          TOTAL WEIGHT OF FOAM IN BED, LBM
VARY  16  94 0.330          SPECIFIC HEAT OF FOAM BTU/LB-F
VARY  16  95 100000.        TIME TO BEGIN DEBUG PRINTOFF, SECONDS.
ID**  17     SPLIT - SAWD BED #1 TO COND HX OR CO2 RECOVERY       20    2
KBAS  17     10          16 2                  2
NSTR  17
VARY  17  65 0.0              SPLIT RATIO - GPOLY1 CALC
ID**  18     GASMIX - SAWD BED #1, SAWD BED #2
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ID**  22     SPLIT - SAND BED #2 TO COND HX OR CO2 RECOVERY                    23    2
KBAS  22      10              21 2                          2
NSTR  22
VARY  22  65 1.0                   SPLIT RATIO - GPOLY1 CALC
ID**  23     GASMIX - SAND BED #1 EXIT GAS, SAND BED #2 EXIT GAS               24    2
KBAS  23      6             -22 2                        17 2
NSTR  23
ID**  24     SPLIT - SAND EXIT GAS TO PREHEAT OR TO CO2 ACCUMULATOR            18    2
KBAS  24      10              23 2                          2
NSTR  24
VARY  24  65 0.0                   SPLIT RATIO - GPOLY1 CALC
ID**  25     GASMIX - STEAM GENERATOR AND PREHEAT STEAMS                       26    2
KBAS  25      6               29 2                       24 2
NSTR  25
ID**  26     SPLIT - STEAM TO SAND BED #1 OR #2.                               15    2
KBAS  26      10              25 2                          2
NSTR  26
VARY  26  65 1.0                   SPLIT RATIO - GPOLY1 CALC
ID**  27     H2O SUPPLY TANK FOR STEAM GENERATOR                               28    2
KBAS  27      30   3               0   1
NSTR  27     1101                          COMPUTE OUTLET FLOW IN GPOLY1
VARY  27   1 2.55                  INITIAL H2O FLOW (LB/HR)
VARY  27  68 168.3                 H2O TANK MAX CAPACITY (LB)
VARY  27  69 168.3                 H2O TANK INITIAL FILL (LB)
VARY  27  70 70.0                  H2O TEMPERATURE (F)
VARY  27  71                       TANK VOLUME (FT3)
VARY  27  72 30.0                  TANK PRESSURE (PSIA)
VARY  27  98                       WATER USED FROM TANK (LB)
VARY  27  99                       WATER ADDED TO TANK (LB)
VARY  27 100 2.55                  H2O FLOW (PPH)
ID**  28     H2O SUPPLY PUMP FOR STEAM GENERATOR                               29    2
KBAS  28      22                27 0   1
NSTR  28     0002                          INPUT PUMP HEAT ADDITION
VARY  28  79 1.0                   PUMP ON/OFF FLAG (1.0=ON)
VARY  28  85 10.0                  HEAT ADDITION (WATTS)
ID**  29     STEAM GENERATOR FOR SAND BED DESORPTION                           25    2
KBAS  29      27                28 2
NSTR  29      1                            CALC ELEC ENERGY REQUIRED
VARY  29  66 40.0                  DESIRED DEGREES OF SUPERHEAT (F)
VARY  29  67                       TEMP OF SATURATED STEAM (F)
VARY  29  68                       ELEC ENERGY REQUIRED (WATTS)
ID**  30     SPLIT - DESORBED GAS TO CABIN OR CO2 ACCUMULATOR.                 32    2
KBAS  30      10                24 2                        2
NSTR  30
VARY  30  65 1.0                   SPLIT RATIO - GPOLY1 CALC
ID**  31     GASMIX - CABIN AIR AND SAND AIR TO HUMD CONTROL HX                 7    2
KBAS  31      6                 3 2                      -19 2
NSTR  31
ID**  32     CO2 ACCUMULATOR TANK                                              31    2
KBAS  32      30      1        30 2
NSTR  32     01000
KARY  32  16             1         CO2 DELIVERY; 0 = OVBD; 1 = CO2 REDUCTION.
VARY  32  70 70.                   CO2 TEMPERATURE (F)
VARY  32  71 2.0                   TANK VOLUME (FT3)
VARY  32  72 30.0                  CO2 PRESSURE (PSIA)
VARY  32  80 0.4644                MASS OF CO2 IN TANK (LB)
TABL   1   1     2                16      0     LIN    LIN
TITL   1   2 CREWMAN METABOLIC RATE (BTU/HR) VS MISSION TIME (SEC)
VALU   1  10 21   .0             2700.       3600.       7200.      .1800E+05   .1980E+05
VALU   1  11 20  450.0           450.0       520.0       650.0       650.0       450.0
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TITL  33  2 ABSORPTION CYCLE TIME (SEC) VS. SAPD FAN FLOW (CFM)
VALU  33 10 2I  0.10       5.00       7.90      11.00      12.80      13.95
VALU  33 11 2D  .0          60.        120.       240.       360.       480.
VALU  33 12 2I  14.60      15.0       15.0       15.0
VALU  33 13 2D  600.       720.       900.       7200.
TABL  41  1    2                16     0    LOG   LIN
TITL  41  2  MOLE FRACTION OF CO2 IN BED SEGMENT VERSUS LOADING.
VALU  41 10 2I        0.0        0.01       0.02       0.03       0.04       0.05
VALU  41 11 2D   .0000001   0.000052    0.00048     0.0019     0.0050     0.0105
VALU  41 12 2I       0.06       0.07      0.075      0.0800     0.0825     0.085
VALU  41 13 2D     0.0225      0.044      0.068      0.1100     0.1500     0.250
VALU  41 14 2I     0.0325      0.090      0.094       1.0
VALU  41 15 2D     0.5100      0.630      1.000       1.0
TABL  51  1    2                12     0    LIN   LIN
TITL  51  2  TEMPERATURE FACTOR ON CALCULATION OF EQUIL YCO2.
VALU  51 10 2I        55.        77.        90.       110.       130.       150.
VALU  51 11 2D       1.20       1.00      0.870      0.790      0.570     0.4400
VALU  51 12 2I       170.       190.      210.0       250.       270.       400.
VALU  51 13 2D     0.2750     0.1550      0.060     0.0300     0.0150     0.0001
TABL  61  1    2                12     0    LIN   LIN
TITL  61  2  WATER LOADING FACTOR ON CALCULATION OF EQUIL YCO2.
VALU  61 10 2I        0.0       0.09      0.105      0.125      0.157      0.175
VALU  61 11 2D      0.551      0.550      0.571      0.745      1.034      1.200
VALU  61 12 2I      0.200      0.225      0.250      0.275      0.300      1.000
VALU  61 13 2D      1.360      1.410      1.429      1.440      1.450      1.450
TABL  71  1    2                13     0    LIN   LIN
TITL  71  2  INFLUENCE OF RELATIVE HUMIDITY ON EQUILIBRIUM WATER LOADING
VALU  71 10 2I     -10.00      0.000      0.010      0.035      0.060      0.083
VALU  71 11 2D       0.00      0.000      0.100      0.200      0.300      0.400
VALU  71 12 2I      0.104      0.145      0.190      0.230      0.275      0.315
VALU  71 13 2D      0.500      0.600      0.700      0.800      0.900      1.000
VALU  71 14 2I      1.000
VALU  71 15 2D      1.000
PLOT0                              ESCM DEMONSTRATION MODEL
PLOT1        2 181                 MISSION TIME (SEC)
PLOT1        2 182                 MISSION TIME (MIN)
PLOT2        1  66                 CREWMAN SEN (BTU/HR)
PLOT2        1  67                 CREWMAN LAT (BTU/HR)
PLOT2        1  68                 O2 USE RATE (LB/HR)
PLOT2        1  69                 CO2 GEN RATE (LB/HR)
PLOT2        1  82                 CREWMAN MET (BTU/HR)
PLOT2        2  89                 REL HUMIDITY (DEC)
PLOT2        2  94                 O2 PRESSURE (PSIA)
PLOT2        2  95                 N2 PRESSURE (PSIA)
PLOT2        2  98                 DEW POINT TEMP (F)
PLOT2        2 100                 CO2 PRESS (MM HG)
PLOT2        2 104                 DRY BULB TEMP (F)
PLOT2        2 105                 TOTAL PRESS (PSIA)
PLOT2        2 165                 O2 MAKEUP (LB/HR)
PLOT2        2 166                 N2 MAKEUP (LB/HR)
PLOT2       15   6                 SA-1 H2O IN (LB/HR)
PLOT2       16   6                 SA-1 H2O OUT (LB/HR)
PLOT2       15  12                 SA-1 CO2 IN (LB/HR)
PLOT2       16  12                 SA-1 CO2 OUT (LB/HR)
PLOT2       16   2                 SA-1 EXIT TEMP (F)
PLOT2       16  82                 SA-1 H2O LOAD(LB/LB)
PLOT2       16  83                 SA-1 CO2 LOAD(LB/LB)
PLOT2       20   6                 SA-2 H2O IN (LB/HR)
PLOT2       21   6                 SA-2 H2O OUT (LB/HR)
PLOT2       20  12                 SA-2 CO2 IN (LB/HR)
```

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BASIC  CASE NO.    1       ESCM: BASELINE, VOL = 8000 FT-3, PCO2 = 2.5, .275 PPH AVERAGE

THE EC/LS MODEL HAS   50 COMPONENTS, THE LAST OF WHICH TO BE SOLVED IS NO.   13

THE MODEL IS    TRANSIENT, WITHOUTFRESSURE DROP DATA ALLOCATION.

NPLOTS =    2
         PLOT RECORDS WILL BE PLACED ON TAPE
&CASE1
DTIME=  15.0000000     ,KCHOUT=           0,KPRNT=          0,KPRUN=          0,KPTINV=          1,         5,         10,
    30,KPUNCH=          0,KRUN=           1,KSTEDY=          0,NOLIM=          0,TIME12=  .0              ,STARPD=
  .0           ,STOPPD=  .0            ,MAXCI=           0,MAXLP=          0,MAXSLP=          4,MAXSSI=         15,MINSSI=
    10,NPASFD=          0,PGMIN=  .0            ,PLMIN=  .0            ,START=  .0            ,TIMEMX=  86400.0000    ,TMAX=
 325.000000    ,TMIN=  .0            ,WTMAX=  1600000.00
&END
&PROP1
CP=  1.00000000    ,  .199999988    ,  .0            ,  .0            ,  .0            ,  .0            ,  .0            ,
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BASIC CASE DATA

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                    ESCM: BASELINE, VOL = 8000 FT-3, PCO2 = 2.5, .275 PPH AVERAGE

101000 ID**  1   0 ARS DEMO MODEL FOR SAND II GENERAL NOTES:
101010 ID**  1  10 FLUID TYPE CODES --
101011 ID**  1  11         1 = WATER
101012 ID**  1  12         2 = CO2 GAS @ 70 F, 3 MM HG
101090 ID**  1  90
101100 ID**  1 100    CREW METABOLIC SIMULATION                          14    2
102000 KBAS  1   0  2  1          5 2
103000 NSTR  1   00                 1    NO TESTS, SS CALCS
104016 KARY  1  16         3      NUMBER OF CREWMEN
105002 VARY  1   2 50.0           TEMP (F)
105003 VARY  1   3 14.7         4 PRESS (PSIA)
105006 VARY  1   6    87.8        H2O VAPOR FLOW  (LB/HR)
105010 VARY  1  10  2046.9        OXYGEN FLOW  (LB/HR)
105011 VARY  1  11  7200.7        NITROGEN FLOW  (LB/HR)
105012 VARY  1  12    46.7        CO2 FLOW  (LB/HR)
105065 VARY  1  65                TOTAL METABOLIC HEAT - ALL CREWMEN (BTU/HR)
105066 VARY  1  66 291.7          SENSIBLE HEAT PER CREWMAN (BTU/HR)
105067 VARY  1  67 175.2          LATENT HEAT PER CREWMAN (BTU/HR)
105068 VARY  1  68                TOTAL OXYGEN USE RATE (LB/HR)
105069 VARY  1  69                TOTAL CO2 GENERATION RATE (LB/HR)
105070 VARY  1  70                TOTAL H2O VAPOR GENERATION RATE (LB/HR)
105075 VARY  1  75                INLET GAS RELATIVE HUMIDITY (DECIMAL)
105076 VARY  1  76                INLET GAS DEW POINT (F)
105077 VARY  1  77                OUTLET GAS RELATIVE HUMIDITY(DECIMAL)
105078 VARY  1  78                OUTLET GAS DEW PONT (F)
105082 VARY  1  82                TOTAL METABOLIC RATE PER CREWMAN (BTU/HR)

201000 ID**  2   0 MAIN CABIN       1 2            -13 2                 3    2
202000 KBAS  2   0  1 25                 PRI P, 5 RESETS, SPECIFY NET FLOWS
203000 NSTR  2   0151011000        CABIN GAS MIXTURE: INITIAL TEMP (F)
205002 VARY  2   2 70.            4 TOTAL PRESSURE  (PSIA)
205003 VARY  2   3 14.7             H2O VAPOR FLOW  (LB/HR)
205006 VARY  2   6    89.7          OXYGEN FLOW  (LB/HR)
205010 VARY  2  10  2046.8          NITROGEN FLOW  (LB/HR)
205011 VARY  2  11  7199.4          CO2 FLOW  (LB/HR)
205012 VARY  2  12    46.3          CABIN GAS MIXTURE: INITIAL TEMP (F)
205021 VARY  2  21 70.           23 TOTAL PRESSURE  (PSIA)
205022 VARY  2  22 14.7             H2O VAPOR FLOW  (LB/HR)
205025 VARY  2  25    13.00         OXYGEN FLOW  (LB/HR)
205029 VARY  2  29   303.76         NITROGEN FLOW  (LB/HR)
205030 VARY  2  30  1068.67         CO2 FLOW  (LB/HR)
205031 VARY  2  31     9.45         TOTAL HEAT ADDED TO CABIN GAS MIXTURE (BTU/HR)
205065 VARY  2  65                  CABIN HEAT LOAD  (BTU/HR) = 5 KW
205066 VARY  2  66 17065.           HEAT LOSS DUE TO OUTBOARD LEAKAGE (BTU/HR)
205071 VARY  2  71                  HEAT GAIN DUE TO MASS ADDITIONS (BTU/HR)
205072 VARY  2  72                  HEAT REQ'D TO FLASH ENTRAINED H2O (BTU/HR)
205073 VARY  2  73                  FLASH EVAPORATION RATE OF ENTRAINED H2O (LB/HR)
205074 VARY  2  74                  CABIN GAS DESIGN TEMP  (F)    (4 MEN)
205087 VARY  2  87 70.0             CABIN GAS DESIGN TEMP TOL (F)  (4 MEN)
205088 VARY  2  88 10.0             CABIN GAS RELATIVE HUMIDITY (DECIMAL)
205089 VARY  2  89                  DESIGN TOTAL PRESSURE (PSIA)
205090 VARY  2  90 14.7             DESIGN TOTAL PRESSURE TOL  (PSIA)
205091 VARY  2  91 0.5              DESIGN OXYGEN PRESSURE  (PSIA)
205092 VARY  2  92 2.9
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405076  VARY   4  76 2100.         CABIN FAN VOLUMETRIC FLOW RATE (CFM)
405084  VARY   4  84 1.0           FAN ON/OFF SWITCH (1.0=ON,0.0=OFF)
405091  VARY   4  91 833.          FAN HEAT ADDITION (WATTS)

501000  ID**   5   0 MAIN CABIN SENSIBLE HX - SENSIBLE HEAT REMOVAL ONLY
                                                        -6 0   1              1    2
502000  KBAS   5   0  4                4 2
503000  NSTR   5   02   0               1    COUNTERFLOW, PRI=GAS, SEC=LIQ, SS CALC
505066  VARY   5  66 6240.            HX COUNTERFLOW UA (BTU/HR-F)

601000  ID**   6   0 COOLING FLUID BOUNDARY COND - CABIN SENSIBLE HX                     2
602000  KBAS   6   0 49      2        0   1
603000  NSTR   6   0
604016  KARY   6  16              0     KPRNT VALUE AT START OF TRANSIENT (GPOLY1)
604017  KARY   6  17              0     KCHOUT VALUE AT START OF TRANSIENT (GPOLY1)
605001  VARY   6   1 1350.              COOLANT FLOW (LB/HR) -GPOLY1 CALC
605002  VARY   6   2 60.0               COOLANT TEMP (F)
605003  VARY   6   3 50.0             4 COOLANT PRESSURE (PSIA)

701000  ID**   7   0 MAIN CABIN CONDENSING HX
                                                        -8 0   1              9    2
702000  KBAS   7   0  4                31 2
703000  NSTR   7   02   0               1    INPUT EFF, PRI=GAS, SEC=LIQ, SS CALCS
705066  VARY   7  66 1000.            CCUNTERFLOW HX UA (BTU/HR-F) _ GPOLY1 CALC

801000  ID**   8   0 COOLING FLUID BOUNDARY COND - CABIN COND HX                         2
802000  KBAS   8   0 49               0   1
803000  NSTR   8   0
805001  VARY   8   1 950.               COOLANT FLOW (LB/HR)
805002  VARY   8   2 45.0               COOLANT TEMP (F)
805003  VARY   8   3 50.0             4 COOLANT PRESSURE (PSIA)

901000  ID**   9   0 SPLIT - COND HX TO WATER SEPARATOR BYPASS, WATER SEPARATOR
                                                          2                   10   2
902000  KBAS   9   0 10  7           7 2
903000  NSTR   9   01                       SPECIFY INDIVIDUAL SPLIT RATIOS
905066  VARY   9  66 0.03            SPLIT RATIO - COND VAPOR
905067  VARY   9  67 1.00            SPLIT RATIO - COND LIQUID
905068  VARY   9  68 0.03            SPLIT RATIO - OXYGEN
905069  VARY   9  69 0.03            SPLIT RATIO - NITROGEN
905070  VARY   9  70 0.03            SPLIT RATIO - CARBON DIOXIDE
905071  VARY   9  71 0.03            SPLIT RATIO - TRACE CONTAMINANTS
905072  VARY   9  72 0.03            SPLIT RATIO - SPECIAL FLOW #1

1001000  ID**  10   0 WATER SEPARATOR - CABIN COND HX                                 11   2
1002000  KBAS  10   0 49  1          -9 2
1003000  NSTR  10   02                      CALC EXIT TMEP GIVEN Q
1005065  VARY  10   65                HEAT ADDED (BTU/HR) - GPOLY1 CALC
1005067  VARY  10   67                CONDENSATE REMOVED (LB/HR) - GPOLY1 CALC

1101000  ID**  11   0 GASMIX - COND HX WATER SEPARATOR, WATER SEPARATOR BYPASS        12   2
1102000  KBAS  11   0  6              9 2                      -10 2
1103000  NSTR  11   0

1201000  ID**  12   0 COND HX FAN                                                      13   2
1202000  KDAS  12   0 23             11 2
1203000  NSTR  12   01                        INPUT CFM & Q
1205076  VARY  12   76 300.            CABIN FAN VOLUMETRIC FLOW RATE (CFM)
1205084  VARY  12   84 1.0             FAN ON/OFF SWITCH (1.0=ON,0.0=OFF)
1205091  VARY  12   91 140.            FAN HEAT ADDITION (WATTS)

1301000  ID**  13   0 GASMIX - SAND-II AND COND HX FAN              30 2               2    2
1302000  KBAS  13   0  6              12 2
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1801000  ID**  18   0 GASMIX - SAND BED #1, SAND BED #2               19   2
1802000  KDAS  18   0  6          17 2                  -22 2
1803000  NSTR  18   0

1901000  ID**  19   0 SAND BED FAN                                    30   2
1902000  KDAS  19   0 23          18 2
                                        INPUT Q ONLY
1903000  NSTR  19   0003               CABIN GAS MIXTURE: INITIAL TEMP (F)
1905002  VARY  19   2 70.            4 TOTAL PRESSURE  (PSIA)
1905003  VARY  19   3 14.7             H2O VAPOR FLOW  (LB/HR)
1905006  VARY  19   6  0.78            OXYGEN FLOW  (LB/HR)
1905010  VARY  19  10 20.55            NITROGEN FLOW  (LB/HR)
1905011  VARY  19  11 71.07            CO2 FLOW  (LB/HR)
1905012  VARY  19  12  0.30            CABIN FAN VOLUMETRIC FLOW RATE (CFM)
1905076  VARY  19  76 15.              FAN ON/OFF SWITCH (1.0=ON,0.0=OFF)
1905084  VARY  19  84 1.0              FAN HEAT ADDITION (WATTS)
1905091  VARY  19  91 50.

2001000  ID**  20   0 GASMIX - STEAM OR CABIN GAS TO SAND BED #2 INLET   21   2
2002000  KDAS  20   0  6         -14 2                  26 2
2003000  NSTR  20   02

2101000  ID**  21   0 SAND BED #2 SIMULATION - ALTCOM                  22   2
2102000  KDAS  21   0 73  0  0    20 2
2103000  NSTR  21   0
2104016  KARY  21  16          1   ABSORB/DESORB FLAG (0 = ABSORB, 1 = DESORB)
2104017  KARY  21  17         16   COMPLEMENTARY BED'S COMPONENT NO.
2104018  KARY  21  18          0   DESORBING FLOW REVERSAL FLAG: 1=YES, 0=NO
2104019  KARY  21  19          5   NUMBER OF BED SEGMENTS
2104020  KARY  21  20         20   DOWNSTREAM COMPONENT NUMBER
2105060  VARY  21  60 70.0         AMBIENT TEMPERATURE (F)
2105061  VARY  21  61 0.8          CAN-TO-AMBIENT KA/X (BTU/HR-F)
2105063  VARY  21  63 70.0         EXTERIOR SURFACE TEMPERATURE, (DEG-F)
2105064  VARY  21  64 0.800        CONDUCTANCE BETWEEN BED AND EXTERIOR, (BTU/HR-F)
2105065  VARY  21  65 1270.        HEAT OF CO2 REACTION WITH RESIN BED (BTU/LB)
2105066  VARY  21  66 0.314        SPECIFIC HEAT OF DRY IR45 RESIN, (BTU/LB-F)
2105067  VARY  21  67 32.70        DENSITY OF DRY RESIN BED, (PCF)
2105068  VARY  21  68 0.319        RESIN BED VOID VOLUME FRACTION
2105069  VARY  21  69 10.0         TIME REQUIRED TO COMPLETE STEAM DESORB (SEC)
2105070  VARY  21  70              GAS STREAM TOTAL SENSIBLE HEAT CHANGE (BTU/HR)
2105071  VARY  21  71              GAS STREAM TOTAL LATENT HEAT CHANGE (BTU/HR)
2105072  VARY  21  72              TOTAL CO2 ABSORPTION(+)/DESORPTION(-) RATE (PPH)
2105073  VARY  21  73              TOTAL H2O EVAPORATION(+)/CONDENSATION(-) RATE (PPH)
2105074  VARY  21  74 1.500        ABSORPTION/DESORPTION RATE (PPH OF CO2/LB-BED/PSI)
2105075  VARY  21  75 0.400        AVG. STEADY STATE DESORPTION STEAM RATE (PPH)
2105076  VARY  21  76 0.604        STEADY STATE CO2 REMOVAL EFFICIENCY
2105077  VARY  21  77 70.00        AVG. STEADY STATE BED TEMPERATURE, (DEG-F)
2105078  VARY  21  78 8.500        TOTAL DRY RESIN BED WEIGHT (LBM)
2105079  VARY  21  79 7.400        TOTAL CANISTER WEIGHT (LBM)
2105080  VARY  21  80 2.080        TOTAL WATER IN BED (LBM)
2105081  VARY  21  81 0.300        TOTAL CO2 IN BED (LBM)
2105082  VARY  21  82              TOTAL BED H2O LOADING (LB H2O/LB BED)
2105083  VARY  21  83              TOTAL BED CO2 LOADING (LB CO2/LB BED)
2105084  VARY  21  84 0.120        SPECIFIC HEAT OF CANISTER (BTU/LB-F)
2105085  VARY  21  85 180.0        EXIT TEMPERATURE TO END DESORPTION, DEG-F
2105086  VARY  21  86 2280.        TIME TO END ABSORPTION, SECONDS
2105087  VARY  21  87 240.         TIME LAG FOR OUTLET TEMPERATURE, SECONDS
2105088  VARY  21  88              BED INLET DEW POINT, DEG-F
2105089  VARY  21  89              BED EXIT DEW POINT, DEG-F
2105090  VARY  21  90              BED INLET CO2 PARTIAL PRESSURE, MM-HG
2105091  VARY  21  91              BED EXIT CO2 PARTIAL PRESSURE, MM-HG
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                                              3 2                    -19 2                          7     2
3102000  KBAS  31    0  6
3103000  NSTR  31    0

3201000  ID**  32    0 CO2 ACCUMULATOR TANK                                                        31     2
3202000  KBAS  32    0 30      1       30 2
3203000  NSTR  32    001000                      CO2 DELIVERY; 0 = OVBD; 1 = CO2 REDUCTION.
3204016  KARY  32   16               1           CO2 TEMPERATURE (F)
3205070  VARY  32   70 70.                       TANK VOLUME (FT3)
3205071  VARY  32   71 2.0                       CO2 PRESSURE (PSIA)
3205072  VARY  32   72 30.0                      MASS OF CO2 IN TANK (LB)
3205080  VARY  32   80 0.4644

                                       16        0     LIN   LIN
1000109010  TABL   1  10   2
1000110020  TITL   1  20CREWMAN METABOLIC RATE (BTU/HR) VS MISSION TIME (SEC)
1000111100  VALU   1 1002I  .0          2700.       3600.       7200.       .1800E+05   .1980E+05
1000111110  VALU   1 1102D  450.0       450.0       520.0       650.0       650.0       450.0
1000111120  VALU   1 1202I  .2340E+05   .2520E+05   .3960E+05   .4140E+05   .4320E+05   .4680E+05
1000111130  VALU   1 1302D  450.0       650.0       650.0       520.0       450.0       450.0
1000111140  VALU   1 1402I  .5040E+05   .5400E+05   .5560E+05   .8640E+05
1000111150  VALU   1 1502D  390.0       520.0       300.0       300.0

                                        3              LIN   STP
1001009010  TABL  10  10   2
1001010020  TITL  10  20PRESSURE CONTROL SYSTEM OPERATION
1001010030  TITL  10  30PRESSURE MODE VS MISSION TIME (SEC)
1001010040  TITL  10  40   =0  14.5 PSI CONTROLLER USED
1001010050  TITL  10  50   =1  8.0 PSI CONTROLLER USED
1001011100  VALU  10 1002I  -8400.      15300.      427864.
1001011110  VALU  10 1102D  0.0         0.0         0.0

                                        6               LIN   LIN
1002009010  TABL  20  10   2
1002010020  TITL  20  20 PRESSURE CONTROL SUBSYSTEM REGULATOR FLOWRATE CURVE
1002010030  TITL  20  30O2 OPENING FLOWS (FROM JULY 1980 PCS TESTING AT JSC)
1002010040  TITL  20  40O2 OPENING FLOWS VS TOTAL PRESSURE (PSIA)
1002011100  VALU  20 1002I      0.0       14.510      14.565      14.666      14.700      100.0
1002011110  VALU  20 1102D     10.0       10.0        0.85        0.2         0.0         0.0

                                        6               LIN   LIN
1002109010  TABL  21  10   2
1002110020  TITL  21  20 PRESSURE CONTROL SUBSYSTEM REGULATOR FLOWRATE CURVE
1002110030  TITL  21  30N2 CLOSING FLOWS VS TOTAL PRESSURE (PSIA)
1002111100  VALU  21 1002I      0.0       14.605      14.672      14.745      14.819      100.0
1002111110  VALU  21 1102D     10.0       10.0        0.6         0.25        0.0         0.0

                                        8               LIN   LIN
1002209010  TABL  22  10   2
1002210020  TITL  22  20 PRESSURE CONTROL SUBSYSTEM REGULATOR FLOWRATE CURVE
1002210030  TITL  22  30N2 OPENING FLOWS (FROM JULY 1980 PCS TESTING AT JSC)
1002210040  TITL  22  40N2 OPENING FLOWS VS TOTAL PRESSURE (PSIA)
1002211100  VALU  22 1002I      0.0       14.500      14.510      14.563      14.583      14.640
1002211110  VALU  22 1102D     67.0       67.0        25.0        7.0         1.0         0.5
1002211120  VALU  22 1202I   14.748      100.0
1002211130  VALU  22 1302D      0.0       0.0

                                        8               LIN   LIN
1002309010  TABL  23  10   2
1002310020  TITL  23  20 PRESSURE CONTROL SUBSYSTEM REGULATOR FLOWRATE CURVE
1002310030  TITL  23  30N2 CLOSING FLOWS (FROM JULY 1980 PCS TESTING AT JSC)
1002311100  VALU  23 1002I      0.0       14.590      14.625      14.658      14.680      14.748
1002311110  VALU  23 1102D     67.0       67.0        11.0        7.0         0.8         0.5
1002311120  VALU  23 1202I   14.813      100.0
1002311130  VALU  23 1302D      0.0       0.0

                                       12        0     LIN   LIN
1003009010  TABL  30  10   2
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UNITED TECHNOLOGIES HAMILTON STANDARD

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SVHSER 9503

KSYPAS= 0 TIME= .0

COMPONENT NO. =		1	2	3	4	5	6	7	8
SUBR. TYPE =		SUITS	CABIN	SPLIT	FAN	ANYHX	ALTCOM	ANYHX	ALTCOM
VR									
1-TOTAL PRI FLOW	P	.0	.0	.0	.0	.0	1350.00	.0	950.000
2-TEMPERATURE	R	50.0000	70.0000	.0	.0	.0	60.0000	.0	45.0000
3-DUCT OUTLET P	I	14.7000	14.7000	.0	.0	.0	50.0000	.0	50.0000
4-COMP OUTLET P	M	14.7000	14.7000	.0	.0	.0	50.0000	.0	50.0000
5-NON-COND FLOW	A	.0	.0	.0	.0	.0	.0	.0	.0
6-COND VAP FLOW	R	87.8000	89.7000	.0	.0	.0	.0	.0	.0
7-COND LIQ FLOW	Y	.0	.0	.0	.0	.0	.0	.0	.0
8-N-C SP HEAT		.0	.0	.0	.0	.0	.0	.0	.0
9-N-C MOL WT	S	.0	.0	.0	.0	.0	.0	.0	.0
10-OXYGEN FLOW	I	2046.90	2046.80	.0	.0	.0	.0	.0	.0
11-DILUENT FLOW	D	7200.70	7199.40	.0	.0	.0	.0	.0	.0
12-CO2 FLOW	E	46.7000	46.3000	.0	.0	.0	.0	.0	.0
13-TRACE CTM FLOW		.0	.0	.0	.0	.0	.0	.0	.0
14-SPCL FLOW 1	D	.0	.0	.0	.0	.0	.0	.0	.0
15-SPCL FLOW 2	A	.0	.0	.0	.0	.0	.0	.0	.0
16-SPCL FLOW 3	T	.0	.0	.0	.0	.0	.0	.0	.0
17-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
18-SPCL FLOW 5		.0	.0	.0	.0	.0	.0	.0	.0
19-SPCL FLOW 6		.0	.0	.0	.0	.0	.0	.0	.0
20-TOTAL SEC FLOW	S	.0	.0	.0	.0	.0	.0	.0	.0
21-TEMPERATURE	E	.0	70.0000	.0	.0	.0	.0	.0	.0
22-DUCT OUTLET P	C	.0	14.7000	.0	.0	.0	.0	.0	.0
23-COMP OUTLET P	O	.0	14.7000	.0	.0	.0	.0	.0	.0
24-NON-COND FLOW	N	.0	.0	.0	.0	.0	.0	.0	.0
25-COND VAP FLOW	D	.0	13.0000	.0	.0	.0	.0	.0	.0
26-COND LIQ FLOW	A	.0	.0	.0	.0	.0	.0	.0	.0
27-N-C SP HEAT	R	.0	.0	.0	.0	.0	.0	.0	.0
28-N-C MOL WT	Y	.0	.0	.0	.0	.0	.0	.0	.0
29-OXYGEN FLOW		.0	303.760	.0	.0	.0	.0	.0	.0
30-DILUENT FLOW	S	.0	1068.67	.0	.0	.0	.0	.0	.0
31-CO2 FLOW	I	.0	9.45000	.0	.0	.0	.0	.0	.0
32-TRACE CTM FLOW	D	.0	.0	.0	.0	.0	.0	.0	.0
33-SPCL FLOW 1	E	.0	.0	.0	.0	.0	.0	.0	.0
34-SPCL FLOW 2		.0	.0	.0	.0	.0	.0	.0	.0
35-SPCL FLOW 3	D	.0	.0	.0	.0	.0	.0	.0	.0
36-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
37-SPCL FLOW 5	T	.0	.0	.0	.0	.0	.0	.0	.0
38-SPCL FLOW 6	A	.0	.0	.0	.0	.0	.0	.0	.0
39-DH, C, DP PRI	P	.0	.0	.0	.0	.0	.0	.0	.0
40-LE, N, K DUCT	R	.0	.0	.0	.0	.0	.0	.0	.0
41-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
42-DH, C, DP PRI	S	.0	.0	.0	.0	.0	.0	.0	.0
43-LE, N, K COMP	S	.0	.0	.0	.0	.0	.0	.0	.0
44-FF AREA		.0	.0	.0	.0	.0	.0	.0	.0
45-DH, C, DP SEC	C	.0	.0	.0	.0	.0	.0	.0	.0
46-LE, N, K DUCT	O	.0	.0	.0	.0	.0	.0	.0	.0
47-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
48-DH, C, DP SEC	F	.0	.0	.0	.0	.0	.0	.0	.0
49-LE, N, K COMP	F	.0	.0	.0	.0	.0	.0	.0	.0
50-FF AREA		.0	.0	.0	.0	.0	.0	.0	.0
51-COMP SOURCE TEMP		.0	.0	.0	.0	.0	.0	.0	.0

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VR(5,117)= .0	VR(5,118)= .0	VR(5,119)= .0	VR(5,120)= .0	VR(5,121)= .0
VR(5,122)= .0	VR(5,123)= .0	VR(5,124)= .0	VR(5,125)= .0	VR(5,126)= .0
VR(6, 65)= .0	VR(6, 66)= .0	VR(7, 65)= .0	VR(7, 66)= 1000.0	VR(7, 67)= .0
VR(7, 68)= .0	VR(7, 69)= .0	VR(7, 70)= .0	VR(7, 71)= .0	VR(7, 72)= .0
VR(7, 73)= .0	VR(7, 74)= .0	VR(7, 75)= .0	VR(7, 76)= .0	VR(7, 77)= .0
VR(7, 78)= .0	VR(7, 79)= .0	VR(7, 80)= .0	VR(7, 81)= .0	VR(7, 82)= .0
VR(7, 83)= .0	VR(7, 84)= .0	VR(7, 85)= .0	VR(7, 86)= .0	VR(7, 87)= .0
VR(7, 88)= .0	VR(7, 89)= .0	VR(7, 90)= .0	VR(7, 91)= .0	VR(7, 92)= .0
VR(7, 93)= .0	VR(7, 94)= .0	VR(7, 95)= .0	VR(7, 96)= .0	VR(7, 97)= .0
VR(7, 98)= .0	VR(7, 99)= .0	VR(7,100)= .0	VR(7,101)= .0	VR(7,102)= .0
VR(7,103)= .0	VR(7,104)= .0	VR(7,105)= .0	VR(7,106)= .0	VR(7,107)= .0
VR(7,108)= .0	VR(7,109)= .0	VR(7,110)= .0	VR(7,111)= .0	VR(7,112)= .0
VR(7,113)= .0	VR(7,114)= .0	VR(7,115)= .0	VR(7,116)= .0	VR(7,117)= .0
VR(7,118)= .0	VR(7,119)= .0	VR(7,120)= .0	VR(7,121)= .0	VR(7,122)= .0
VR(7,123)= .0	VR(7,124)= .0	VR(7,125)= .0	VR(7,126)= .0	VR(8, 65)= .0
VR(8, 66)= .0	VR(			

COMPONENT NO. = SUBR. TYPE =	1 SUITS	2 CABIN	3 SPLIT	4 FAN	5 ANYHX	6 ALTCOM	7 ANYHX	8 ALTCOM
KR								
1-SUBR NO./EXV/EXK	2001000	1025000	10000000	23000000	4000000	49000002	4000000	49000000
2-PRI SOR/FLO CODE	502	102	-202	202	402	0	3102	0
3-PRI SPFL TYP 1-3	0	0	0	0	0	10000	0	10000
4-PRI SPFL TYP 4-6	0	0	0	0	0	0	0	0
5-SEC SOR/FLO CODE	0	-1302	2	0	-600	0	-800	0
6-SEC SPFL TYP 1-3	0	0	0	0	10000	0	10000	0
7-SEC SPFL TYP 4-6	0	0	0	0	0	0	0	0
8-NEXT COMP/CABIN	1400002	300002	400002	500002	100002	2	900002	2
9-COMP NSTR 1-9	0	151011000	0	100000000	200000000	0	200000000	0
10-COMP NSTR 10-18	100	0	0	0	100	0	100	0
11-NCFL/NLFL/NPASS	0	0	0	0	0	0	0	0
12-PRI VISC/DENSITY	0	0	0	0	0	0	0	0
13-PRI OP/DP/OP/DP	0	0	0	0	0	0	0	0
14-SEC VISC/DENSITY	0	0	0	0	0	0	0	0
15-SEC OP/DP/OP/DP	0	0	0	0	0	0	0	0

SUBROUTINE DEPENDENT K ARRAY DATA - - -

KR(1, 16)= 3	KR(2, 16)= 0	KR(2, 17)= 0	KR(4, 16)= 0	KR(4, 17)= 0
KR(4, 18)= 0	KR(5, 16)= 0	KR(6, 16)= 0	KR(6, 17)= 0	KR(7, 16)= 0

```
52-EFF SUMMED COND       .0   .0   .0   .0   .0   .0   .0   .0
53-COMP QTOTOL LOSS      .0   .0   .0   .0   .0   .0   .0   .0
54-AMBIENT GAS TEMP      .0   .0   .0   .0   .0   .0   .0   .0
55-AMBIENT UA            .0   .0   .0   .0   .0   .0   .0   .0
56-AMB CONV Q LOSS       .0   .0   .0   .0   .0   .0   .0   .0
57-AMB WALL TEMP         .0   .0   .0   .0   .0   .0   .0   .0
58-AMB SCRIPT(F)*A       .0   .0   .0   .0   .0   .0   .0   .0
59-AMB RAD Q LOSS        .0   .0   .0   .0   .0   .0   .0   .0
60-STRUCTURE TEMP        .0   .0   .0   .0   .0   .0   .0   70.0000
61-STRUCTURE KA/X        .0   .0   .0   .0   .0   .0   .0   .800000
62-STRUCTURE Q LOSS      .0   .0   .0   .0   .0   .0   .0   .0
63-INSULATION TEMP       .0   .0   .0   .0   .0   .0   .0   70.0000
64-INSULATION KA/X       .0   .0   .0   .0   .0   .0   .0   .800000

SUBROUTINE DEPENDENT V ARRAY DATA - - -

VR(  9, 65)= .0          VR(  9, 66)= .30000E-01  VR(  9, 67)= 1.0000      VR(  9, 68)= .30000E-01  VR(  9, 69)= .30000E-01
VR(  9, 70)= .30000E-01  VR(  9, 71)= .30000E-01  VR(  9, 72)= .30000E-01  VR( 10, 65)= .0          VR( 10, 66)= .0
VR( 10, 67)= .0          VR( 11, 65)= .0          VR( 12, 65)= .0          VR( 12, 66)= .0          VR( 12, 67)= .0
VR( 12, 68)= .0          VR( 12, 69)= .0          VR( 12, 70)= .0          VR( 12, 71)= .0          VR( 12, 72)= .0
VR( 12, 73)= .0          VR( 12, 74)= .0          VR( 12, 75)= .0          VR( 12, 76)= 300.00      VR( 12, 77)= .0
VR( 12, 78)= .0          VR( 12, 79)= .0          VR( 12, 80)= .0          VR( 12, 81)= .0          VR( 12, 82)= .0
VR( 12, 83)= .0          VR( 12, 84)= 1.0000      VR( 12, 85)= .0          VR( 12, 86)= .0          VR( 12, 87)= .0
VR( 12, 88)= .0          VR( 12, 89)= .0          VR( 12, 90)= .0          VR( 12, 91)= 140.00      VR( 12, 92)= .0
VR( 12, 93)= .0          VR( 13, 65)= .0          VR( 14, 65)= .0          VR( 15, 65)= .0          VR( 16, 65)= 1270.0
VR( 16, 66)= .31400      VR( 16, 67)= 32.700      VR( 16, 68)= .31900      VR( 16, 69)= 10.000      VR( 16, 70)= .0
VR( 16, 71)= .0          VR( 16, 72)= .0          VR( 16, 73)= .0          VR( 16, 74)= 1.5000      VR( 16, 75)= .40000
VR( 16, 76)= .60400      VR( 16, 77)= 70.000      VR( 16, 78)= 8.5000      VR( 16, 79)= 7.4000      VR( 16, 80)= 2.5500
VR( 16, 81)= .50000E-02  VR( 16, 82)= .0          VR( 16, 83)= .0          VR( 16, 84)= .12000      VR( 16, 85)= 180.00
VR( 16, 86)= 2230.0      VR( 16, 87)= 240.00      VR( 16, 88)= .0          VR( 16, 89)= .0          VR( 16, 90)= .0
VR( 16, 91)= .0          VR( 16, 92)= .0          VR( 16, 93)= .47000      VR( 16, 94)= .33000      VR( 16, 95)= .10000E+06
VR( 16, 96)= .0          VR( 16, 97)= .0          VR( 16, 98)= .0          VR( 16, 99)= .0          VR( 16,100)= .0
VR( 16,101)= .0          VR( 16,102)= .0          VR( 16,103)= .0          VR( 16,104)= .0          VR( 16,105)= .0
VR( 16,106)= .0          VR( 16,107)= .0          VR( 16,108)= .0          VR( 16,109)= .0          VR( 16,110)= .0
VR( 16,111)= .0          VR( 16,112)= .0          VR( 16,113)= .0          VR( 16,114)= .0          VR( 16,115)= .0
VR( 16,116)= .0          VR( 16,117)= .0          VR( 16,118)= .0          VR( 16,119)= .0          VR( 16,120)= .0
VR( 16,121)= .0          VR( 16,122)= .0          VR( 16,123)= .0          VR( 16,124)= .0          VR( 16,125)= .0
VR( 16,126)= .0          VR( 16,127)= .0          VR( 16,128)= .0          VR( 16,129)= .0          VR( 16,130)= .0
VR( 16,131)= .0          VR( 16,132)= .0          VR( 16,133)= .0          VR( 16,134)= .0          VR( 16,135)= .0
VR( 16,136)= .0          VR( 16,137)= .0          VR( 16,138)= .0          VR( 16,139)= .0          VR( 16,140)= .0
VR( 16,141)= .0          VR( 16,142)= .0          VR( 16,143)= .0          VR( 16,144)= .0          VR( 16,145)= .0
VR( 16,146)= .0          VR( 16,147)= .0          VR( 16,148)= .0          VR( 16,149)= .0          VR( 16,150)= .0
VR( 16,151)= .0          VR( 16,152)= .0          VR( 16,153)= .0          VR( 16,154)= .0          VR( 16,155)= .0
VR( 16,156)= .0          VR( 16,157)= .0          VR( 16,158)= .0          VR( 16,159)= .0          VR( 16,160)= .0
VR( 16,161)= .0          VR( 16,162)= .0          VR( 16,163)= .0          VR( 16,164)= .0          VR( 16,165)= .0
VR( 16,166)= .0          VR( 16,167)= .0          VR( 16,168)= .0          VR( 16,169)= .0          VR( 16,170)= .0
VR( 16,171)= .0          VR( 16,172)= .0          VR( 16,173)= .0          VR( 16,174)= .0          VR( 16,175)= .0
VR( 16,176)= .0          VR( 16,177)= .0          VR( 16,178)= .0          VR( 16,179)= .0          VR( 16,180)= .0
VR( 16,181)= .0          VR( 16,182)= .0          VR( 16,183)= .0          VR( 16,184)= .0          VR( 16,185)= .0
VR( 16,186)= .0          VR( 16,187)= .0          VR( 16,188)= .0          VR( 16,189)= .0          VR( 16,190)= .0
VR( 16,191)= .0          VR( 16,192)= .0          VR( 16,193)= .0          VR( 16,194)= .0          VR( 16,195)= .0
VR( 16,196)= .0          VR( 16,197)= .0          VR( 16,198)= .0          VR( 16,199)= .0          VR( 16,200)= .0
VR( 16,201)= .0          VR( 16,202)= .0          VR( 16,203)= .0          VR( 16,204)= .0          VR( 16,205)= .0
VR( 16,206)= .0          VR( 16,207)= .0          VR( 16,208)= .0          VR( 16,209)= .0          VR( 16,210)= .0
VR( 16,211)= .0          VR( 16,212)= .0          VR( 16,213)= .0          VR( 16,214)= .0          VR( 16,215)= .0
VR( 16,216)= .0          VR( 16,217)= .0          VR( 16,218)= .0          VR( 16,219)= .0          VR( 16,220)= .0
VR( 16,221)= .0          VR( 16,222)= .0          VR( 16,223)= .0          VR( 16,224)= .0          VR( 16,225)= .0
VR( 16,226)= .0          VR( 16,227)= .0          VR( 16,228)= .0          VR( 16,229)= .0          VR( 16,230)= .0
VR( 16,231)= .0          VR( 16,232)= .0          VR( 16,233)= .0          VR( 16,234)= .0          VR( 16,235)= .0
VR( 16,236)= .0          VR( 16,237)= .0          VR( 16,238)= .0          VR( 16,239)= .0          VR( 16,240)= .0
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SVHSER 9503

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KSTPAS= 0 TIME= .0

COMPONENT NO. =		17	18	19	20	21	22	23	24
SUBR. TYPE =		SPLIT	GASMIX	FAN	GASMIX	IR45	SPLIT	GASMIX	SPLIT
VR									
1-TOTAL PRI FLOW	P	.0	.0	.0	.0	.0	.0	.0	.0
2-TEMPERATURE	R	.0	.0	70.0000	.0	.0	.0	.0	.0
3-DUCT OUTLET P	I	.0	.0	14.7000	.0	.0	.0	.0	.0
4-COMP OUTLET P	M	.0	.0	14.7000	.0	.0	.0	.0	.0
5-NON-COND FLOW	A	.0	.0	.0	.0	.0	.0	.0	.0
6-COND VAP FLOW	R	.0	.0	.780000	.0	.0	.0	.0	.0
7-COND LIQ FLOW	Y	.0	.0	.0	.0	.0	.0	.0	.0
8-N-C SP HEAT		.0	.0	.0	.0	.0	.0	.0	.0
9-N-C MOL WT	S	.0	.0	.0	.0	.0	.0	.0	.0
10-OXYGEN FLOW	I	.0	.0	20.5500	.0	.0	.0	.0	.0
11-DILUENT FLOW	D	.0	.0	71.8700	.0	.0	.0	.0	.0
12-CO2 FLOW	E	.0	.0	.300000	.0	.0	.0	.0	.0
13-TRACE CTM FLOW		.0	.0	.0	.0	.0	.0	.0	.0
14-SPCL FLOW 1	D	.0	.0	.0	.0	.0	.0	.0	.0
15-SPCL FLOW 2	A	.0	.0	.0	.0	.0	.0	.0	.0
16-SPCL FLOW 3	T	.0	.0	.0	.0	.0	.0	.0	.0
17-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
18-SPCL FLOW 5		.0	.0	.0	.0	.0	.0	.0	.0
19-SPCL FLOW 6		.0	.0	.0	.0	.0	.0	.0	.0
20-TOTAL SEC FLOW	S	.0	.0	.0	.0	.0	.0	.0	.0
21-TEMPERATURE	E	.0	.0	.0	.0	.0	.0	.0	.0
22-DUCT OUTLET P	C	.0	.0	.0	.0	.0	.0	.0	.0
23-COMP OUTLET P	O	.0	.0	.0	.0	.0	.0	.0	.0
24-NON-COND FLOW	N	.0	.0	.0	.0	.0	.0	.0	.0
25-COND VAP FLOW	D	.0	.0	.0	.0	.0	.0	.0	.0
26-COND LIQ FLOW	A	.0	.0	.0	.0	.0	.0	.0	.0
27-N-C SP HEAT	R	.0	.0	.0	.0	.0	.0	.0	.0
28-N-C MOL WT	Y	.0	.0	.0	.0	.0	.0	.0	.0
29-OXYGEN FLOW		.0	.0	.0	.0	.0	.0	.0	.0
30-DILUENT FLOW	S	.0	.0	.0	.0	.0	.0	.0	.0
31-CO2 FLOW	I	.0	.0	.0	.0	.0	.0	.0	.0
32-TRACE CTM FLOW	D	.0	.0	.0	.0	.0	.0	.0	.0
33-SPCL FLOW 1	E	.0	.0	.0	.0	.0	.0	.0	.0
34-SPCL FLOW 2		.0	.0	.0	.0	.0	.0	.0	.0
35-SPCL FLOW 3	D	.0	.0	.0	.0	.0	.0	.0	.0
36-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
37-SPCL FLOW 5	T	.0	.0	.0	.0	.0	.0	.0	.0
38-SPCL FLOW 6	A	.0	.0	.0	.0	.0	.0	.0	.0
39-DH, C, DP PRI	P	.0	.0	.0	.0	.0	.0	.0	.0
40-LE, N, K DUCT	R	.0	.0	.0	.0	.0	.0	.0	.0
41-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
42-DH, C, DP PRI	S	.0	.0	.0	.0	.0	.0	.0	.0
43-LE, N, K COMP	S	.0	.0	.0	.0	.0	.0	.0	.0
44-FF AREA		.0	.0	.0	.0	.0	.0	.0	.0
45-DH, C, DP SEC	C	.0	.0	.0	.0	.0	.0	.0	.0
46-LE, N, K DUCT	O	.0	.0	.0	.0	.0	.0	.0	.0
47-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
48-DH, C, DP SEC	F	.0	.0	.0	.0	.0	.0	.0	.0
49-LE, N, K COMP	F	.0	.0	.0	.0	.0	.0	.0	.0
50-FF AREA		.0	.0	.0	.0	.0	.0	.0	.0
51-COMP SOURCE TEMP		.0	.0	.0	.0	.0	.0	.0	.0

SVHSER 9503

VR(24, 65)= .0 VR(

COMPONENT NO. = SUBR. TYPE =	17 SPLIT	18 GASMIX	19 FAN	20 GASMIX	21 IR45	22 SPLIT	23 GASMIX	24 SPLIT
KR								
1-SUBR NO./EXV/ENK	10000000	6000000	23000000	6000000	73000000	10000000	6000000	10000000
2-PRI SOR/FLO CODE	1602	1702	1802	-1402	2002	2102	-2202	2302
3-PRI SPFL TYP 1-3	0	0	0	0	0	0	0	0
4-PRI SPFL TYP 4-6	0	0	0	0	0	0	0	0
5-SEC SOR/FLO CODE	2	-2200	0	2600	0	2	1700	2
6-SEC SPFL TYP 1-3	0	0	0	0	0	0	0	0
7-SEC SPFL TYP 4-6	0	0	0	0	0	0	0	0
8-NEXT COMP/CABIN	2000002	1900002	3000002	2100002	2200002	2300002	2400002	1800002
9-COMP NSTR 1-9	0	0	3000000	200000000	0	0	0	0
10-COMP NSTR 10-18	0	0	0	0	0	0	0	0
11-NCFL/NLFL/NPASS	0	0	0	0	0	0	0	0
12-PRI VISC/DENSITY	0	0	0	0	0	0	0	0
13-PRI OP/DP/OP/DP	0	0	0	0	0	0	0	0
14-SEC VISC/DENSITY	0	0	0	0	0	0	0	0
15-SEC OP/DP/OP/DP	0	0	0	0	0	0	0	0

SUBROUTINE DEPENDENT K ARRAY DATA - - -

KR(19, 16)= 0 KR(19, 17)= 0 KR(19, 18)= 0 KR(21, 16)= 1 KR(21, 17)= 16
KR(21, 18)= 0 KR(21, 19)= 5 KR(21, 20)= 20 KR(

52-EFF SUMMED COND	.0	.0	.0	.0	.0	.0	.0	.0
53-COMP QTOTOL LOSS	.0	.0	.0	.0	.0	.0	.0	.0
54-AMBIENT GAS TEMP	.0	.0	.0	.0	.0	.0	.0	.0
55-AMBIENT UA	.0	.0	.0	.0	.0	.0	.0	.0
56-AMB CONV Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
57-AMB WALL TEMP	.0	.0	.0	.0	.0	.0	.0	.0
58-AMB SCRIPT(F)*A	.0	.0	.0	.0	.0	.0	.0	.0
59-AMB RAD Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
60-STRUCTURE TEMP	.0	.0	.0	.0	.0	.0	.0	.0
61-STRUCTURE KA/X	.0	.0	.0	.0	.0	.0	.0	.0
62-STRUCTURE Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
63-INSULATION TEMP	.0	.0	.0	.0	.0	.0	.0	.0
64-INSULATION KA/X	.0	.0	.0	.0	.0	.0	.0	.0

SUBROUTINE DEPENDENT V ARRAY DATA - - -

VR(25, 65)= .0	VR(26, 65)= 1.0000	VR(27, 65)= .0	VR(27, 66)= .0	VR(27, 67)= .0
VR(27, 68)= 168.30	VR(27, 69)= 168.30	VR(27, 70)= 70.000	VR(27, 71)= .0	VR(27, 72)= 30.000
VR(27, 73)= .0	VR(27, 74)= .0	VR(27, 75)= .0	VR(27, 76)= .0	VR(27, 77)= .0
VR(27, 78)= .0	VR(27, 79)= .0	VR(27, 80)= .0	VR(27, 81)= .0	VR(27, 82)= .0
VR(27, 83)= .0	VR(27, 84)= .0	VR(27, 85)= .0	VR(27, 86)= .0	VR(27, 87)= .0
VR(27, 88)= .0	VR(27, 89)= .0	VR(27, 90)= .0	VR(27, 91)= .0	VR(27, 92)= .0
VR(27, 93)= .0	VR(27, 94)= .0	VR(27, 95)= .0	VR(27, 96)= .0	VR(27, 97)= .0
VR(27, 98)= .0	VR(27, 99)= .0	VR(27,100)= 2.5500	VR(28, 65)= .0	VR(28, 66)= .0
VR(28, 67)= .0	VR(28, 68)= .0	VR(28, 69)= .0	VR(28, 70)= .0	VR(28, 71)= .0
VR(28, 72)= .0	VR(28, 73)= .0	VR(28, 74)= .0	VR(28, 75)= .0	VR(28, 76)= .0
VR(28, 77)= .0	VR(28, 78)= .0	VR(28, 79)= 1.0000	VR(28, 80)= .0	VR(28, 81)= .0
VR(28, 82)= .0	VR(28, 83)= .0	VR(28, 84)= .0	VR(28, 85)= 10.000	VR(29, 65)= .0
VR(29, 66)= 40.000	VR(29, 67)= .0	VR(29, 68)= .0	VR(29, 69)= .0	VR(29, 70)= .0
VR(30, 65)= 1.0000	VR(31, 65)= .0	VR(32, 65)= .0	VR(32, 66)= .0	VR(32, 67)= .0
VR(32, 68)= .0	VR(32, 69)= .0	VR(32, 70)= 70.000	VR(32, 71)= 2.0000	VR(32, 72)= 30.000
VR(32, 73)= .0	VR(32, 74)= .0	VR(32, 75)= .0	VR(32, 76)= .0	VR(32, 77)= .0
VR(32, 78)= .0	VR(32, 79)= .0	VR(32, 80)= .46440	VR(32, 81)= .0	VR(32, 82)= .0
VR(32, 83)= .0	VR(32, 84)= .0	VR(32, 85)= .0	VR(32, 86)= .0	VR(32, 87)= .0
VR(32, 88)= .0	VR(32, 89)= .0	VR(32, 90)= .0	VR(32, 91)= .0	VR(32, 92)= .0
VR(32, 93)= .0	VR(32, 94)= .0	VR(32, 95)= .0	VR(32, 96)= .0	VR(32, 97)= .0

COMPONENT NO. =	25	26	27	28	29	30	31	32
SUBR. TYPE =	GASMIX	SPLIT	TANKG	PUMP	SMGEN	SPLIT	GASMIX	TANKG
KR								
1-SUBR NO./EXV/EXK	6000000	10000000	30003000	22000000	27000000	10000000	6000000	30000001
2-PRI SOP/FLO CODE	2902	2502	0	2700	2802	2402	302	3002
3-PRI SPFL TYP 1-3	0	0	10000	10000	0	0	0	0
4-PRI SPFL TYP 4-6	0	0	0	0	0	0	0	0
5-SEC SOP/FLO CODE	2400	2	0	0	0	2	-1900	0
6-SEC SPFL TYP 1-3	0	0	0	0	0	0	0	0
7-SEC SPFL TYP 4-6	0	0	0	0	0	0	0	0
8-NEXT COMP/CABIN	2600002	1500002	2800002	2900002	2500002	3200002	700002	3100002
9-COMP NSTR 1-9	0	0	110100000	200000	10000000	0	0	10000000
10-COMP NSTR 10-13	0	0	0	0	0	0	0	0
11-NCFL/NLFL/NPASS	0	0	0	0	0	0	0	0

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START OF STEADY STATE SOLUTION RESULTS

```
                                                                          COMP PASS NO     1        TIME =      0.0 SEC
COMP NO    2  CABIN     SUBR NO   1    PRI SOR     1    SEC SOR   -13                                             PP=       0
                        FAILURE FLAGS -- COMP=  1    LOOP=  0    ELAPSED TIME IN MILLISEC -- CP=*****
VR(  1)=  9382.2    VR(  2)=  70.000    VR(  3)=  14.700    VR(  4)=  14.700    VR(  5)=  9292.5    VR(  6)=  89.700
VR(  7)=  .0        VR(  8)=  .24314    VR(  9)=  28.857    VR( 10)=  2046.8    VR( 11)=  7199.4    VR( 12)=  46.300
VR( 13)=  .0        VR( 14)=  .0        VR( 20)=  1394.9    VR( 21)=  70.000    VR( 22)=  14.700    VR( 23)=  14.700
VR( 24)=  1331.9    VR( 25)=  13.000    VR( 26)=  .0        VR( 27)=  .24306    VR( 28)=  28.876    VR( 29)=  303.76
VR( 30)=  1063.7    VR( 31)=  9.4500    VR( 32)=  .0        VR( 33)=  .0        VR( 65)=  17318.    VR( 66)=  17065.
VR( 67)=  .0        VR( 68)=  .0        VR( 69)=  .0        VR( 70)=  .0        VR( 71)=  2.0018    VR( 72)=  254.62
VR( 73)=  .0        VR( 74)=  .0        VR( 75)=  .0        VR( 76)=  .0        VR( 77)=  .0        VR( 78)=  .0
VR( 79)=  .0        VR( 80)=  .0        VR( 81)=  .0        VR( 82)=  .0        VR( 83)=  .0        VR( 84)=  .0
VR( 85)=  .0        VR( 86)=  .0        VR( 87)=  70.000    VR( 88)=  10.000    VR( 89)=  .93687    VR( 90)=  14.700
VR( 91)=  .50000    VR( 92)=  2.9000    VR( 93)=  .50000    VR( 94)=  2.8759    VR( 95)=  11.557    VR( 96)=  50.000
VR( 97)=  30.000    VR( 98)=  55.639    VR( 99)=  20.000    VR(100)=  2.4670    VR(101)=  250.00    VR(102)=  .0
VR(103)=  9382.2    VR(104)=  57.418    VR(105)=  14.700    VR(106)=  14.700    VR(107)=  9294.2    VR(108)=  88.032
VR(109)=  .0        VR(110)=  .24314    VR(111)=  28.858    VR(112)=  2046.9    VR(113)=  7200.6    VR(114)=  46.700
VR(115)=  .0        VR(116)=  .0        VR(117)=  .0        VR(118)=  .0        VR(119)=  .0        VR(120)=  .0
VR(121)=  .0        VR(122)=  .83300E-01 VR(123)=  .82518E-01 VR(124)=  .78159E-03 VR(125)=  .0     VR(126)=  .23300
VR(127)=  .0        VR(128)=  .23300    VR(129)=  .0        VR(130)=  70.000    VR(131)=  .0        VR(132)=  70.000
VR(133)=  .0        VR(134)=  .0        VR(135)= -1395.0    VR(136)= -1380.1    VR(137)= -14.900    VR(138)=  .0
VR(139)=  6000.0    VR(140)=  .0        VR(141)=  .0        VR(142)=  .0        VR(143)=  .0        VR(144)=  .0
VR(145)=  .0        VR(146)=  .0        VR(147)=  .0        VR(148)=  .0        VR(149)=  .0        VR(150)=  .0
VR(151)=  .0        VR(152)=  .0        VR(153)=  .0        VR(154)=  .0        VR(155)=  .0        VR(156)=  .0
VR(157)=  .0        VR(158)=  .0        VR(159)=  .0        VR(160)=  .18173E-01 VR(161)=  .63931E-01 VR(162)=  .41462E-03
VR(163)=  .0        VR(164)=  .0        VR(165)=  .0        VR(166)=  .0        VR(167)=  .0        VR(168)=  .0
VR(169)=  .0        VR(170)=  70.000    VR(171)=  70.000    VR(172)=  70.000    VR(173)=  70.000    VR(174)=  70.000
VR(175)= -303.66    VR(176)= -1067.4    VR(177)= -9.0500    VR(178)=  .0        VR(179)=  .0        VR(180)=  .0
VR(181)=  15.000    VR(182)=  .25000    VR(183)=  1.0000    VR(184)=  8.0000    VR(
                       CPP=  .24507        WTHP=  28.692       RHOP=  .74172E-01   VISCP=  .44000      XKP=  .14600
                       CPS=  .24495        WTHS=  23.714       RHOS=  .74229E-01   VISCS=  .44000      XKS=  .14600
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  SPACE STATION AIR REVITALIZATION SUBSYSTEM SAND II DEMONSTRATION MODEL.  MISSION TIME:      0. SEC ( 0.0  HR)   DATE: 01/26/85

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                                                                                   X
X          CABIN (2)                     CREW (1)             FROM CABIN                              *****           TO CABIN   X
X                                                             M= 9382.                                 *               M= 9346.  X
X  VOLUME        = 8000. CU-FT   NO OF MEN   =  3             T= 70.0                                 *T= 70.5         T= 65.1   X
X  AIR MASS      = ****** LBM    TOTAL Q     = 1350.0 B/HR      A        -------------          ------------             A       X
X  TEMP          =   70.3 F      METABOLIC Q =  450.0 B/HR/MAN  A        |SENSIBLE   |          |SENSIBLE   |            A       X
X  DEW PT        =   55.7 F        SENSIBLE  =  321.9 B/HR/MAN  A        |HX FAN (4) | T= 71.2  |HX (5)     |            A       X
X  TOTAL PRESS   = 14.70 PSIA      LATENT    =  128.1 B/HR/MAN  AAAAAAAAA|Q  =  2843.|AAAAAAAAAA|Q=-14148.  |AAAAAAAAAAAAAAAA      X
X  O2 PRESS      =   2.88 PSIA   O2 USAGE    = 0.2200 PPH         -----> |CFM=  2100.|          |           |   ------->          X
X  CO2 PRESS     =   2.56 MM-HG  CO2 PROD    = 0.2592 PPH                -------------          ------------                     X
X  GAS LEAKAGE   = 0.083 PPH                                                                          *                          X
X  O2 MAKEUP     = 0.000 PPH                                                                   M=1350. *                         X
X  N2 MAKEUP     = 0.000 PPH           FROM                                                    T= 60.0 *        TO CABIN         X
X  NON ECLSS Q:                        CABIN                                                   *********        M= 1390.         X
X    SENSIBLE    = 17065. B/HR         M= 1327.          ********                               ---->           T= 51.3          X
X    LATENT      =    261. B/HR        T= 70.0           *                                                          A            X
X  ECLSS Q:                              A               *T= 55.2                                                  A A           X
X    SENSIBLE    =   6444. B/HR        | A           ------------                                   -------------  A |           X
X    LATENT      =    129. B/HR        | A  M= 1394. |REL. HUMD. |                        M= 1391.  |REL. HUMD. |  A |           X
X  REL HUMIDITY  = 59.50 PCT           V A  T= 69.2  |HX (7)     | T= 49.9      M= 1349.  T= 49.9   |HX FAN (12)|  A |           X
X                                     (31)AAAAAAAAAA|Q= -9670.  |AAAAAAAAA(9)AAAAAAAAAAAAAAA(11)AAAAAAAAAAAAAA|Q  = 478.  |AAA |     X
X                                       A   ----->  |           |  -----> A                  A    ----->  |CFM= 300.  |            X
X                                     A A           -------------        | A  ------------   A            -------------            X
X                                     | A M= 66.93        *              | A |H2O SEP (10)|  A M= 41.7                             X
X                                     | A T= 71.1         *M= 950.       V AA|Q    =   13. |AAA T= 51.2                            X
X                                     | A                 *T= 45.0           |CFM  =    9. |                                       X
X FROM CABIN                          | A            ******                  --------------                                        X
X M= 66.81                              A            ---->                         W   ---->   H2O INTERFACE: M ADDED =    0.0     X
X T= 70.0                       ---------------                                    WWWWWWWWWW M=  2.9                            X
X      A                        |SAND FAN (19)|               <------                                                              X
X      A |                      |Q   = 171.   |AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                             X
X      A |                      |CFM=  15.    |                          P= 14.70                   A A                            X
X      A V                      ---------------    M= 66.81-------------- M= 66.93                  A |                            X
X      A      M= 66.81                             T= 70.0 |  AMINE    | T= 60.8      M= 66.93      A |                            X
X   (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)AAAAAAAAAA| BED 1 (16)|AAAAAAAAAA(17)AAAAAAAAA(18)                              X
X      A                    ----->          S     ---->  |Q   =    0.|   ---->   C     ---->   A    TO CABIN                       X
X      A  H2O INTERFACE                     S            |MCO2= 0.005|           C           A A    M=  0.0                        X
X      A  M USED =    0.0                   S A          |MH2O= 2,550|           C |         | A    T= 70.0                        X
X      A     W                              S |          -------------           C |         | A      A                            X
X      A   | W                    M=   0.0  S |                        M=   0.0  C |         | A    A A                            X
X    | A   | W M=  2.55                     S |                                  C |         | A    | A                            X
X    | A   V W T= 70.0                      S |                                  C V           A    | A         -------------      X
X    | A  ---------  -----------            S                                    C             A    | A         | CO2       |      X
X    | A  |PUMP  |  T= 83.4|STEAM    | T=290.1  S      M=  0.0                   C    M=  0.27A   A M=  0.27 |ACCUM (32)|      X
X    V A  |(28)  |WWWWWWWWWW|GEN (29)|SSSSSSSS(25/26)SSSSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)CCCCCCCC)A(CCCC(30)CCCCCCCC|          |      X
X      A  |Q= 34.|  ----->  |Q= 2905.|  ----->  S     <-----                     C   ---->   A         ---->  | M= 0.464 |      X
X      A  ---------         -----------         S |                              C A         A A              | P= 30.00 |      X
X      A                            M=  2.55    S |                    M=  0.27C |         A |              -------------      X
X      A                                        S |                              C |         A |                 | C             X
X      A                                        S |        -------------- P= 30.00 C |       A |                 | C             X
X      A                                        S V M=  2.55|  AMINE     | M=  0.27 C |      A |                 V C             X
X      A      M=  0.0                           S   T=290.1 | BED 2 (21)| T= 70.0   C   M=  0.0  A            TO OVBD OR         X
X      AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)SSSSSSSSSS|Q    =-2690.|CCCCCCCCCC(22)AAAAAAAAAAA           RECOVERY         X
X                            ----->                   ---->  |MCO2= 0.300|   ---->          ---->            M=  0.27          X
X                                                            |MH2O= 2.080|                                   T= 70.0           X
X                                                            --------------                                                    X
X                                                                                                                              X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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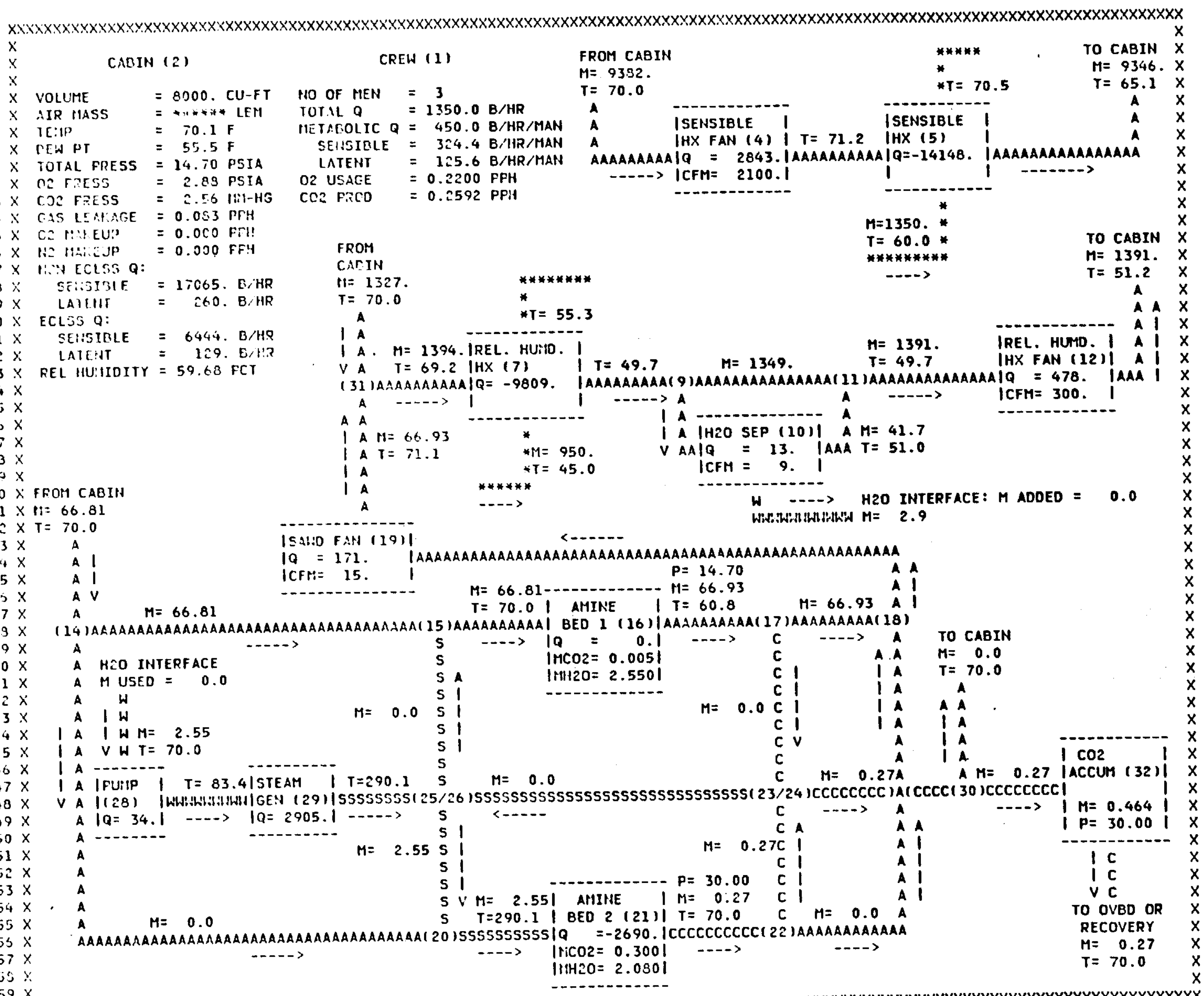
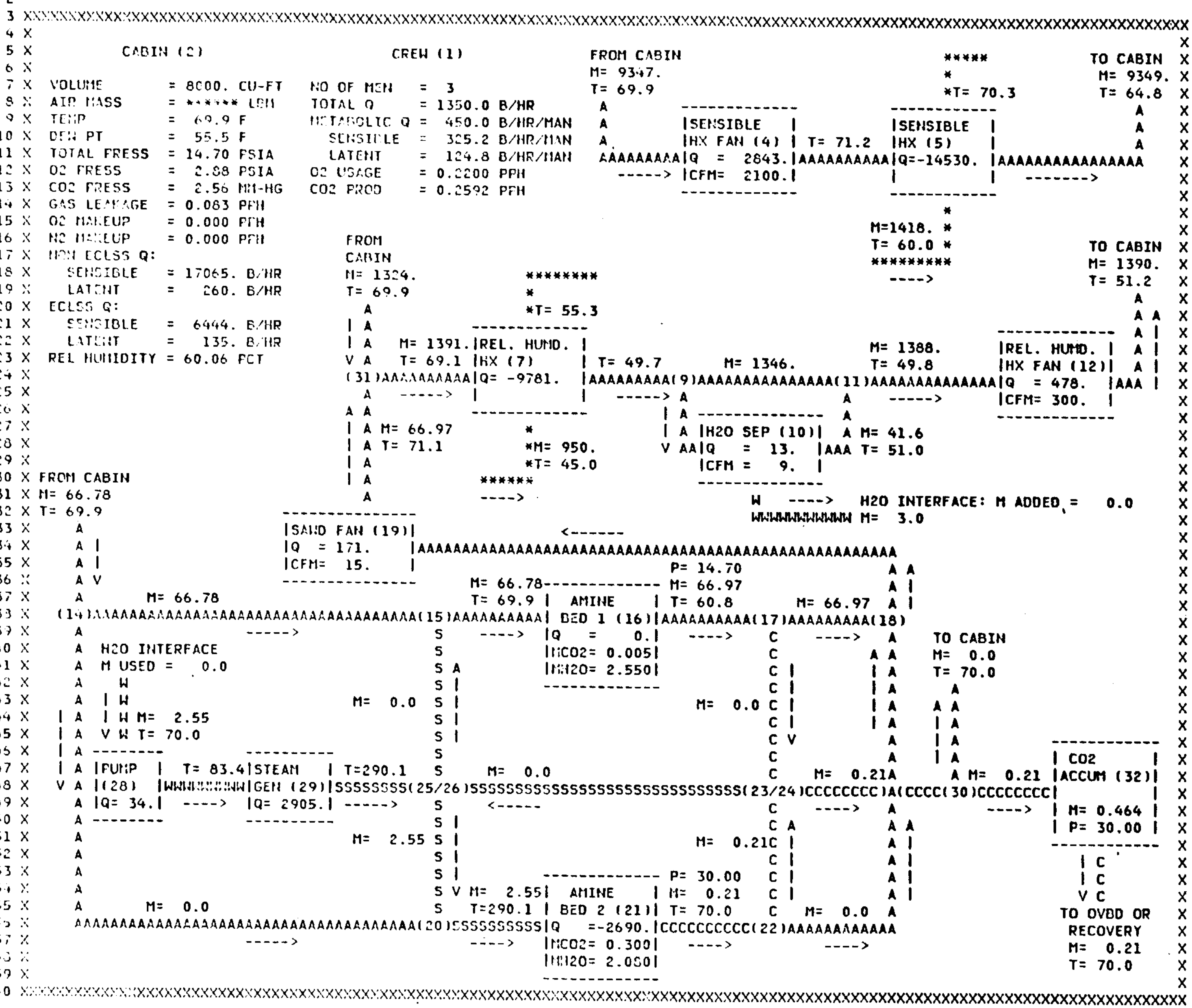
SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL. MISSION TIME: 0. SEC (0.0 HR) DATE: 01/26/85



SPACE STATION AIR REVITALIZATION SUBSYSTEM SAND II DEMONSTRATION MODEL. MISSION TIME: 0. SEC (0.0 HR) DATE: 01/26/85



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SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL.  MISSION TIME:      0. SEC ( 0.0  HR)   DATE: 01/26/85
                                                                                                                              X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                           FROM CABIN                     *****            TO CABIN       X
X        CABIN (2)                       CREW (1)           M= 9351.                       *                M= 9356.       X
X                                                           T= 69.7                        *T= 69.9         T= 64.5        X
X                                                                       -------------   -------------            A         X
X  VOLUME        = 8000. CU-FT    NO OF MEN     =  3          A         |SENSIBLE    |   |SENSIBLE    |           A         X
X  AIR MASS      = ****** LBM     TOTAL Q       = 1350.0 B/HR A         |HX FAN (4)  | T= 70.9 |HX (5)   |       A         X
X  TEMP          =   69.7 F       METABOLIC Q =  450.0 B/HR/MAN A       |Q  =  2843.|AAAAAAAAAA|Q=-14654. |AAAAAAAAAAAAAAAA   X
X  DEW PT        =   54.5 F         SENSIBLE  =  325.9 B/HR/MAN AAAAAAAAA|CFM=  2100.|          |          |  ------->       X
X  TOTAL PRESS   = 14.70 PSIA       LATENT    =  124.1 B/HR/MAN  -----> -------------   -------------                     X
X  O2 PRESS      =   2.88 PSIA    O2 USAGE      = 0.2200 PPH                                    *                         X
X  CO2 PRESS     =   2.57 MM-HG   CO2 PROD      = 0.2592 PPH                                                              X
X  GAS LEAKAGE   = 0.083 PPH                                                               M=1483. *        TO CABIN      X
X  O2 MAKEUP     = 0.000 PPH                                                               T= 60.0 *        M= 1391.      X
X  N2 MAKEUP     = 0.000 PPH               FROM                                            *********        T= 50.8       X
X  NON ECLSS Q:                            CABIN                 ********                   ---->              A          X
X    SENSIBLE    = 17065. B/HR             M= 1324.              *                                             A A        X
X    LATENT      =    254. B/HR            T= 69.7               *T= 54.9                                       A |       X
X  ECLSS Q:                                 A             -------------                            -------------  A |     X
X    SENSIBLE    =   6444. B/HR           | A                                          M= 1388.   |REL. HUMD. |  A |       X
X    LATENT      =    142. B/HR           | A    M= 1391. |REL. HUMD. |                T= 49.4    |HX FAN (12)|  A |       X
X  REL HUMIDITY = 58.32 PCT               V A     T= 68.9 |HX (7)     | T= 49.4   M= 1346.        |Q  = 478.  |AAA |       X
X                                        (31)AAAAAAAAAA|Q= -9433.  |AAAAAAAAA(9)AAAAAAAAAAAAAAA(11)AAAAAAAAAAAAAAA|CFM= 300.  |   X
X                                           A   ----->  |          |  -----> A          A      ----->  -------------          X
X                                         A A           -------------     | A  -------------  A                               X
X                                         | A M= 67.02       *            | A |H2O SEP (10)| A M= 41.6                       X
X                                         | A T= 70.4        *M= 950.     V AA|Q   =  13.  |AAA T= 50.7                      X
X                                         | A                *T= 45.0         |CFM =   9.  |                                 X
X                                         | A            ******               -------------                                  X
X FROM CABIN                              | A            ---->                    W   ---->   H2O INTERFACE: M ADDED =   0.0  X
X M= 66.83                                  A                                     WWWWWWWWWWW M=  2.6                         X
X T= 69.7                            -------------                                                                          X
X      A                             |SAWD FAN (19)|           <------                                                     X
X      A |                           |Q  = 171.   |AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                        X
X      A |                           |CFM=  15.   |             P= 14.70                 A A                               X
X      A V                           -------------  M= 66.83------------- M= 67.02       A |                               X
X      A       M= 66.83                             T= 69.7 |  AMINE    | T= 60.2  M= 67.02 A |                            X
X  (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)AAAAAAAAAA| BED 1 (16)|AAAAAAAAAA(17)AAAAAAAAA(18)                    X
X      A               ----->          S     ----->  |Q   =    0.|  ----->    C     ----->   A        TO CABIN          X
X      A                               S             |MCO2= 0.005|            C            A A        M=  0.0           X
X      A  H2O INTERFACE                S A           |MH2O= 2.550|            C |          | A        T= 70.0           X
X      A  M USED =    0.0              S |           -------------            C |          | A             A            X
X      A     W                M=  0.0  S |                           M=  0.0  C |          | A           A A            X
X      A   | W                         S |                                    C |          | A           | A            X
X    | A   | W M=  2.55                S |                                    C V            A           | A     -------------  X
X    | A   V W T= 70.0                 S                                      C              A           | A     | CO2        | X
X    | A --------     ---------        S                                      C   M=  0.21A           A M=  0.21 |ACCUM (32)| X
X    | A |PUMP    | T= 83.4|STEAM   | T=290.1 S     M=  0.0                                                       |          | X
X    V A |(28)    |[illegible]|GEN (29)|SSSSSSSS(25/26)SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)CCCCCCCC)A(CCCC(30)CCCCCCCC|   X
X      A |Q= 34.|  ----->  |Q= 2905.| ----->  S      <-----            C     ----->   A          ----> | M= 0.464 | X
X      A --------          ----------        S |                      C A             A A             | P= 30.00 | X
X      A                          M=  2.55   S |              M=  0.21C |             A |             -------------  X
X      A                                     S |                      C |             A |                | C          X
X      A                                     S |    ------------- P= 30.00 C |       A |                | C          X
X      A                                     S V M=  2.55| AMINE  | M=  0.21 C |       A |                V C          X
X      A                                     S  T=290.1 | BED 2 (21)| T= 70.0 C  M=  0.0 A             TO OVBD OR      X
X      A       M=  0.0                                                                                 RECOVERY        X
X      AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)SSSSSSSSS|Q   =-2690.|CCCCCCCCCC(22)AAAAAAAAAAAA     M=  0.21    X
X                     ----->                ----->  |MCO2= 0.300|  ----->        ----->              T= 70.0         X
X                                                   |MH2O= 2.080|                                                     X
X                                                   -------------                                                      X
X                                                                                                                    XXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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UNITED TECHNOLOGIES HAMILTON STANDARD

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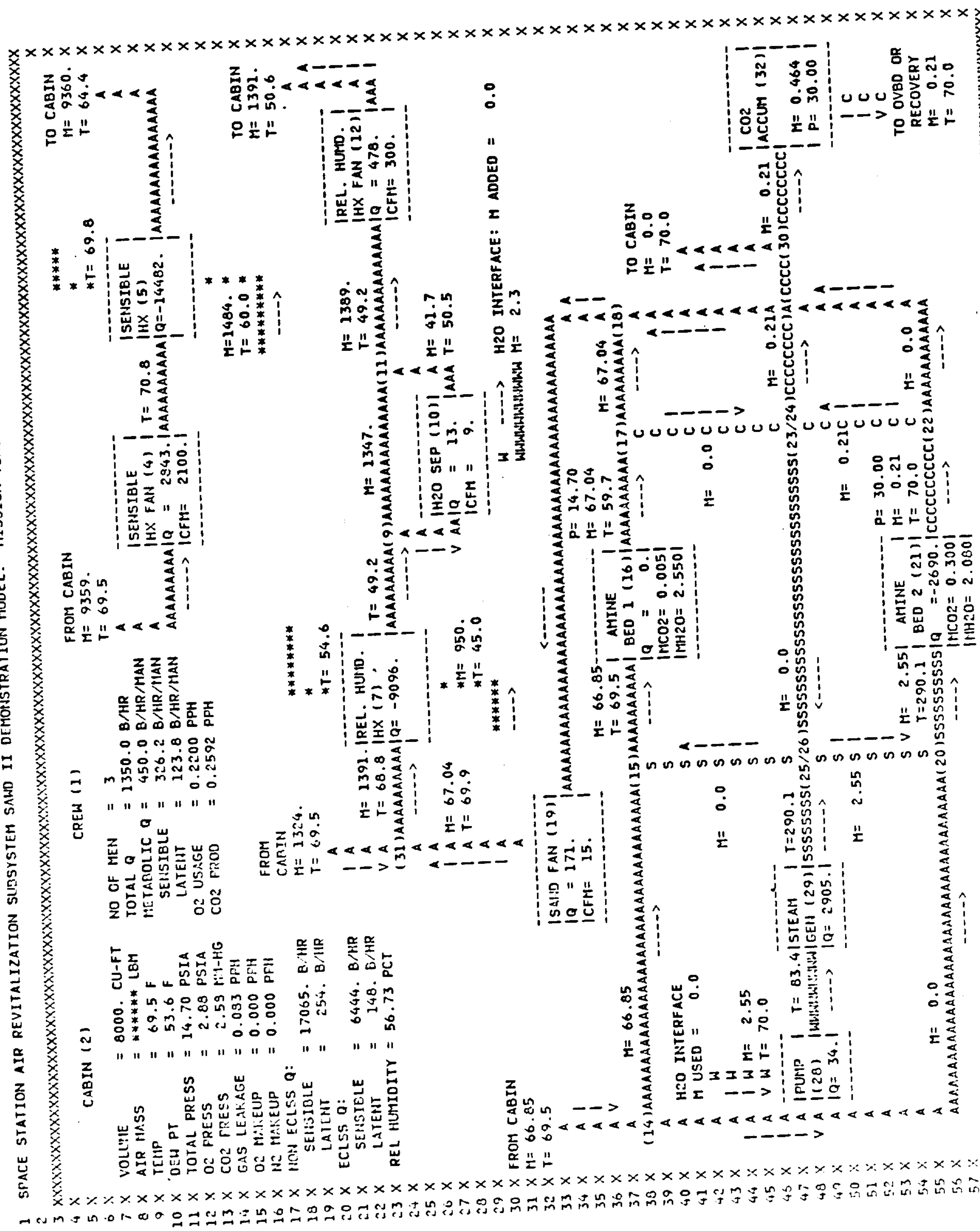

CONGRATULATIONS - THE RUN WAS A HOWLING SUCCESS.

NONE OF THE COMPONENTS HAVE FAILURE FLAGS.

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KSYPAS= 10 TIME= .0

COMPONENT NO. = SUBR. TYPE =		1 SUITS	2 CABIN	3 SPLIT	4 FAN	5 ANYHX	6 ALTCOM	7 ANYHX	8 ALTCOM
VR									
1-TOTAL PRI FLOW	P	9359.93	9358.87	1324.12	9359.54	9359.54	1483.83	1391.16	950.000
2-TEMPERATURE	R	64.3754	69.5328	69.5328	70.7732	64.4484	60.0000	49.2122	45.0000
3-DUCT OUTLET P	I	14.7000	14.7000	14.7000	14.7080	14.7000	50.0000	14.7000	50.0000
4-COMP OUTLET P	M	14.7000	14.7000	14.7000	14.7000	14.7000	50.0000	14.7000	50.0000
5-NON-COND FLOW	A	9278.05	9277.35	1312.58	9278.01	9278.01	.0	1378.65	.0
6-COND VAP FLOW	R	81.8399	81.5304	11.5351	81.5362	81.5362	.0	10.2333	.0
7-COND LIQ FLOW	Y	.0	.0	.0	.0	.0	.0	2.28426	.0
8-N-C SP HEAT		.243129	.243129	.243129	.243129	.243129	.0	.243136	.0
9-N-C MOL WT	S	28.8603	28.8601	28.8601	28.8601	28.8601	.0	28.8586	.0
10-OXYGEN FLOW	I	2043.65	2043.73	289.152	2043.87	2043.87	.0	303.751	.0
11-DILUENT FLOW	D	7185.52	7135.01	1016.55	7185.52	7185.52	.0	1067.88	.0
12-CO2 FLOW	E	48.8764	48.6135	6.87801	48.6172	48.6172	.0	7.01553	.0
13-TRACE CTM FLOW		.0	.0	.0	.0	.0	.0	.0	.0
14-SPCL FLOW 1	D	.0	.0	.0	.0	.0	.0	.0	.0
15-SPCL FLOW 2	A	.0	.0	.0	.0	.0	.0	.0	.0
16-SPCL FLOW 3	T	.0	.0	.0	.0	.0	.0	.0	.0
17-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
18-SPCL FLOW 5		.0	.0	.0	.0	.0	.0	.0	.0
19-SPCL FLOW 6		.0	.0	.0	.0	.0	.0	.0	.0
20-TOTAL SEC FLOW	S	.0	1391.24	66.8540	.0	1483.83	.0	950.000	.0
21-TEMPERATURE	E	.0	69.5328	69.5328	.0	69.7598	.0	54.5742	.0
22-DUCT OUTLET P	C	.0	14.7000	14.7000	.0	50.0000	.0	50.0000	.0
23-COMP OUTLET P	O	.0	14.7000	14.7000	.0	50.0000	.0	50.0000	.0
24-NON-COND FLOW	N	.0	1379.12	66.5336	.0	.0	.0	.0	.0
25-COND VAP FLOW	D	.0	12.1199	.534705	.0	.0	.0	.0	.0
26-COND LIQ FLOW	A	.0	.0	.0	.0	.0	.0	.0	.0
27-N-C SP HEAT	R	.0	.243129	.243129	.0	.0	.0	.0	.0
28-N-C MOL WT	Y	.0	28.8601	28.8601	.0	.0	.0	.0	.0
29-OXYGEN FLOW		.0	303.809	14.6568	.0	.0	.0	.0	.0
30-DILUENT FLOW	S	.0	1068.09	51.5281	.0	.0	.0	.0	.0
31-CO2 FLOW	I	.0	7.22665	.348640	.0	.0	.0	.0	.0
32-TRACE CTM FLOW	D	.0	.0	.0	.0	.0	.0	.0	.0
33-SPCL FLOW 1	E	.0	.0	.0	.0	.0	.0	.0	.0
34-SPCL FLOW 2		.0	.0	.0	.0	.0	.0	.0	.0
35-SPCL FLOW 3	D	.0	.0	.0	.0	.0	.0	.0	.0
36-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
37-SPCL FLOW 5	T	.0	.0	.0	.0	.0	.0	.0	.0
38-SPCL FLOW 6	A	.0	.0	.0	.0	.0	.0	.0	.0
39-DH, C, DP PRI	P	.0	.0	.0	.0	.0	.0	.0	.0
40-LE, N, K DUCT	R	.0	.0	.0	.0	.0	.0	.0	.0
41-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
42-DH, C, DP PRI	S	.0	.0	.0	.0	.0	.0	.0	.0
43-LE, N, K COMP	S	.0	.0	.0	.0	.0	.0	.0	.0
44-FF AREA		.0	.0	.0	.0	.0	.0	.0	.0
45-DH, C, DP SEC	C	.0	.0	.0	.0	.0	.0	.0	.0
46-LE, N, K DUCT	O	.0	.0	.0	.0	.0	.0	.0	.0
47-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
48-DH, C, DP SEC	F	.0	.0	.0	.0	.0	.0	.0	.0
49-LE, N, K COMP	F	.0	.0	.0	.0	.0	.0	.0	.0
50-FF AREA		.0	.0	.0	.0	.0	.0	.0	.0
51-COMP SOURCE TEMP		.0	.0	.0	.0	.0	.0	.0	.0

```
VR(  5,117)=  .0       VR(  5,118)=  .0       VR(  5,119)=  .0       VR(  5,120)=  .0       VR(  5,121)=  .0
VR(  5,122)=  .0       VR(  5,123)=  .0       VR(  5,124)=  .0       VR(  5,125)=  .0       VR(  5,126)=  .0
VR(  6, 65)=  .0       VR(  6, 66)=  .0       VR(  7, 65)=  9095.5   VR(  7, 66)=  1106.2   VR(  7, 67)=  .82206
VR(  7, 68)=  2.2843   VR(  7, 69)=  .0       VR(  7, 70)=  .49034   VR(  7, 71)=  2.3748   VR(  7, 72)=  .33460
VR(  7, 73)=  1.0000   VR(  7, 74)=  .0       VR(  7, 75)=  .0       VR(  7, 76)=  .0       VR(  7, 77)=  .0
VR(  7, 78)=  .0       VR(  7, 79)=  .0       VR(  7, 80)=  .0       VR(  7, 81)=  .0       VR(  7, 82)=  .0
VR(  7, 83)=  .0       VR(  7, 84)=  .0       VR(  7, 85)=  .0       VR(  7, 86)=  .0       VR(  7, 87)=  .0
VR(  7, 88)=  .0       VR(  7, 89)=  .0       VR(  7, 90)=  .0       VR(  7, 91)=  .0       VR(  7, 92)=  .0
VR(  7, 93)=  .0       VR(  7, 94)=  .0       VR(  7, 95)=  .0       VR(  7, 96)=  .0       VR(  7, 97)=  .0
VR(  7, 98)=  .0       VR(  7, 99)=  .0       VR(  7,100)=  .0       VR(  7,101)=  .0       VR(  7,102)=  .0
VR(  7,103)=  .0       VR(  7,104)=  .0       VR(  7,105)=  .0       VR(  7,106)=  .0       VR(  7,107)=  .0
VR(  7,108)=  .0       VR(  7,109)=  .0       VR(  7,110)=  .0       VR(  7,111)=  .0       VR(  7,112)=  .0
VR(  7,113)=  .0       VR(  7,114)=  .0       VR(  7,115)=  .0       VR(  7,116)=  .0       VR(  7,117)=  .0
VR(  7,118)=  .0       VR(  7,119)=  .0       VR(  7,120)=  .0       VR(  7,121)=  .0       VR(  7,122)=  .0
VR(  7,123)=  .0       VR(  7,124)=  .0       VR(  7,125)=  .0       VR(  7,126)=  .0       VR(  8, 65)=  .0
VR(  8, 66)=  .0       VR(
```

COMPONENT NO. = SUBR. TYPE =	1 SUITS	2 CABIN	3 SPLIT	4 FAN	5 ANYHX	6 ALTCOM	7 ANYHX	8 ALTCOM
KR								
1-SUBR NO./EXV/EXK	2001000	1025000	10000000	23000000	4000000	49000002	4000000	49000000
2-PRI SOR/FLO CODE	502	102	-202	202	402	0	3102	0
3-PRI SPFL TYP 1-3	0	0	0	0	0	10000	0	10000
4-PRI SPFL TYP 4-6	0	0	0	0	0	0	0	0
5-SEC SOR/FLO CODE	0	-1302	2	0	-600	0	-800	0
6-SEC SPFL TYP 1-3	0	0	0	0	10000	0	10000	0
7-SEC SPFL TYP 4-6	0	0	0	0	0	0	0	0
8-NEXT COMP/CABIN	1400002	300002	400002	500002	100002	2	900002	2
9-COMP NSTR 1-9	0	101011000	0	100000000	200000000	0	200000000	0
10-COMP NSTR 10-18	100	0	0	0	100	0	100	0
11-NCFL/NLFL/NPASS	10	10	10	10	10	0	10	0
12-PRI VISC/DENSITY	0	0	0	0	0	0	0	0
13-PRI OP/DP/OP/DP	0	0	0	0	0	0	0	0
14-SEC VISC/DENSITY	0	0	0	0	0	0	0	0
15-SEC OP/DP/OP/DP	0	0	0	0	0	0	0	0

SUBROUTINE DEPENDENT K ARRAY DATA - - -

```
KR(  1, 16)=   3   KR(  2, 16)=   0   KR(  2, 17)=   0   KR(  4, 16)=   0   KR(  4, 17)=   0
KR(  4, 18)=   0   KR(  5, 16)=   0   KR(  6, 16)=   0   KR(  6, 17)=   0   KR(  7, 16)=   0
```

52-EFF SUMMED COND	.0	.0	.0	.0	.0	.0	.0	.0
53-COMP QTOTOL LOSS	.0	.0	.0	.0	.0	.0	.0	.0
54-AMBIENT GAS TEMP	.0	.0	.0	.0	.0	.0	.0	.0
55-AMBIENT UA	.0	.0	.0	.0	.0	.0	.0	.0
56-AMB CONV Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
57-AMB WALL TEMP	.0	.0	.0	.0	.0	.0	.0	.0
58-AMB SCRIPT(F)*A	.0	.0	.0	.0	.0	.0	.0	.0
59-AMB RAD Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
60-STRUCTURE TEMP	.0	.0	.0	.0	.0	.0	.0	70.0000
61-STRUCTURE KA/X	.0	.0	.0	.0	.0	.0	.0	.800000
62-STRUCTURE Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
63-INSULATION TEMP	.0	.0	.0	.0	.0	.0	.0	70.0000
64-INSULATION KA/X	.0	.0	.0	.0	.0	.0	.0	.800000

SUBROUTINE DEPENDENT V ARRAY DATA - - -

```
VR(  9, 65)= .0           VR(  9, 66)= .30000E-01 VR(  9, 67)= 1.0000      VR(  9, 68)= .30000E-01 VR(  9, 69)= .30000E-01
VR(  9, 70)= .30000E-01   VR(  9, 71)= .30000E-01 VR(  9, 72)= .30000E-01  VR( 10, 65)= 13.106     VR( 10, 66)= .0
VR( 10, 67)= 2.2643       VR( 11, 65)= 49.214     VR( 12, 65)= 477.82      VR( 12, 66)= .0         VR( 12, 67)= .0
VR( 12, 68)= .0           VR( 12, 69)= .0         VR( 12, 70)= .0          VR( 12, 71)= .0         VR( 12, 72)= .0
VR( 12, 73)= .0           VR( 12, 74)= .0         VR( 12, 75)= .0          VR( 12, 76)= 300.00     VR( 12, 77)= .0
VR( 12, 78)= .0           VR( 12, 79)= .0         VR( 12, 80)= .0          VR( 12, 81)= .0         VR( 12, 82)= .0
VR( 12, 83)= .0           VR( 12, 84)= 1.0000     VR( 12, 85)= .0          VR( 12, 86)= .0         VR( 12, 87)= .0
VR( 12, 88)= .0           VR( 12, 89)= .0         VR( 12, 90)= .0          VR( 12, 91)= 140.00     VR( 12, 92)= .0
VR( 12, 93)= .0           VR( 13, 65)= 49.214     VR( 14, 65)= .0          VR( 15, 65)= 53.644     VR( 16, 65)= 1270.0
VR( 16, 66)= .31400       VR( 16, 67)= 32.700     VR( 16, 68)= .31900      VR( 16, 69)= 10.000     VR( 16, 70)= .0
VR( 16, 71)= .0           VR( 16, 72)= .20975     VR( 16, 73)= .40000      VR( 16, 74)= 1.5000     VR( 16, 75)= .40000
VR( 16, 76)= .60400       VR( 16, 77)= 70.000     VR( 16, 78)= 8.5000      VR( 16, 79)= 7.4000     VR( 16, 80)= 2.5500
VR( 16, 81)= .50000E-02   VR( 16, 82)= .30000     VR( 16, 83)= .58823E-03  VR( 16, 84)= .12000     VR( 16, 85)= 180.00
VR( 16, 86)= 2280.0       VR( 16, 87)= 240.00     VR( 16, 88)= .0          VR( 16, 89)= .0         VR( 16, 90)= .0
VR( 16, 91)= .0           VR( 16, 92)= .0         VR( 16, 93)= .47000      VR( 16, 94)= .33000     VR( 16, 95)= .10000E+06
VR( 16, 96)= .0           VR( 16, 97)= .0         VR( 16, 98)= .0          VR( 16, 99)= .0         VR( 16,100)= .12251E-02
VR( 16,101)= 70.000       VR( 16,102)= 14.700     VR( 16,103)= 14.700      VR( 16,104)= .12072E-02 VR( 16,105)= .17952E-04
VR( 16,106)= .0           VR( 16,107)= .24327     VR( 16,108)= 28.829      VR( 16,109)= .26678E-03 VR( 16,110)= .93790E-03
VR( 16,111)= .25130E-05   VR( 16,112)= .0         VR( 16,113)= .0          VR( 16,114)= .0         VR( 16,115)= .0
VR( 16,116)= .0           VR( 16,117)= .0         VR( 16,118)= .0          VR( 16,119)= 70.000     VR( 16,120)= .10000E-02
VR( 16,121)= .51000       VR( 16,122)= 1.7000     VR( 16,123)= 1.4800      VR( 16,124)= .16584E-01 VR( 16,125)= .0
VR( 16,126)= .0           VR( 16,127)= .94000E-01 VR( 16,128)= .0          VR( 16,129)= .0         VR( 16,130)= .12251E-02
VR( 16,131)= 70.000       VR( 16,132)= 14.700     VR( 16,133)= 14.700      VR( 16,134)= .12072E-02 VR( 16,135)= .17952E-04
VR( 16,136)= .0           VR( 16,137)= .24327     VR( 16,138)= 28.829      VR( 16,139)= .26678E-03 VR( 16,140)= .93790E-03
VR( 16,141)= .25130E-05   VR( 16,142)= .0         VR( 16,143)= .0          VR( 16,144)= .0         VR( 16,145)= .0
VR( 16,146)= .0           VR( 16,147)= .0         VR( 16,148)= .0          VR( 16,149)= 70.000     VR( 16,150)= .10000E-02
VR( 16,151)= .51000       VR( 16,152)= 1.7000     VR( 16,153)= 1.4800      VR( 16,154)= .16584E-01 VR( 16,155)= .0
VR( 16,156)= .0           VR( 16,157)= .94000E-01 VR( 16,158)= .0          VR( 16,159)= .0         VR( 16,160)= .12251E-02
VR( 16,161)= 70.000       VR( 16,162)= 14.700     VR( 16,163)= 14.700      VR( 16,164)= .12072E-02 VR( 16,165)= .17952E-04
VR( 16,166)= .0           VR( 16,167)= .24327     VR( 16,168)= 28.829      VR( 16,169)= .26678E-03 VR( 16,170)= .93790E-03
VR( 16,171)= .25130E-05   VR( 16,172)= .0         VR( 16,173)= .0          VR( 16,174)= .0         VR( 16,175)= .0
VR( 16,176)= .0           VR( 16,177)= .0         VR( 16,178)= .0          VR( 16,179)= 70.000     VR( 16,180)= .10000E-02
VR( 16,181)= .51000       VR( 16,182)= 1.7000     VR( 16,183)= 1.4800      VR( 16,184)= .16584E-01 VR( 16,185)= .0
VR( 16,186)= .0           VR( 16,187)= .94000E-01 VR( 16,188)= .0          VR( 16,189)= .0         VR( 16,190)= .12251E-02
VR( 16,191)= 70.000       VR( 16,192)= 14.700     VR( 16,193)= 14.700      VR( 16,194)= .12072E-02 VR( 16,195)= .17952E-04
VR( 16,196)= .0           VR( 16,197)= .24327     VR( 16,198)= 28.829      VR( 16,199)= .26678E-03 VR( 16,200)= .93790E-03
VR( 16,201)= .25130E-05   VR( 16,202)= .0         VR( 16,203)= .0          VR( 16,204)= .0         VR( 16,205)= .0
VR( 16,206)= .0           VR( 16,207)= .0         VR( 16,208)= .0          VR( 16,209)= 70.000     VR( 16,210)= .10000E-02
VR( 16,211)= .51000       VR( 16,212)= 1.7000     VR( 16,213)= 1.4800      VR( 16,214)= .16584E-01 VR( 16,215)= .0
VR( 16,216)= .0           VR( 16,217)= .94000E-01 VR( 16,218)= .0          VR( 16,219)= .0         VR( 16,220)= .12251E-02
VR( 16,221)= 70.000       VR( 16,222)= 14.700     VR( 16,223)= 14.700      VR( 16,224)= .12072E-02 VR( 16,225)= .17952E-04
VR( 16,226)= .0           VR( 16,227)= .24327     VR( 16,228)= 28.829      VR( 16,229)= .26678E-03 VR( 16,230)= .93790E-03
VR( 16,231)= .25130E-05   VR( 16,232)= .0         VR( 16,233)= .0          VR( 16,234)= .0         VR( 16,235)= .0
VR( 16,236)= .0           VR( 16,237)= .0         VR( 16,238)= .0          VR( 16,239)= 70.000     VR( 16,240)= .10000E-02
```

KSYPAS= 10 TIME= .0

COMPONENT NO. = SUBR. TYPE =		17 SPLIT	18 GASMIX	19 FAN	20 GASMIX	21 IR45	22 SPLIT	23 GASMIX	24 SPLIT
VR									
1-TOTAL PRI FLOW	P	67.0442	67.0442	67.0442	2.55000	.209749	.0	.209749	.209749
2-TEMPERATURE	R	59.6547	59.6547	69.9042	290.123	70.0000	70.0000	70.0000	70.0000
3-DUCT OUTLET P	I	14.7000	14.7000	14.7000	29.9997	29.9997	29.9997	29.9997	29.9997
4-COMP OUTLET P	M	14.7000	14.7000	14.7000	29.9997	29.9997	29.9997	29.9997	29.9997
5-NON-COND FLOW	A	66.0618	66.0618	66.0618	.0	.209749	.0	.209749	.209749
6-COND VAP FLOW	R	.726703	.726703	.726703	2.55000	.0	.0	.0	.0
7-COND LIQ FLOW	Y	.255699	.255699	.255699	.0	.0	.0	.0	.0
8-N-C SP HEAT		.243266	.243266	.243266	.0	.200000	.0	.200000	.200000
9-N-C MOL WT	S	28.8286	28.8286	28.8286	.100000E-29	44.0100	.0	44.0100	44.0100
10-OXYGEN FLOW	I	14.5991	14.5991	14.5991	.0	.0	.0	.0	.0
11-DILUENT FLOW	D	51.3252	51.3252	51.3252	.0	.0	.0	.0	.0
12-CO2 FLOW	E	.137518	.137518	.137518	.0	.209749	.0	.209749	.209749
13-TRACE CTM FLOW		.0	.0	.0	.0	.0	.0	.0	.0
14-SPCL FLOW 1	D	.0	.0	.0	.0	.0	.0	.0	.0
15-SPCL FLOW 2	A	.0	.0	.0	.0	.0	.0	.0	.0
16-SPCL FLOW 3	T	.0	.0	.0	.0	.0	.0	.0	.0
17-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
18-SPCL FLOW 5		.0	.0	.0	.0	.0	.0	.0	.0
19-SPCL FLOW 6		.0	.0	.0	.0	.0	.0	.0	.0
20-TOTAL SEC FLOW	S	.0	.0	.0	.0	.0	.209749	.0	.0
21-TEMPERATURE	E	59.6547	.0	.0	.0	.0	70.0000	.0	70.0000
22-DUCT OUTLET P	C	14.7000	.0	.0	.0	.0	29.9997	.0	29.9997
23-COMP OUTLET P	O	14.7000	.0	.0	.0	.0	29.9997	.0	29.9997
24-NON-COND FLOW	N	.0	.0	.0	.0	.0	.209749	.0	.0
25-COND VAP FLOW	D	.0	.0	.0	.0	.0	.0	.0	.0
26-COND LIQ FLOW	A	.0	.0	.0	.0	.0	.0	.0	.0
27-N-C SP HEAT	R	.0	.0	.0	.0	.0	.200000	.0	.0
28-N-C MOL WT	Y	.0	.0	.0	.0	.0	44.0100	.0	.0
29-OXYGEN FLOW		.0	.0	.0	.0	.0	.0	.0	.0
30-DILUENT FLOW	S	.0	.0	.0	.0	.0	.0	.0	.0
31-CO2 FLOW	I	.0	.0	.0	.0	.0	.209749	.0	.0
32-TRACE CTM FLOW	D	.0	.0	.0	.0	.0	.0	.0	.0
33-SPCL FLOW 1	E	.0	.0	.0	.0	.0	.0	.0	.0
34-SPCL FLOW 2		.0	.0	.0	.0	.0	.0	.0	.0
35-SPCL FLOW 3	D	.0	.0	.0	.0	.0	.0	.0	.0
36-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
37-SPCL FLOW 5	T	.0	.0	.0	.0	.0	.0	.0	.0
38-SPCL FLOW 6	A	.0	.0	.0	.0	.0	.0	.0	.0
39-DH, C, DP PRI	P	.0	.0	.0	.0	.0	.0	.0	.0
40-LE, N, K DUCT	R	.0	.0	.0	.0	.0	.0	.0	.0
41-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
42-DH, C, DP PRI	S	.0	.0	.0	.0	.0	.0	.0	.0
43-LE, N, K COMP	S	.0	.0	.0	.0	.0	.0	.0	.0
44-FF AREA		.0	.0	.0	.0	.0	.0	.0	.0
45-DH, C, DP SEC	C	.0	.0	.0	.0	.0	.0	.0	.0
46-LE, N, K DUCT	O	.0	.0	.0	.0	.0	.0	.0	.0
47-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
48-DH, C, DP SEC	F	.0	.0	.0	.0	.0	.0	.0	.0
49-LE, N, K COMP	F	.0	.0	.0	.0	.0	.0	.0	.0
50-FF AREA		.0	.0						
51-COMP SOURCE TEMP		.0	.0	.0	.0	.0	.0	.0	.0

VR(24, 65)= .0 VR(

KR	17	18	19	20	21	22	23	24
COMPONENT NO. =	17	18	19	20	21	22	23	24
SUBR. TYPE =	SPLIT	GASMIX	FAN	GASMIX	IR45	SPLIT	GASMIX	SPLIT
1-SUBR NO./EXV/EXK	10000000	6000000	23000000	6000000	73000000	10000000	6000000	10000000
2-PRI SOR/FLO CODE	1602	1702	1802	-1402	2002	2102	-2202	2302
3-PRI SPFL TYP 1-3	0	0	0	0	0	0	0	0
4-PRI SPFL TYP 4-6	0	0	0	0	0	0	0	0
5-SEC SOR/FLO CODE	2	-2200	0	2600	0	2	1700	2
6-SEC SPFL TYP 1-3	0	0	0	0	0	0	0	0
7-SEC SPFL TYP 4-6	0	0	0	0	0	0	0	0
8-NEXT COMP/CABIN	2000002	1900002	3000002	2100002	2200002	2300002	2400002	1800002
9-COMP NSTR 1-9	0	0	3000000	200000000	0	0	0	0
10-COMP NSTR 10-18	0	0	0	0	0	0	0	0
11-NCFL/NLFL/NFASS	10	10	10	10	10	10	10	10
12-PRI VISC/DENSITY	0	0	0	0	0	0	0	0
13-PRI OP/DP/OP/DP	0	0	0	0	0	0	0	0
14-SEC VISC/DENSITY	0	0	0	0	0	0	0	0
15-SEC OP/DP/OP/DP	0	0	0	0	0	0	0	0

SUBROUTINE DEPENDENT K ARRAY DATA - - -

KR(19, 16)= 0 KR(19, 17)= 0 KR(19, 18)= 0 KR(21, 16)= 1 KR(21, 17)= 16
KR(21, 18)= 0 KR(21, 19)= 5 KR(21, 20)= 20 KR(

52-EFF SUMMED COND	.0	.0	.0	.0	.0	.0	.0	.0
53-COMP QIOTOL LOSS	.0	.0	.0	.0	.0	.0	.0	.0
54-AMBIENT GAS TEMP	.0	.0	.0	.0	.0	.0	.0	.0
55-AMBIENT UA	.0	.0	.0	.0	.0	.0	.0	.0
56-AMB CONV Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
57-AMB WALL TEMP	.0	.0	.0	.0	.0	.0	.0	.0
58-AMB SCRIPT(F)*A	.0	.0	.0	.0	.0	.0	.0	.0
59-AMB R'D Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
60-STRUCTURE TEMP	.0	.0	.0	.0	.0	.0	.0	.0
61-STRUCTURE KA/X	.0	.0	.0	.0	.0	.0	.0	.0
62-STRUCTURE Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
63-INSULATION TEMP	.0	.0	.0	.0	.0	.0	.0	.0
64-INSULATION KA/X	.0	.0	.0	.0	.0	.0	.0	.0

SUBROUTINE DEPENDENT V ARRAY DATA - - -

VR(25, 65)= 250.12	VR(26, 65)= 1.0000	VR(27, 65)= .0	VR(27, 66)= .0	VR(27, 67)= .0
VR(27, 68)= 168.30	VR(27, 69)= 168.30	VR(27, 70)= 70.000	VR(27, 71)= 2.6971	VR(27, 72)= 30.000
VR(27, 73)= .0	VR(27, 74)= .0	VR(27, 75)= .0	VR(27, 76)= .0	VR(27, 77)= .0
VR(27, 78)= .0	VR(27, 79)= .0	VR(27, 80)= .0	VR(27, 81)= .0	VR(27, 82)= .0
VR(27, 83)= .0	VR(27, 84)= .0	VR(27, 85)= .0	VR(27, 86)= .0	VR(27, 87)= .0
VR(27, 88)= 1.0000	VR(27, 89)= 62.400	VR(27, 90)= 2.4200	VR(27, 91)= 18.016	VR(27, 92)= .0
VR(27, 93)= .0	VR(27, 94)= .0	VR(27, 95)= .0	VR(27, 96)= .0	VR(27, 97)= -2.5500
VR(27, 93)= .0	VR(27, 99)= .0	VR(27,100)= 2.5500	VR(28, 65)= 34.130	VR(28, 66)= .0
VR(28, 67)= .0	VR(28, 68)= .0	VR(28, 69)= .0	VR(28, 70)= .0	VR(28, 71)= .0
VR(28, 72)= .0	VR(28, 73)= .0	VR(28, 74)= .0	VR(28, 75)= .0	VR(28, 76)= .0
VR(28, 77)= .0	VR(28, 78)= .0	VR(28, 79)= 1.0000	VR(28, 80)= .0	VR(28, 81)= .0
VR(28, 82)= .0	VR(28, 83)= .0	VR(28, 84)= .0	VR(28, 85)= 10.000	VR(29, 65)= .0
VR(29, 66)= 40.000	VR(29, 67)= 250.12	VR(29, 68)= 851.20	VR(29, 69)= .0	VR(29, 70)= .0
VR(30, 65)= .0	VR(31, 65)= 54.510	VR(32, 65)= .0	VR(32, 66)= .0	VR(32, 67)= .0
VR(32, 68)= .0	VR(32, 69)= .46436	VR(32, 70)= 70.000	VR(32, 71)= 2.0000	VR(32, 72)= 30.000
VR(32, 73)= .46436	VR(32, 74)= .0	VR(32, 75)= .0	VR(32, 76)= .20000	VR(32, 77)= 44.010
VR(32, 78)= .0	VR(32, 79)= .0	VR(32, 80)= .46436	VR(32, 81)= .0	VR(32, 82)= .0
VR(32, 83)= .0	VR(32, 84)= .0	VR(32, 85)= .0	VR(32, 86)= .0	VR(32, 87)= .0
VR(32, 88)= .20000	VR(32, 89)= .23218	VR(32, 90)= .44000	VR(32, 91)= 44.010	VR(32, 92)= .0
VR(32, 93)= .0	VR(32, 94)= .0	VR(32, 95)= .0	VR(32, 96)= .0	VR(32, 97)= .0

COMPONENT NO. =	25	26	27	28	29	30	31	32
SUBR. TYPE =	GASMIX	SPLIT	TANKG	PUMP	SMGEN	SPLIT	GASMIX	TANKG
FR								
1-SUBR NO./EXV/EXK	6000000	10000000	30003000	22000000	27000000	10000000	6000000	30000001
2-PRI SOR/FLO CODE	2902	2502	0	2700	2802	2402	302	3002
3-PRI SPFL TYP 1-3	0	0	10000	10000	0	0	0	0
4-PRI SPFL TYP 4-6	0	0	0	0	0	0	0	0
5-SEC SOR/FLO CODE	2400	2	0	0	0	2	-1900	0
6-SEC SPFL TYP 1-3	0	0	0	0	0	0	0	0
7-SEC SPFL TYP 4-6	0	0	0	0	0	0	0	0
8-NEXT COMP/CABIN	2600002	1500002	2800002	2900002	2500002	3200002	700002	3100002
9-COMP NSTR 1-9	0	0	110100000	200000	10000000	0	0	10000000
10-COMP NSTR 10-18	0	0	0	0	0	0	0	0
11-NCFL/NLFL/NPASS	10	10	10	10	10	10	10	10

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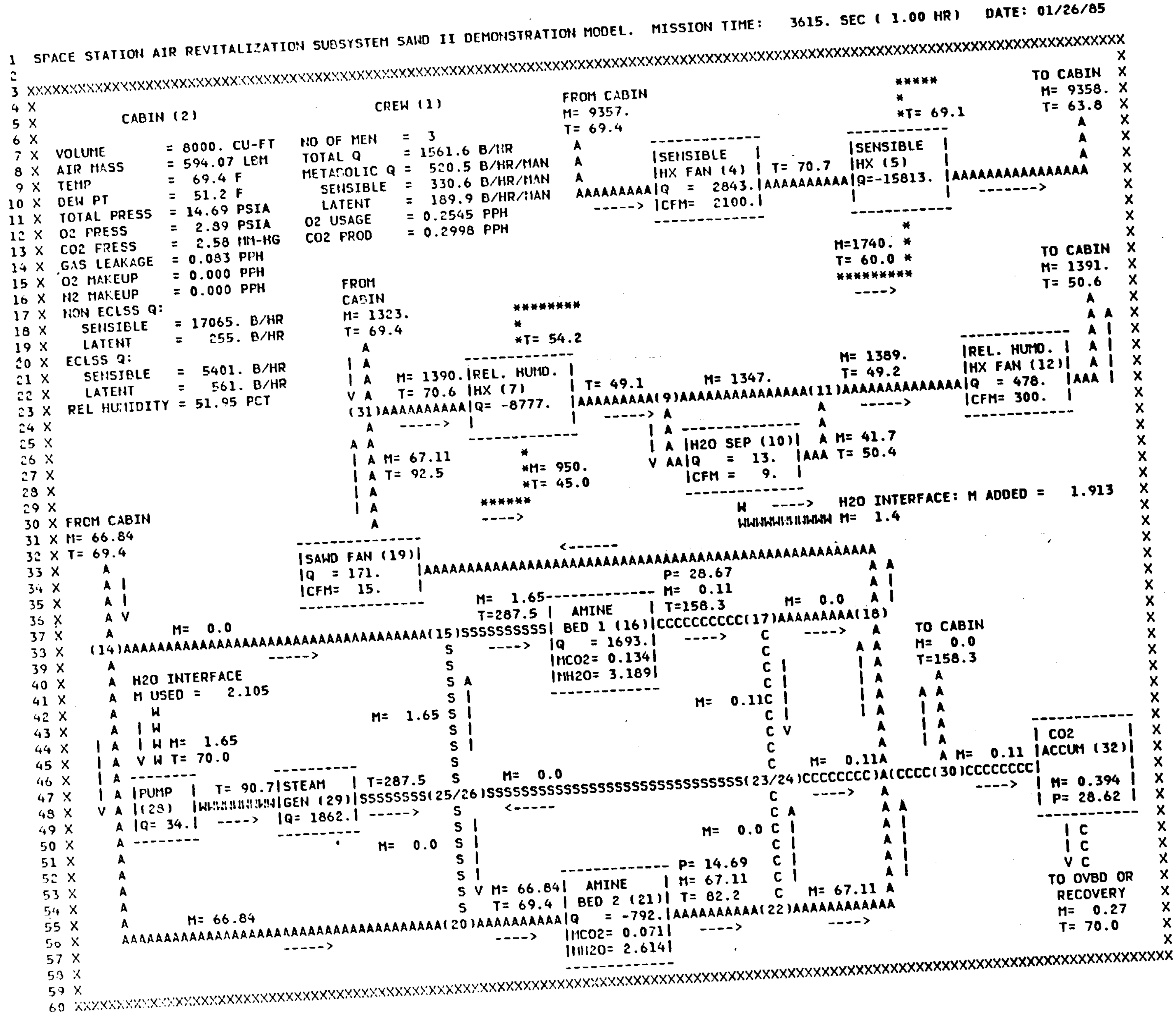
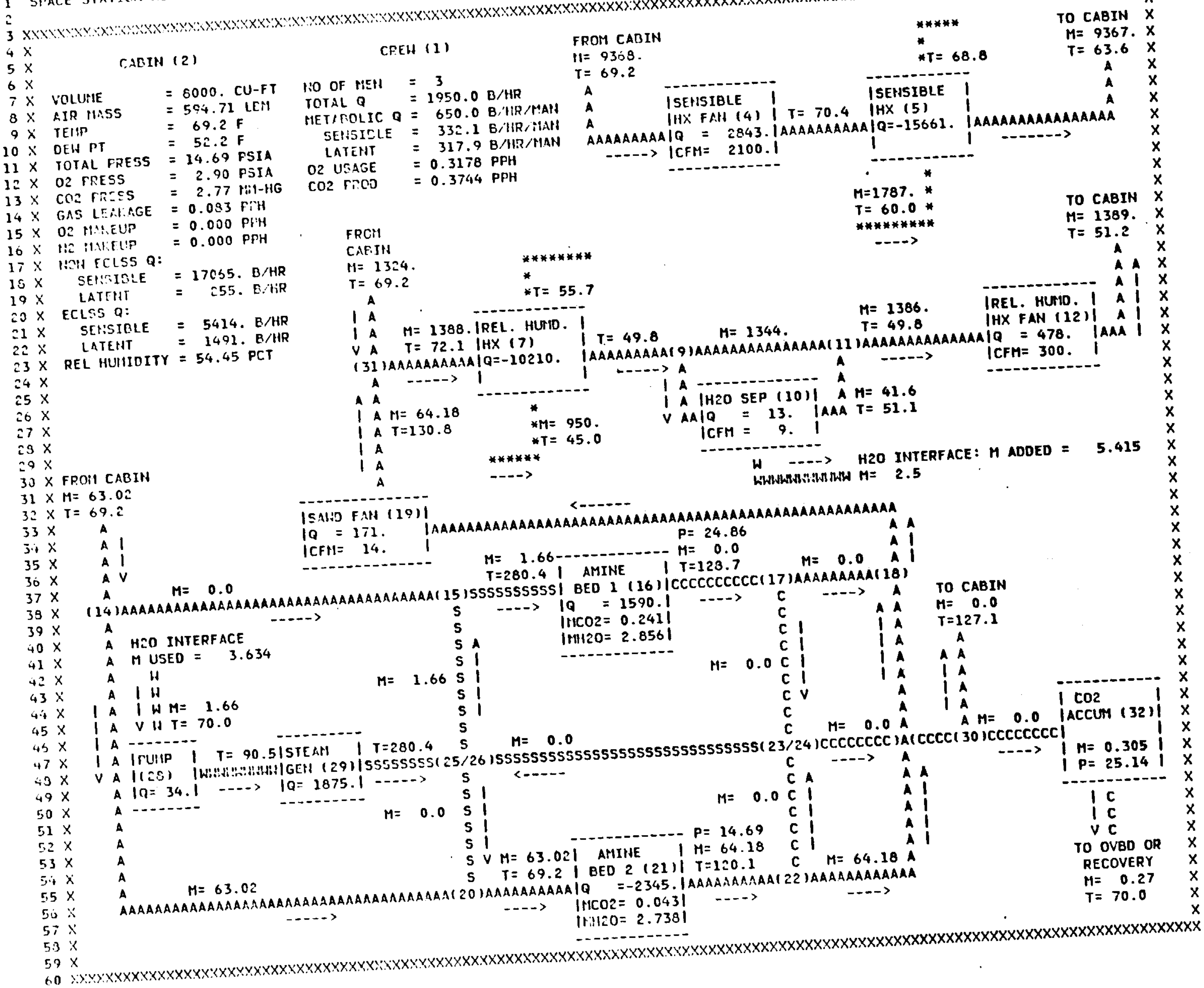
BEGINNING OF TRANSIENT CASE

ESCM: BASELINE, VOL = 8000 FT-3, PCO2 = 2.5, .275 PPH AVERAGE

COMP NO   12  FAN     SUBR NO  23    PRI SOR     11      SEC SOR     0            COMP PASS NO      1     TIME =    15.0 SEC
                      FAILURE FLAGS -- COMP=  1       LOOP=  0       ELAPSED TIME IN MILLISEC -- CP=  465     PP=      0
VR(  1)=  1394.3      VR(  2)=  50.338   VR(  3)=  14.700   VR(  4)=  14.700   VR(  5)=  1384.2   VR(  6)=  10.137
VR(  7)=  .0          VR(  8)=  .24295   VR(  9)=  28.901   VR( 10)=  303.68   VR( 11)=  1067.6   VR( 12)=  12.909
VR( 13)=  .0          VR( 14)=  .0       VR( 20)=  .0       VR( 21)=  .0       VR( 22)=  .0       VR( 23)=  .0
VR( 65)=  477.82      VR( 66)=  .0       VR( 67)=  .0       VR( 68)=  .0       VR( 69)=  .0       VR( 70)=  .0
VR( 71)=  .0          VR( 72)=  .0       VR( 73)=  .0       VR( 74)=  .0       VR( 75)=  .0       VR( 76)=  300.00
VR( 77)=  .0          VR( 78)=  .0       VR( 79)=  .0       VR( 80)=  .0       VR( 81)=  .0       VR( 82)=  .0
VR( 83)=  .0          VR( 84)=  1.0000   VR( 85)=  .0       VR( 86)=  .0       VR( 87)=  .0       VR( 88)=  .0
VR( 89)=  .0          VR( 90)=  .0       VR( 91)=  140.00   VR( 92)=  .0       VR( 93)=  .0       VR(
                         CPP=  .24442       WTMP=  28.775      RHOP=  .77251E-01  VISCP=  .44000     XKP=  .14600
                         CPS=  .0           WTMS=  .0          RHOS=  .0          VISCS=  .0         XKS=  .0
```


SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL. MISSION TIME: 3615. SEC (1.00 HR) DATE: 01/26/85
CABIN (2)
VOLUME = 8000. CU-FT
AIR MASS = 594.07 LBM
TEMP = 69.4 F
DEW PT = 51.2 F
TOTAL PRESS = 14.69 PSIA
O2 PRESS = 2.89 PSIA
CO2 PRESS = 2.58 MM-HG
GAS LEAKAGE = 0.083 PPH
O2 MAKEUP = 0.000 PPH
N2 MAKEUP = 0.000 PPH
NON ECLSS Q:
SENSIBLE = 17065. B/HR
LATENT = 255. B/HR
ECLSS Q:
SENSIBLE = 5401. B/HR
LATENT = 561. B/HR
REL HUMIDITY = 51.95 PCT
CREW (1)
NO OF MEN = 3
TOTAL Q = 1561.6 B/HR
METABOLIC Q = 520.5 B/HR/MAN
SENSIBLE = 330.6 B/HR/MAN
LATENT = 189.9 B/HR/MAN
O2 USAGE = 0.2545 PPH
CO2 PROD = 0.2998 PPH
FROM CABIN M= 9357. T= 69.4
SENSIBLE HX FAN (4) Q = 2843. CFM= 2100.
T= 70.7
SENSIBLE HX (5) Q=-15813.
*T= 69.1
TO CABIN M= 9358. T= 63.8
M=1740. T= 60.0
TO CABIN M= 1391. T= 50.6
FROM CABIN M= 1323. T= 69.4
*T= 54.2
M= 1390. T= 70.6
REL. HUMD. HX (7) Q= -8777.
(31)
T= 49.1
(9)
M= 1347.
(11)
M= 1389. T= 49.2
REL. HUMD. HX FAN (12) Q = 478. CFM= 300.
M= 67.11 T= 92.5
*M= 950. *T= 45.0
H2O SEP (10) Q = 13. CFM = 9.
M= 41.7 T= 50.4
H2O INTERFACE: M ADDED = 1.913
M= 1.4
FROM CABIN M= 66.84 T= 69.4
SAWD FAN (19) Q = 171. CFM= 15.
P= 28.67 M= 0.11 T=158.3
M= 1.65 T=287.5
AMINE BED 1 (16) Q = 1693. MCO2= 0.134 MH2O= 3.189
M= 0.0
(17) (18)
TO CABIN M= 0.0 T=158.3
M= 0.0
(14) (15)
H2O INTERFACE M USED = 2.105
M= 1.65 T= 70.0
M= 1.65
M= 0.11
PUMP (28) Q= 34.
T= 90.7
STEAM GEN (29) Q= 1862.
T=287.5
(25/26)
M= 0.0
(23/24)
M= 0.11
(30)
M= 0.11
CO2 ACCUM (32) M= 0.394 P= 28.62
M= 0.0
M= 0.0
TO OVBD OR RECOVERY M= 0.27 T= 70.0
P= 14.69 M= 67.11 T= 82.2
M= 66.84 T= 69.4
AMINE BED 2 (21) Q = -792. MCO2= 0.071 MH2O= 2.614
M= 67.11
M= 66.84
(20) (22)

SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL.   MISSION TIME: 10815. SEC (3.00 HR)   DATE: 01/26/85



UNITED TECHNOLOGIES HAMILTON STANDARD

SVHSER 9503

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SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL.  MISSION TIME:  18015. SEC ( 5.00 HR)   DATE: 01/26/85

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                                                            X
X        CABIN (2)                       CREW (1)             FROM CABIN                    *****    TO CABIN   X
X                                                             M= 9371.                      *        M= 9370.   X
X                                                             T= 69.3                       *T= 68.9  T= 63.6   X
X VOLUME         = 8000. CU-FT    NO OF MEN      =  3          A                                       A        X
X AIR MASS       = 594.90 LBM     TOTAL Q        = 1945.0 B/HR A    -------------        -----------    A        X
X TEMP           =   69.3 F       METABOLIC Q =  648.3 B/HR/MAN A  |SENSIBLE    |        |SENSIBLE  |    A        X
X DEW PT         =   51.9 F         SENSIBLE   =  330.6 B/HR/MAN A  |HX FAN (4)  | T= 70.6 |HX (5)   |             X
X TOTAL PRESS    = 14.70 PSIA       LATENT     =  317.8 B/HR/MAN AAAAAAAAA|Q  =  2843.|AAAAAAAAAA|Q=-15898. |AAAAAAAAAAAAAAAA X
X O2 PRESS       =   2.90 PSIA    O2 USAGE       = 0.3170 PPH     ----->  |CFM=  2100.|          |          |  -------> X
X CO2 PRESS      =   2.95 MM-HG   CO2 PROD       = 0.3734 PPH             -------------        -----------            X
X GAS LEAKAGE    = 0.033 PPH                                                               *                         X
X O2 MAKEUP      = 0.003 PPH                                                         M=1791. *         TO CABIN     X
X N2 MAKEUP      = 0.000 PPH          FROM                                           T= 60.0 *         M= 1392.     X
X NON ECLSS Q:                        CABIN                                          *********         T= 50.7      X
X   SENSIBLE     = 17065. B/HR        M= 1373.         ********                       ---->                  A       X
X   LATENT       =   255. B/HR        T= 69.3          *                                                     A A     X
X ECLSS Q:                               A             *T= 54.2                                  ------------  A |    X
X   SENSIBLE     =  3505. B/HR         | A          -------------                              |REL. HUMD. |  A |    X
X   LATENT       =   565. B/HR         | A  M= 1394.|REL. HUMD. |                     M= 1393.  |HX FAN (12)|  A |    X
X REL HUMIDITY = 53.59 PCT             V A  T= 69.9 |HX (7)     | T= 49.3   M= 1351.  T= 49.3   |Q  = 478.  |AAA |   X
X                                     (31)AAAAAAAAAA|Q= -8785.  |AAAAAAAAA(9)AAAAAAAAAAAAAA(11)AAAAAAAAAAAAAA|CFM= 300.  |     X
X                                        A  ----->  |           |  -----> A            A   ----->           ------------      X
X                                       A A         -------------       | A ---------------  A                        X
X                                       | A M= 20.95     *              | A |H2O SEP (10)|  A M= 41.8                 X
X                                       | A T=106.4      *M= 950.       V AA|Q   =  13.  |AAA T= 50.5                 X
X                                       | A              *T= 45.0           |CFM =   9.  |                           X
X                                       | A          ******                 ---------------                           X
X FROM CABIN                            | A          ---->                    W  ---->  H2O INTERFACE: M ADDED =   9.042  X
X M= 20.30                                A                                 WWWWWWWWWWW M=  1.6                     X
X T= 69.3                         ----------------                                                                 X
X     A                           |SAWD FAN (19)|          <------                                                 X
X     A |                         |Q  = 171.    |AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA         X
X     A |                         |CFM=   5.    |                       P= 14.70                     A A          X
X     A V                         ----------------  M= 28.35------------ M= 20.95                    A |          X
X     A      M=  0.0                                T=184.1 |  AMINE   | T= 73.7      M= 20.95      A |          X
X  (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)SSSSSSSSSS| BED 1 (16)|AAAAAAAAAA(17)AAAAAAAAA(18)             X
X     A                     ----->             S    ---->  |Q   = 8189.|  ---->    S     ---->    A   TO CABIN  X
X     A  H2O INTERFACE                          S          |MCO2= 0.303|           S             A A   M=  0.0   X
X     A  M USED =    5.215                      S A        |MH2O= 2.525|           S |           | A   T=184.1   X
X     A     W                                   S |        -------------           S |           | A      A      X
X     A   | W                         M= 28.35 S |                     M=   0.0  S |           | A    A A      X
X   | A   | W M=  0.0                           S |                                S |           | A    | A      X
X   | A   V W T= 70.0                           S |                                S V             A    | A    ------------ X
X   | A --------      ----------                S                                  S               A    | A   | CO2      | X
X   | A |PUMP |   T= 70.0|STEAM   | T=277.6     S      M= 28.35                    S    M=  0.0 A    A M=  0.0 |ACCUM (32)| X
X   V A |(28) |WWWWWWWWW|GEN (29)|SSSSSSSS(25/26)SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)SSSSSSSS)A(SSSS(30)CCCCCCCC|          | X
X     A |Q=  0.|  ----> |Q=    0.| ------>      S        <-----                    S     ---->  A          ----> | M= 0.289 | X
X     A --------        ----------              S |                                S A           A A              | P= 23.98 | X
X     A                              M=  0.0    S |                    M= 28.35S |           A |              ------------ X
X     A                                         S |                                S |           A |                | C      X
X     A                                         S |       -------------- P= 14.70  S |           A |                | C      X
X     A                                         S V M= 20.30|  AMINE   | M= 28.35  S |           A |                V C      X
X     A      M= 20.30                           S   T= 69.3 | BED 2 (21)| T=184.1   S    M=  0.0  A            TO OVBD OR  X
X  AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)AAAAAAAAAA|Q   =-9391.|SSSSSSSSSS(22)AAAAAAAAAAA          RECOVERY    X
X                  ----->                         ---->    |MCO2= 0.018|   ---->          ---->           M=  0.0     X
X                                                          |MH2O= 3.224|                                  T= 70.0     X
X                                                          -------------                                              X
X                                                                                                                     X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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  SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL.  MISSION TIME:  25215. SEC ( 7.00 HR)   DATE: 01/26/85

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                                                                                  X
X          CABIN (2)                      CREW (1)               FROM CABIN                               *****           TO CABIN X
X                                                                M= 9373.                                 *                M= 9369. X
X  VOLUME        = 8000. CU-FT    NO OF MEN    =  3              T= 69.2                                  *T= 68.7         T= 63.6  X
X  AIR MASS      = 595.00 LBM     TOTAL Q      = 1950.0 B/HR       A        -------------            ------------               A     X
X  TEMP          =  69.2 F        METABOLIC Q  =  650.0 B/HR/MAN   A        |SENSIBLE   |            |SENSIBLE   |              A     X
X  DEW PT        =  51.0 F          SENSIBLE   =  332.5 B/HR/MAN   A        |HX FAN (4) | T= 70.4    |HX (5)     |              A     X
X  TOTAL PRESS   = 14.69 PSIA        LATENT    =  317.5 B/HR/MAN   AAAAAAAAA|Q  =  2843.|AAAAAAAAAA|Q=-15662.  |AAAAAAAAAAAAAAA     X
X  O2 PRESS      =  2.91 PSIA     O2 USAGE     = 0.3178 PPH          -----> |CFM=  2100.|          |           |  ------->         X
X  CO2 PRESS     =  2.96 MM-HG    CO2 PROD     = 0.3744 PPH                 -------------           ------------                    X
X  GAS LEAKAGE   = 0.083 PPH                                                                                 *                      X
X  O2 MAKEUP     = 0.000 PPH                                                                         M=1800. *                      X
X  N2 MAKEUP     = 0.000 PPH            FROM                                                         T= 60.0 *         TO CABIN     X
X  NON ECLSS Q:                         CABIN                                                        *********         M= 1392.     X
X    SENSIBLE    = 17065. B/HR          M= 1325.        ********                                      ---->            T= 50.4      X
X    LATENT      =   255. B/HR          T= 69.2         *                                                                   A       X
X  ECLSS Q:                               A             *T= 53.8                                                            A A     X
X    SENSIBLE    =  3505. B/HR            | A         -------------                                         --------------  A |     X
X    LATENT      =   304. B/HR            | A   M= 1392. |REL. HUMD. |                           M= 1391.   |REL. HUMD.  |  A |     X
X  REL HUMIDITY  = 52.09 PCT              V A   T= 69.8  |HX (7)     | T= 48.9        M= 1349.   T= 49.0    |HX FAN (12)|  A |     X
X                                        (31)AAAAAAAAAA|Q= -8400.  |AAAAAAAAA(9)AAAAAAAAAAAAAAA(11)AAAAAAAAAAAAAA|Q  = 478.  |AAA |     X
X                                         A   ----->   |           |  -----> A                   A     ----->  |CFM= 300.  |          X
X                                       A A          -------------         | A  -------------  A              -------------         X
X                                       | A M= 67.03      *                | A |H2O SEP (10)| A M= 41.7                               X
X                                       | A T= 82.4       *M= 950.         V AA|Q   =   13.  |AAA T= 50.2                             X
X                                       | A               *T= 45.0             |CFM =    9.   |                                      X
X FROM CABIN                            | A          ******                    ---------------                                      X
X M= 66.92                                A          ---->                         W   ---->   H2O INTERFACE: M ADDED =  12.341     X
X T= 69.2                          ---------------                                 WWWWWWWWWWW M=  1.2                              X
X    A                             |SAWD FAN (19)|              <------                                                             X
X    A |                           |Q  = 171.    |AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                                X
X    A |                           |CFM=  15.    |                           P= 14.69             A A                               X
X    A V                           ---------------     M= 66.92------------- M= 67.03             A |                               X
X    A          M= 66.92                               T= 69.2 |  AMINE   | T= 72.0   M= 67.03  A |                               X
X  (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)AAAAAAAAAA| BED 1 (16)|AAAAAAAAAA(17)AAAAAAAAA(18)                                     X
X    A                   ----->            S    ----> |Q  = -445.|   ----->   C    ----->  A       TO CABIN                      X
X    A  H2O INTERFACE                      S          |MCO2= 0.289|           C             A A      M=  0.0                       X
X    A  M USED =    7.083                  S A        |MH2O= 1.999|           C |           | A      T=207.7                       X
X    A     W                               S |        -------------           C |           | A        A                           X
X    A   | W                     M=  0.0   S |                        M=  0.0 C |           | A      A A                           X
X  | A   | W M=  0.0                       S |                                C |           | A      | A                           X
X  | A   V W T= 70.0                       S |                                C V             A      | A        -------------      X
X  | A  ---------         ----------       S                                  C               A      | A        | CO2       |      X
X  | A  |PUMP   | T= 70.0|STEAM     | T=277.9 S    M=  0.0                     C      M=  0.00A      A M=  0.00 |ACCUM (32)|      X
X  | A  |(28)   |WWWWWWWW|GEN (29)  |SSSSSSSS(25/26)SSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)CCCCCCCC)A(CCCC(30)CCCCCCCCC|           |      X
X  V A  |Q=  0.| ----->  |Q=     0.| ----->  S     <-----                      C   ---->     A         ---->   | M= 0.289  |      X
X    A  ---------         ----------        S |                               C A           A A               | P= 24.00  |      X
X    A                                      S |                      M=  0.00C |           A |               -------------      X
X    A                          M=  0.0     S |                               C |           A |                 | C              X
X    A                                      S |                               C |           A |                 | C              X
X    A                                      S |         ------------- P= 23.99 C |           A |                 V C              X
X    A                                      S V M=  0.0 |  AMINE    | M=  0.00 C |           A |              TO OVBD OR          X
X    A         M=  0.0                      S  T=289.8  | BED 2 (21)| T=207.7  C   M=  0.0  A               RECOVERY            X
X    AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)SSSSSSSSS|Q  =   -0.|CCCCCCCCCC(22)AAAAAAAAAAAA                                    X
X                       ----->                      ---->  |MCO2= 0.008|  ---->        ---->                    M=  0.27           X
X                                                          |MH2O= 3.743|                                        T= 70.0            X
X                                                          -------------                                                           X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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OF POOR QUALITY

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SPACE STATION AIR REVITALIZATION SUBSYSTEM SAND II DEMONSTRATION MODEL.  MISSION TIME:  32415. SEC ( 9.00 HR)   DATE: 01/26/85
                                                                                                              X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                          *****                  TO CABIN   X
X        CABIN (2)                  CREW (1)          FROM CABIN          *                      M= 9378.   X
X                                                     M= 9376.            *T= 70.1               T= 66.0    X
X                                                     T= 69.0         -------------                 A       X
X  VOLUME       = 8000. CU-FT  NO OF MEN    =  3       A     -------------   |SENSIBLE   |          A       X
X  AIR MASS     = 595.37 LBM   TOTAL Q      = 1950.0 B/HR A  |SENSIBLE   | T= 70.2 |HX (5)  |       A       X
X  TEMP         =  69.0 F      METABOLIC Q =  650.0 B/HR/MAN A |HX FAN (4) |AAAAAAAAAA|Q= -9562. |AAAAAAAAAAAAAAAA X
X  DEW PT       =  52.0 F        SENSIBLE  =  334.6 B/HR/MAN AAAAAAAAA|Q  =  2843.|    |        |  ------->  X
X  TOTAL PRESS  = 14.70 PSIA     LATENT    =  315.4 B/HR/MAN ----->|CFM=  2100.|   -------------            X
X  O2 PRESS     =  2.92 PSIA   O2 USAGE     = 0.3178 PPH        -------------             *                X
X  CO2 PRESS    =  3.12 MM-HG  CO2 PROD     = 0.3744 PPH                          M= 950. *     TO CABIN  X
X  GAS LEAKAGE  = 0.083 PPH                                                       T= 60.0 *     M= 1392.  X
X  O2 MAKEUP    = 0.000 PPH                                                       *********     T= 50.5   X
X  N2 MAKEUP    = 0.000 PPH       FROM                                              ---->          A      X
X  NON ECLSS Q:                   CABIN       ********                                            A A     X
X    SENSIBLE   = 17065. B/HR     M= 1325.    *                                     -------------  A |    X
X    LATENT     =   255. B/HR     T= 69.0     *T= 54.1                  M= 1391.   |REL. HUMD. |  A |    X
X  ECLSS Q:                        A     -------------                  T= 49.1    |HX FAN (12)|  A |    X
X    SENSIBLE   =  3505. B/HR     | A  M= 1392.|REL. HUMD. | T= 49.1    M= 1349.    |Q  = 478.  |AAA |    X
X    LATENT     =   413. B/HR     | A  T= 69.6 |HX (7)     |AAAAAAAAA(9)AAAAAAAAAAAAAAA(11)AAAAAAAAAAAAAA|CFM= 300.  |  X
X  REL HUMIDITY = 54.36 PCT       V A  (31)AAAAAAAAAA|Q= -8680.  | -----> A          A     ----->  -------------  X
X                                  A   ----->  |            |          | A  -------------  A                  X
X                                A A      -------------                | A |H2O SEP (10)|  A M= 41.7         X
X                                | A M= 67.09        *                 V AA|Q   =  13.  |AAA T= 50.4         X
X                                | A T= 82.8         *M= 950.              |CFM =   9.  |                    X
X                                | A                 *T= 45.0              -------------                    X
X                                | A              ******                W  ---->  H2O INTERFACE: M ADDED =  16.143  X
X FROM CABIN                        A              ---->                 WWWWWWWWWWW M=  1.6                 X
X M= 66.98                  ---------------                                                                X
X T= 69.0                   |SAND FAN (19)|                 <------                                        X
X   A                       |Q  = 171.    |AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA           X
X   A |                     |CFM=  15.    |                    P= 14.70                A A                X
X   A |                     ---------------                    M= 67.09                A |                X
X   A V                                M= 66.98-------------   T= 72.4       M= 67.09  A |                X
X   A     M= 66.98                     T= 69.0 |  AMINE     |                          A                  X
X  (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)AAAAAAAAAA| BED 1 (16)|AAAAAAAAAA(17)AAAAAAAAA(18)   TO CABIN   X
X   A            ----->              S     ---->  |Q   = -484.|   ---->   C     ---->  A A   M=  0.0    X
X   A  H2O INTERFACE                 S            |MCO2= 0.272|           C          | A    T=199.5     X
X   A  M USED =   8.971              S A          |MH2O= 2.032|           C |        | A      A         X
X   A    W                           S |          -------------    M=  0.0 C |        | A     A A        X
X   A  | W                   M=  0.0 S |                                  C |        | A     | A        X
X | A  | W M=  0.0                   S |                                  C V          A     | A        X
X | A  V W T= 70.0                   S |                                  C            A     | A    -------------  X
X | A  --------     ---------- T=280.1 S       M=  0.0                   C    M=  0.01A    A M=  0.01 | CO2        |  X
X | A |PUMP  | T= 70.0|STEAM    |SSSSSSSS(25/26)SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)CCCCCCCC)A(CCCC(30)CCCCCCCC|ACCUM (32)|  X
X V A |(28)  |WWWWWWWW|GEN (29)|----->  S      <-----                    C    ----->  A     ----->  | M= 0.308  |  X
X   A |Q=  0.|  ----> |Q=    0.|        S |                              C A          A A          | P= 25.03  |  X
X   A --------        ----------        S |                      M=  0.01C |          A |          -------------  X
X   A                       M=  0.0     S |                              C |          A |            | C      X
X   A                                   S |      -------------  P= 25.11 C |          A |            | C      X
X   A                                   S |     |  AMINE     |  M=  0.01 C |          A |            V C      X
X   A                                   S V M=  0.0 | BED 2 (21)| T=199.5 C   M=  0.0  A         TO OVBD OR   X
X   A                                   S  T=290.1 |Q   =    5.|CCCCCCCCCC(22)AAAAAAAAAAA        RECOVERY     X
X   A       M=  0.0                                |MCO2= 0.010|  ---->      ---->              M=  0.27     X
X  AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)SSSSSSSSSS|MH2O= 3.721|                           T= 70.0      X
X                 ----->                  ---->      -------------                                         X
X                                                                                                            X
X                                                                                                            X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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PLOT0			ESCM DEMONSTRATION MODEL
PLOT1	2	181	MISSION TIME (SEC)
PLOT1	2	182	MISSION TIME (MIN)
PLOT2	1	66	CREWMAN SEN (BTU/HR)
PLOT2	1	67	CREWMAN LAT (BTU/HR)
PLOT2	1	68	O2 USE RATE (LB/HR)
PLOT2	1	69	CO2 GEN RATE (LB/HR)
PLOT2	1	82	CREWMAN MET (BTU/HR)
PLOT2	2	89	REL HUMIDITY (DEC)
PLOT2	2	94	O2 PRESSURE (PSIA)
PLOT2	2	95	N2 PRESSURE (PSIA)
PLOT2	2	98	DEW POINT TEMP (F)
PLOT2	2	100	CO2 PRESS (MM HG)
PLOT2	2	104	DRY BULB TEMP (F)
PLOT2	2	106	TOTAL PRESS (PSIA)
PLOT2	2	165	O2 MAKEUP (LB/HR)
PLOT2	2	166	N2 MAKEUP (LB/HR)
PLOT2	15	6	SA-1 H2O IN (LB/HR)
PLOT2	16	6	SA-1 H2O OUT (LB/HR)
PLOT2	15	12	SA-1 CO2 IN (LB/HR)
PLOT2	16	12	SA-1 CO2 OUT (LB/HR)
PLOT2	16	2	SA-1 EXIT TEMP (F)
PLOT2	16	82	SA-1 H2O LOAD(LB/LB)
PLOT2	16	83	SA-1 CO2 LOAD(LB/LB)
PLOT2	20	6	SA-2 H2O IN (LB/HR)
PLOT2	21	6	SA-2 H2O OUT (LB/HR)
PLOT2	20	12	SA-2 CO2 IN (LB/HR)
PLOT2	21	12	SA-2 CO2 OUT (LB/HR)
PLOT2	21	2	SA-2 EXIT TEMP (F)
PLOT2	21	82	SA-2 H2O LOAD(LB/LB)
PLOT2	21	83	SA-2 CO2 LOAD(LB/LB)
PLOT2	21	101	BED 2, SEGMENT 1, TEMP
PLOT2	21	131	BED 2, SEGMENT 2
PLOT2	21	161	BED 2, SEGMENT 3
PLOT2	21	191	BED 2, SEGMENT 4
PLOT2	21	221	BED 2, SEGMENT 5
PLOT2	21	126	BED 2, SEGMENT 1, H2O LOAD
PLOT2	21	156	BED 2, SEGMENT 2
PLOT2	21	186	BED 2, SEGMENT 3
PLOT2	21	216	BED 2, SEGMENT 4
PLOT2	21	246	BED 2, SEGMENT 5
PLOT2	21	125	BED 2, SEGMENT 1, CO2 LOAD
PLOT2	21	155	BED 2, SEGMENT 2
PLOT2	21	185	BED 2, SEGMENT 3
PLOT2	21	215	BED 2, SEGMENT 4
PLOT2	21	245	BED 2, SEGMENT 5

5000 LOCATIONS ALLOTED IN MAIN PROGRAM (G189) FOR K AND V ARRAY
THE RECOMMENDED MINIMUM IS 5000 FOR THE K AND V ARRAY

2029 LOCATIONS USED FOR COMP. K AND V DATA

2447 IS LAST LOCATION USED FOR TABLE DATA

THERE ARE 2553 UNUSED K AND V ARRAY LOCATIONS

EDITED COMPONENT DATA AT BEGINNING OF STEADY STATE

ESCM: BASELINE, VOL = 8000 FT-3, PCO2 = 2.5, .275 PPH AVERAGE

IBM CLOCK TIME(HH-MM-SS) = 15:57:53

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SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL.  MISSION TIME:  43215. SEC (12.00 HR)   DATE: 01/26/85
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                                                        X
X                                              FROM CABIN                        *****       TO CABIN    X
X          CABIN (2)              CREW (1)     M= 9376.                          *           M= 9379.    X
X                                              T= 69.4                           *T= 70.0    T= 64.9     X
X VOLUME       = 8000. CU-FT  NO OF MEN    = 3             A                                     A       X
X AIR MASS     = 595.43 LBM   TOTAL Q      = 1350.0 B/HR   A    |SENSIBLE   |          |SENSIBLE |  A    X
X TEMP         =  69.4 F      METABOLIC Q  =  450.0 B/HR/MAN A  |HX FAN (4) | T= 70.6  |HX (5)   |  A    X
X DEW PT       =  51.1 F        SENSIBLE   =  326.6 B/HR/MAN AAAAAAAAA|Q = 2843.|AAAAAAAAAA|Q=-13109. |AAAAAAAAAAAAAAAA X
X TOTAL PRESS  = 14.71 PSIA     LATENT     =  123.4 B/HR/MAN  -----> |CFM= 2100.|         |         |  ------->  X
X O2 PRESS     =  2.93 PSIA   O2 USAGE     = 0.2200 PPH                                                  X
X CO2 PRESS    =  3.28 MM-HG  CO2 PROD     = 0.2592 PPH                               *                  X
X GAS LEAKAGE  = 0.083 PPH                                                        M=1317. *              X
X O2 MAKEUP    = 0.000 PPH                                                        T= 60.0 *   TO CABIN   X
X N2 MAKEUP    = 0.000 PPH                FROM                                    *********   M= 1394.   X
X NON ECLSS Q:                            CABIN                                   ---->       T= 50.5    X
X   SENSIBLE   = 17065. B/HR              M= 1326.        ********                                A      X
X   LATENT     =   255. B/HR              T= 69.4         *                                       A A    X
X ECLSS Q:                                  A             *T= 54.0                  -------------  A |   X
X   SENSIBLE   =  3505. B/HR              | A             ------------       M= 1392.  |REL. HUMD. | A |  X
X   LATENT     =   475. B/HR              | A  M= 1393. |REL. HUMD. | T= 49.0   M= 1350.  T= 49.1  |HX FAN (12)| A | X
X REL HUMIDITY = 51.93 PCT                V A  T= 70.0  |HX (7)     |AAAAAAAAA(9)AAAAAAAAAAAAAAA(11)AAAAAAAAAAAAAA|Q = 478. |AAA | X
X                                      (31)AAAAAAAAAA|Q= -8544.  |  -----> A        A   -----> |CFM= 300.  |  X
X                                           A  ----->|           |         A ------------- A   -------------  X
X                                          A A M= 67.13 -----------      | A |H2O SEP (10)| A M= 41.8       X
X                                          | A T= 81.8     *             V AA|Q  =  13.   |AAA T= 50.3      X
X                                          | A           *M= 950.           |CFM =   9.  |                  X
X                                          | A           *T= 45.0           -------------                  X
X FROM CABIN                               | A          ******           W  ---->  H2O INTERFACE: M ADDED =  22.159 X
X M= 66.99                                   A          ---->            WWWWWWWWWWW M=  1.3               X
X T= 69.4                              ---------------                    <------                          X
X    A                                 |SAWD FAN (19)|                                                     X
X    A |                               |Q  = 171.    |AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA X
X    A |                               |CFM=  15.    |         P= 29.04                      A A           X
X    A V                               ---------------  M=  0.0 ------------ M=  0.01         A |           X
X    A         M=  0.0                      T=290.1 | AMINE     | T=188.7     M=  0.0       A |           X
X (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)SSSSSSSSSS| BED 1 (16)|CCCCCCCCCC(17)AAAAAAAAA(18)     X
X    A                  ----->             S    ---->  |Q  =   8.|   ---->   C    ---->   A   TO CABIN   X
X    A  H2O INTERFACE                      S           |MCO2= 0.011|         C         A A   M=  0.0    X
X    A  M USED =  11.904                   S A         |MH2O= 3.266|         C |       | A   T=188.7    X
X    A     W                               S |         -------------         C |       | A      A       X
X    A  | W                    M=  0.0     S |                      M=  0.01C |       | A    A A       X
X  | A  | W M=  0.0                        S |                               C |       | A    | A       X
X  | A  V W T= 70.0                        S |                               C V       A      | A      ------------ X
X  | A --------  -----------  ---------    S                                 C         A      | A      | CO2       | X
X  | A |PUMP | T= 70.0|STEAM    | T=288.3  S      M=  0.0                    C   M=  0.01A    A M=  0.01 |ACCUM (32)| X
X  V A |(28) |WWWWWWWWW|GEN (29)|SSSSSSSS(25/26)SSSSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)CCCCCCCC)A(CCCC(30)CCCCCCCC|  | X
X    A |Q=  0.| ----> |Q=   0.| ----->  S   <-----                     C    ---->    A       ----> | M= 0.362 | X
X    A --------     -----------          S |                            C A          A A           | P= 28.95 | X
X    A                                   S |                 M=  0.0  C |         A |           ------------ X
X    A                          M=  0.0  S |                            C |         A |             | C      X
X    A                                   S |                            C |         A |             | C      X
X    A                                   S |  ------------- P= 14.71    C |         A |             V C      X
X    A                                   S V M= 66.99| AMINE     | M= 67.13  C |       A |           TO OVBD OR X
X    A       M= 66.99                    S   T= 69.4 | BED 2 (21)| T= 71.4   C   M= 67.13 A          RECOVERY X
X    AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)AAAAAAAAAA|Q  = -526.|AAAAAAAAAA(22)AAAAAAAAAAAA  M=  0.27 X
X               ----->                     ---->  |MCO2= 0.225|  ---->        ---->           T= 70.0     X
X                                                 |MH2O= 2.327|                                            X
X                                                 -------------                                            X
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SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL.  MISSION TIME:  50415. SEC (14.00 HR)   DATE: 01/26/85

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                                                                         X
X          CABIN (2)                     CREW (1)             FROM CABIN                              *****       TO CABIN X
X                                                             M= 9378.                                *            M= 9376. X
X  VOLUME       = 8000. CU-FT   NO OF MEN    =  3             T= 68.9                                 *T= 68.5     T= 63.5 X
X  AIR MASS     = 595.46 LBM    TOTAL Q      = 1171.6 B/HR     A        -------------           ------------          A   X
X  TEMP         =   68.9 F      METABOLIC Q =  390.5 B/HR/MAN  A        |SENSIBLE   |           |SENSIBLE   |         A   X
X  DEW PT       =   50.5 F        SENSIBLE   =  281.5 B/HR/MAN  A        |HX FAN (4) | T= 70.1  |HX (5)     |         A   X
X  TOTAL PRESS  = 14.69 PSIA      LATENT     =  109.1 B/HR/MAN  AAAAAAAAA|Q  =  2043.|AAAAAAAAAA|Q=-15275.  |AAAAAAAAAAAAAAA X
X  O2 PRESS     =   2.93 PSIA   O2 USAGE     = 0.1910 PPH         -----> |CFM=  2100.|          |           |   -------> X
X  CO2 PRESS    =   3.21 MM-HG  CO2 PROD     = 0.2250 PPH               -------------           ------------              X
X  GAS LEAKAGE  = 0.053 PPH                                                                          *                    X
X  O2 MAKEUP    = 0.000 PPH                                                                   M=1800. *                   X
X  N2 MAKEUP    = 0.000 PPH          FROM                                                     T= 60.0 *       TO CABIN X
X  NON ECLSS Q:                      CABIN                                                    *********       M= 1392. X
X    SENSIBLE   = 17065. B/HR        M= 1325.          ********                                 ---->         T= 50.3 X
X    LATENT     =   255. B/HR        T= 68.9           *                                                          A   X
X  ECLSS Q:                           A                *T= 53.7                                                   A A X
X    SENSIBLE   =  5489. B/HR        | A           -------------                                   -------------  A | X
X    LATENT     =   469. B/HR        | A  M= 1392.|REL. HUMD. |                         M= 1391.  |REL. HUMD. |  A | X
X  REL HUMIDITY = 51.54 PCT          V A   T= 69.5 |HX (7)     | T= 48.9      . M= 1349.    T= 48.9   |HX FAN (12)|  A | X
X                                   (31)AAAAAAAAAA|Q= -8229.  |AAAAAAAAA(9)AAAAAAAAAAAAAAA(11)AAAAAAAAAAAAAA|Q  = 478.  |AAA | X
X                                     A   ----->  |           |   -----> A            A   ----->  |CFM= 300.  |      X
X                                   A A           -------------        | A --------------   A      -------------      X
X                                   | A M= 67.10        *              | A |H2O SEP (10)|  A M= 41.7                  X
X                                   | A T= 81.6         *M= 950.       V AA|Q    =  13.  |AAA T= 50.1                  X
X                                   | A                 *T= 45.0          |CFM =   9.   |                             X
X FROM CABIN                        | A             ******                --------------                              X
X M= 66.97                            A             ---->                  W    ---->  H2O INTERFACE: M ADDED =  25.168 X
X T= 68.9                     ----------------                              WWWWWWWWWWW M=  1.1                      X
X    A                        |SAWD FAN (19)|                <-------                                                 X
X    A |                      |Q  = 171.    |AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                   X
X    A |                      |CFM=  15.    |                               P= 29.98             A A                  X
X    A V                      ----------------    M=  1.72-------------- M=  0.92              A |                  X
X    A        M=  0.0                             T=290.1 |  AMINE     | T=164.9       M=  0.0  A |                  X
X  (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)SSSSSSSSS| BED 1 (16)|CCCCCCCCCC(17)AAAAAAAAA(18)                  X
X    A                   ----->          S     ----> |Q    = 1563.|   ---->    C     ---->   A    TO CABIN            X
X    A  H2O INTERFACE                    S           |MCO2= 0.026|             C           A A    M=  0.0             X
X    A  M USED =  13.804                 S A         |MH2O= 3.203|             C |         | A    T=164.9             X
X    A    W                              S |         -------------             C |         | A      A                 X
X    A   | W                   M=  1.72  S |                          M=  0.92C |         | A    A A                 X
X  | A   | W M=  1.72                    S |                                   C |         | A     | A                 X
X  | A   V W T= 70.0                     S |                                   C V           A     | A   --------------  X
X  | A --------          ----------      S                                     C             A     | A   | CO2        | X
X  | A |PUMP  |  T= 89.8|STEAM    | T=290.1  S       M=  0.0                    C     M=  0.92A       A M=  0.92 |ACCUM (32)| X
X  V A |(28)  |WWWWWWWWWW|GEN (29)|SSSSSSSS(25/26)SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)CCCCCCCC)A(CCCC(30)CCCCCCCC|          | X
X    A |Q= 34.|  ---->  |Q= 1950.| ----->   S       <-----                       C     ---->   A          ----> | M= 0.362 | X
X    A --------          ----------          S |                                   C A           A A              | P= 29.99 | X
X    A                         M=  0.0     S |                       M=  0.0 C |           A |             -------------- X
X    A                                     S |                                   C |           A |                | C         X
X    A                                     S |        -------------- P= 14.69    C |           A |                | C         X
X    A                                     S V M= 66.97|  AMINE     | M= 67.10    C |           A |                V C         X
X    A        M= 66.97                     S   T= 68.9 | BED 2 (21)| T= 71.3     C     M= 67.10 A              TO OVBD OR   X
X    AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)AAAAAAAAAA|Q    = -531.|AAAAAAAAAA(22)AAAAAAAAAAAA                RECOVERY     X
X                        ----->                ---->   |MCO2= 0.188|   ---->          ---->                  M=  0.84     X
X                                                      |MH2O= 2.289|                                         T= 70.0      X
X                                                      -------------                                                      X
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SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL.  MISSION TIME:  57615. SEC (16.00 HR)   DATE: 01/26/85

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                        FROM CABIN                               *****          TO CABIN   X
X         CABIN (2)                      CREW (1)        M= 9382.                                 *              M= 9382.   X
X                                                        T= 68.8                                  *T= 68.5       T= 63.5    X
X                                                        A            -------------           -------------        A        X
X  VOLUME        = 8000. CU-FT     NO OF MEN    =  3     A           |SENSIBLE    |          |SENSIBLE    |        A        X
X  AIR MASS      = 595.61 LBM      TOTAL Q      =  900.0 B/HR        |HX FAN (4)  | T= 70.1  |HX (5)      |AAAAAAAAAAAAAAAA X
X  TEMP          =   68.8 F        METABOLIC Q  =  300.0 B/HR/MAN   AAAAAAAAA|Q  =  2843.|AAAAAAAAAA|Q=-14917.  |  ------->   X
X  DEW PT        =   50.4 F          SENSIBLE   =  211.1 B/HR/MAN    ----->  |CFM=  2100.|          |            |            X
X  TOTAL PRESS   = 14.69 PSIA        LATENT     =   88.9 B/HR/MAN            -------------           -------------            X
X  O2 PRESS      =   2.95 PSIA     O2 USAGE     = 0.1467 PPH                                               *                 X
X  CO2 PRESS     =   3.12 MM-HG    CO2 PROD     = 0.1728 PPH                                     M=1747. *    TO CABIN      X
X  GAS LEAKAGE   = 0.083 PPH                                                                      T= 60.0 *    M= 1393.      X
X  O2 MAKEUP     = 0.000 PPH                                                                      *********    T= 50.3       X
X  N2 MAKEUP     = 0.000 PPH                  FROM                                                  ---->         A          X
X  NON ECLSS Q:                               CABIN          ********                                             A A        X
X     SENSIBLE   = 17065. B/HR                M= 1326.       *                                           ------------- A |    X
X     LATENT     =   255. B/HR                T= 68.8        *T= 53.6                                    |REL. HUMD. | A |    X
X  ECLSS Q:                                    A         ---------------                  M= 1392.       |HX FAN (12)| A |    X
X     SENSIBLE   =  3505. B/HR                | A  M= 1393.|REL. HUMD.  | T= 48.8   M= 1350.  T= 48.9   |Q  = 478.  |AAA   X
X     LATENT     =   476. B/HR                | A  T= 69.4 |HX (7)      |AAAAAAAAA(9)AAAAAAAAAAAAAAA(11)AAAAAAAAAAAAAAA|CFM= 300.  |    X
X  REL HUMIDITY = 51.49 PCT                   V A          |Q= -8169.   |  ------> A        A     ----->  -------------       X
X                                           (31)AAAAAAAAAA|            |          A  -------------  A                       X
X                                              A   ----->  ---------------        | A |H2O SEP (10)| A M= 41.8              X
X                                            A A                                  | A |Q   =  13.  |AAA T= 50.1             X
X                                            | A M= 67.15            *            V AA|CFM =   9.  |                        X
X                                            | A T= 81.3             *M= 950.         -------------                         X
X                                            | A                     *T= 45.0           W  ---->   H2O INTERFACE: M ADDED =  28.035 X
X                                            | A                ******                  WWWWWWWWWWW M=  1.1                     X
X  FROM CABIN                                  A                ---->                                                          X
X  M= 67.01                              ---------------                 <------                                               X
X  T= 68.8                               |SAWD FAN (19)|AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                   X
X       A                                |Q  = 171.    |                   P= 14.69               A A                          X
X       A |                              |CFM=  15.    |                   M=  0.0                A |                          X
X       A |                              ---------------   M=  0.0 -------------- T=182.3  M=  0.0  A |                          X
X       A V                                                T=289.9 | AMINE      |CCCCCCCCCC(17)AAAAAAAAA(18)                      X
X       A        M=  0.0                                            |BED 1 (16) |   ---->  C   ---->  A      TO CABIN            X
X (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)SSSSSSSSSS|Q    =   0.|            C          A A    M=  0.0           X
X      A                       ----->        S       ---->   |MCO2= 0.045|            C |        | A    T=182.0           X
X      A   H2O INTERFACE                     S               |MH2O= 3.048|            C |        | A      A               X
X      A   M USED =  15.577                  S A             -------------             C |        | A    A A               X
X      A     W                               S |                               M=  0.0 C |        | A    | A               X
X      A   | W                  M=  0.0      S |                                       C V          A    | A               X
X    | A   | W M=  0.0                       S |                                       C            A    | A    -------------  X
X    | A   V W T= 70.0                       S                                         C   M=  0.0  A  A M=  0.0 | CO2       |  X
X    | A  ---------  ---------                S         M=  0.0                                                   |ACCUM (32)|  X
X    | A  |PUMP   | T= 70.0|STEAM   | T=288.4 SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)CCCCCCCC)A(CCCC(30)CCCCCCCC|          |  X
X    V A  |(28)   |WWWWWWWW|GEN (29)|SSSSSSSS(25/26)SSSS    <-----                  C   ----->     A       ----->   | M= 0.345 |  X
X      A  |Q=  0.| ---->   |Q=   0.| ----->   S                                   C A            A A              | P= 29.03 |  X
X      A  ---------        ---------          S |                         M=  0.0 C |            A |              -------------  X
X      A                          M=  0.0     S |                                  C |            A |                | C         X
X      A                                      S |    ------------- P= 14.69       C |            A |                | C         X
X      A                                      S |   |  AMINE    | M= 67.15       C |            A |                V C         X
X      A                                      S V M= 67.01|BED 2 (21)| T= 70.9  C    M= 67.15 A              TO OVBD OR     X
X      A                                         T= 68.8 |Q   = -528.|AAAAAAAAAA(22)AAAAAAAAAAAA            RECOVERY       X
X      A      M= 67.01                                    |MCO2= 0.165|  ---->        ---->                M=  0.27       X
X  AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)AAAAAAAAAA|MH2O= 2.272|                                  T= 70.0        X
X                  ----->                      ---->      -------------                                                   X
X                                                                                                                          X
X                                                                                                                          X
X                                                                                                                          X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL.  MISSION TIME:  64815. SEC (18.00 HR)   DATE: 01/26/85
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                                                                X
X                                      CREW (1)              FROM CABIN                 *****        TO CABIN    X
X         CABIN (2)                                          M= 9384.                   *            M= 9384.    X
X                                                            T= 68.8                    *T= 68.5     T= 63.5     X
X  VOLUME       = 8000. CU-FT      NO OF MEN    =  3          A         ------------   ------------      A       X
X  AIR MASS     = 595.76 LBM       TOTAL Q      =  900.0 B/HR A        |SENSIBLE   |  |SENSIBLE   |      A       X
X  TEMP         =   68.8 F         METABOLIC Q  =  300.0 B/HR/MAN A    |HX FAN (4) | T= 70.1 |HX (5) |   A       X
X  DEW PT       =   50.3 F           SENSIBLE   =  211.1 B/HR/MAN AAAAAAAAA|Q = 2843.|AAAAAAAAAA|Q=-14910. |AAAAAAAAAAAAAAAA X
X  TOTAL PRESS  = 14.70 PSIA          LATENT    =   88.9 B/HR/MAN  ----->|CFM= 2100.|         |          |  ------->  X
X  O2 PRESS     =   2.96 PSIA       O2 USAGE     = 0.1467 PPH          ------------   ------------                  X
X  CO2 PRESS    =   2.94 MM-HG      CO2 PROD     = 0.1728 PPH                          *                            X
X  GAS LEAKAGE  = 0.083 PPH                                                    M=1747. *        TO CABIN           X
X  O2 MAKEUP    = 0.000 PPH                                                    T= 60.0 *        M= 1393.           X
X  N2 MAKEUP    = 0.000 PPH        FROM                                        *********        T= 50.3            X
X  NON ECLSS Q:                    CABIN                ********                ---->               A              X
X    SENSIBLE   = 17065. B/HR      M= 1326.             *                                          A A             X
X    LATENT     =   255. B/HR      T= 68.8              *T= 53.6                      ------------  A |             X
X  ECLSS Q:                          A              -------------           M= 1392.  |REL. HUMD. | A |           X
X    SENSIBLE   =  5493. B/HR      | A   M= 1394. |REL. HUMD. | T= 48.8   M= 1351.  T= 48.9 |HX FAN (12)| A |     X
X    LATENT     =   456. B/HR      V A   T= 69.4  |HX (7)     |AAAAAAAAA(9)AAAAAAAAAAAAAAA(11)AAAAAAAAAAAAAA|Q = 478. |AAA | X
X  REL HUMIDITY = 51.35 PCT        (31)AAAAAAAAAA|Q= -8136.  | -----> A              A   ----->  |CFM= 300. |     X
X                                    A   ----->   |           |        | A  ------------  A        -----------       X
X                                  A A            -------------        | A |H2O SEP (10)| A M= 41.8                 X
X                                  | A M= 67.16        *             V AA|Q   =  13.  |AAA T= 50.1                X
X                                  | A T= 81.8         *M= 950.          |CFM =   9.  |                           X
X                                  | A               *T= 45.0             ------------                             X
X                                  | A            ******                 W  ---->  H2O INTERFACE: M ADDED =  30.685 X
X  FROM CABIN                        A            ---->                  WWWWWWWWWWW M= 1.0                         X
X  M= 67.03                      -----------------               <------                                           X
X  T= 68.8                       |SAND FAN (19)|AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                 X
X     A                          |Q  =  171.   |                  P= 29.72                A A                      X
X     A |                        |CFM=  15.    |                  M=  0.0                 A |                      X
X     A |                        ---------------  M=  1.73-------------- T=154.9  M=  0.0 A |                      X
X     A V        M=  0.0                          T=289.8 |  AMINE     |CCCCCCCCCC(17)AAAAAAAAA(18)  TO CABIN      X
X     A                                                   | BED 1 (16)|  ---->   C    ---->   A       M=  0.0      X
X (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)SSSSSSSSSS|Q   = 1699.|          C          A A      T=154.9      X
X     A                      ----->          S    ---->  |MCO2= 0.093|          C |        | A          A        X
X     A  H2O INTERFACE                       S           |MH2O= 3.018|          C |        | A        A A        X
X     A  M USED =  17.333                    S A         -------------          C |        | A        | A        X
X     A    W                                 S |                       M=  0.0  C |        | A        | A        X
X     A  | W                       M=  1.73  S |                                C V        | A        | A        X
X   | A  | W M=  1.73                        S |                                C            A        A M=  0.0  ----------- X
X   | A  V W T= 70.0                         S |                                C            A                 | CO2      | X
X   | A ---------   ---------                S       M=  0.0                    C     M=  0.0 A(CCCC(30)CCCCCCCC|ACCUM (32)| X
X   | A |PUMP   | T= 89.8|STEAM    | T=289.8                                                  A   ---->       |          | X
X   V A |(28)   |WWWWWWWWW|GEN (29)|SSSSSSSS(25/26)SSSSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)CCCCCCCC)A       | M= 0.354 | X
X     A |Q= 34.|  ---->  |Q= 1955.|  ----->  S     <-----                   C  ---->   A A     | P= 29.75 | X
X     A ---------        ----------          S |                   M=  0.0  C A        A |     ------------ X
X     A                            M=  0.0   S |                            C |        A |         | C     X
X     A                                      S |                            C |        A |         | C     X
X     A                                      S |      ------------- P= 14.70 C |       A |         V C     X
X     A                                      S V M= 67.03|  AMINE   | M= 67.16 C |     A        TO OVBD OR X
X     A                                      S   T= 68.8 | BED 2 (21)| T= 71.5  C  M= 67.16 A    RECOVERY X
X     A          M= 67.03                                |Q   = -517.|AAAAAAAAAA(22)AAAAAAAAAAAA  M=  0.27 X
X     AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)AAAAAAAAAAA|MCO2= 0.140|  ---->       ---->      T= 70.0 X
X                    ----->                      ---->   |MH2O= 2.237|                                  X
X                                                        -------------                                  X
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SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL.  MISSION TIME:  72015. SEC (20.00 HR)   DATE: 01/26/85

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                                                                                  X
X          CABIN (2)                     CREW (1)                FROM CABIN                               *****          TO CABIN  X
X                                                                M= 9384.                                 *               M= 9387. X
X   VOLUME        = 8000. CU-FT   NO OF MEN    =  3              T= 69.4                                  *T= 69.8        T= 64.6  X
X   AIR MASS      = 595.91 LBM    TOTAL Q      =  900.0 B/HR      A          -------------            ------------            A    X
X   TEMP          =   69.4 F      METABOLIC Q =  300.0 B/HR/MAN   A          |SENSIBLE   |            |SENSIBLE   |           A    X
X   DEW PT        =   50.3 F        SENSIBLE   =  209.7 B/HR/MAN  A          |HX FAN (4) | T= 70.6    |HX (5)     |           A    X
X   TOTAL PRESS   = 14.71 PSIA       LATENT    =   90.3 B/HR/MAN  AAAAAAAAA|Q  =  2843.|AAAAAAAAAA|Q=-13643.  |AAAAAAAAAAAAAAAA  X
X   O2 PRESS      =   2.98 PSIA   O2 USAGE     = 0.1467 PPH         -----> |CFM=  2100.|          |           |   ------->      X
X   CO2 PRESS     =   2.79 MM-HG  CO2 PROD     = 0.1728 PPH                 -------------          ------------                    X
X   GAS LEAKAGE   = 0.083 PPH                                                                         *                            X
X   O2 MAKEUP     = 0.000 PPH                                                                    M=1393.  *                        X
X   N2 MAKEUP     = 0.000 PPH          FROM                                                      T= 60.0  *            TO CABIN    X
X   NON ECLSS Q:                       CABIN                                                     *********             M= 1395.    X
X     SENSIBLE    = 17065. B/HR        M= 1327.              ********                             ---->                T= 50.3     X
X     LATENT      =   255. B/HR        T= 69.4               *                                                           A         X
X   ECLSS Q:                             A                   *T= 53.7                                                    A A       X
X     SENSIBLE    =  5494. B/HR        | A              -------------                                       -------------  A |     X
X     LATENT      =   414. B/HR        | A   M= 1394. |REL. HUMD. |                          M= 1393.      |REL. HUMD. |  A |     X
X   REL HUMIDITY = 50.39 PCT           V A   T= 70.1  |HX (7)     | T= 48.9      M= 1351.     T= 48.9       |HX FAN (12)|  A |     X
X                                      (31)AAAAAAAAAA|Q= -8288.   |AAAAAAAAA(9)AAAAAAAAAAAAAAA(11)AAAAAAAAAAAAAAA|Q  = 478.  |AAA |  X
X                                        A   ----->  |            |  -----> A                  A      ----->  |CFM= 300.  |       X
X                                      A A          --------------         | A  --------------  A            -------------        X
X                                      | A M= 67.16         *              | A |H2O SEP (10)|  A M= 41.8                          X
X                                      | A T= 85.8          *M= 950.       V AA|Q   =  13.   |AAA T= 50.2                         X
X                                      | A                  *T= 45.0       .   |CFM =   9.   |                                    X
X   FROM CABIN .                       | A             ******                  --------------                                     X
X   M= 67.05                             A             ---->                   W   ---->  H2O INTERFACE: M ADDED =  33.212        X
X   T= 69.4                     ----------------                               WWWWWWWWWWW M=  1.0                                X
X       A                       |SAWD FAN (19)|                   <------                                                         X
X       A |                     |Q  = 171.    |AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                             X
X       A |                     |CFM=  15.    |                      P= 30.01                A A                                  X
X       A V                     ----------------  M=  1.73------------- M=  0.49              A |                                  X
X       A        M=  0.0                          T=290.1 |  AMINE    | T=164.7      M=  0.0  A |                                  X
X  (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)SSSSSSSSS| BED 1 (16)|CCCCCCCCCC(17)AAAAAAAAA(18)                               X
X       A                 ----->                S   ---->  |Q   = 1675.|  ---->     C     ---->   A    TO CABIN                  X
X       A  H2O INTERFACE                        S          |MCO2= 0.096|            C           A A    M=  0.0                   X
X       A  M USED =  18.755                     S A        |MH2O= 2.909|            C |         | A    T=164.7                   X
X       A    W                                  S |        -------------            C |         | A       A                      X
X       A  | W                         M=  1.73 S |                         M=  0.49C |         | A     A A                      X
X     | A  | W M=  1.73                         S |                                 C |         | A     | A                      X
X     | A  V W T= 70.0                          S |                                 C V           A     | A     -------------    X
X     | A --------   ---------                  S                                   C             A     | A     | CO2         |  X
X     | A |PUMP  |  T= 89.8|STEAM    | T=290.1  S        M=  0.0                  M=  0.49A       A M=  0.49 |ACCUM (32)|        X
X   V A |(28)    |WWWWWWWWW|GEN (29) |SSSSSSSS(25/26)SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)CCCCCCCC)A(CCCC(30)CCCCCCCC|         |  X
X       A |Q= 34.|  ---->  |Q= 1956.| ----->  S       <-----                      C     ---->       A       ---->      | M= 0.362 |  X
X       A --------         ----------           S |                                 C A             A A                | P= 29.95 |  X
X       A                              M=  0.0  S |                         M=  0.0 C |             A |                -----------  X
X       A                                       S |                                 C |             A |                  | C        X
X       A                                       S |        ------------- P= 14.71   C |             A |                  | C        X
X       A                                       S V M= 67.05|  AMINE    | M= 67.16   C |             A |                  V C        X
X       A         M= 67.05                      S   T= 69.4 | BED 2 (21)| T= 75.5    C     M= 67.16  A              TO OVBD OR    X
X       AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)AAAAAAAAAA|Q   = -537.|AAAAAAAAAA(22)AAAAAAAAAAAA                RECOVERY      X
X                         ----->                    ---->   |MCO2= 0.153|   ---->          ---->                    M=  0.53     X
X                                                           |MH2O= 2.037|                                           T= 70.0      X
X                                                           -------------                                                        X
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SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL.  MISSION TIME:  79215. SEC (22.00 HR)   DATE: 01/26/85

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                                                                                  X
X          CABIN (2)                    CREW (1)               FROM CABIN                              *****           TO CABIN    X
X                                                              M= 9306.                                *                M= 9389.   X
X  VOLUME        = 8000. CU-FT    NO OF MEN    =  3            T= 69.2                                 *T= 70.0         T= 65.1    X
X  AIR MASS      = 596.07 LBM     TOTAL Q      =  900.0 B/HR     A        -------------         ------------              A        X
X  TEMP          =   69.2 F       METABOLIC Q  =  300.0 B/HR/MAN A        |SENSIBLE   |         |SENSIBLE    |            A        X
X  DEW PT        =   50.3 F         SENSIBLE   =  210.1 B/HR/MAN A        |HX FAN (4) | T= 70.4 |HX (5)      |            A        X
X  TOTAL PRESS   = 14.71 PSIA       LATENT     =   89.9 B/HR/MAN AAAAAAAAA|Q  =  2843.|AAAAAAAAAA|Q=-12205.  |AAAAAAAAAAAAAAAA    X
X  O2 PRESS      =  2.99 PSIA     O2 USAGE     = 0.1467 PPH        -----> |CFM=  2100.|         |            |  -------->         X
X  CO2 PRESS     =  2.66 MM-HG    CO2 PROD     = 0.1728 PPH               -------------         ------------                       X
X  GAS LEAKAGE   = 0.083 PPH                                                                            *                          X
X  O2 MAKEUP     = 0.000 PPH                                                                    M=1225. *          TO CABIN        X
X  N2 MAKEUP     = 0.000 PPH           FROM                                                     T= 60.0 *          M= 1395.        X
X  NON ECLSS Q:                        CABIN                                                    *********          T= 50.3         X
X    SENSIBLE    = 17065. B/HR         M= 1326.            ********                              ---->                 A           X
X    LATENT      =   255. B/HR         T= 69.2             *                                                           A A         X
X  ECLSS Q:                              A                 *T= 53.7                                                    A |         X
X    SENSIBLE    =  5495. B/HR         | A           -------------                                        ------------- A |        X
X    LATENT      =   420. B/HR         | A   M= 1393. |REL. HUMD. |                         M= 1392.      |REL. HUMD. | A |        X
X  REL HUMIDITY  = 50.70 PCT           V A   T= 70.0  |HX (7)     | T= 48.9      M= 1351.     T= 48.9     |HX FAN (12)| A |        X
X                                     (31)AAAAAAAAAA|Q=' -8275.  |AAAAAAAAA(9)AAAAAAAAAAAAAAA(11)AAAAAAAAAAAAAA|Q  = 478.  |AAA |   X
X                                       A   ----->  |            |   -----> A                 A    ----->     |CFM= 300.  |        X
X                                     A A           -------------        | A --------------   A               -------------        X
X                                     | A M= 67.19       *               | A |H2O SEP (10)|  A M= 41.8                             X
X                                     | A T= 86.6        *M= 950.        V AA|Q  =  13.   |AAA T= 50.2                             X
X                                     | A                *T= 45.0            |CFM =   9.  |                                        X
X FROM CABIN                          | A             ******                 -------------                                         X
X M= 67.07                              A             ---->                        W   ---->  H2O INTERFACE: M ADDED =  35.744     X
X T= 69.2                       ----------------                                   WWWWWWWWWWW M=  1.0                             X
X    A                          |SAWD FAN (19)|                   <------                                                          X
X    A |                        |Q  = 171.    |AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                             X
X    A |                        |CFM=  15.    |                     P= 29.71                A A                                    X
X    A V                        ----------------      M=  1.73------------- M=  0.0         A |                                    X
X    A       M=  0.0                                  T=290.3 |  AMINE    | T=173.2      M=  0.0   A |                              X
X  (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)SSSSSSSSSS| BED 1 (16)|CCCCCCCCCC(17)AAAAAAAAA(18)                              X
X    A                     ----->             S   ---->   |Q   = 1727.|  ---->   C    ---->   A      TO CABIN                      X
X    A  H2O INTERFACE                         S           |MCO2= 0.068|          C           A A     M=  0.0                       X
X    A  M USED =  20.574                      S A         |MH2O= 2.867|          C |         | A     T=172.7                       X
X    A     W                                  S |         -------------          C |         | A       A                           X
X    A   | W                        M=  1.73  S |                        M=  0.0 C |         | A     A A                           X
X  | A   | W M=  1.73                         S |                                C |         | A     | A                           X
X  | A   V W T= 70.0                          S |                                C V           A     | A         -------------     X
X  | A --------            ----------         S                                  C             A     | A         | CO2       |     X
X  | A |PUMP  |   T= 89.8|STEAM    | T=290.3  S      M=  0.0                     C     M=  0.0 A       A M=  0.0 |ACCUM (32)|      X
X  V A |(28)  |WWWWWWWWW|GEN (29)|SSSSSSSS(25/26)SSSSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)CCCCCCCC)A(CCCC(30)CCCCCCCC|           |     X
X    A |Q= 34.|  ---->  |Q= 1956.|  ----->    S    <-----                        C    ---->    A          ----->  | M= 0.338 |     X
X    A --------          ----------           S |                              C A            A A               | P= 29.87 |     X
X    A                              M=  0.0   S |                      M=  0.0 C |            A |               -------------     X
X    A                                        S |                              C |            A |                  | C           X
X    A                                        S |         -------------- P= 14.71 C |         A |                  | C           X
X    A                                        S V M= 67.07|  AMINE     | M= 67.19 C |         A |                  V C           X
X    A       M= 67.07                         S   T= 69.2 | BED 2 (21)| T= 76.3  C    M= 67.19 A                TO OVBD OR       X
X    AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)AAAAAAAAAA|Q   = -563.|AAAAAAAAAA(22)AAAAAAAAAAAA                RECOVERY        X
X                          ----->                ---->    |MCO2= 0.099|   ---->        ---->                    M=  0.40        X
X                                                         |MH2O= 2.081|                                         T= 70.0         X
X                                                         -------------                                                            X
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SPACE STATION AIR REVITALIZATION SUBSYSTEM SAWD II DEMONSTRATION MODEL.  MISSION TIME:  86295. SEC (23.97 HR)   DATE: 01/26/85

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                                                                              X
X         CABIN (2)                   CREW (1)                 FROM CABIN                                                      X
X                                                              M= 9390.                                 *****          TO CABIN X
X  VOLUME        = 8000. CU-FT   NO OF MEN     =  3            T= 69.4                                  *              M= 9388. X
X  AIR MASS      = 596.22 LBM    TOTAL Q       =  900.0 B/HR     A                                      *T= 68.9       T= 63.6  X
X  TEMP          =  69.4 F       METABOLIC Q   =  300.0 B/HR/MAN A       -------------      ------------                   A      X
X  DEW PT        =  50.4 F         SENSIBLE    =  209.6 B/HR/MAN A       |SENSIBLE    |     |SENSIBLE   |                  A      X
X  TOTAL PRESS   = 14.72 PSIA      LATENT      =   90.4 B/HR/MAN A       |HX FAN (4)  | T= 70.6 |HX (5)  |                  A      X
X  O2 PRESS      =  3.00 PSIA    O2 USAGE      = 0.1467 PPH    AAAAAAAAA|Q  =  2843.|AAAAAAAAAA|Q=-15992. |AAAAAAAAAAAAAAAA       X
X  CO2 PRESS     =  2.55 MM-HG   CO2 PROD      = 0.1728 PPH      -----> |CFM=  2100.|          |          |    -------->          X
X  GAS LEAKAGE   = 0.083 PPH                                             -------------      ------------                          X
X  O2 MAKEUP     = 0.000 PPH                                                                            *                         X
X  N2 MAKEUP     = 0.000 PPH             FROM                                                  M=1800. *                          X
X  NON ECLSS Q:                          CABIN                                                 T= 60.0 *              TO CABIN X
X    SENSIBLE    = 17065. B/HR           M= 1328.            ********                          *********              M= 1395. X
X    LATENT      =   255. B/HR           T= 69.4             *                                   ---->                T= 50.4  X
X  ECLSS Q:                                A                 *T= 53.9                                                    A     X
X    SENSIBLE    =  5492. B/HR           | A              -------------                                                  A A   X
X    LATENT      =   505. B/HR           | A   M= 1395. |REL. HUMD.  |                                   -------------   A |   X
X  REL HUMIDITY  = 50.48 PCT             V A   T= 70.6  |HX (7)      | T= 49.0      M= 1352.       M= 1394.   |REL. HUMD. |  A |   X
X                                        (31)AAAAAAAAAA|Q= -8493.   |AAAAAAAAA(9)AAAAAAAAAAAAAAA(11)AAAAAAAAAAAAAA|HX FAN (12)|  A |   X
X                                          A    ----->  |            |   -----> A           A    ----->   |Q  = 478.  |AAA |   X
X                                        A A            -------------          | A          A              |CFM= 300.  |         X
X                                        | A M= 67.27        *                 | A -------------  A        -------------         X
X                                        | A T= 94.0         *M= 950.          | A |H2O SEP (10)| A M= 41.8                      X
X                                        | A                 *T= 45.0        V AA|Q   =   13.  |AAA T= 50.2                      X
X FROM CABIN                             | A             ******                  |CFM =    9.  |                                 X
X M= 67.06                                 A             ---->                   -------------                                   X
X T= 69.4                        --------------                                   W  ---->  H2O INTERFACE: M ADDED =  38.183     X
X     A                          |SAWD FAN (19)|                  <------        WWWWWWWWWWW M=  1.1                              X
X     A |                        |Q  =  171.   |AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                           X
X     A |                        |CFM=  15.    |                    P= 27.78           A A                                      X
X     A V                        --------------    M=  1.73------------- M=  0.0          A |                                      X
X     A      M=  0.0                               T=285.9 |  AMINE    | T=155.1    M=  0.0  A |                                      X
X   (14)AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(15)SSSSSSSSS| BED 1 (16)|CCCCCCCCCC(17)AAAAAAAAA(18)                                X
X     A                    ----->          S   ---->   |Q   = 1775.|  ---->  C    ---->  A     TO CABIN                          X
X     A   H2O INTERFACE                    S           |MCO2= 0.157|         C         A A     M=  0.0                           X
X     A   M USED =  22.011                 S A         |MH2O= 2.668|         C |       | A     T=152.7                           X
X     A     W                              S |         -------------         C |       | A        A                              X
X     A   | W                    M=  1.73  S |                       M=  0.0 C |       | A      A A                              X
X   | A   | W M=  1.73                     S |                               C |       | A      | A                              X
X   | A   V W T= 70.0                      S |                               C |         A      | A                              X
X   | A --------         ----------        S                                 C V         A      | A              ------------    X
X   | A |PUMP   |  T= 89.8|STEAM    | T=285.9  S      M=  0.0                 C           A      | A              | CO2      |    X
X   V A |(28)   |WWWWWWWWW|GEN (29)|SSSSSSSS(25/26)SSSSSSSSSSSSSSSSSSSSSSSSSSSS(23/24)CCCCCCCC)A(CCCC(30)CCCCCCCC|ACCUM (32)|    X
X     A |Q= 34.|  ---->   |Q= 1953.|  ----->  S    <-----                      C     ---->  A               .----> |          |    X
X     A --------         ----------         S |                              C     M=  0.0 A                     | M= 0.312 |    X
X     A                                     S |                              C A           A A                   | P= 27.72 |    X
X     A                        M=  0.0      S |                      M=  0.0 C |           A |                   ------------    X
X     A                                     S |                              C |           A |                      | C          X
X     A                                     S |      -------------  P= 14.72 C |           A |                      | C          X
X     A                                     S V M= 67.06|  AMINE    | M= 67.27 C |           A |                      V C          X
X     A       M= 67.06                      S   T= 69.4 | BED 2 (21)| T= 83.7  C    M= 67.27 A                   TO OVBD OR       X
X    AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA(20)AAAAAAAAAA|Q   = -758.|AAAAAAAAAA(22)AAAAAAAAAAAA                RECOVERY      X
X                      ----->                  ---->    |MCO2= 0.072|   ---->       ---->                 M=  0.27        X
X                                                       |MH2O= 2.088|                                     T= 70.0         X
X                                                       -------------                                                    X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

FINAL RESULTS

ESCM: BASELINE, VOL = 8000 FT-3, PCO_2 = 2.5, .275 PPH AVERAGE

COMPONENT SOLUTION RESULTS AT END OF TRANSIENT, TIME = 86400.0 SEC SYSTEM PASS = 5760

ESCM: BASELINE, VOL = 8000 FT-3, PCO2 = 2.5, .275 PPH AVERAGE

ORIGINAL PAGE IS
OF POOR QUALITY

KSYPAS= 5760 TIME= 86400.0

COMPONENT NO. = SUBR. TYPE =		1 SUITS	2 CABIN	3 SPLIT	4 FAN	5 ANYHX	6 ALTCOM	7 ANYHX	8 ALTCOM
VR									
1-TOTAL PRI FLOW	P	9391.98	9388.71	1326.52	9391.59	9391.59	1438.53	1393.77	950.000
2-TEMPERATURE	R	64.9568	69.4055	69.4055	70.6439	64.5301	60.0000	48.9429	45.0000
3-DUCT OUTLET P	I	14.7228	14.7228	14.7228	14.7228	14.7228	50.0000	14.7228	50.0000
4-COMP OUTLET P	M	14.7228	14.7228	14.7228	14.7228	14.7228	50.0000	14.7228	50.0000
5-NON-COND FLOW	A	9319.47	9316.53	1316.33	9319.43	9319.43	.0	1382.62	.0
6-COND VAP FLOW	R	72.5153	72.1405	10.1927	72.1626	72.1626	.0	10.1305	.0
7-COND LIQ FLOW	Y	.0	.0	.0	.0	.0	.0	1.02096	.0
8-N-C SP HEAT		.242897	.242888	.242888	.242888	.242888	.0	.242896	.0
9-N-C MOL WT	S	28.8893	28.8896	28.8896	28.8896	28.8896	.0	28.8876	.0
10-OXYGEN FLOW	I	2128.83	2128.44	300.726	2129.10	2129.10	.0	315.933	.0
11-DILUENT FLOW	D	7142.16	7139.97	1008.80	7142.16	7142.16	.0	1059.81	.0
12-CO2 FLOW	E	48.4414	48.1675	6.80554	48.1823	48.1823	.0	6.87158	.0
13-TRACE CTM FLOW		.0	.0	.0	.0	.0	.0	.0	.0
14-SPCL FLOW 1	D	.0	.0	.0	.0	.0	.0	.0	.0
15-SPCL FLOW 2	A	.0	.0	.0	.0	.0	.0	.0	.0
16-SPCL FLOW 3	T	.0	.0	.0	.0	.0	.0	.0	.0
17-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
18-SPCL FLOW 5		.0	.0	.0	.0	.0	.0	.0	.0
19-SPCL FLOW 6		.0	.0	.0	.0	.0	.0	.0	.0
20-TOTAL SEC FLOW	S	.0	1395.46	67.0828	.0	1438.53	.0	950.000	.0
21-TEMPERATURE	E	.0	69.4055	69.4055	.0	69.7442	.0	53.8414	.0
22-DUCT OUTLET P	C	.0	14.7228	14.7228	.0	50.0000	.0	50.0000	.0
23-COMP OUTLET P	O	.0	14.7228	14.7228	.0	50.0000	.0	50.0000	.0
24-NON-COND FLOW	N	.0	1384.74	68.4081	.0	.0	.0	.0	.0
25-COND VAP FLOW	D	.0	10.7224	.529700	.0	.0	.0	.0	.0
26-COND LIQ FLOW	A	.0	.0	.0	.0	.0	.0	.0	.0
27-N-C SP HEAT	R	.0	.242897	.242897	.0	.0	.0	.0	.0
28-N-C MOL WT	Y	.0	28.8896	28.8896	.0	.0	.0	.0	.0
29-OXYGEN FLOW		.0	316.354	15.6284	.0	.0	.0	.0	.0
30-DILUENT FLOW	S	.0	1061.23	52.4261	.0	.0	.0	.0	.0
31-CO2 FLOW	I	.0	7.15921	.353676	.0	.0	.0	.0	.0
32-TRACE CTM FLOW	D	.0	.0	.0	.0	.0	.0	.0	.0
33-SPCL FLOW 1	E	.0	.0	.0	.0	.0	.0	.0	.0
34-SPCL FLOW 2		.0	.0	.0	.0	.0	.0	.0	.0
35-SPCL FLOW 3	D	.0	.0	.0	.0	.0	.0	.0	.0
36-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
37-SPCL FLOW 5	T	.0	.0	.0	.0	.0	.0	.0	.0
38-SPCL FLOW 6	A	.0	.0	.0	.0	.0	.0	.0	.0
39-DH, C, DP PRI	P	.0	.0	.0	.0	.0	.0	.0	.0
40-LE, N, K DUCT	R	.0	.0	.0	.0	.0	.0	.0	.0
41-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
42-DH, C, DP PRI	S	.0	.0	.0	.0	.0	.0	.0	.0
43-LE, N, K COMP	S	.0	.0	.0	.0	.0	.0	.0	.0
44-FF AREA		.0	.0	.0	.0	.0	.0	.0	.0
45-DH, C, DP SEC	C	.0	.0	.0	.0	.0	.0	.0	.0
46-LE, N, K DUCT	O	.0	.0	.0	.0	.0	.0	.0	.0
47-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
48-DH, C, DP SEC	F	.0	.0	.0	.0	.0	.0	.0	.0
49-LE, N, K COMP	F	.0	.0	.0	.0	.0	.0	.0	.0
50-FF AREA		.0	.0	.0	.0	.0	.0	.0	.0
51-COMP SOURCE TEMP		.0	.0	.0	.0	.0	.0	.0	.0

VR(5,117)= .0	VR(5,118)= .0	VR(5,119)= .0	VR(5,120)= .0	VR(5,121)= .0
VR(5,122)= .0	VR(5,123)= .0	VR(5,124)= .0	VR(5,125)= .0	VR(5,126)= .0
VR(6, 65)= .0	VR(6, 66)= .0	VR(7, 65)= 8399.4	VR(7, 66)= 956.07	VR(7, 67)= .84488
VR(7, 68)= 1.0210	VR(7, 69)= .0	VR(7, 70)= .41213	VR(7, 71)= 2.4419	VR(7, 72)= .28096
VR(7, 73)= 1.0000	VR(7, 74)= .0	VR(7, 75)= .0	VR(7, 76)= .0	VR(7, 77)= .0
VR(7, 78)= .0	VR(7, 79)= .0	VR(7, 80)= .0	VR(7, 81)= .0	VR(7, 82)= .0
VR(7, 83)= .0	VR(7, 84)= .0	VR(7, 85)= .0	VR(7, 86)= .0	VR(7, 87)= .0
VR(7, 88)= .0	VR(7, 89)= .0	VR(7, 90)= .0	VR(7, 91)= .0	VR(7, 92)= .0
VR(7, 93)= .0	VR(7, 94)= .0	VR(7, 95)= .0	VR(7, 96)= .0	VR(7, 97)= .0
VR(7, 98)= .0	VR(7, 99)= .0	VR(7,100)= .0	VR(7,101)= .0	VR(7,102)= .0
VR(7,103)= .0	VR(7,104)= .0	VR(7,105)= .0	VR(7,106)= .0	VR(7,107)= .0
VR(7,108)= .0	VR(7,109)= .0	VR(7,110)= .0	VR(7,111)= .0	VR(7,112)= .0
VR(7,113)= .0	VR(7,114)= .0	VR(7,115)= .0	VR(7,116)= .0	VR(7,117)= .0
VR(7,118)= .0	VR(7,119)= .0	VR(7,120)= .0	VR(7,121)= .0	VR(7,122)= .0
VR(7,123)= .0	VR(7,124)= .0	VR(7,125)= .0	VR(7,126)= .0	VR(8, 65)= .0
VR(8, 66)= .0	VR(			

COMPONENT NO. =	1	2	3	4	5	6	7	8
SUBR. TYPE =	SUITS	CABIN	SPLIT	FAN	ANYHX	ALTCOM	ANYHX	ALTCOM
KR								
1-SUBR NO./EXV/EXK	2001000	1025000	10000000	23000000	4000000	49000002	4000000	49000000
2-PRI SOR/FLO CODE	502	102	-202	202	402	0	3102	0
3-PRI SPFL TYP 1-3	0	0	0	0	0	10000	0	10000
4-PRI SPFL TYP 4-6	0	0	0	0	0	0	0	0
5-SEC SOR/FLO CODE	0	-1302	2	0	-600	0	-800	0
6-SEC SPFL TYP 1-3	0	0	0	0	10000	0	10000	0
7-SEC SPFL TYP 4-6	0	0	0	0	0	0	0	0
8-NEXT COMP/CABIN	1400002	300002	400002	500002	100002	2	900002	2
9-COMP NSTR 1-9	0	101011000	0	100000000	200000000	0	200000000	0
10-COMP NSTR 10-18	100	0	0	0	100	0	100	0
11-NCFL/NLFL/NPASS	5760	5760	5760	5760	5760	0	5760	0
12-PRI VISC/DENSITY	0	0	0	0	0	0	0	0
13-PRI OP/DP/OP/DP	0	0	0	0	0	0	0	0
14-SEC VISC/DENSITY	0	0	0	0	0	0	0	0
15-SEC OP/DP/OP/DP	0	0	0	0	0	0	0	0

SUBROUTINE DEPENDENT K ARRAY DATA - - -

KR(1, 16)= 3	KR(2, 16)= 0	KR(2, 17)= 0	KR(4, 16)= 0	KR(4, 17)= 0
KR(4, 18)= 0	KR(5, 16)= 0	KR(6, 16)= 0	KR(6, 17)= 0	KR(7, 16)= 0

52-EFF SUMMED COND	.0	.0	.0	.0	.0	.0	.0	.0
53-COMP QTOTOL LOSS	.0	.0	.0	.0	.0	.0	.0	.0
54-AMBIENT GAS TEMP	.0	.0	.0	.0	.0	.0	.0	.0
55-AMBIENT UA	.0	.0	.0	.0	.0	.0	.0	.0
56-AMB CONV Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
57-AMB WALL TEMP	.0	.0	.0	.0	.0	.0	.0	.0
58-AMB SCRIPT(F)*A	.0	.0	.0	.0	.0	.0	.0	.0
59-AMB RAD Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
60-STRUCTURE TEMP	.0	.0	.0	.0	.0	.0	.0	70.0000
61-STRUCTURE KA/X	.0	.0	.0	.0	.0	.0	.0	.800000
62-STRUCTURE Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
63-INSULATION TEMP	.0	.0	.0	.0	.0	.0	.0	70.0000
64-INSULATION KA/X	.0	.0	.0	.0	.0	.0	.0	.800000

SUBROUTINE DEPENDENT V ARRAY DATA - - -

VR(9, 65)= .0	VR(9, 66)= .30000E-01	VR(9, 67)= 1.0000	VR(9, 68)= .30000E-01	VR(9, 69)= .30000E-01
VR(9, 70)= .30000E-01	VR(9, 71)= .30000E-01	VR(9, 72)= .30000E-01	VR(10, 65)= 13.106	VR(10, 66)= .0
VR(10, 67)= 1.0210	VR(11, 65)= 48.945	VR(12, 65)= 477.82	VR(12, 66)= .0	VR(12, 67)= .0
VR(12, 68)= .0	VR(12, 69)= .0	VR(12, 70)= .0	VR(12, 71)= .0	VR(12, 72)= .0
VR(12, 73)= .0	VR(12, 74)= .0	VR(12, 75)= .0	VR(12, 76)= 300.00	VR(12, 77)= .0
VR(12, 78)= .0	VR(12, 79)= .0	VR(12, 80)= .0	VR(12, 81)= .0	VR(12, 82)= .0
VR(12, 83)= .0	VR(12, 84)= 1.0000	VR(12, 85)= .0	VR(12, 86)= .0	VR(12, 87)= .0
VR(12, 88)= .0	VR(12, 89)= .0	VR(12, 90)= .0	VR(12, 91)= 140.00	VR(12, 92)= .0
VR(12, 93)= .0	VR(13, 65)= 48.945	VR(14, 65)= 1.0000	VR(15, 65)= 247.83	VR(16, 65)= 1270.0
VR(16, 66)= .31400	VR(16, 67)= 32.700	VR(16, 68)= .31900	VR(16, 69)= 15.000	VR(16, 70)= -1544.3
VR(16, 71)= 1544.3	VR(16, 72)= .43669	VR(16, 73)= 1.5352	VR(16, 74)= 1.5000	VR(16, 75)= .40000
VR(16, 76)= .60400	VR(16, 77)= 70.000	VR(16, 78)= 8.5000	VR(16, 79)= 7.4000	VR(16, 80)= 2.7156
VR(16, 81)= .13848	VR(16, 82)= .31948	VR(16, 83)= .16292E-01	VR(16, 84)= .12000	VR(16, 85)= 180.00
VR(16, 86)= 2280.0	VR(16, 87)= 240.00	VR(16, 88)= .0	VR(16, 89)= .0	VR(16, 90)= .0
VR(16, 91)= .0	VR(16, 92)= .0	VR(16, 93)= .47000	VR(16, 94)= .33000	VR(16, 95)= .10000E+06
VR(16, 96)= .0	VR(16, 97)= .0	VR(16, 98)= .0	VR(16, 99)= .0	VR(16,100)= .10640E-02
VR(16,101)= 243.95	VR(16,102)= 14.700	VR(16,103)= 26.896	VR(16,104)= .45238E-07	VR(16,105)= .10640E-02
VR(16,106)= .0	VR(16,107)= .20000	VR(16,108)= 44.010	VR(16,109)= .12965E-24	VR(16,110)= .43517E-24
VR(16,111)= .45238E-07	VR(16,112)= .0	VR(16,113)= .0	VR(16,114)= .0	VR(16,115)= .0
VR(16,116)= .0	VR(16,117)= .0	VR(16,118)= .0	VR(16,119)= 243.95	VR(16,120)= .12277E-02
VR(16,121)= .52477	VR(16,122)= 1.7000	VR(16,123)= 1.4800	VR(16,124)= .16584E-01	VR(16,125)= .0
VR(16,126)= .0	VR(16,127)= .94000E-01	VR(16,128)= .0	VR(16,129)= .0	VR(16,130)= .10693E-02
VR(16,131)= 243.91	VR(16,132)= 14.700	VR(16,133)= 26.896	VR(16,134)= .89773E-05	VR(16,135)= .10604E-02
VR(16,136)= .0	VR(16,137)= .20000	VR(16,138)= 44.010	VR(16,139)= .14944E-24	VR(16,140)= .50157E-24
VR(16,141)= .89773E-05	VR(16,142)= .0	VR(16,143)= .0	VR(16,144)= .0	VR(16,145)= .0
VR(16,146)= .0	VR(16,147)= .0	VR(16,148)= .0	VR(16,149)= 243.91	VR(16,150)= .15475E-02
VR(16,151)= .59874	VR(16,152)= 1.7000	VR(16,153)= 1.4800	VR(16,154)= .16584E-01	VR(16,155)= .0
VR(16,156)= .0	VR(16,157)= .94000E-01	VR(16,158)= .0	VR(16,159)= .0	VR(16,160)= .10916E-02
VR(16,161)= 245.47	VR(16,162)= 14.700	VR(16,163)= 27.636	VR(16,164)= .11441E-05	VR(16,165)= .10904E-02
VR(16,166)= .0	VR(16,167)= .20000	VR(16,168)= 44.010	VR(16,169)= .15804E-21	VR(16,170)= .53045E-21
VR(16,171)= .11441E-05	VR(16,172)= .0	VR(16,173)= .0	VR(16,174)= .0	VR(16,175)= .0
VR(16,176)= .0	VR(16,177)= .0	VR(16,178)= .0	VR(16,179)= 245.47	VR(16,180)= .26893E-02
VR(16,181)= .65041	VR(16,182)= 1.7000	VR(16,183)= 1.4800	VR(16,184)= .16584E-01	VR(16,185)= .0
VR(16,186)= .0	VR(16,187)= .94000E-01	VR(16,188)= .0	VR(16,189)= .0	VR(16,190)= .15302E-02
VR(16,191)= 171.39	VR(16,192)= 14.700	VR(16,193)= 27.636	VR(16,194)= .52706E-03	VR(16,195)= .10031E-02
VR(16,196)= .0	VR(16,197)= .20000	VR(16,198)= 44.010	VR(16,199)= .54055E-17	VR(16,200)= .18143E-16
VR(16,201)= .52706E-03	VR(16,202)= .0	VR(16,203)= .0	VR(16,204)= .0	VR(16,205)= .0
VR(16,206)= .0	VR(16,207)= .0	VR(16,208)= .0	VR(16,209)= 171.39	VR(16,210)= .55183E-01
VR(16,211)= .52083	VR(16,212)= 1.7000	VR(16,213)= 1.4800	VR(16,214)= .16584E-01	VR(16,215)= .0
VR(16,216)= .0	VR(16,217)= .94000E-01	VR(16,218)= .0	VR(16,219)= .0	VR(16,220)= .27912E-02
VR(16,221)= 161.40	VR(16,222)= 14.700	VR(16,223)= 28.309	VR(16,224)= .25779E-02	VR(16,225)= .21336E-03
VR(16,226)= .0	VR(16,227)= .20000	VR(16,228)= 44.010	VR(16,229)= .19346E-15	VR(16,230)= .64933E-15
VR(16,231)= .25779E-02	VR(16,232)= .0	VR(16,233)= .0	VR(16,234)= .0	VR(16,235)= .0
VR(16,236)= .0	VR(16,237)= .0	VR(16,238)= .0	VR(16,239)= 161.40	VR(16,240)= .77787E-01

UNITED TECHNOLOGIES HAMILTON STANDARD

SVHSER 9503

ORIGINAL PAGE IS OF POOR QUALITY

KSYPAS= 5760 TIME= 86400.0

COMPONENT NO. =		17	18	19	20	21	22	23	24
SUBR. TYPE =		SPLIT	GASMIX	FAN	GASMIX	IR45	SPLIT	GASMIX	SPLIT
VR									
1-TOTAL PRI FLOW	P	.0	67.2456	67.2456	67.0828	67.2456	67.2456	.0	.0
2-TEMPERATURE	R	157.310	79.6027	89.9208	69.4055	79.6027	79.6027	157.013	157.013
3-DUCT OUTLET P	I	28.4045	14.7228	14.7228	14.7228	14.7228	14.7228	14.7228	14.7228
4-COMP OUTLET P	M	28.4045	14.7228	14.7228	14.7228	14.7228	14.7228	14.7228	14.7228
5-NON-COND FLOW	A	.0	66.2868	66.2868	66.5674	66.2868	66.2868	.0	.0
6-COND VAP FLOW	R	.0	.958824	.958824	.515447	.958824	.958824	.0	.0
7-COND LIQ FLOW	Y	.0	.0	.0	.0	.0	.0	.0	.0
8-N-C SP HEAT		.242193	.243067	.243067	.242888	.243067	.243067	.0	.200128
9-N-C MOL WT	S	29.0517	28.8480	28.8480	28.8896	28.8480	28.8480	.0	43.9413
10-OXYGEN FLOW	I	.0	15.2072	15.2072	15.2078	15.2072	15.2072	.0	.0
11-DILUENT FLOW	D	.0	51.0136	51.0136	51.0154	51.0136	51.0136	.0	.0
12-CO2 FLOW	E	.0	.660405E-01	.660405E-01	.344159	.660405E-01	.660405E-01	.0	.0
13-TRACE CTM FLOW		.0	.0	.0	.0	.0	.0	.0	.0
14-SPCL FLOW 1	D	.0	.0	.0	.0	.0	.0	.0	.0
15-SPCL FLOW 2	A	.0	.0	.0	.0	.0	.0	.0	.0
16-SPCL FLOW 3	T	.0	.0	.0	.0	.0	.0	.0	.0
17-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
18-SPCL FLOW 5		.0	.0	.0	.0	.0	.0	.0	.0
19-SPCL FLOW 6		.0	.0	.0	.0	.0	.0	.0	.0
20-TOTAL SEC FLOW	S	.0	.0	.0	.0	.0	.0	.0	.0
21-TEMPERATURE	E	157.310	.0	.0	.0	.0	79.6027	.0	157.013
22-DUCT OUTLET P	C	28.4045	.0	.0	.0	.0	14.7228	.0	14.7228
23-COMP OUTLET P	O	28.4045	.0	.0	.0	.0	14.7228	.0	14.7228
24-NON-COND FLOW	N	.0	.0	.0	.0	.0	.0	.0	.0
25-COND VAP FLOW	D	.0	.0	.0	.0	.0	.0	.0	.0
26-COND LIQ FLOW	A	.0	.0	.0	.0	.0	.0	.0	.0
27-N-C SP HEAT	R	.200128	.0	.0	.0	.0	.243113	.0	.243113
28-N-C MOL WT	Y	43.9413	.0	.0	.0	.0	28.8378	.0	28.8378
29-OXYGEN FLOW		.0	.0	.0	.0	.0	.0	.0	.0
30-DILUENT FLOW	S	.0	.0	.0	.0	.0	.0	.0	.0
31-CO2 FLOW	I	.0	.0	.0	.0	.0	.0	.0	.0
32-TRACE CTM FLOW	D	.0	.0	.0	.0	.0	.0	.0	.0
33-SPCL FLOW 1	E	.0	.0	.0	.0	.0	.0	.0	.0
34-SPCL FLOW 2		.0	.0	.0	.0	.0	.0	.0	.0
35-SPCL FLOW 3	D	.0	.0	.0	.0	.0	.0	.0	.0
36-SPCL FLOW 4	A	.0	.0	.0	.0	.0	.0	.0	.0
37-SPCL FLOW 5	T	.0	.0	.0	.0	.0	.0	.0	.0
38-SPCL FLOW 6	A	.0	.0	.0	.0	.0	.0	.0	.0
39-DH, C, DP PRI	P	.0	.0	.0	.0	.0	.0	.0	.0
40-LE, N, K DUCT	R	.0	.0	.0	.0	.0	.0	.0	.0
41-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
42-DH, C, DP PRI	S	.0	.0	.0	.0	.0	.0	.0	.0
43-LE, N, K COMP	S	.0	.0	.0	.0	.0	.0	.0	.0
44-FF AREA		.0	.0	.0	.0	.0	.0	.0	.0
45-DH, C, DP SEC	C	.0	.0	.0	.0	.0	.0	.0	.0
46-LE, N, K DUCT	O	.0	.0	.0	.0	.0	.0	.0	.0
47-FF AREA	E	.0	.0	.0	.0	.0	.0	.0	.0
48-DH, C, DP SEC	F	.0	.0	.0	.0	.0	.0	.0	.0
49-LE, N, K COMP	F	.0	.0	.0	.0	.0	.0	.0	.0
50-FF AREA		.0	.0	.0	.0	.0	.0	.0	.0
51-COMP SOURCE TEMP		.0	.0	.0	.0	.0	.0	.0	.0

VR(24, 65)= .0 VR(

COMPONENT NO. = / SUBR. TYPE =	17 SPLIT	18 GASMIX	19 FAN	20 GASMIX	21 IR45	22 SPLIT	23 GASMIX	24 SPLIT
KR								
1-SUBR NO./EXV/EXK	10000000	6000000	23000000	6000000	73000000	10000000	6000000	10000000
2-PRI SOR/FLO CODE	1602	1702	1802	-1402	2002	2102	-2202	2302
3-PRI SPFL TYP 1-3	0	0	0	0	0	0	0	0
4-PRI SPFL TYP 4-6	0	0	0	0	0	0	0	0
5-SEC SOR/FLO CODE	2	-2200	0	2600	0	2	1700	2
6-SEC SPFL TYP 1-3	0	0	0	0	0	0	0	0
7-SEC SPFL TYP 4-6	0	0	0	0	0	0	0	0
8-NEXT COMP/CABIN	2000002	1900002	3000002	2100002	2200002	2300002	2400002	1800002
9-COMP NSTR 1-9	0	0	3000000	200000000	0	0	0	0
10-COMP NSTR 10-18	0	0	0	0	0	0	0	0
11-NCFL/NLFL/NPASS	5760	5760	5760	5760	5760	5760	5760	5760
12-PRI VISC/DENSITY	0	0	0	0	0	0	0	0
13-PRI OP/DP/OP/DP	0	0	0	0	0	0	0	0
14-SEC VISC/DENSITY	0	0	0	0	0	0	0	0
15-SEC OP/DP/OP/DP	0	0	0	0	0	0	0	0

SUBROUTINE DEPENDENT K ARRAY DATA - - -

KR(19, 16)= 0 KR(19, 17)= 0 KR(19, 18)= 0 KR(21, 16)= 0 KR(21, 17)= 16
KR(21, 18)= 0 KR(21, 19)= 5 KR(21, 20)= 20 KR(

52-EFF SUMMED COND	.0	.0	.0	.0	.0	.0	.0	.0
53-COMP QTOTOL LOSS	.0	.0	.0	.0	.0	.0	.0	.0
54-AMBIENT GAS TEMP	.0	.0	.0	.0	.0	.0	.0	.0
55-AMBIENT UA	.0	.0	.0	.0	.0	.0	.0	.0
56-AMB CONV Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
57-AMB WALL TEMP	.0	.0	.0	.0	.0	.0	.0	.0
58-AMB SCRIPT(F)*A	.0	.0	.0	.0	.0	.0	.0	.0
59-AMB RAD Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
60-STRUCTURE TEMP	.0	.0	.0	.0	.0	.0	.0	.0
61-STRUCTURE KA/X	.0	.0	.0	.0	.0	.0	.0	.0
62-STRUCTURE Q LOSS	.0	.0	.0	.0	.0	.0	.0	.0
63-INSULATION TEMP	.0	.0	.0	.0	.0	.0	.0	.0
64-INSULATION KA/X	.0	.0	.0	.0	.0	.0	.0	.0

SUBROUTINE DEPENDENT V ARRAY DATA - - -

```
VR(  25, 65)=  247.83       VR(  26, 65)=  .0           VR(  27, 65)=  .0           VR(  27, 66)=  .0        VR(  27, 67)=  .0
VR(  27, 68)=  168.30       VR(  27, 69)=  146.21       VR(  27, 70)=  70.000       VR(  27, 71)=  2.6971    VR(  27, 72)=  28.817
VR(  27, 73)=  .0           VR(  27, 74)=  .0           VR(  27, 75)=  .0           VR(  27, 76)=  .0        VR(  27, 77)=  .0
VR(  27, 78)=  .0           VR(  27, 79)=  .0           VR(  27, 80)=  .0           VR(  27, 81)=  .0        VR(  27, 82)=  .0
VR(  27, 83)=  .0           VR(  27, 84)=  .0           VR(  27, 85)=  .0           VR(  27, 86)=  .0        VR(  27, 87)=  .0
VR(  27, 88)=  1.0000       VR(  27, 89)=  62.400       VR(  27, 90)=  2.4200       VR(  27, 91)=  18.016    VR(  27, 92)=  .0
VR(  27, 93)=  .0           VR(  27, 94)=  .0           VR(  27, 95)=  .0           VR(  27, 96)=  .0        VR(  27, 97)= -1.7270
VR(  27, 98)=  22.061       VR(  27, 99)=  38.213       VR(  27,100)=  1.7270       VR(  28, 65)=  34.130    VR(  28, 66)=  .0
VR(  28, 67)=  .0           VR(  28, 68)=  .0           VR(  28, 69)=  .0           VR(  28, 70)=  .0        VR(  28, 71)=  .0
VR(  28, 72)=  .0           VR(  28, 73)=  .0           VR(  28, 74)=  .0           VR(  28, 75)=  .0        VR(  28, 76)=  .0
VR(  28, 77)=  .0           VR(  28, 78)=  .0           VR(  28, 79)=  1.0000       VR(  28, 80)=  .0        VR(  28, 81)=  .0
VR(  28, 82)=  .0           VR(  28, 83)=  .0           VR(  28, 84)=  .0           VR(  28, 85)=  10.000    VR(  29, 65)=  .0
VR(  29, 66)=  40.000       VR(  29, 67)=  247.83       VR(  29, 68)=  572.75       VR(  29, 69)=  .0        VR(  29, 70)=  .0
VR(  30, 65)=  .0           VR(  31, 65)=  51.448       VR(  32, 65)=  .0           VR(  32, 66)=  .0        VR(  32, 67)=  .0
VR(  32, 68)=  .0           VR(  32, 69)=  .32559       VR(  32, 70)=  70.000       VR(  32, 71)=  2.0000    VR(  32, 72)=  28.592
VR(  32, 73)=  .25242       VR(  32, 74)=  .73079E-01   VR(  32, 75)=  .93537E-04   VR(  32, 76)=  .20373    VR(  32, 77)=  42.092
VR(  32, 78)=  .50143E-02   VR(  32, 79)=  .16849E-01   VR(  32, 80)=  .23055       VR(  32, 81)=  .0        VR(  32, 82)=  .0
VR(  32, 83)=  .0           VR(  32, 84)=  .0           VR(  32, 85)=  .0           VR(  32, 86)=  .0        VR(  32, 87)=  .0
VR(  32, 88)=  .25812       VR(  32, 89)=  .16408       VR(  32, 90)=  .44000       VR(  32, 91)=  32.377    VR(  32, 92)=  .0
VR(  32, 93)=  .0           VR(  32, 94)=  .0           VR(  32, 95)=  .0           VR(  32, 96)=  .0        VR(  32, 97)= -.27500
```

COMPONENT NO. =	25	26	27	28	29	30	31	32
SUBR. TYPE =	GASMIX	SPLIT	TANKG	PUMP	SMGEN	SPLIT	GASMIX	TANKG
KR								
1-SUBR NO./EXV/EXK	6000000	10000000	30003000	22000000	27000000	10000000	6000000	30000001
2-PRI SOR/FLO CODE	2902	2502	0	2700	2802	2402	302	3002
3-PRI SPFL TYP 1-3	0	0	10000	10000	0	0	0	0
4-PRI SPFL TYP 4-6	0	0	0	0	0	0	0	0
5-SEC SOR/FLO CODE	2400	2	0	0	0	2	-1900	0
6-SEC SPFL TYP 1-3	0	0	0	0	0	0	0	0
7-SEC SPFL TYP 4-6	0	0	0	0	0	0	0	0
8-NEXT COMP/CABIN	2600002	1500002	2800002	2900002	2500002	3200002	700002	3100002
9-COMP NSTR 1-9	0	0	110100000	200000	10000000	0	0	10000000
10-COMP NSTR 10-18	0	0	0	0	0	0	0	0
11-NCFL/NLFL/NPASS	5760	5760	5760	5760	5760	5760	5760	5760

UNITED TECHNOLOGIES
HAMILTON STANDARD

SVHSER 9503

IBM CLOCK TIME(HH-MM-SS) = 16:03:25

C 3

INPUT CARD IMAGES LISTED BELOW

ICUT = 0 IPRT = 0
ENDR

UNITED TECHNOLOGIES
HAMILTON STANDARD

Appendix D

Sample Plots

UNITED TECHNOLOGIES
HAMILTON STANDARD

The following plots in this Appendix were obtained from the data generated by the sample problem of Appendix C. The Hamilton Standard MERIAM program was used to generate a tape for use on the CALCOMP plotter. The procedure described in Section 4.3 was used with the plotting files shown in Appendix B.

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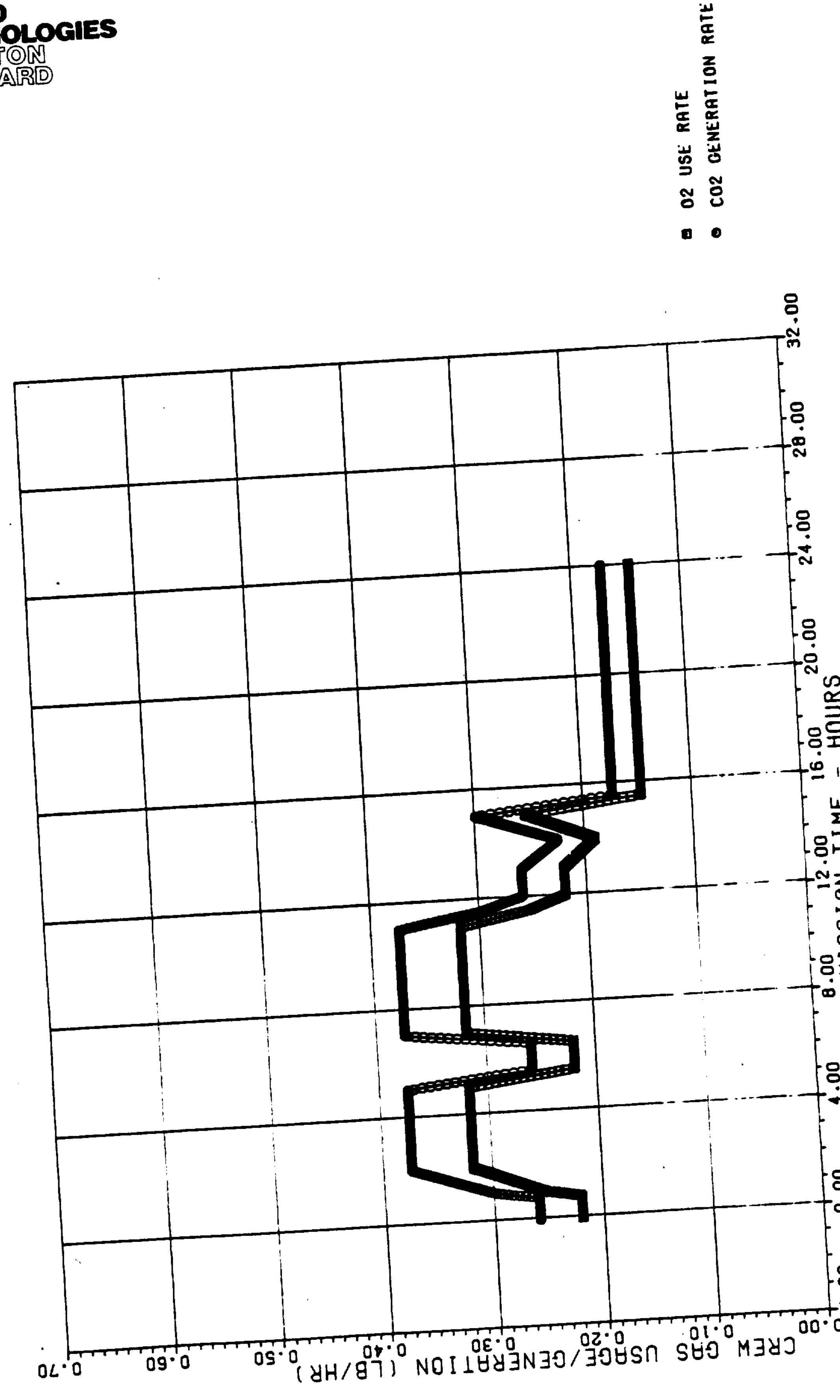
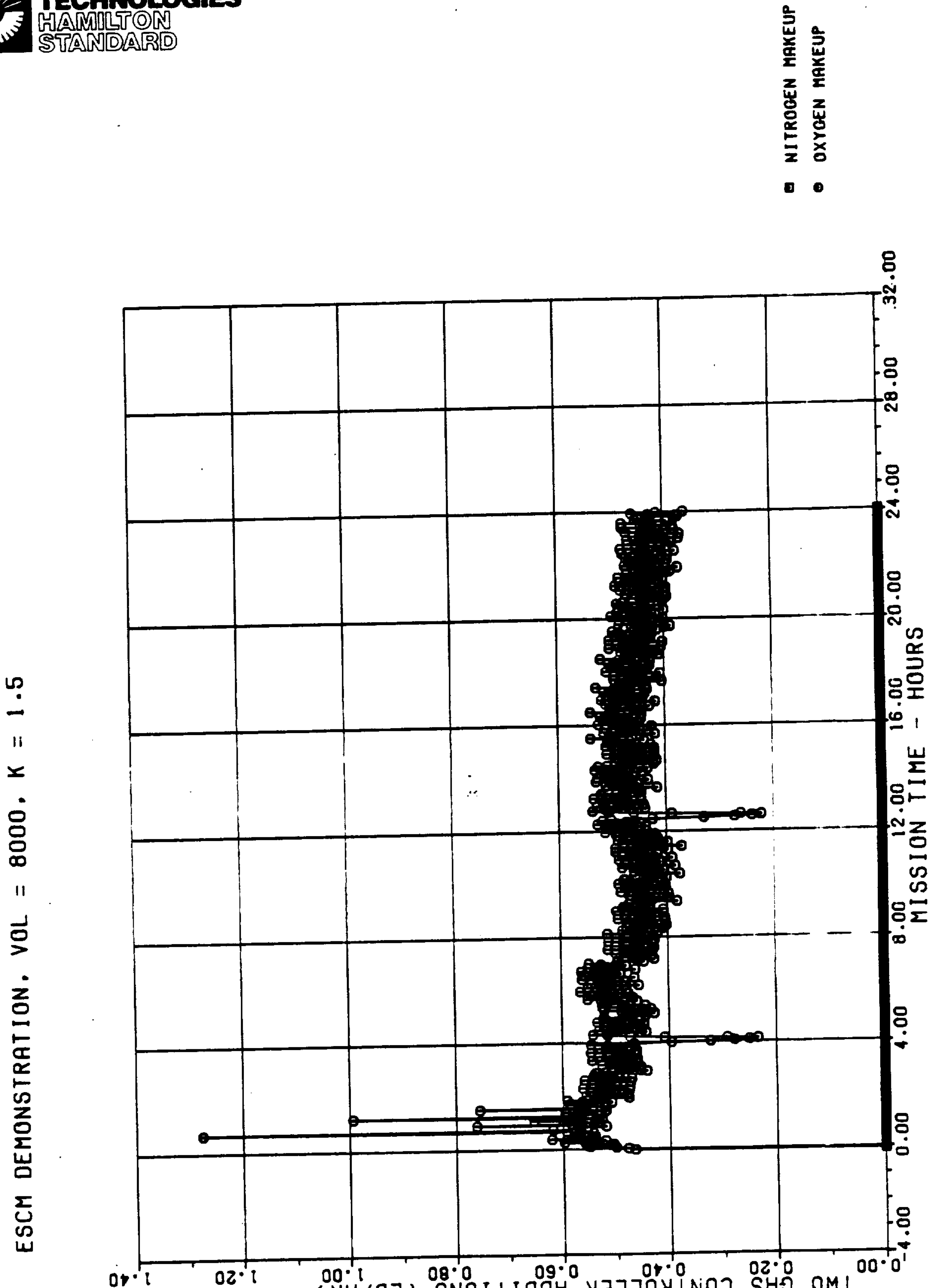
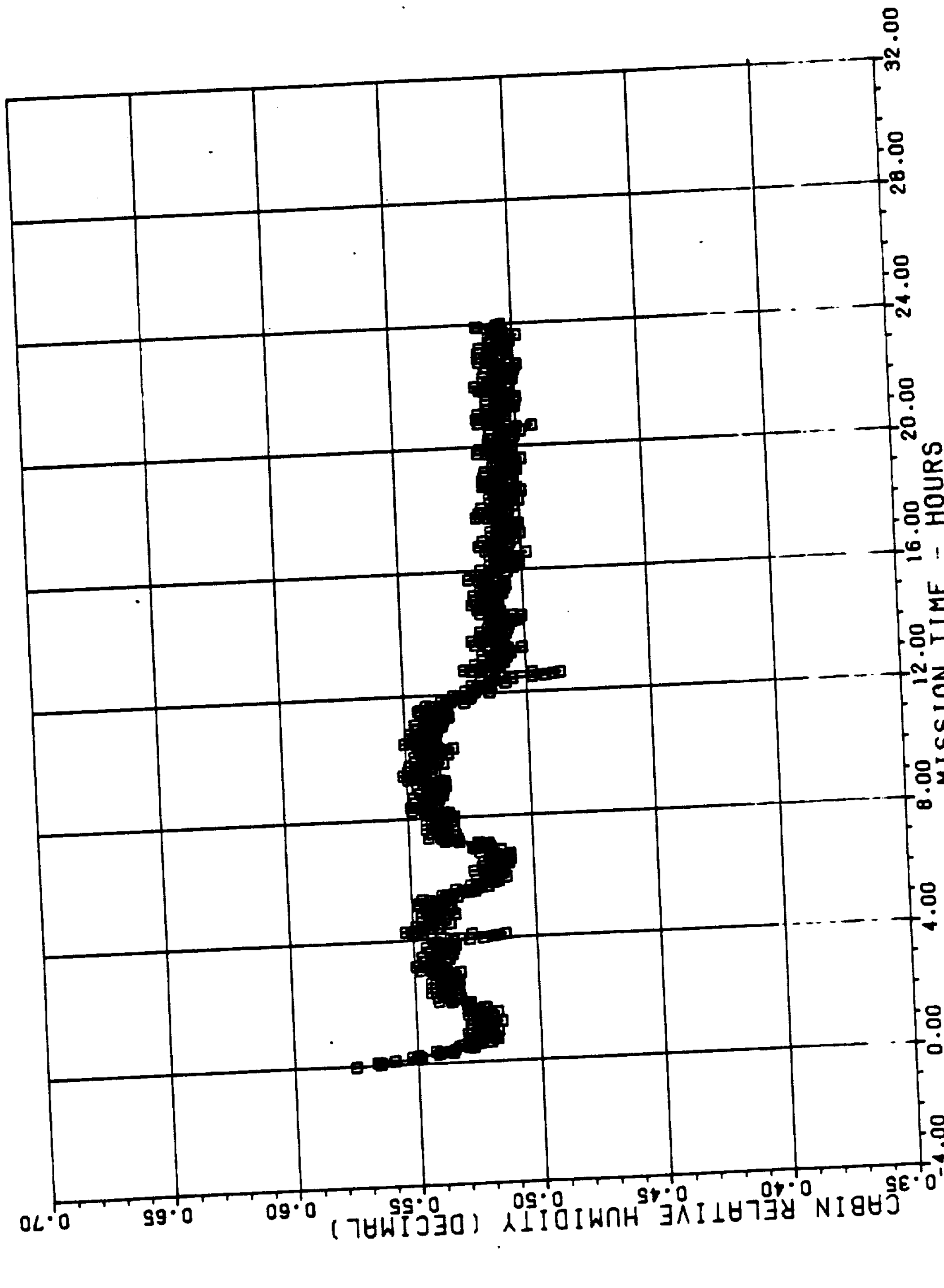
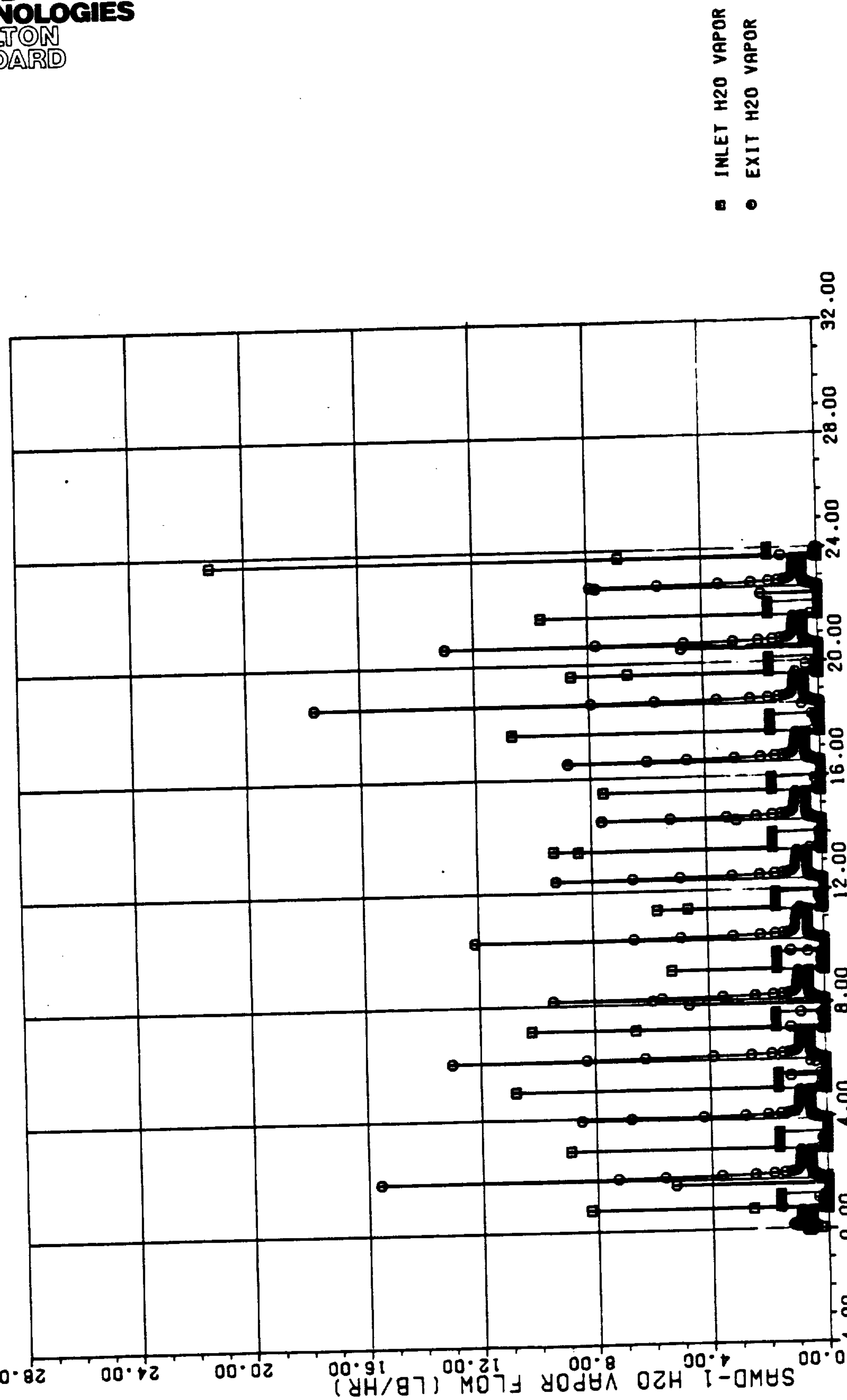
ESCM DEMONSTRATION. VOL = 8000. K = 1.5




ESCM DEMONSTRATION, VOL = 8000, K = 1.5
NITROGEN MAKEUP
OXYGEN MAKEUP
MISSION TIME - HOURS
-4.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
TWO GAS CONTROLLER ADDITIONS (LB/HR)
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40

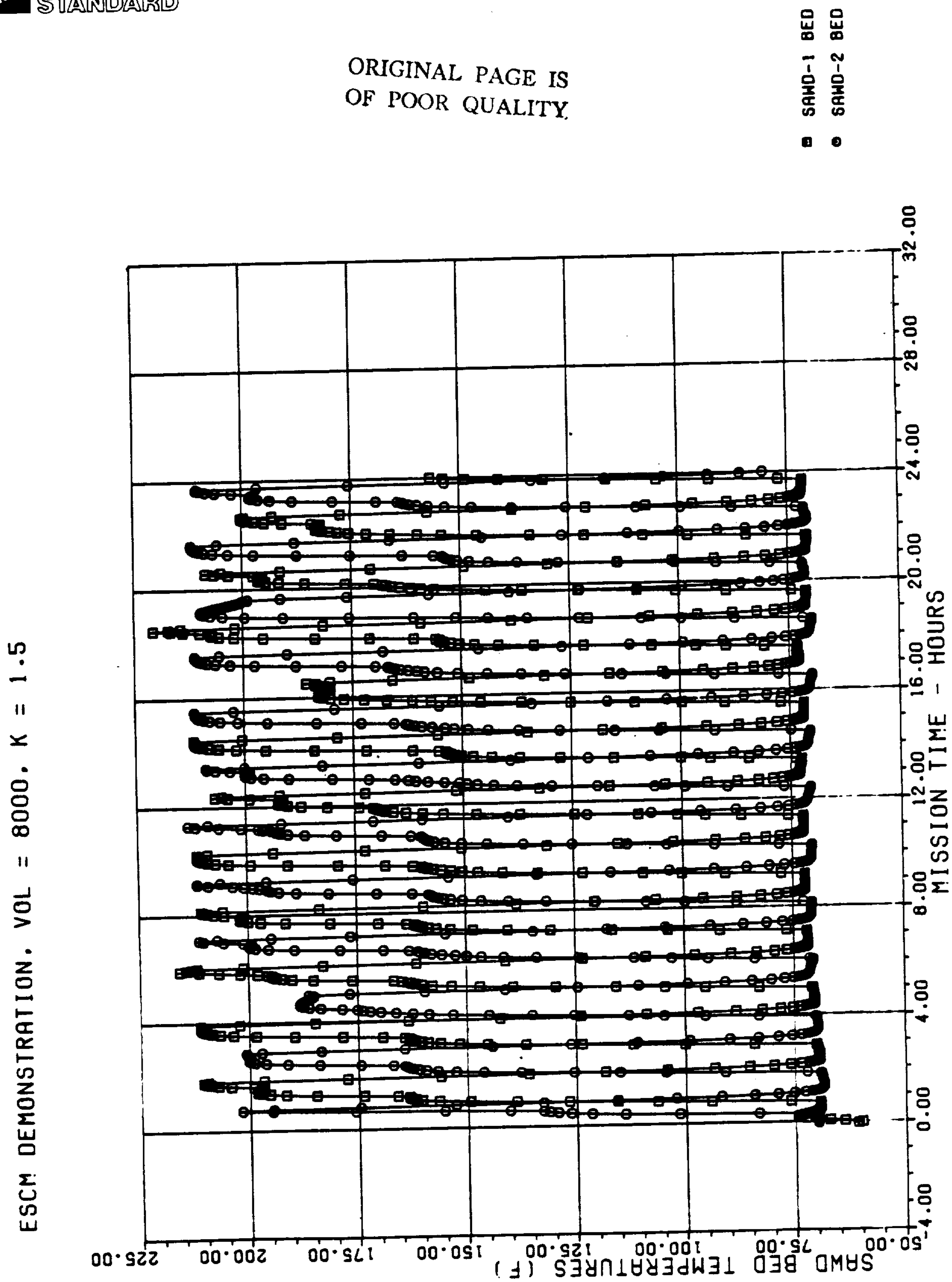
ESCM DEMONSTRATION, VOL = 8000, K = 1.5



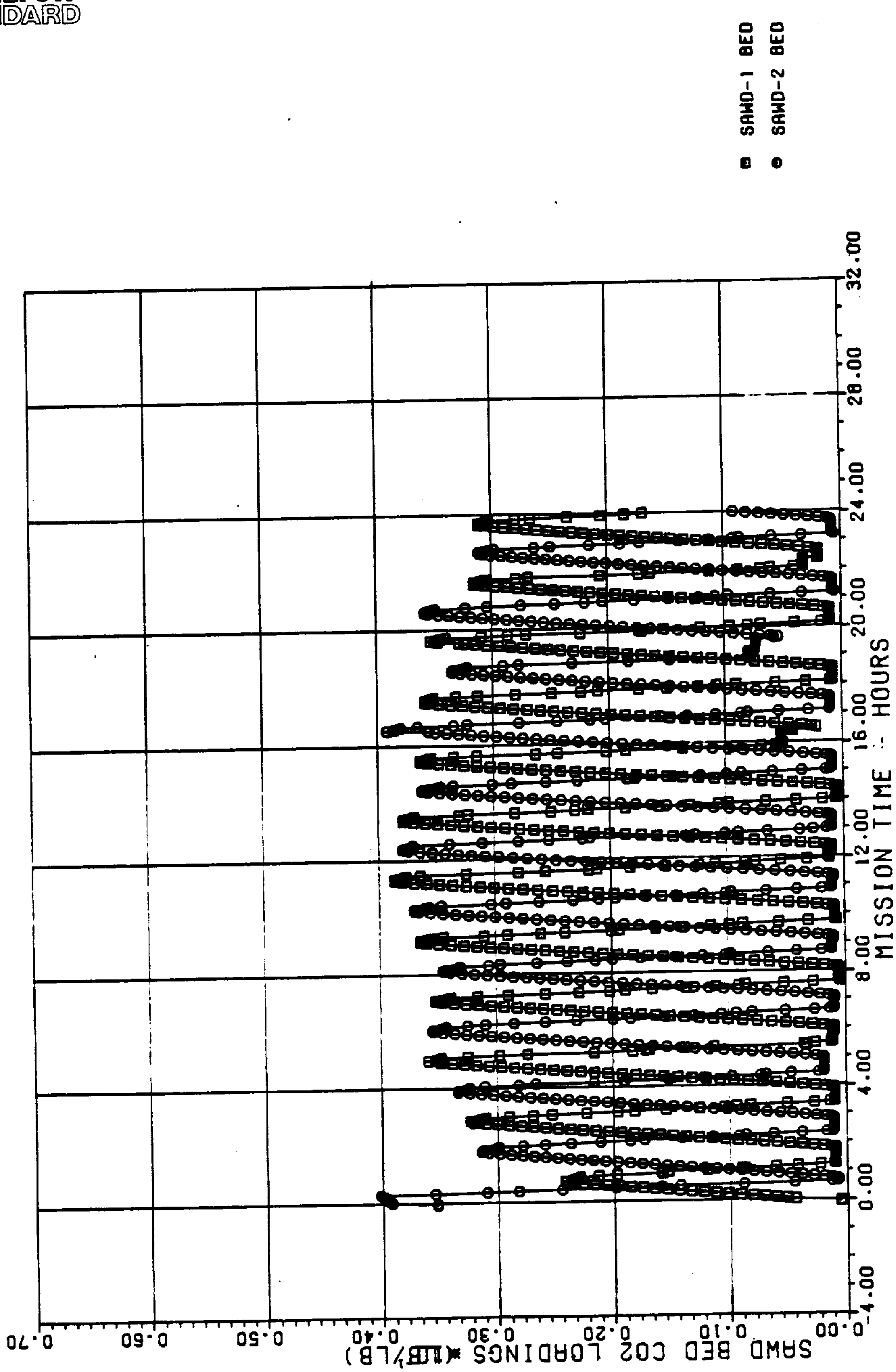


ESCM DEMONSTRATION. VOL = 8000. K = 1.5

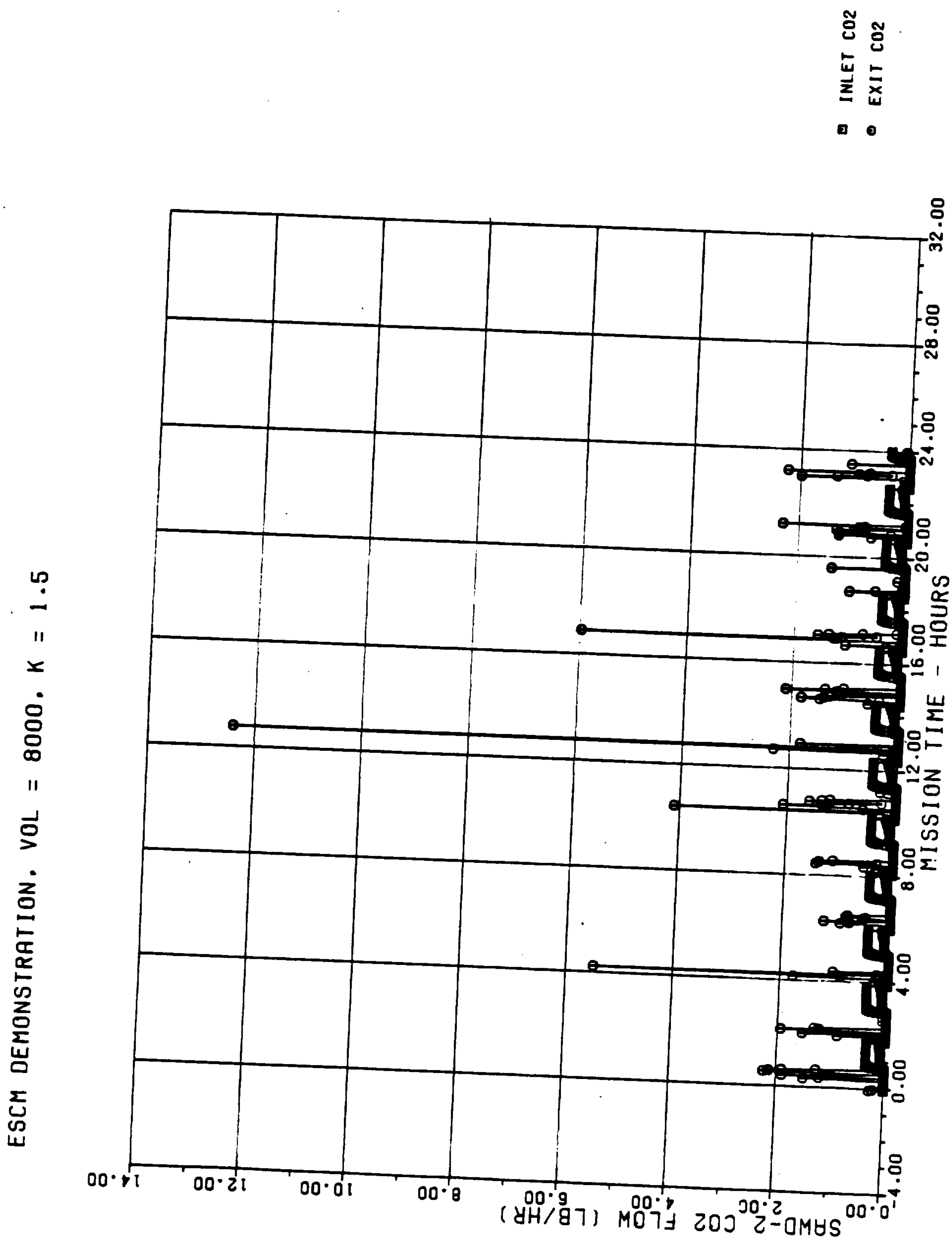
ORIGINAL PAGE IS
OF POOR QUALITY



UNITED TECHNOLOGIES
HAMILTON STANDARD



ESCM DEMONSTRATION. VOL = 8000. K = 1.5


ESCM DEMONSTRATION, VOL = 8000, K = 1.5
INLET CO2
EXIT CO2
MISSION TIME - HOURS
-4.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
SAWD-2 CO2 FLOW (LB/HR)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00

Report Documentation Page

National Aeronautics and Space Administration

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16. Abstract

This manual describes how to use the Emulation/Simulation Computer Model, ESCM. Based on G189A, ESCM computes the transient performance of a Space Station atmospheric revitalization subsystem (ARS) with CO_2 removal provided by a solid amine water desorbed subsystem called SAWD. Many performance parameters are computed some of which are cabin CO_2 partial pressure, relative humidity, temperature, O_2 partial pressure, and dew point. The program allows the user to simulate various possible combinations of man loading, metabolic profiles, cabin volumes and certain hypothesized failures that could occur.

17. Key Words (Suggested by Author(s)) Computer Simulation, Environmental Control Space Station, Life Support, Computer Modeling	18. Distribution Statement Unclassified - Unlimited Subj. Cat. - 54

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