Scout

THE
COMPUTER PROGRAM
FOR FACILITY/HVAC
DESIGN AND ENERGY
ANALYSIS

GATX
GARD, INC.

What Is SCOUT?

SCOUT is a versatile building design and energy analysis tool which has embodied within it ASHRAE state-of-the-art techniques for performing thermal load calculation and energy usage predictions. SCOUT is actually a series of individual computer programs described below:

1. DATA CHECK
   Interrogates card input data to prevent errors.

2. LOAD ANALYSIS
   Performs hourly transient heat transfer calculations for each building space utilizing actual hourly recorded weather or design day data, geometry and construction of the building, scheduled internal loads and astronomy of the sun.

3. RESPONSE FACTOR
   For wall or roof structures different from the typical ones built into SCOUT, the Response Factor Program, using a layer-by-layer description of the surface, will calculate and output the set of response factors required to perform transient heat transfer analysis.

4. TEMPERATURE VARIATION
   Modifies the thermal loads calculated above to account for temperature swings occurring within each space due to thermostat action, equipment capacity and equipment scheduling.

5. SYSTEMS ANALYSIS
   For a specified type of distribution system allocation and type of energy conversion equipment, this program determines the total load on each distribution system, transfers it to the energy conversion equipment, and, based upon part load efficiencies, determines the building's monthly demand and consumption of all forms of fuels and energy.

6. LIFE CYCLE COSTS
   For the expected life of the building, it calculates the expected annual expenditures to own and operate the building utility systems. Calculates payback period to compare alternatives.

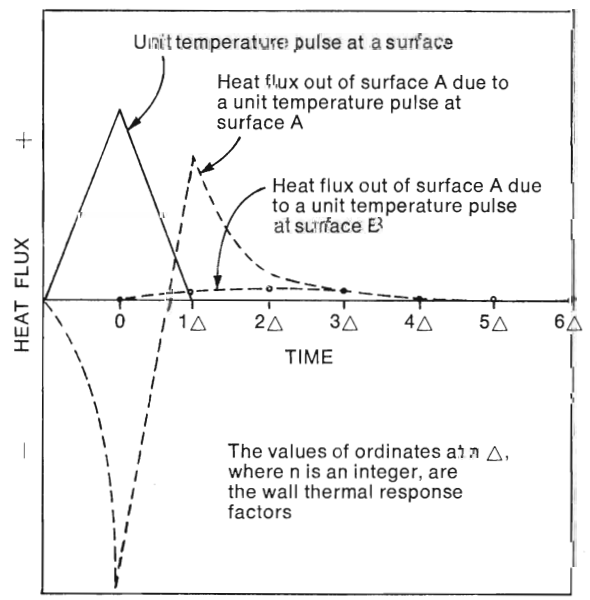
Why Use SCOUT?

SCOUT is the most powerful and versatile energy analysis program available. Much of the thinking behind SCOUT is based on NECAP (NASA's Energy/Cost Analysis Program) that GARD developed for NASA. It gives you the options to make the analysis as simple or as sophisticated and complete as you need to make it. It is surprisingly economical to use. SCOUT is *not* a "black box." It is fully documented and supported by GARD. SCOUT users are kept informed of new improvements and changes. Experienced GARD engineers stand ready to answer your questions, to assist you if needed, and to suggest approaches to handle your unusual problems.

What Makes SCOUT Unique?

SCOUT is unique among all other energy analysis programs presently on the market because of the thorough engineering treatment that it gives to all aspects of the energy analysis problem. The features which make SCOUT the superior program include:

- TRANSIENT HEAT TRANSFER ANALYSIS
  Most programs use the 1972 ASHRAE design load calculation procedure along with various interpolation algorithms to project design load points into hourly load data. SCOUT uses ASHRAE's "Procedures for Determining Heating and Cooling Loads For Computerized Energy Calculations." The heart of these procedures is the response factor method used to calculate transient heat flow through exterior wall and roof sections. Briefly, the response factor technique requires the description of thermal properties of each wall or roof layer so that the heat flux factors for the outer layer, inner layer and through the surface can be properly calculated as a function of time. These three sets of heat flux factors are commonly referred to as the X (outer), Y (through), and Z (inner) time response series. They can be depicted as indicated below.



These response characteristics for a given wall or roof construction need only be determined once for a unit temperature and then each hour multiplied by the actual temperature pulse to get the surface heat flux at succeeding time increments. Since the temperature pulse is continually changing, the net heat flux at any point in time is the sum of the temperature pulse effects for all hours previous.

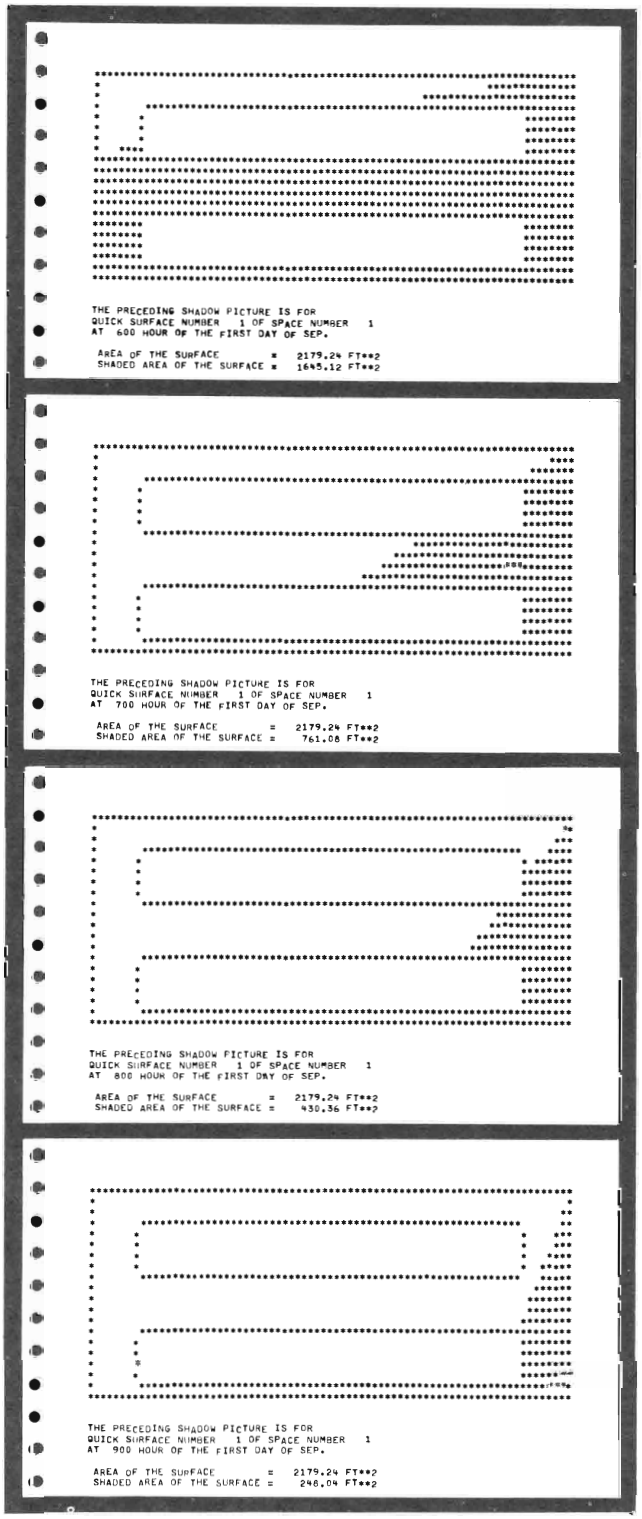
- ALGORITHMS PUBLISHED BY ASHRAE
  SCOUT's Load Analysis Program and Systems Analysis Program are based upon ASHRAE's algorithms published in

  1. "Procedures For Determining Heating and Cooling Loads for Computerized Energy Calculations," ASHRAE, 1975.
  2. "Procedures For Simulating The Performance of Components and Systems For Energy Calculations," ASHRAE, 1975.

- HOURLY BUILDING & SYSTEM SIMULATION USING ACTUAL WEATHER DATA
  SCOUT's Load Program does not perform an abbreviated hourly analysis as some programs do, but rather an 8760 hour building simulation using actual weather data. When performing a transient heat transfer analysis, you cannot compromise on this matter. In like manner, the Systems Analysis Program also performs an hourly simulation of the systems and equipment. There have been no compromises made anywhere, the latest state-of-the-art is represented in SCOUT. The level of sophistication is consistent throughout the program series.

- TEMPERATURE VARIATION ANALYSIS
  To investigate the effects of thermostat type (floating, deadband, throttling, seasonal, etc.), operating range, equipment undersizing and equipment operating schedules, the Load Analysis Program need not be rerun each time, but an interface program called the Temperature Variation Program can be used to create a corrected set of hourly loads to be used for the system and equipment simulation. This program allows the user to follow temperature variations within a space or ceiling plenum during conditioned and unconditioned periods. No other program on the market offers this feature, yet it is an extremely valuable design tool.

- OPTIONAL SHADOW ANALYSIS
  Buildings are now being designed to take advantage of solar shading, not just localized shading but the shading of one building section by another building section. Some programs allow for treatment of localized shading but none the latter. SCOUT allows both and will even give you a picture of what is taking place at any hour.



- COMPREHENSIVE LIBRARY OF SYSTEMS FOR SIMULATION

  A large portion of a building's energy requirement stems from the operating inefficiencies inherent in its environmental control system. HVAC system and equipment characteristics and their corresponding economies may now be quantified for your specific application with SCOUT's Systems Analysis Program.

  ENERGY DISTRIBUTION SYSTEMS

  The Program includes capability to simulate all commonly used distribution systems. Also included is the ability to vary number of parameters for each system. This allows the user to make minor modifications or "fine tune" a given configuration.

ENERGY DISTRIBUTION SYSTEMS SIMULATED

Single Zone Fan System with Face and By-pass Dampers
Multi-Zone Fan System
Dual Duct Fan System
Single Zone Fan System with Sub-Zone Reheat
Unit Ventilator
Unit Heater
Floor Panel Heating
Two-pipe Fancoil System
Four-pipe Fancoil System
Two-pipe Induction Unit Fan System
Four-pipe Induction Unit Fan System
Variable Volume Fan System with Optional Reheat
Constant Volume Reheat Fan System

OPTIONS WITHIN A GIVEN DISTRIBUTION SYSTEM

Relative humidity set-point
AHU discharge temperature
AHU discharge temperature control mode
Pre-sizing of supply air quantities
Outside air volume
Outside/Return air control
VAV fan control
Heat recovery (sensible and/or latent)
Baseboard heating
Hot water temperature

ENERGY CONVERSION SYSTEMS

Simulations of the following major equipment are offered:

Chillers

hermetic reciprocating
hermetic centrifugal
open centrifugal; electric
steam absorption
open centrifugal; steam turbine driven

Direct Expansion Packaged Cooling Units

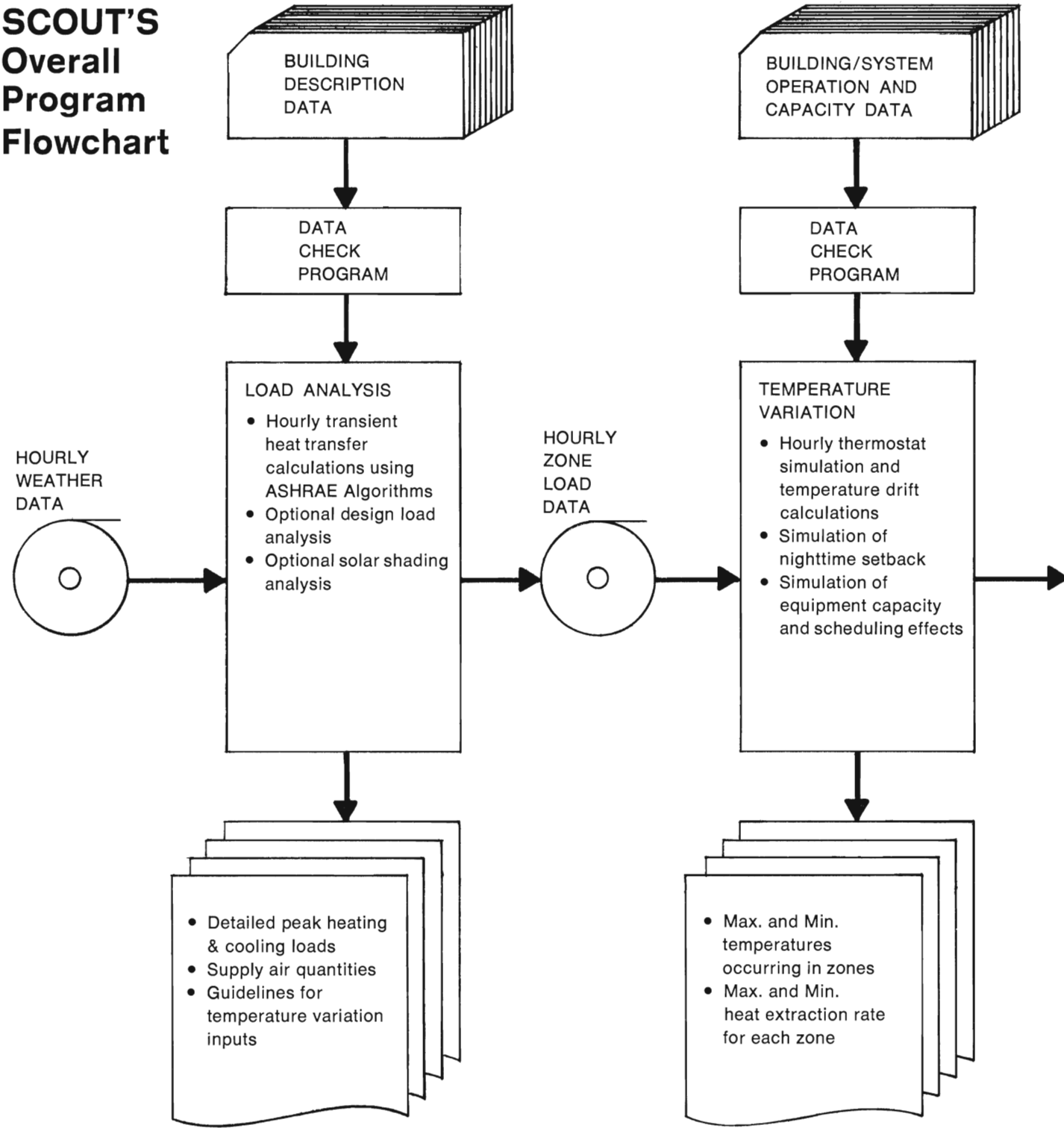
Heat Pumps

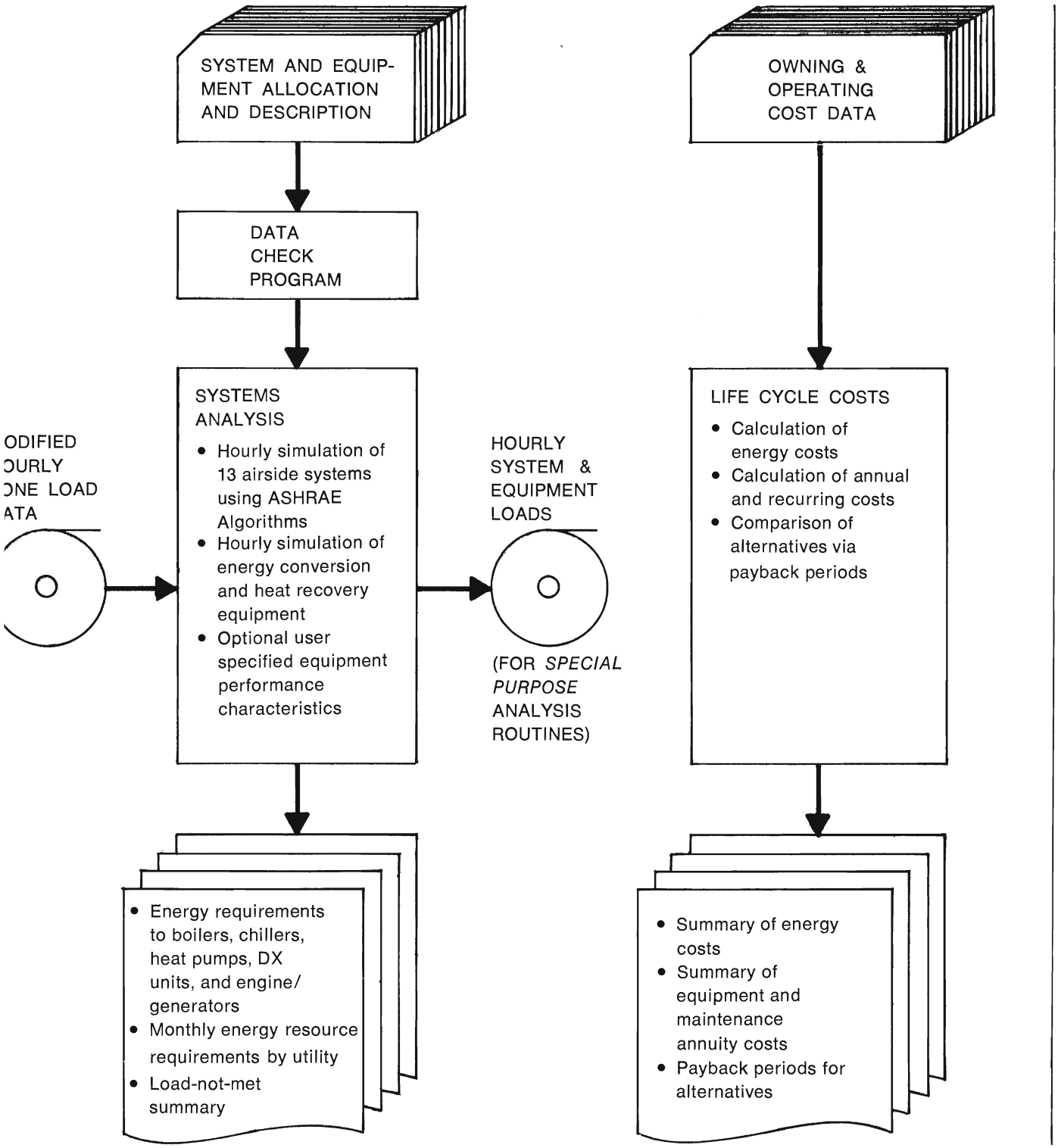
Boilers

Engine/Generator Sets

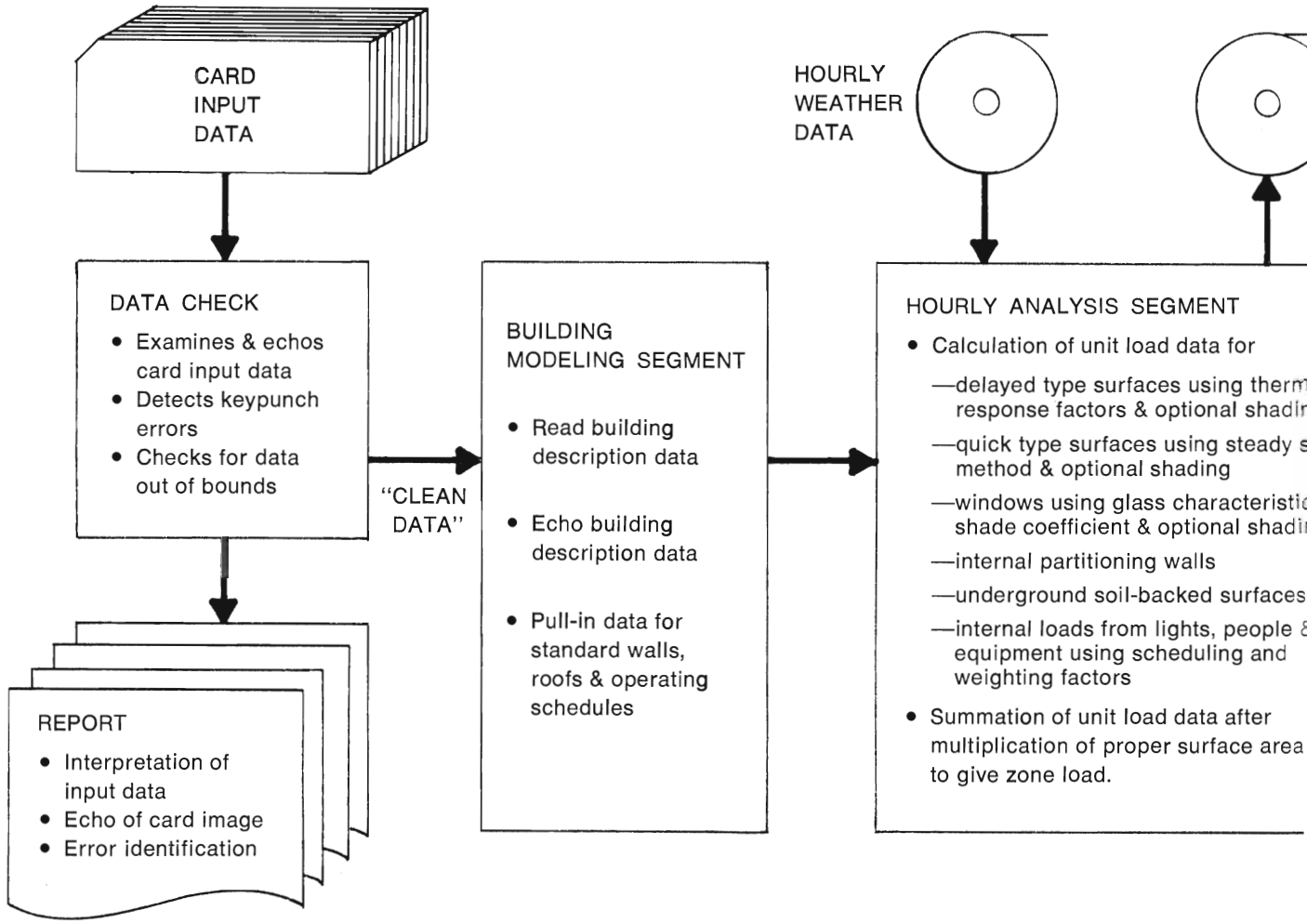
More details on SCOUT's organization and capabilities are presented in the following flowcharts:

SCOUT'S Overall Program Flowchart




SYSTEM AND EQUIP-
MENT ALLOCATION
AND DESCRIPTION
OWNING &
OPERATING
COST DATA
DATA
CHECK
PROGRAM
SYSTEMS
ANALYSIS
• Hourly simulation of 13 airside systems using ASHRAE Algorithms
• Hourly simulation of energy conversion and heat recovery equipment
• Optional user specified equipment performance characteristics
ODIFIED
OURLY
ONE LOAD
ATA
HOURLY
SYSTEM &
EQUIPMENT
LOADS
(FOR SPECIAL
PURPOSE
ANALYSIS
ROUTINES)
LIFE CYCLE COSTS
• Calculation of energy costs
• Calculation of annual and recurring costs
• Comparison of alternatives via payback periods
• Energy requirements to boilers, chillers, heat pumps, DX units, and engine/ generators
• Monthly energy resource requirements by utility
• Load-not-met summary
• Summary of energy costs
• Summary of equipment and maintenance annuity costs
• Payback periods for alternatives

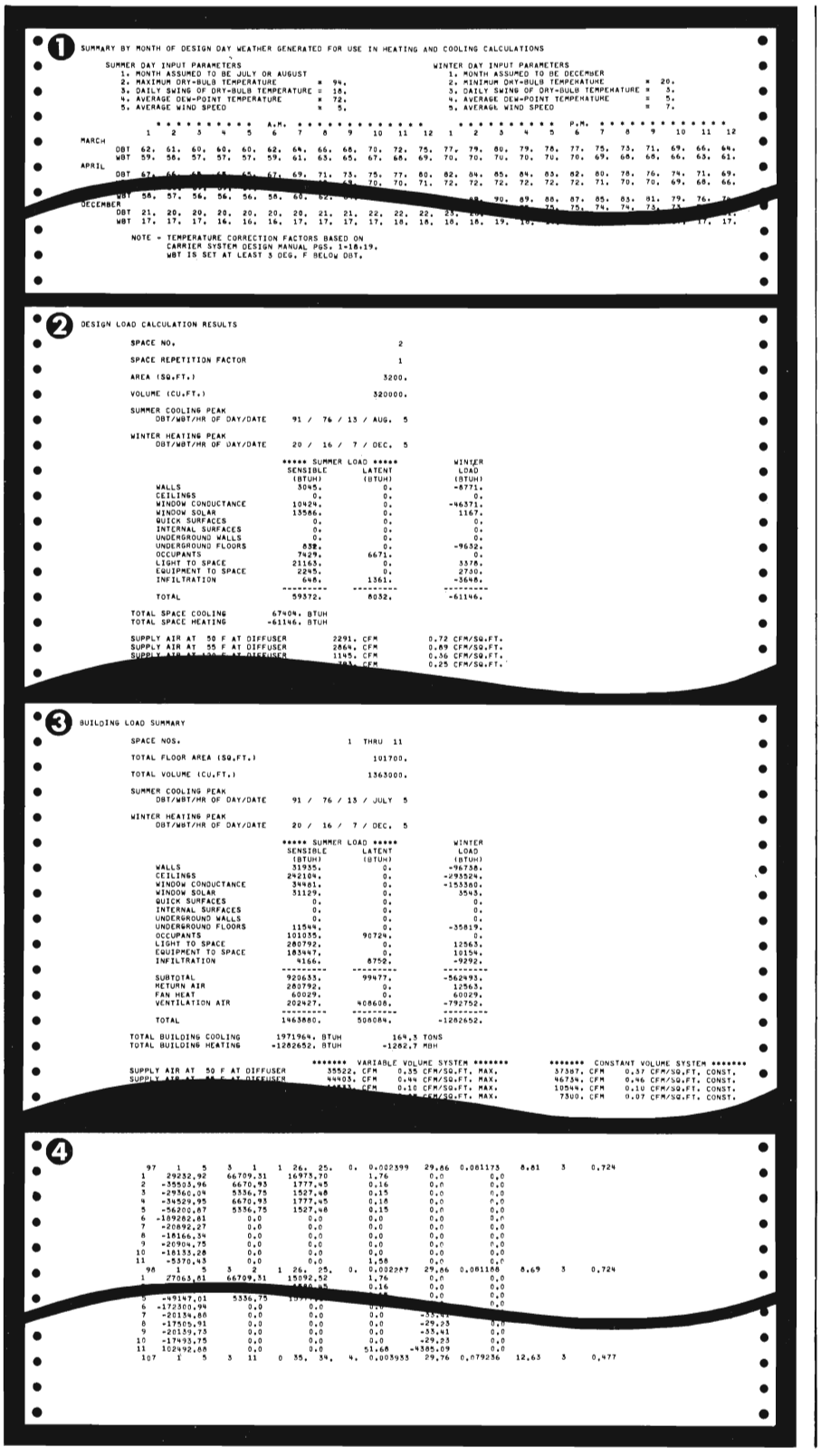
SCOUT: Load Analysis Program



HOURLY
ZONE
LOAD
DATA

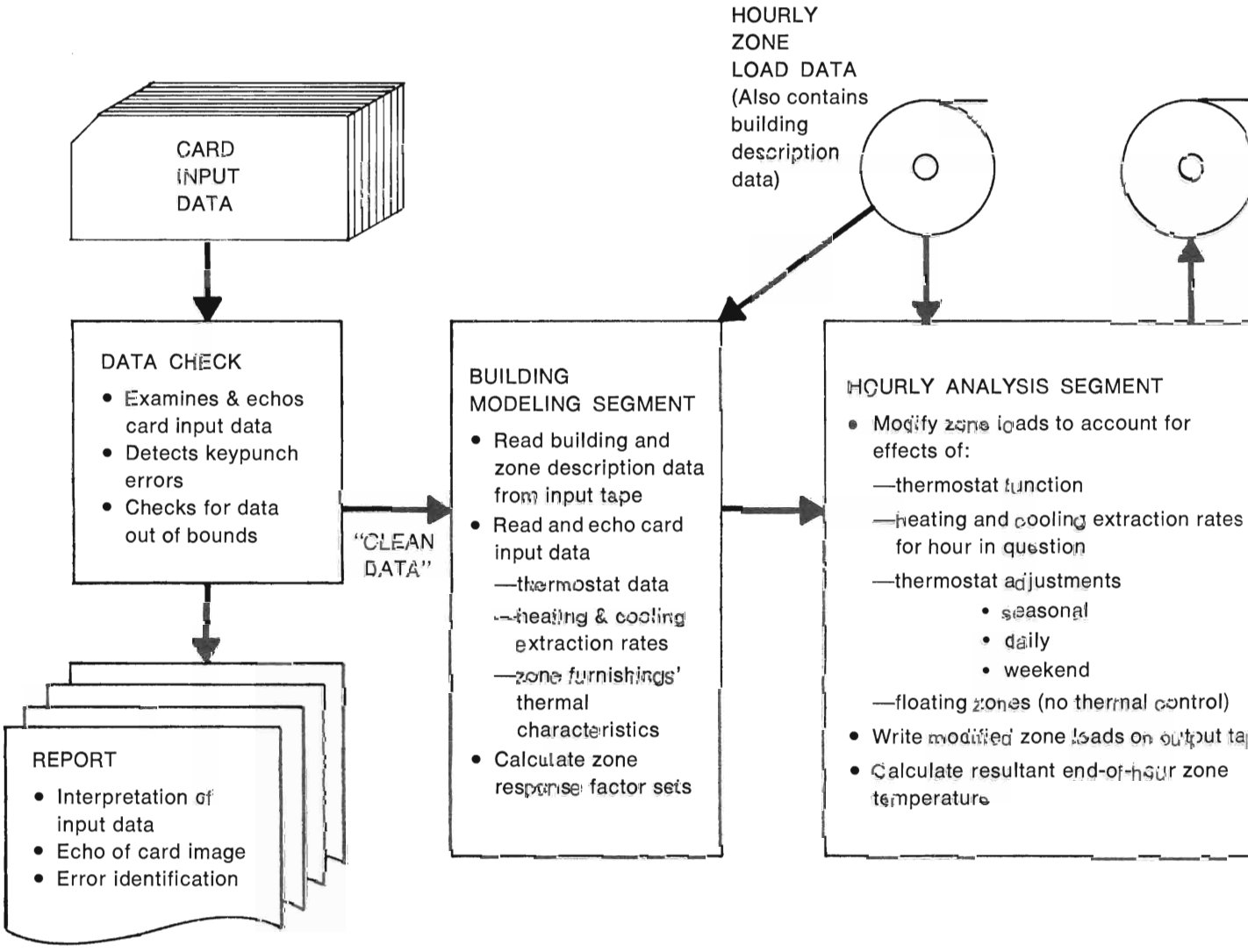
REPORT SEGMENT

1. Design load weather data (design load runs only)
2. Peak zone thermal loads & air flows (heating & cooling)
3. Peak building thermal loads & airflows (heating & cooling)
4. Hourly trace of resultant zone load calculations



EXAMPLE OUTPUTS

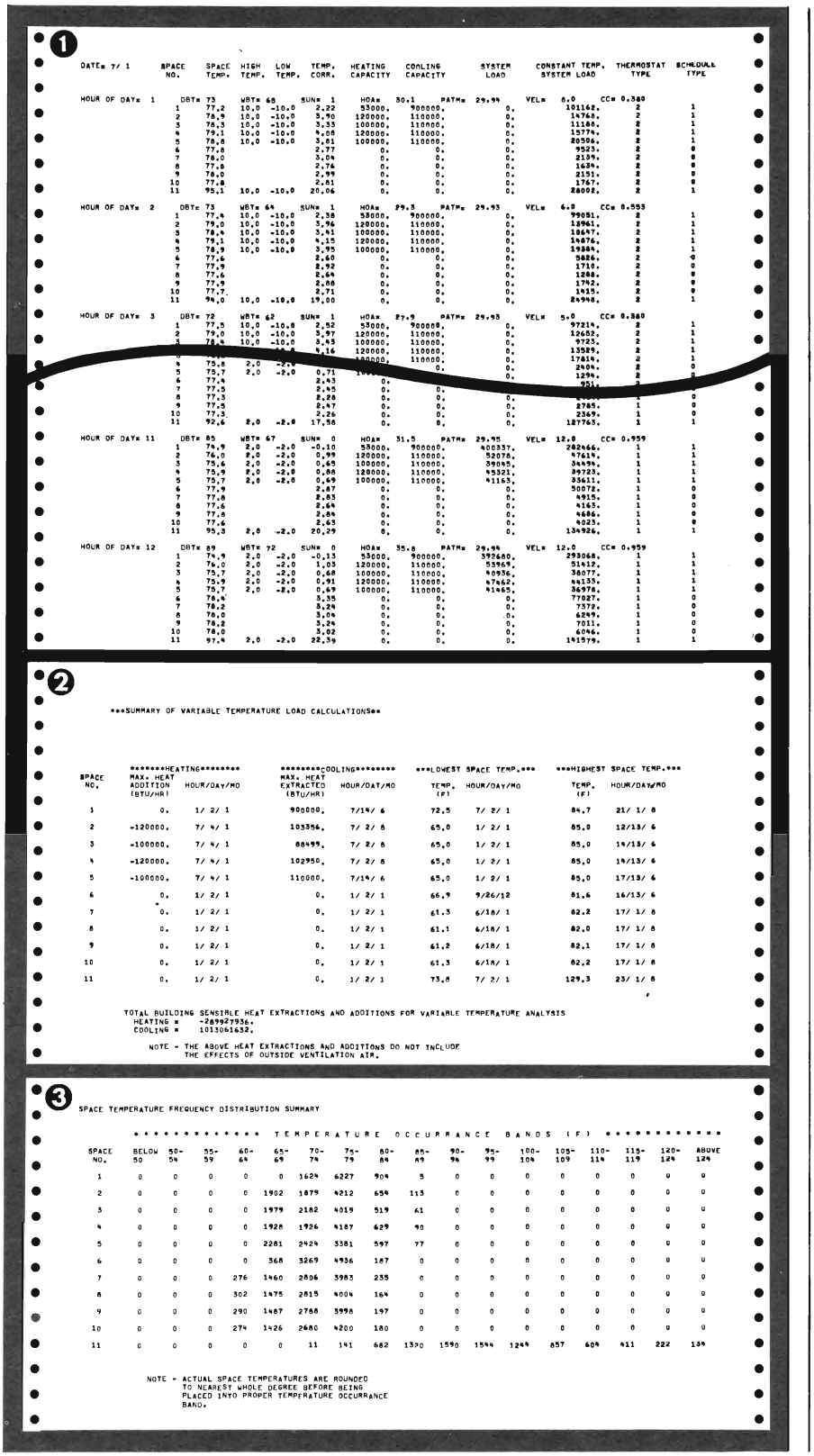
SCOUT: Temperature Variation Program



MODIFIED
HOURLY
ZONE
LOAD
DATA

REPORT SEGMENT

1. Optional hourly trace of selected days
2. Highest & lowest temperature and maximum heating & cooling rates for each zone
3. Temperature frequency distribution for each zone



1

DATE= 7/ 1

SPACE NO.	SPACE TEMP.	HIGH TEMP.	LOW TEMP.	TEMP. CORR.	HEATING CAPACITY	COOLING CAPACITY	SYSTEM LOAD	CONSTANT TEMP. SYSTEM LOAD	THERMOSTAT TYPE	SCHEDULE TYPE
HOUR OF DAY= 1 DBT= 73		WBT= 65		SUN= 1	HOA=	30.1 PATM=	29.94	VEL= 6.0	CC= 0.880	
1	77.2	10.0	-10.0	2.22	53000.	900000.	0.	101162.	2	1
2	78.9	10.0	-10.0	3.90	120000.	110000.	0.	14768.	2	1
3	78.3	10.0	-10.0	3.33	100000.	110000.	0.	11188.	2	1
4	79.1	10.0	-10.0	4.08	120000.	110000.	0.	15774.	2	1
5	78.8	10.0	-10.0	3.81	100000.	110000.	0.	80506.	2	1
6	77.8			2.77	0.	0.	0.	9523.	2	0
7	78.0			3.04	0.	0.	0.	2139.	2	0
8	77.8			2.76	0.	0.	0.	1634.	2	0
9	78.0			2.99	0.	0.	0.	2151.	2	0
10	77.8			2.81	0.	0.	0.	1767.	2	0
11	95.1	10.0	-10.0	20.06	0.	0.	0.	88092.	2	1
HOUR OF DAY= 2 DBT= 73		WBT= 64		SUN= 1	HOA=	29.3 PATM=	29.93	VEL= 6.0	CC= 0.883	
1	77.4	10.0	-10.0	2.38	53000.	900000.	0.	99051.	2	1
2	79.0	10.0	-10.0	3.96	120000.	110000.	0.	13961.	2	1
3	78.4	10.0	-10.0	3.41	100000.	110000.	0.	10647.	2	1
4	79.1	10.0	-10.0	4.15	120000.	110000.	0.	14876.	2	1
5	78.9	10.0	-10.0	3.95	100000.	110000.	0.	19884.	2	1
6	77.6			2.60	0.	0.	0.	9826.	2	0
7	77.9			2.92	0.	0.	0.	1710.	2	0
8	77.6			2.64	0.	0.	0.	1248.	2	0
9	77.9			2.88	0.	0.	0.	1792.	2	0
10	77.7			2.71	0.	0.	0.	1415.	2	0
11	94.0	10.0	-10.0	19.00	0.	0.	0.	84948.	2	1
HOUR OF DAY= 3 DBT= 72		WBT= 62		SUN= 1	HOA=	27.9 PATM=	29.93	VEL= 5.0	CC= 0.880	
1	77.5	10.0	-10.0	2.52	53000.	900000.	0.	97214.	2	1
2	79.0	10.0	-10.0	3.97	120000.	110000.	0.	12652.	2	1
3	78.4	10.0	-10.0	3.43	100000.	110000.	0.	9723.	2	1
[illegible]				4.16	120000.	110000.	0.	13589.	2	1
[illegible]					100000.	110000.	0.	17814.	2	1
4	75.8	2.0	-2.0				0.	2404.	2	0
5	75.7	2.0	-2.0	0.71			0.	1294.	2	0
6	77.4			2.43	0.	0.		951.	2	0
7	77.5			2.45	0.	0.		[illegible]	2	0
8	77.3			2.28	0.	0.	0.	[illegible]	1	0
9	77.5			2.47	0.	0.	0.	8785.	1	0
10	77.3			2.26	0.	0.	0.	2369.	1	0
11	92.6	2.0	-2.0	17.58	0.	0.	0.	127763.	1	1
HOUR OF DAY= 11 DBT= 85		WBT= 67		SUN= 0	HOA=	31.5 PATM=	29.95	VEL= 12.0	CC= 0.959	
1	74.9	2.0	-2.0	-0.10	53000.	900000.	400337.	282466.	1	1
2	76.0	2.0	-2.0	0.99	120000.	110000.	52078.	47619.	1	1
3	75.6	2.0	-2.0	0.65	100000.	110000.	39045.	34496.	1	1
4	75.9	2.0	-2.0	0.88	120000.	110000.	45321.	39723.	1	1
5	75.7	2.0	-2.0	0.69	100000.	110000.	41163.	35611.	1	1
6	77.9			2.87	0.	0.	0.	50072.	1	0
7	77.8			2.83	0.	0.	0.	4915.	1	0
8	77.6			2.64	0.	0.	0.	4163.	1	0
9	77.8			2.84	0.	0.	0.	4686.	1	0
10	77.6			2.63	0.	0.	0.	4023.	1	0
11	95.3	2.0	-2.0	20.29	0.	0.	0.	134926.	1	1
HOUR OF DAY= 12 DBT= 89		WBT= 72		SUN= 0	HOA=	35.8 PATM=	29.94	VEL= 12.0	CC= 0.959	
1	74.9	2.0	-2.0	-0.13	53000.	900000.	392680.	293068.	1	1
2	76.0	2.0	-2.0	1.03	120000.	110000.	53969.	51412.	1	1
3	75.7	2.0	-2.0	0.68	100000.	110000.	40936.	38077.	1	1
4	75.9	2.0	-2.0	0.91	120000.	110000.	47462.	44133.	1	1
5	75.7	2.0	-2.0	0.69	100000.	110000.	41465.	36978.	1	1
6	78.4			3.35	0.	0.	0.	77027.	1	0
7	78.2			3.24	0.	0.	0.	7372.	1	0
8	78.0			3.04	0.	0.	0.	6249.	1	0
9	78.2			3.24	0.	0.	0.	7011.	1	0
10	78.0			3.02	0.	0.	0.	6046.	1	0
11	97.4	2.0	-2.0	22.39	0.	0.	0.	1415?9.	1	1

2

***SUMMARY OF VARIABLE TEMPERATURE LOAD CALCULATIONS**

SPACE NO.	*******HEATING******* MAX. HEAT ADDITION (BTU/HR)	HOUR/DAY/MO	********COOLING******** MAX. HEAT EXTRACTED (BTU/HR)	HOUR/DAY/MO	***LOWEST SPACE TEMP.*** TEMP. (F)	HOUR/DAY/MO	***HIGHEST SPACE TEMP.*** TEMP. (F)	HOUR/DAY/MO
1	0.	1/ 2/ 1	900000.	7/14/ 6	72.5	7/ 2/ 1	84.7	21/ 1/ 8
2	-120000.	7/ 4/ 1	103356.	7/ 2/ 8	65.0	1/ 2/ 1	85.0	12/13/ 6
3	-100000.	7/ 4/ 1	88499.	7/ 2/ 8	65.0	1/ 2/ 1	85.0	14/13/ 6
4	-120000.	7/ 4/ 1	102950.	7/ 2/ 8	65.0	1/ 2/ 1	85.0	14/13/ 6
5	-100000.	7/ 4/ 1	110000.	7/14/ 6	65.0	1/ 2/ 1	85.0	17/13/ 6
6	0.	1/ 2/ 1	0.	1/ 2/ 1	66.9	9/26/12	81.6	16/13/ 6
7	0.	1/ 2/ 1	0.	1/ 2/ 1	61.3	6/18/ 1	82.2	17/ 1/ 8
8	0.	1/ 2/ 1	0.	1/ 2/ 1	61.1	6/18/ 1	82.0	17/ 1/ 8
9	0.	1/ 2/ 1	0.	1/ 2/ 1	61.2	6/18/ 1	82.1	17/ 1/ 8
10	0.	1/ 2/ 1	0.	1/ 2/ 1	61.3	6/18/ 1	82.2	17/ 1/ 8
11	0.	1/ 2/ 1	0.	1/ 2/ 1	73.8	7/ 2/ 1	129.3	23/ 1/ 8

TOTAL BUILDING SENSIBLE HEAT EXTRACTIONS AND ADDITIONS FOR VARIABLE TEMPERATURE ANALYSIS
HEATING = -28992736.
COOLING = 1013061632.

NOTE - THE ABOVE HEAT EXTRACTIONS AND ADDITIONS DO NOT INCLUDE THE EFFECTS OF OUTSIDE VENTILATION AIR.

3

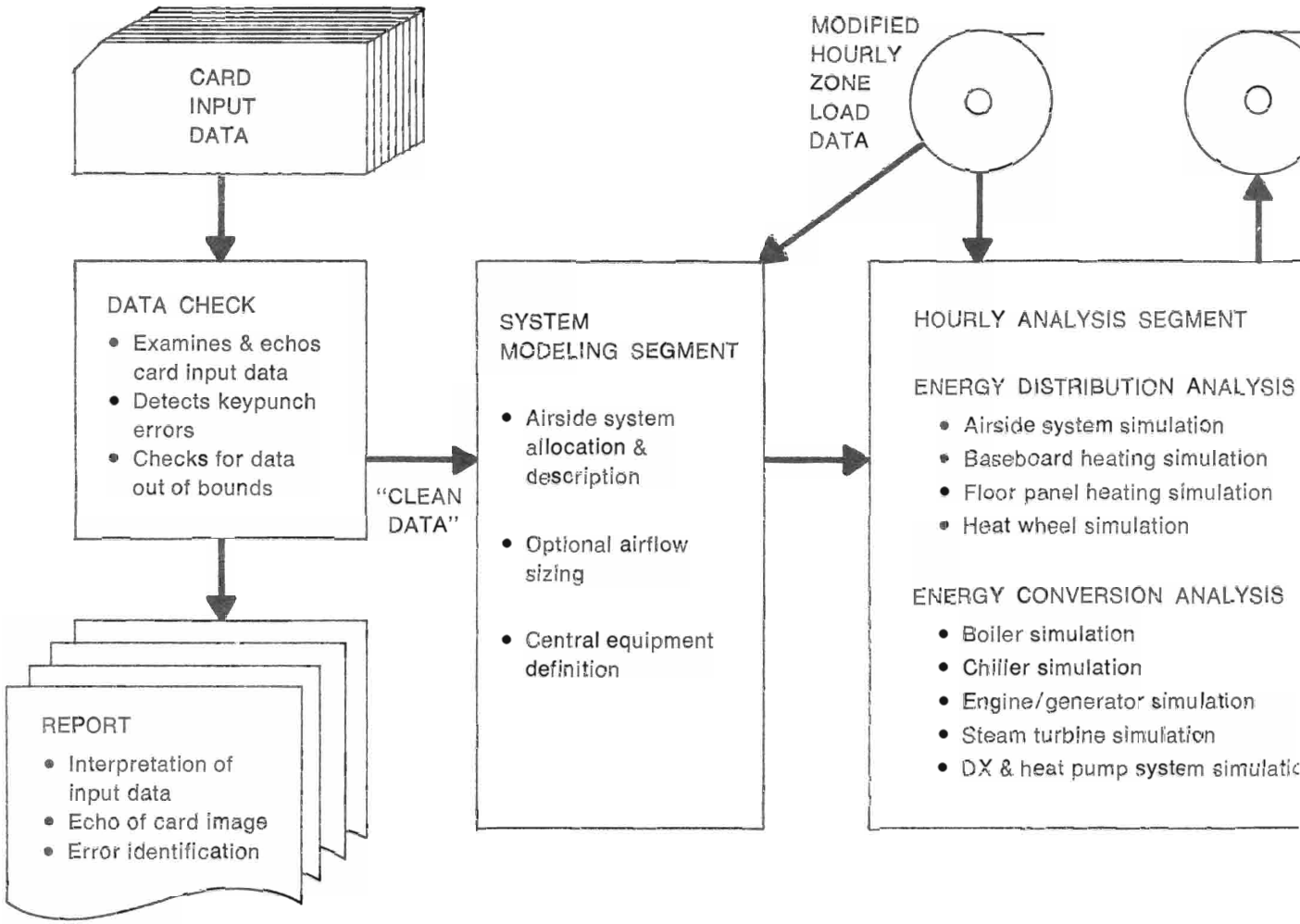
SPACE TEMPERATURE FREQUENCY DISTRIBUTION SUMMARY

SPACE NO.	BELOW 50	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99	100-104	105-109	110-114	115-119	120-124	ABOVE 124
	* * * * * * * * * * * * * TEMPERATURE OCCURRANCE BANDS (F) * * * * * * * * * * * *																
1	0	0	0	0	0	1624	6227	904	5	0	0	0	0	0	0	0	0
2	0	0	0	0	1902	1879	4212	654	113	0	0	0	0	0	0	0	0
3	0	0	0	0	1979	2182	4019	519	61	0	0	0	0	0	0	0	0
4	0	0	0	0	1928	1924	4187	629	90	0	0	0	0	0	0	0	0
5	0	0	0	0	2281	2424	3381	597	77	0	0	0	0	0	0	0	0
6	0	0	0	0	368	3269	4936	187	0	0	0	0	0	0	0	0	0
7	0	0	0	276	1460	2806	3983	235	0	0	0	0	0	0	0	0	0
8	0	0	0	302	1475	2815	4004	164	0	0	0	0	0	0	0	0	0
9	0	0	0	290	1487	2788	3998	197	0	0	0	0	0	0	0	0	0
10	0	0	0	274	1426	2680	4200	180	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	11	141	682	1390	1590	1544	1248	857	604	411	222	134

NOTE - ACTUAL SPACE TEMPERATURES ARE ROUNDED TO NEAREST WHOLE DEGREE BEFORE BEING PLACED INTO PROPER TEMPERATURE OCCURRANCE BAND.

EXAMPLE OUTPUTS

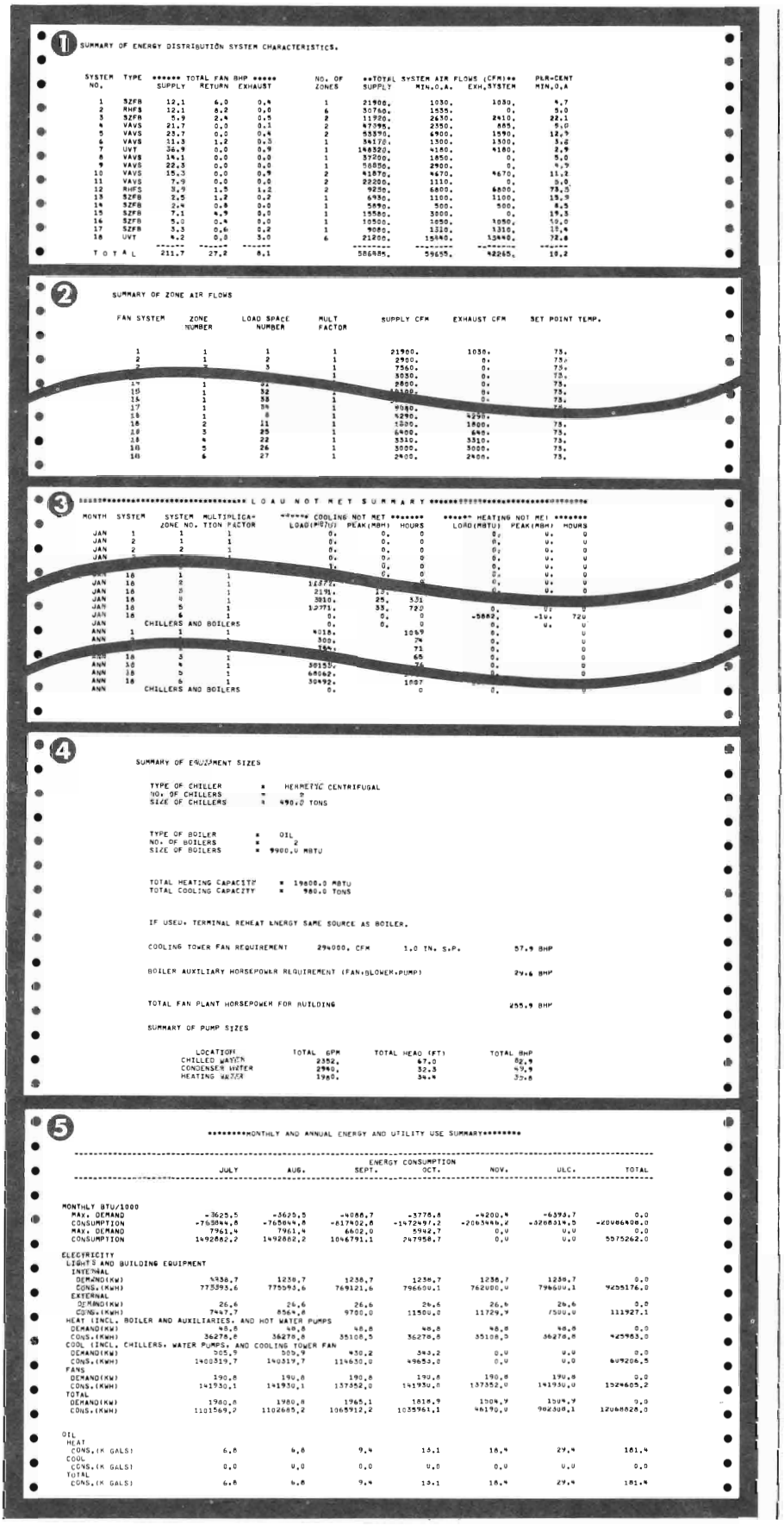
SCOUT: Systems Analysis Program



HOURLY
SYSTEM
AND
EQUIPMENT
LOADS

REPORT SEGMENT

1. Distribution system summary
2. Zone airflow summary
3. Load-not-met summary
4. Equipment size summary
5. Monthly energy & resource utilization



1 SUMMARY OF ENERGY DISTRIBUTION SYSTEM CHARACTERISTICS.

SYSTEM NO.	TYPE	****** TOTAL FAN BHP ***** SUPPLY	RETURN	EXHAUST	NO. OF ZONES	**TOTAL SYSTEM AIR FLOWS (CFM)** SUPPLY	MIN.O.A.	EXH.SYSTEM	PER-CENT MIN.O.A
1	SZFB	12.1	6.0	0.4	1	21900.	1030.	1030.	4.7
2	RHFS	12.1	6.2	0.0	6	30760.	1535.	0.	5.0
3	SZFB	5.9	2.4	0.5	2	11920.	2630.	2410.	22.1
4	VAVS	21.7	0.0	0.1	2	47095.	2350.	885.	5.0
5	VAVS	23.7	0.0	0.4	2	53370.	4900.	1590.	12.9
6	VAVS	11.3	1.2	0.3	1	24170.	1300.	1300.	5.4
7	UVT	36.9	0.0	0.9	1	146320.	4180.	4180.	2.9
8	VAVS	14.1	0.0	0.0	1	37200.	1850.	0.	5.0
9	VAVS	22.3	0.0	0.0	1	58850.	2900.	0.	4.9
10	VAVS	15.3	0.0	0.9	2	41870.	4670.	4670.	11.2
11	VAVS	7.9	0.0	0.0	2	22200.	1110.	0.	5.0
12	RHFS	3.9	1.5	1.2	2	9256.	6800.	6800.	73.5
13	SZFB	2.5	1.2	0.2	1	6936.	1100.	1100.	15.9
14	SZFB	2.4	0.8	0.0	1	5890.	500.	500.	8.5
15	SZFB	7.1	4.9	0.0	1	19580.	3800.	0.	19.3
16	SZFB	5.0	0.4	0.0	1	10500.	1050.	1050.	10.0
17	SZFB	3.3	0.6	0.2	1	9080.	1310.	1310.	14.4
18	UVT	4.2	0.8	3.0	6	21200.	15440.	13440.	72.8
TOTAL		211.7	27.2	8.1		586685.	59655.	42265.	10.2

2 SUMMARY OF ZONE AIR FLOWS

FAN SYSTEM	ZONE NUMBER	LOAD SPACE NUMBER	MULT FACTOR	SUPPLY CFM	EXHAUST CFM	SET POINT TEMP.
1	1	1	1	21900.	1030.	75.
2	1	2	1	2900.	0.	75.
2	2	3	1	7560.	0.	75.
2	3	4	1	3030.	0.	75.
17	1	31	1	9800.	0.	75.
15	1	32	1	14100.	0.	75.
14	1	33	1	5890.	0.	75.
17	1	34	1	9080.	0.	75.
15	1	8	1	4290.	4290.	75.
18	2	11	1	1800.	1800.	75.
18	3	25	1	6400.	640.	75.
18	4	22	1	3310.	3310.	75.
18	5	26	1	3000.	3000.	75.
18	6	27	1	2400.	2400.	75.

3 ********** L O A D N O T M E T S U M M A R Y **********

MONTH	SYSTEM	SYSTEM ZONE NO.	MULTIPLICATION FACTOR	***** COOLING NOT MET ***** LOAD(MBTU)	PEAK(MBH)	HOURS	***** HEATING NOT MET ***** LOAD(MBTU)	PEAK(MBH)	HOURS
JAN	1	1	1	0.	0.	0	0.	0.	0
JAN	2	1	1	0.	0.	0	0.	0.	0
JAN	2	2	1	0.	0.	0	0.	0.	0
JAN	2	3	1	0.	0.	0	0.	0.	0
JAN	2	4	1	0.	0.	0	0.	0.	0
JAN	18	1	1	0.	0.	0	0.	0.	0
JAN	18	2	1	11892.	25.	528	0.	0.	0
JAN	18	3	1	2191.	12.	0	0.	0.	0
JAN	18	4	1	3810.	25.	331			
JAN	18	5	1	12771.	33.	720	0.	0.	0
JAN	18	6	1	0.	0.	0	-5882.	-14.	720
JAN		CHILLERS AND BOILERS		0.	0.	0	0.	0.	0
ANN	1	1	1	4018.		1059	0.		0
ANN	2	1	1	300.		74	0.		0
ANN	2	2	1	1041.		71	0.		0
ANN	18	3	1	1		65	0.		0
ANN	18	4	1	30153.		78	0.		0
ANN	18	5	1	68062.		1887	0.		0
ANN	18	6	1	30492.		1887			
ANN		CHILLERS AND BOILERS		0.		0	0.		0

4 SUMMARY OF EQUIPMENT SIZES

TYPE OF CHILLER = HERMETIC CENTRIFUGAL
NO. OF CHILLERS = 2
SIZE OF CHILLERS = 490.0 TONS

TYPE OF BOILER = OIL
NO. OF BOILERS = 2
SIZE OF BOILERS = 9900.0 MBTU

TOTAL HEATING CAPACITY = 19800.0 MBTU
TOTAL COOLING CAPACITY = 980.0 TONS

IF USED, TERMINAL REHEAT ENERGY SAME SOURCE AS BOILER.

COOLING TOWER FAN REQUIREMENT 294000. CFM 1.0 IN. S.P. 57.9 BHP

BOILER AUXILIARY HORSEPOWER REQUIREMENT (FAN+BLOWER+PUMP) 29.6 BHP

TOTAL FAN PLANT HORSEPOWER FOR BUILDING 255.9 BHP

SUMMARY OF PUMP SIZES

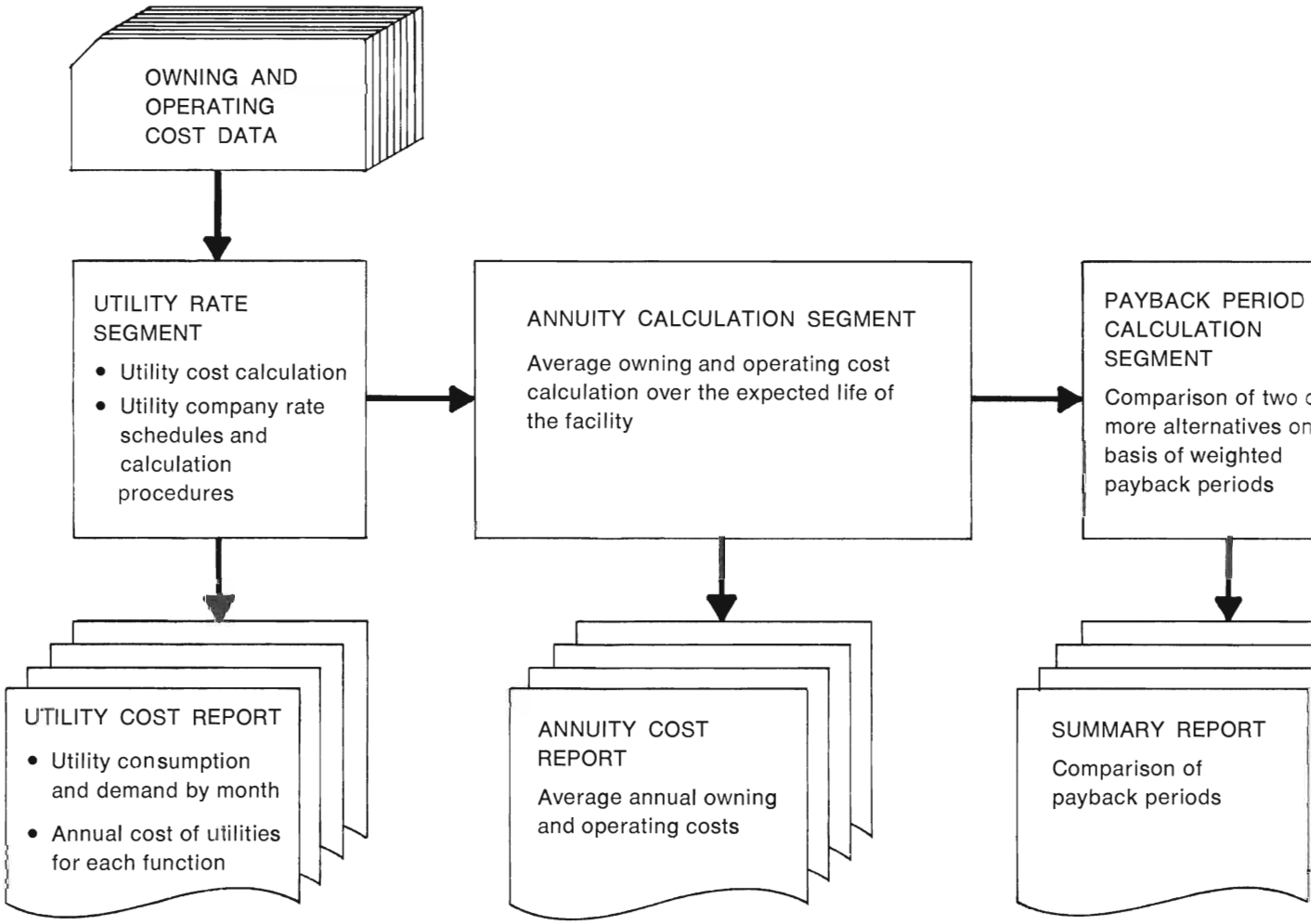
LOCATION	TOTAL GPM	TOTAL HEAD (FT)	TOTAL BHP
CHILLED WATER	2352.	67.0	82.9
CONDENSER WATER	2940.	52.5	49.9
HEATING WATER	1980.	34.4	32.8

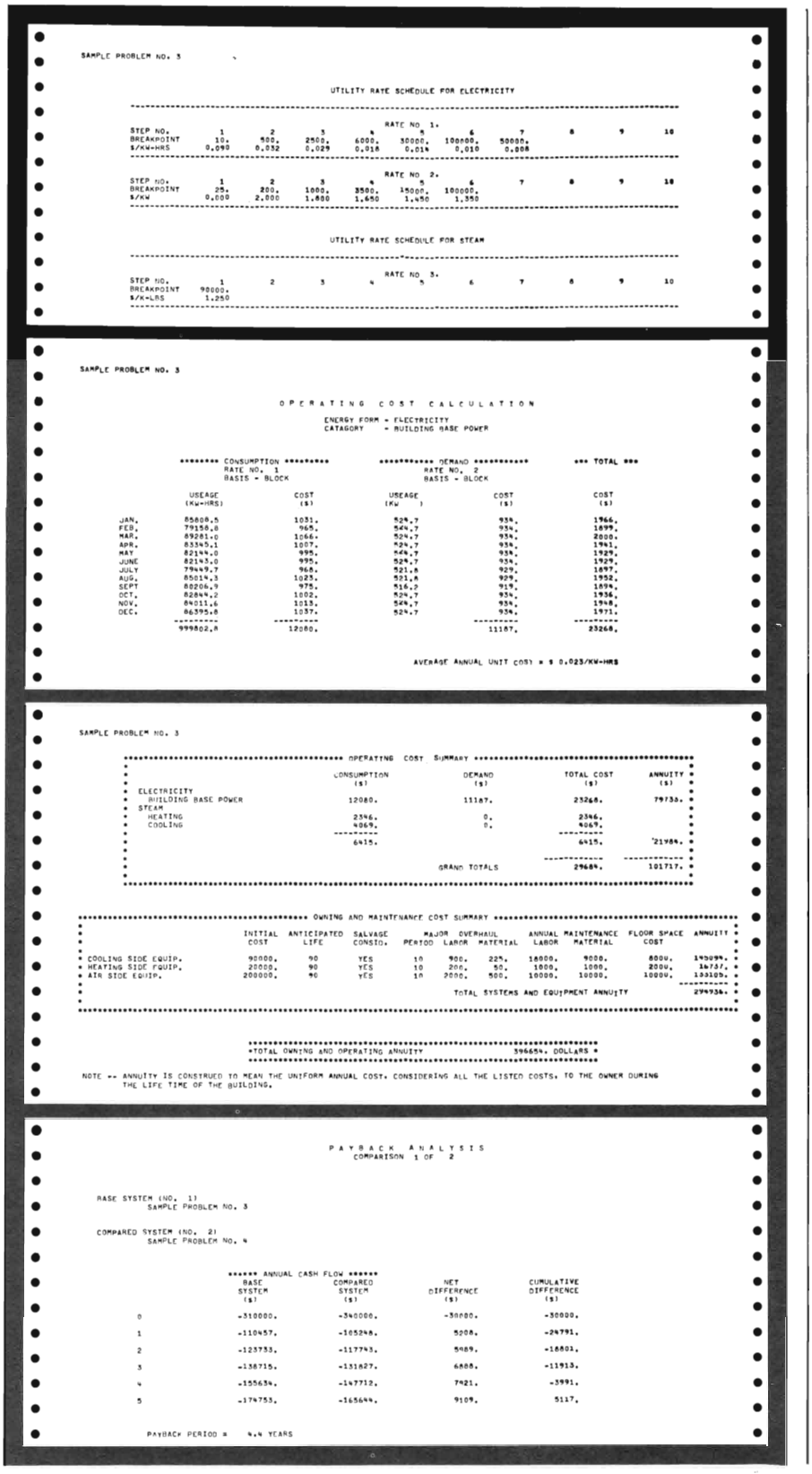
5 ********MONTHLY AND ANNUAL ENERGY AND UTILITY USE SUMMARY********

	ENERGY CONSUMPTION JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
MONTHLY BTU/1000							
MAX. DEMAND	-3625.5	-3625.5	-4088.7	-3778.8	-4200.4	-4398.7	0.0
CONSUMPTION	-768044.8	-768044.8	-817402.8	-1472497.2	-2063446.2	-3268314.5	-20086408.0
MAX. DEMAND	7961.4	7961.4	6602.0	5942.7	0.0	0.0	0.0
CONSUMPTION	1492882.2	1492882.2	1046791.1	247958.7	0.0	0.0	5575262.0
ELECTRICITY							
LIGHTS AND BUILDING EQUIPMENT							
INTERNAL							
DEMAND(KW)	1238.7	1238.7	1238.7	1238.7	1238.7	1238.7	0.0
CONS.(KWH)	775393.6	775593.6	769121.6	796600.1	762000.0	796600.1	9255176.0
EXTERNAL							
DEMAND(KW)	26.6	26.6	26.6	26.6	26.6	26.6	0.0
CONS.(KWH)	7447.7	8564.8	9780.0	11500.0	11729.9	7500.0	111927.1
HEAT (INCL. BOILER AND AUXILIARIES. AND HOT WATER PUMPS							
DEMAND(KW)	48.8	48.8	48.8	48.8	48.8	48.8	0.0
CONS.(KWH)	36278.8	36278.8	35108.5	36278.8	35108.5	36278.8	425983.0
COOL (INCL. CHILLERS. WATER PUMPS. AND COOLING TOWER FAN							
DEMAND(KW)	505.9	505.9	430.2	343.2	0.0	0.0	0.0
CONS.(KWH)	140319.7	140319.7	114630.0	49653.0	0.0	0.0	609206.5
FANS							
DEMAND(KW)	190.8	190.8	190.8	190.8	190.8	190.8	0.0
CONS.(KWH)	141930.1	141930.1	137852.0	141930.0	137352.0	141930.0	1524605.2
TOTAL							
DEMAND(KW)	1980.8	1980.8	1965.1	1818.9	1504.9	1504.9	0.0
CONS.(KWH)	1101569.2	1102685.2	1065912.2	1035961.1	46190.9	982308.1	12068828.0
OIL							
HEAT							
CONS.(K GALS)	6.8	6.8	9.4	13.1	18.4	29.4	181.4
COOL							
CONS.(K GALS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL							
CONS.(K GALS)	6.8	6.8	9.4	13.1	18.4	29.4	181.4

EXAMPLE OUTPUTS

SCOUT: Life Cycle Costs Program





SAMPLE PROBLEM NO. 3

UTILITY RATE SCHEDULE FOR ELECTRICITY

RATE NO. 1.

STEP NO.	1	2	3	4	5	6	7	8	9	10
BREAKPOINT	10.	500.	2500.	6000.	30000.	100000.	50000.			
$/KW-HRS	0.090	0.052	0.029	0.018	0.014	0.010	0.008			

RATE NO. 2.

STEP NO.	1	2	3	4	5	6	7	8	9	10
BREAKPOINT	25.	200.	1000.	3500.	15000.	100000.				
$/KW	0.000	2.000	1.800	1.650	1.450	1.350				

UTILITY RATE SCHEDULE FOR STEAM

RATE NO. 3.

STEP NO.	1	2	3	4	5	6	7	8	9	10
BREAKPOINT	90000.									
$/K-LBS	1.250									

SAMPLE PROBLEM NO. 3

O P E R A T I N G C O S T C A L C U L A T I O N

ENERGY FORM = ELECTRICITY
CATAGORY = BUILDING BASE POWER

	******** CONSUMPTION ********* RATE NO. 1 BASIS = BLOCK USEAGE (KW-HRS)	COST ($)	********** DEMAND ********** RATE NO. 2 BASIS = BLOCK USEAGE (KW)	COST ($)	*** TOTAL *** COST ($)
JAN.	85808.5	1031.	524.7	934.	1966.
FEB.	79158.8	965.	524.7	934.	1899.
MAR.	89281.0	1066.	524.7	934.	2000.
APR.	83345.1	1007.	524.7	934.	1941.
MAY	82144.8	995.	524.7	934.	1929.
JUNE	82145.0	995.	524.7	934.	1929.
JULY	79449.7	968.	521.8	929.	1897.
AUG.	85014.3	1023.	521.8	929.	1952.
SEPT	88206.9	975.	515.2	919.	1894.
OCT.	82844.2	1002.	524.7	934.	1936.
NOV.	84011.6	1013.	524.7	934.	1948.
DEC.	86395.8	1037.	524.7	934.	1971.
	999802.8	12080.		11187.	23268.

AVERAGE ANNUAL UNIT COST = $ 0.023/KW-HRS

SAMPLE PROBLEM NO. 3

OPERATING COST SUMMARY

	CONSUMPTION ($)	DEMAND ($)	TOTAL COST ($)	ANNUITY ($)
ELECTRICITY				
BUILDING BASE POWER	12080.	11187.	23268.	79730.
STEAM				
HEATING	2346.	0.	2346.	
COOLING	4069.	0.	4069.	
	6415.		6415.	21984.
GRAND TOTALS			29684.	101717.

OWNING AND MAINTENANCE COST SUMMARY

	INITIAL COST	ANTICIPATED LIFE	SALVAGE CONSID.	MAJOR PERIOD	OVERHAUL LABOR	OVERHAUL MATERIAL	ANNUAL MAINTENANCE LABOR	ANNUAL MAINTENANCE MATERIAL	FLOOR SPACE COST	ANNUITY
COOLING SIDE EQUIP.	90000.	90	YES	10	900.	22%.	18000.	9000.	8000.	145099.
HEATING SIDE EQUIP.	20000.	90	YES	10	200.	50.	1000.	1000.	2000.	16737.
AIR SIDE EQUIP.	200000.	90	YES	10	2000.	500.	10000.	10000.	10000.	133109.
TOTAL SYSTEMS AND EQUIPMENT ANNUITY										294936.

*TOTAL OWNING AND OPERATING ANNUITY 396654. DOLLARS *

NOTE -- ANNUITY IS CONSTRUED TO MEAN THE UNIFORM ANNUAL COST, CONSIDERING ALL THE LISTED COSTS, TO THE OWNER DURING THE LIFE TIME OF THE BUILDING.

P A Y B A C K A N A L Y S I S
COMPARISON 1 OF 2

BASE SYSTEM (NO. 1)
SAMPLE PROBLEM NO. 3

COMPARED SYSTEM (NO. 2)
SAMPLE PROBLEM NO. 4

	****** ANNUAL CASH FLOW ****** BASE SYSTEM ($)	COMPARED SYSTEM ($)	NET DIFFERENCE ($)	CUMULATIVE DIFFERENCE ($)
0	-310000.	-340000.	-30000.	-30000.
1	-110457.	-105248.	5208.	-24791.
2	-123733.	-117743.	5989.	-18801.
3	-138715.	-131827.	6888.	-11913.
4	-155634.	-147712.	7921.	-3991.
5	-174753.	-165644.	9109.	5117.

PAYBACK PERIOD = 4.4 YEARS

EXAMPLE OUTPUTS

How Can You Utilize SCOUT?

Some clients wish to access SCOUT through their terminals. Others desire varying levels of assistance from GARD in executing SCOUT. In order to fully respond to such varying needs GARD offers a full range of services. Specifically, a potential user may:

- Access and use SCOUT on a remote access nationwide computer network. (This service will commence on January 1, 1976.)
- Perform his own data take-off and retain GARD's services to execute SCOUT, to interpret results, and to provide consultation. These services are available both on "Time & Material" and Fixed-Price basis.
- Retain GARD's services to conduct a complete facility/system design and energy analysis program.

In order to facilitate user preparation of data, easy-to-follow input forms have been developed and are available. SCOUT users are provided copies of Input Instruction Manuals and Applications Manuals including system diagrams, sample problems, and guides for interpreting results. They are periodically notified of program improvements and training seminars.

What Will It Cost To Use SCOUT?

SCOUT is an accurate and thorough yet streamlined program designed to be utilized at minimum cost. The cost of running SCOUT depends primarily on the complexity of the building. The principal ingredient of this is the number of zones being considered and to a lesser extent, the number of delayed surfaces, and wall types. Use of optional shading and number of energy distribution systems also impact the cost figure. For example, a five-zone building with one energy distribution system may be run for under $200 with the user doing the data take-off. More complex buildings will be more costly to run. Jobs in which GARD's services are directly required will be quoted on a per-job basis.

If you have a current need for SCOUT or if you desire additional information, please call our SCOUT Support Team at (312) 647-9000.

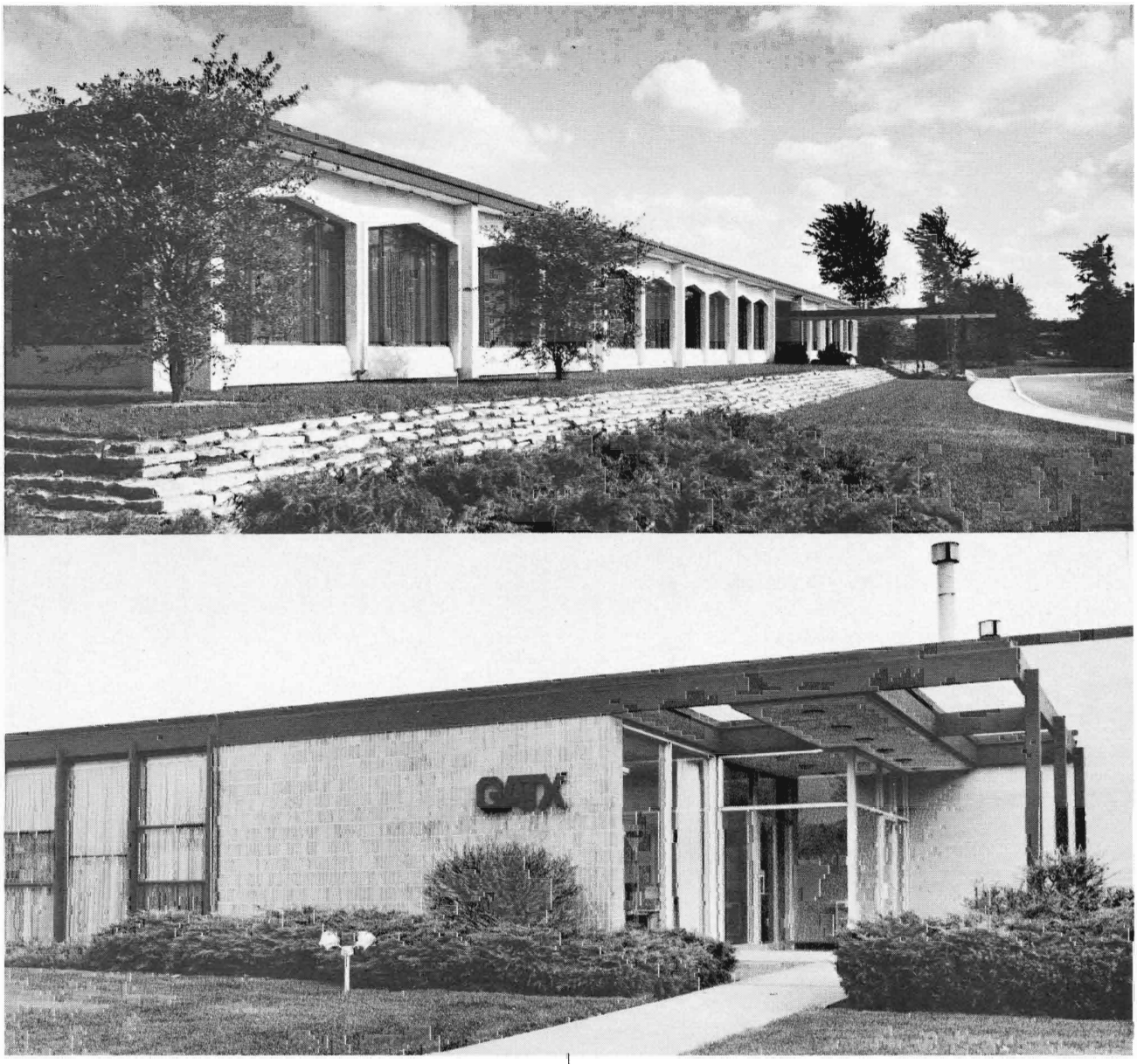
What Is GARD's Background In Energy Analysis?

GARD has extensive experience in the development, support, and application of computerized energy analysis programs, dating back to 1968 when it began work on the U. S. Postal Service Program. Since that time GARD has developed similar programs for various government agencies and private firms including NASA, U. S. Army Corps of Engineers, Mammoth Division of Lear Siegler and two utility associations. Most other proprietary programs presently being offered are modifications or simplifications of one or more of the above. GARD engineers have been members of ASHRAE Task Groups and Technical Committees and have been directly involved in the preparation of such ASHRAE publications as:

1. "Procedures for Determining Heating And Cooling Loads for Computerized Energy Calculations."

2. "Procedures For Simulating The Performance Of Components And Systems For Energy Calculations."

With SCOUT, GARD offers to the engineering community, a powerful energy conservation, design, analysis and research tool containing the capabilities of the aforementioned programs, and makes available to you the results of a decade of extensive research, development, testing and application experience in the facility/HVAC design and energy analysis field—in a surprisingly economical way.



GARD, INC.

is a leading applied engineering, research and development contractor for Government and Industry. Our offices, laboratories and shops are located a few miles from Chicago's O'Hare airport. GARD's broad capabilities span the areas of:

- **Analysis**
- **Systems & Procedures**
- **Design**
- **Prototype Fabrication & Evaluation**
- **Field Installation & Testing**

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