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A Heliostat Cost Analysis Tool

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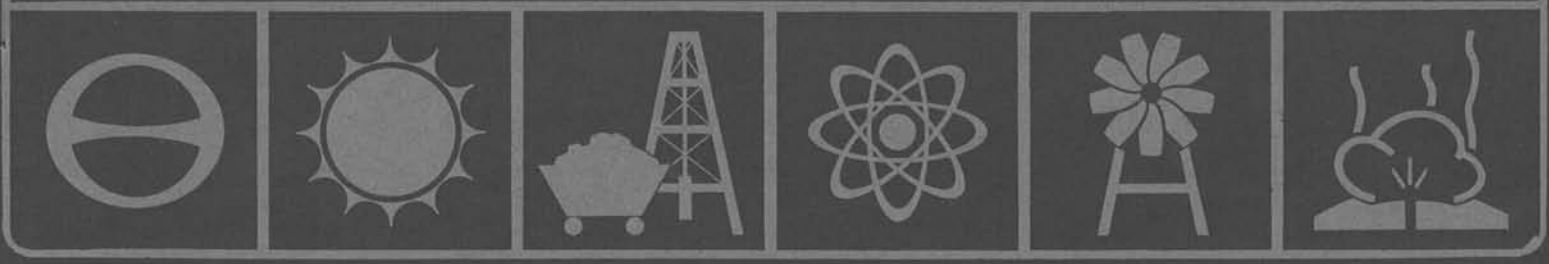

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A HELIOSTAT COST ANALYSIS TOOL

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ABSTRACT

Estimated production costs of solar energy systems serve as guides for future component development and as measures of the potential economic viability of the technologies. The analysis of heliostat costs is particularly important since the heliostat field is the largest cost component of a solar central receiver plant. A heliostat cost analysis tool (HELCAT) that processes manufacturing, transportation, and installation cost data has been developed to provide a consistent structure for cost analyses. HELCAT calculates a representative product price based on direct input data (e.g. direct materials, direct labor, capital requirements) and various economic, financial, and accounting assumptions. The characteristics of this tool and its initial application in the evaluation of second generation heliostat cost estimates are discussed. A set of nominal economic and financial parameters is also suggested.

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NOMENCLATURE

ADEP - annualized depreciation allowance
AEQR - annualized return to equity holders
AIDC - allowance for interest during construction
AINT - annualized interest expense
AOTC - annualized one-time costs
ARPL - annualied capital replacement allowance
ATXINS - annualized property tax and insurance allowance
C_o - required revenue (for factory) before taxes at the end of the startup period
CACRE - cost of improved land per acre
CBS - Cost Breakdown Structure
CEQPP - equipment cost per heliostat
CEQP - total equipment cost
CFAC - facility cost
CFACP - facility cost per heliostat
CLNDP - land cost per heliostat
CNM - consumables
COLA - cost of living allowance
CRC - cost reduction coefficient
CRSU - startup learning coefficient
CSQFT - facility cost per square foot
CTL - tooling cost
CTLP - tooling cost per heliostat
DB - double declining balance depreciation
DL - direct labor cost
DLC - fully loaded labor rate
DLH - direct labor hours
DM - direct materials
DMP - purchased materials
DMR - raw materials
EGA - general and administrative expense
EMTN - maintenance and plant engineering expense
EQR(•) - return to equity
ESCP - expense due to scrap
FAC - production facility size in square feet
FACSU - excess cost during factory startup
FCR - cost reduction factor
FEQ - equity financing fraction
FGA - general and administrative fraction
FIDC - interest during construction fraction
FINDC - indirect fraction - capital
FINDL - indirect fraction - labor
FINDM - indirect fraction - materials
FITC - investment tax credit fraction

FMTN - maintenance fraction
FPLENG - facility initial engineering fraction
FSCPP - scrap rate for purchased materials
FSCPR - scrap rate for raw materials
FTXINS - property taxes and insurance fraction
FWC - working capital fraction
IND - indirect costs
INDO - other indirect costs
INT(•) - return to bond holders
LEQA - equipment life in years
LEQT - equipment tax life in years
LFCA - facility life in years
LFCT - facility tax life in years
LND - land for the production facility in acres
LNDSU - cost of land financing
LTLA - tooling life in years
LTLT - tooling tax life in years
OTC - one-time costs
OTHEXP - other expenses
PV(•,•,•) - present value operator
Q - basis quantity in heliostats/year or heliostats/site
QCUM - cumulative number of units produced
QL - reference quantity for learning curve reduction
QSU - facility startup quantity
RATCC - after-tax cost of capital
REQR - return to equity holders
REV - required revenue
RI - inflation rate
RINT - return to bond holders
RPL(•) - capital replacement allowance
RR - real discount rate
SL - straight line depreciation
SOYD - sum of the years' digits depreciation
STCAPP - site retained capital
SUBC - subcontracts and flow-through expenses
TAU - combined federal and state income tax rate
TAX - combined federal and state income taxes
TC - facility construction period in years
TCINV - investment tax credit
TI - taxable income
TRIN - special transportation charges
TXIN(•) - property taxes and insurance
VBK(•) - total book value
WC(•) - working capital

A HELIOSTAT COST ANALYSIS TOOL

1. Summary

Designs and prototype hardware for the latest generation of glass-metal heliostats have been completed by four second generation heliostat contractors (ARCO, Boeing, Martin Marietta, and McDonnell Douglas). As a part of the design process, the installed cost of heliostats produced at rates near 50,000 units annually was estimated by each contractor. Sandia National Laboratories, Livermore (SNLL) has the responsibility of evaluating the design, prototype performance, and costs of the second generation heliostats. The HELiostat Cost Analysis Tool, HELCAT, has been developed to assist in the evaluation and comparison of helistat cost estimates.

HELCAT serves several roles in the cost evaluation process. It provides a standard format within which costs and assumptions can be examined for omissions, abnormal estimates, or other irregularities. It employs a computer algorithm to process cost information, hence allowing easy computation of the effects of changes in component costs or financial and economic assumptions. HELCAT performs an independent calculation of various burden, tax, and profit items to yield a fully loaded price for each of several heliostat profit centers. The total installed cost from HELCAT includes itemized factory costs, site costs, and transportation costs from factory to site.

HELCAT processes input data (e.g. direct material costs, direct labor quantity, capital costs) using an internal cost accounting model to yield an installed heliostat price. The primary determinants of installed price are the direct data inputs to HELCAT. However, the price also depends on the structure and parameters employed in the internal cost model. Achieving credible results using HELCAT requires a thorough understanding of both the cost model and the estimates being used as a basis for the input data.

This report explains the detailed structure of the model and proposes a nominal set of financial and accounting parameters. The nominal scenario provides a basis for comparing estimates rather than a projected market price for a particular manufacturer. Since business practices (and hence costs) will differ among firms producing heliostats, the nominal scenario represents only a typical firm in the heliostat business and should not be considered a norm for all heliostat suppliers.

The HELCAT description contained here provides only a partial picture of the second generation cost evaluation process. The work done to understand and validate the various input cost data is documented in references [1] and [2].

2. Purpose and Structure of HELCAT

2.1 Second Generation Cost Evaluation

The goal of the second generation cost evaluation is to compare and, whenever possible, validate the mass production cost estimates provided by the second generation contractors. An adequate comparison of the estimates requires that they be examined within a uniform cost accounting structure. A key task in the evaluation process is to define a consistent structure and to place the contractors' estimates into that structure. Validating cost estimates is difficult due to the diversity of the designs and production concepts and the lack of an accepted cost data base for the wide range of components used in heliostat manufacture. In the absence of actual production cost data or a uniform data base for estimates, the individual elements of heliostat cost must be examined to determine whether each is reasonable within the hypothetical production and installation scenario. Such an examination requires an item-by-item review of the bill of materials and a detailed analysis of the manufacturing plans.

A computerized heliostat cost model can serve an important role in the cost evaluation process. A well-documented model provides the uniform structure needed for cost comparisons. By explicitly defining the factors that make up the estimates, each contractor's costs are made more understandable and hence more useful to the other contractors and to potential users of the solar central receiver technology. With a single cost model one can identify the differences in the manufacturing concepts and costs for each contractor. A clear summary of the heliostat cost elements can highlight those cost components that fall outside reasonable bounds and can identify areas in which cost reduction would be most beneficial. Finally, such a tool can provide a means for understanding the sensitivity of heliostat price to the assumptions underlying the cost estimates.

The existence of a computerized cost accounting tool does not reduce the need for a detailed examination of the determinants of heliostat cost (e.g. direct materials costs, direct labor required, capital costs). A cost model can provide a means for clearly displaying and processing cost data, hence insuring that all major cost elements are considered. However, any cost model must be used with caution. The prices calculated in the model are based on a particular set of financial and economic assumptions that might not accurately represent a manufacturer's production scenario. It is the combination of an explicit cost model with a thorough understanding of the inputs that is necessary for a complete analysis of any product cost estimate.

2.2 Structure of HELCAT

A HELiostat Cost Analysis Tool (HELCAT) provides an estimate of installed heliostat price based on a buildup of elemental cost components. HELCAT is a computerized model that structures and processes direct input data and calculates an estimate of those remaining costs (burden costs) necessary to determine a nominal price. It does not replace the detailed analysis and production design activities that were a part of the second generation contracts. Instead, it permits easy and consistent use of the information generated by the detailed analyses. The major functions of the model are:

1. To provide a standardized format for use in comparing the individual elements that make up heliostat price.

2. To structure a data bank consisting of the inputs required to estimate heliostat price.

3. To compute an independent estimate of burden costs using an internal accounting model and the input direct material, labor, and capital cost data.

4. To provide a fully loaded price for major factory, site, and transportation profit centers.

5. To provide an effective means of performing sensitivity studies that relate possible changes in cost inputs and economic factors to the resulting change in estimated overall price.

The role of the cost analysis tool is not to redesign the heliostat, production facility, or installation process. The model takes certain direct inputs (direct materials, direct labor, consumables, capital costs) from the contractors' estimates and computes from them a price for the installed heliostat. The internal computational algorithm solves only the problems of adding burden costs to the direct inputs. The difficult task of insuring the credibility of the heliostat design and production processes remains outside the model. In this way it differs from production models such as SAMICS [3] which serves as a design tool for production facilities.

The costs associated with heliostat production and installation are allocated to specific profit centers for processing in HELCAT. Table 2-1 lists the profit centers that are defined for use in the second generation evaluation. Those potential profit centers not included in the evaluation are areas in which insignificant costs are incurred. For example, reflective assembly and drive fabrication are charged to factory profit centers, and installation is included in the overall assembly/installation (Cost Breakdown Structure number 4460)

profit center. Hence site profit centers are not required for the reflective assembly and drives. HELCAT is structured so that profit centers are easily added or deleted in the future if needed.

All costs necessary to support an independent business producing the specified product or service make up each profit center total. This includes direct costs, all burden costs, and a reasonable allowance for taxes and profit. The profit center total price, which will also be called the required revenue, is therefore the price at which the component would be sold under normal business conditions. In some cases, a cost that applies to several profit centers will appear in the contractor estimates. These costs must be allocated to a particular profit center before being input to HELCAT. In other cases, it will be useful to aggregate profit center calculations for purposes of discussion. Comparisons involving total factory costs and total site costs will be made later in this report.

TABLE 2-1
Second Generation Profit Centers

CBS* Number	Component Description	Factory Costs	Factory to Site Transportation Costs	Site Costs
4410	Reflective Assembly	x	x	
4420	Drives	x	x	
4430	Control/Power/Data Distribution	x	x	x
4440	Foundation/Pedestal	x	x	x
4450	Support Structure	x	x	
4460	Assembly/Installation	x		x

*Cost Breakdown Structure

The outputs generated by HELCAT for each profit center are shown in Table 2-2. These output cost elements encompass all expenses that are normally included in the price of a product. A more detailed definition of each entry is contained in Appendix A. The symbols used to represent the output cost categories are shown in the right hand columns of Table 2-2. The set of accounts chosen for HELCAT is not unique. Other equally valid cost estimation structures may break costs into finer detail, aggregate costs into larger categories, or even allocate costs among categories diferently. However, a single structure must be chosen for consistent comparisons to be made. The chosen breakdown matches the level of resolution of most second generation estimates and, taken together with the inputs that determine each cost element, provides an understanding of the basis for heliostat costs.

TABLE 2-2
HELCAT Output
Cost Account Structure
(Costs expressed in $/heliostat)

COST ELEMENT	SYMBOL
Direct Materials	DM
Purchased Materials	DMP
Raw Materials	DMR
Scrap	ESCP
Direct Labor	DL
Consumables	CNM
Indirect Costs	IND
Maintenance/Plant Engineering	EMTN
Other Indirects	INDO
Capital Replacement Allowance	ARPL
Property Tax and Insurance	ATXINS
General and Administrative Expense	EGA
Interest Expense	AINT
Income Taxes	TAX
Return to Equity Holders	AEQR
Other Expenses	OTHEXP
Annualized One-time Costs	AOTC
Subcontracts and Flow-Through Expenses	SUBC
Site-retained Capital	STCAPP
Special Transportation Charges	TRIN
Required Revenue (Price)	REV

The structure of the inputs required by HELCAT is illustrated in Figure 2.1. These user-specified inputs are divided into two groups. The first consists of the direct inputs. They include direct materials costs, consumables costs, direct labor hours, and capital costs. Some of these costs flow directly through to the overall heliostat price (e.g., direct materials, consumables) while the others must be processed in HELCAT to determine their impact on price. The second input group consists of the cost model parameters. These are the financial, accounting and other cost assumptions that permit estimation of a price from the direct inputs.

As illustrated in Figure 2-1, the direct inputs are unchanged by the cost model while the derived cost components depend, at least in part, on assumptions within the model. Specification of a particular cost component as either a direct input or derived cost is somewhat arbitrary. For example, consumables might be considered a fixed fraction of direct material and hence could be a derived cost. Similarly, the contributors to indirect labor could be modeled and costed in detail by the contractors and hence included as a direct input. The structure outlined in Figure 2-1 is a reasonable one for heliostat cost analysis because the critical production cost elements are retained as direct inputs and because the structure corresponds to the level of detail available in the second generation estimates.

The HELCAT model takes the values of the direct inputs as given. There is no provision for modeling the direct resource requirements of production and installation. The analysis of the direct inputs has been another major focus of the second generation cost evaluation [1,2].

In the sections that follow, the algorithm used to derive price from the direct inputs and model parameters is explained in detail. A nominal set of HELCAT financial and accounting parameters is then proposed.

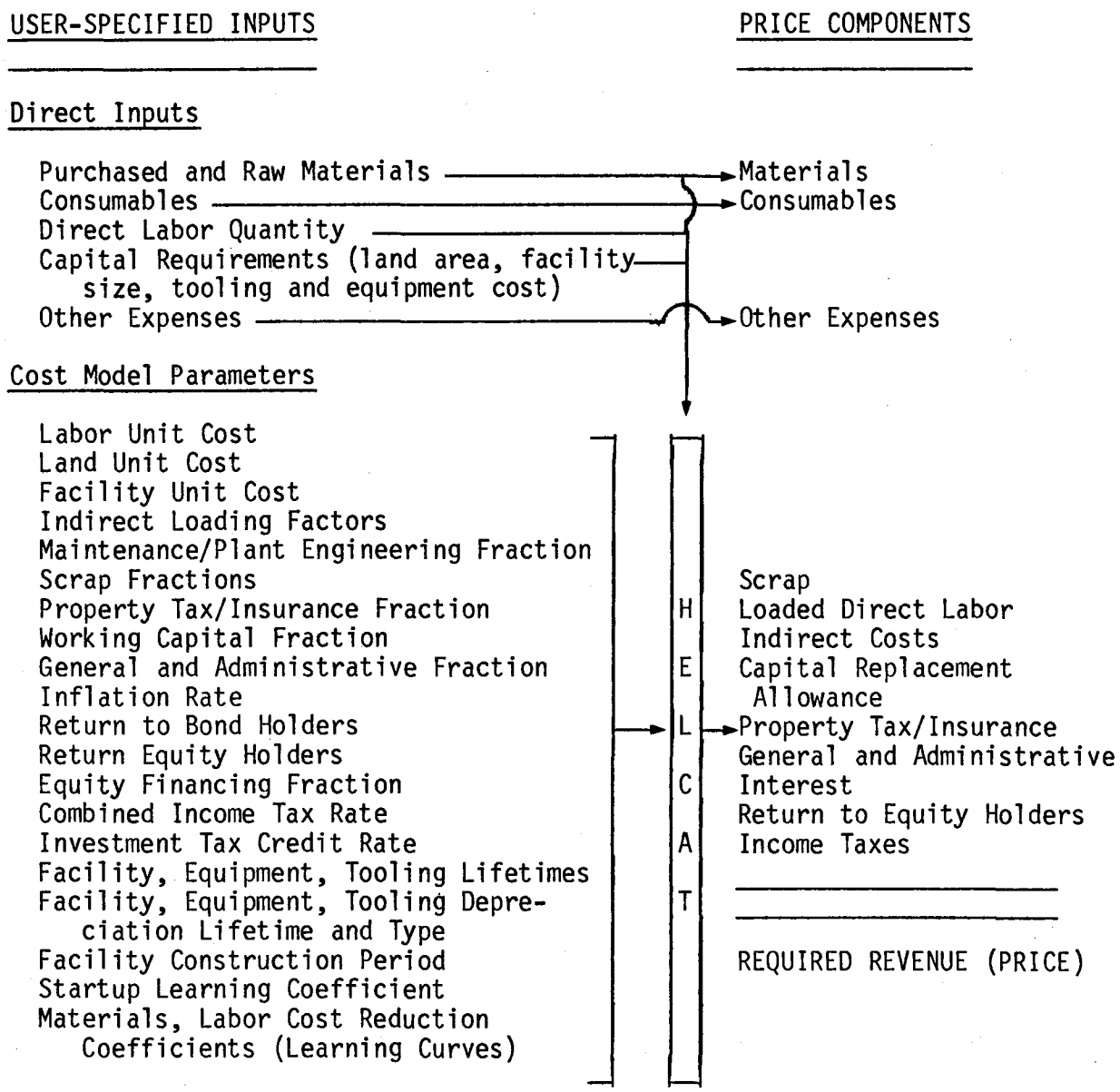


Figure 2-1. Structure of the Heliostat Cost Model

3. Descriptions of HELCAT Cost Models

3.1 Direct Inputs

The direct inputs needed for each profit center price calculation are shown in Table 3-1. More detailed descriptions of these input cost accounts are contained in Appendix A. Since these data are used without modification in HELCAT, they must be derived and verified externally. In most cases the entries in Table 3-1 represent a much larger list of cost components. For example, the materials costs represent the total of all purchased and raw materials required by a profit center. An example of an expanded direct input list is shown in Appendix D.

TABLE 3-1
Direct Input Categories

Description	Units	Symbol
Purchased Materials	$/heliostat	DMP
Raw Materials	$/heliostat	DMR
Consumables	$/heliostat	CNM
Direct Labor	hrs/heliostat	DLH
Land (production facility)	acres	LND
Facility Size (production facility)	sq ft	FAC
Equipment Cost	$	CEQP
Tooling Cost	$	CTL
Basis Quantity	heliostat/yr or heliostat/site	Q
Other*		

*Certain direct expenses categories such as site-retained capital, subcontracts and flow-through expenses, and direct transportation charges are also permitted.

3.2 Required Revenue (Price)

The price that a purchaser might expect to pay for the components or services produced within a profit center is called the required revenue (REV). It includes all expenses normally encountered in the operation of a firm. The required revenue is equal to the sum of all cost categories shown in Table 3-2:

$$REV = DM + DL + CNM + IND + ARPL + ATXINS + EGA + AINT + TAX + AEQR + OTHEXP \quad (3.1)$$

Most of the cost components in equation (3.1) are derived within HELCAT based on both direct inputs and the internal cost model. The expenses

that make up required revenue are discussed individually in the sections that follow.

TABLE 3-2
Components of Required Revenue

COST ELEMENT	SYMBOL
Direct Materials	DM
Direct Labor	DL
Consumables	CNM
Indirect Costs	IND
Capital Replacement Allowance	ARPL
Property Tax and Insurance	ATXINS
General and Administrative Expense	EGA
Interest Expense	AINT
Income Taxes	TAX
Return to Equity Holders	AEQR
Other Expenses	OTHEXP

3.3 Direct Material, Direct Labor, Consumables, Land, and Facility Cost

The input direct material costs, DMP and DMR, are increased by the addition of a scrap allowance. The purchased and raw materials are assumed to experience fractional scrap rates of FSCPP and FSCPR respectively. The resulting expense for scrap is given by:

$$ESCP = (FSCPP)*(DMP) + (FSCPR)*(DMR). \qquad (3.2)$$

The scrap expense is added to the input material costs, DMP and DMR, to yield the total direct material charge DM:

$$DM = DMP + DMR + ESCP.$$

The direct labor cost DL is given by the hourly rate DLC times the direct labor input DLH (in hours). The rate DLC is a fully loaded rate that includes all fringe benefits such as payroll taxes/insurance, pension and benefits, premiums (overtime, shift differential, cost of living allowance), vacation, holidays, and personal leave:

$$DL = DLC * DLH.$$

The input consumables cost CNM remains unchanged in the HELCAT cost model.

The cost of improved land CACRE ($ per acre) for the production facility is a HELCAT parameter. The improved land acreage LND multiplied by the unit cost CACRE yields total land cost. The land cost per heliostat CLNDP is obtained by dividing by the basis quantity Q.

$$CLNDP = (LND * CACRE)/Q$$

The facility cost CFAC is obtained by multiplying the unit facility cost CSQFT ($ per square foot) by the input facility size FAC. A fractional increase FPLENG in facility, equipment, and tooling cost due to design and engineering costs during construction is allowed in HELCAT. These expenses are also expressed per heliostat by dividing by the basis quantity Q.

$$CFACP = (1. + FPLENG)*(FAC*CSQFT)/Q$$
$$CEQPP = (1. + FPLENG)*(CEQP)/Q$$
$$CTLP = (1. + FPLENG)*(CTL)/Q$$

3.4 Indirect Costs

The indirect accounts encompass a wide range of activities. These include plant supervision, plant maintenance and engineering, quality control, shipping/receiving, and some plant administrative services. The indirect expenses are estimated as fractions of various direct charges. Table 3-3 indicates the loading assumed for particular indirect expenses.

TABLE 3-3
Loading Assumptions for Indirect Costs

Expense	Estimated as a Fraction of	Fraction
Maintenance/ Plant Enginering	Facility, Equipment, Tooling	FMTN
Quality Control/Inspectors Supervision Production Control/Scheduling Material Handling	Direct Labor	FINDL
Shipping/Receiving Purchasing/Accounting	Direct Materials	FINDM
Security Janitorial	Facility, Equipment, Tooling	FINDC

The total indirect cost is separated into two categories: 1) maintenance and plant engineering EMTN, and 2) other indirects INDO. The indirect cost is the sum of the indirect loading fractions times the appropriate direct costs as shown in equation (3.3).

$$IND = \overbrace{(FMTN*(CTLP+CEQPP+CFACP))}^{EMTN} + \overbrace{(FINDL*DL) + (FINDM*DM) + (FINDC*(CTLP + CEQPP+ CFACP))}^{INDO} \quad (3.3)$$

3.5 Capital-related Expenses

There are several profit center costs that depend on the value of the capital facilities. The replacement cost ARPL is the amount allocated for amortization of the initial investment. Property taxes and insurance ATXINS depend on the value of the capital stock. The return to investors, AINT and AEQR, depends on the value of the capital stock being financed by them.

The book value of the capital stock as a function of time is calculated as shown in Figure 3-1. The initial costs of land, facilities, equipment and tooling are taken from the direct inputs. The time horizon is the facility lifetime LFCA, after which the book value is equal to the land value. Both equipment and tooling are replaced at the ends of their lifetimes (LEQA and LTLA, respectively). The replacement cost is equal to the initial cost times a factor for inflation. An allowance for working capital WC is also included in the book value. The value of working capital in the i^{th} year is approximated by the yearly direct plus indirect expense (corrected for inflation) times the fraction FWC of the year that cost must be financed by the investors.

$$WC(i) = FWC * (DM + CNM + DL + IND)*(1 + RI)^{i} \quad (3.4)$$

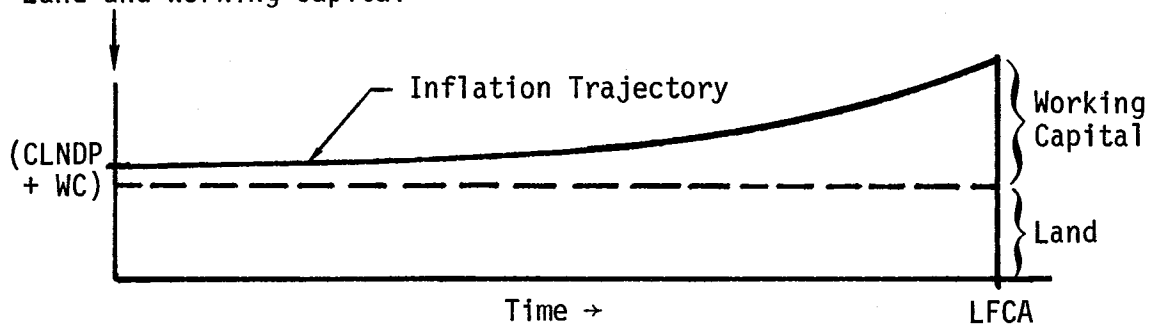
The total book value in the i^{th} year, VBK(i), is the sum of the land, facility, equipment, tooling and working capital costs in that year expressed on a per heliostat basis.

The capital replacement allowance RPL(i) is the difference between the book value in year (i-1) and year (i) not attributable to the differences in working capital.

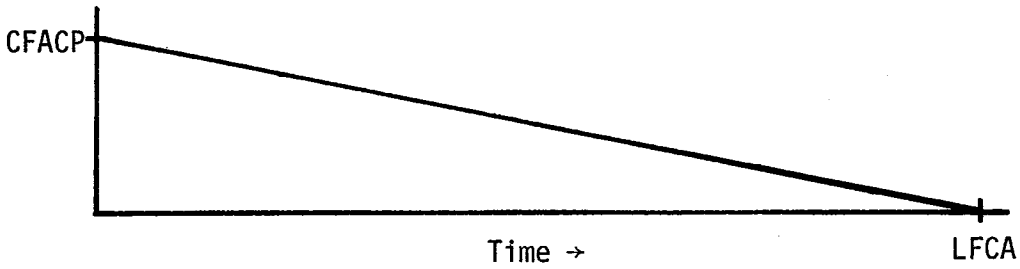
$$RPL(i) = VBK(i-1) - VBK(i) - (WC\ (i-1) - WC\ (i))$$

The capital replacement allowance is equivalent to a straight line depreciation allowance over the economic life. This does not preclude the use of accelerated depreciation in the calculation of income taxes (to be discussed below).

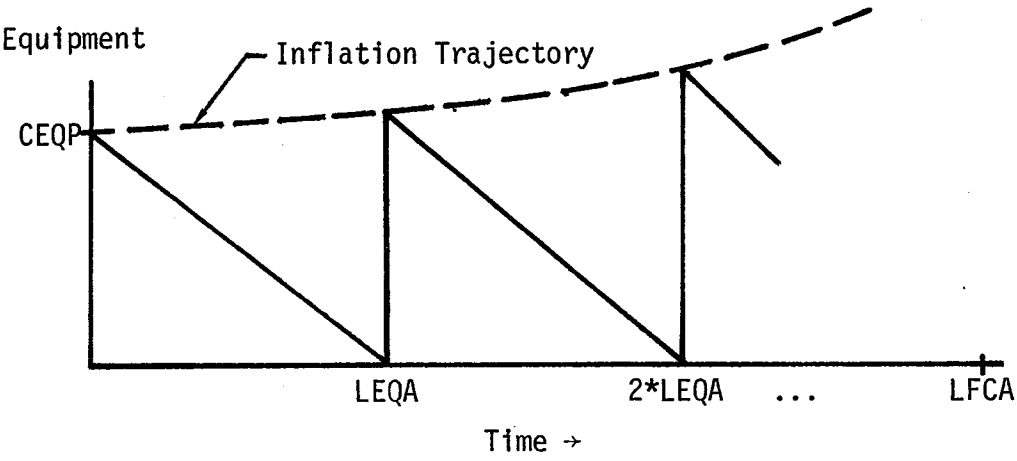
1. Land and Working Capital



2. Facility



3. Equipment



4. Tooling

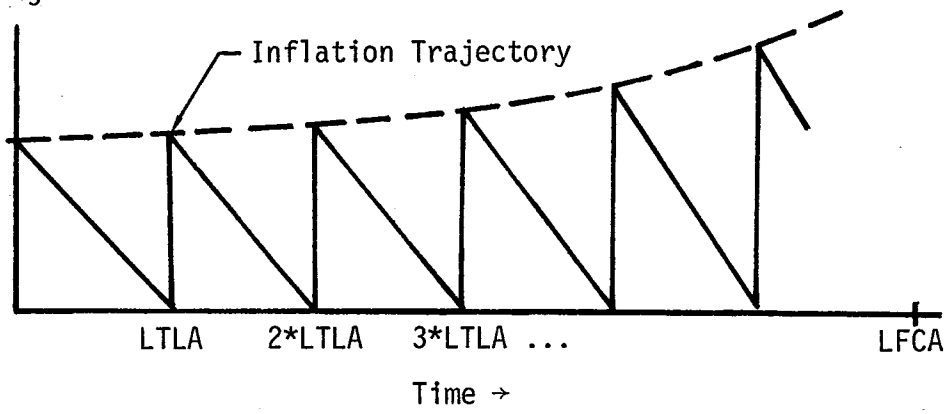


Figure 3-1. Calculation of Book Value Trajectory.

Book Value = Current Value of: (Land) + (Working Capital) + (Facilities) + (Equipment) + (Tooling)

Land is not depreciated in HELCAT. However, a constant land value is included in the working capital and hence is financed by the investors over the lifetime of the facility.

Property taxes and insurance are a fraction FTXINS of the current book value.

$$TXINS(i) = FTXINS * VBK(i)$$

The return to bond and equity holders is given respectively by the cost of the debt RINT and the cost of equity REQR times that portion of the book value financed by each. The fraction of equity financing is FEQ.

$$INT(i) = (1-FEQ) * RINT * VBK(i)$$
$$EQR(i) = FEQ * REQR * VBK(i)$$

In order to obtain a single cost that escalates at a fixed inflation rate rather than a stream of costs that are proportional to book value, the time varying expenses that depend upon book value are annualized. An annualized cost is a cost that is constant in real terms and whose present value over the facility lifetime is equal to the present value of the actual cost stream. For example, if AC is the annualized equivalent to cost stream C(i) over lifetime L then equation (3.5) provides a way of finding AC.

$$PV\ (k, \{AC*(1+RI)^{i}\}_{i=1}^{L}, L) = PV\ (k, \{C(i)\}_{i=1}^{L}, L) \qquad (3.5)$$

where

$PV(\cdot,\cdot,\cdot)$ = present value operator

$$PV(k, \{C(i)\}_{i=1}^{L}, L) \equiv \sum_{i=1}^{L} \frac{1}{(1+k)^{i}} C(i)$$

k = discount rate

L = lifetime

RI = inflation rate

The discount rate used for annualizing is the after-tax cost of capital RATCC. The combined (federal plus state) income tax rate is TAU.

$$RATCC = (1 - TAU)*(1 - FEQ)*(RINT) + (FEQ)*(RINT) \qquad (3.6)$$

The annualized values for replacement expense ARPL, property taxes and insurance ATXINS, and return to investors (AINT and AEQR) are defined by the following equations. Annualized costs are expressed in terms of dollars per heliostat and are calculated according to equations (3.7)-(3.10).

$$PV\ (RATCC, \{ARPL*(1 + RI)^i\}, LFCA) = PV\ (RATCC, \{RPL(i)\}, LFCA) \quad (3.7)$$

$$PV\ (RATCC, \{ATXINS*(1 + RI)^i\}, LFCA) = PV\ (RATCC, \{TXINS(i)\}, LFCA) \quad (3.8)$$

$$PV\ (RATCC, \{AINT*(1 + RI)^i\}, LFCA) = PV\ (RATCC, \{INT(i)\}, LFCA) \quad (3.9)$$

$$PV\ (RATCC, \{AEQR*(1 + RI)^i\}, LFCA) = PV\ (RATCC, \{EQR(i)\}, LFCA) \quad (3.10)$$

3.6 General and Administrative Expense

The general and administrative expense EGA is modeled in HELCAT as a fraction of the total before-tax profit center cost. The only excluded costs are income taxes and return to equity holders which are not yet considered as expense items when the G & A loading factor FGA is applied.

$$EGA = FGA * (DM + DL + CNM + IND + ARPL + AINT + ATXINS) \quad (3.11)$$

The general and administrative category includes a wide variety of expenses and is discussed in more detail in Appendix A.

3.7 Income Taxes and Other Expenses

The taxable income TI that must exist in order to yield a return to equity holders of AEQR is given as:

$$TI = (AEQR + ARPL - ADEP)/(1. - TAU). \quad (3.12)$$

The annualized depreciation ADEP can be calculated using straight line, double declining balance, or sum of the years' digits schedules within HELCAT. The excess deduction over straight line depreciation is given by (ARPL-ADEP) and is assumed to reduce required taxable income. For example, when straight line depreciation is elected and the tax life is equal to the accounting life, ARPL=ADEP so the amount expensed to the profit center is equal to the tax deduction and there are no tax benefits. When accelerated depreciation is employed or when the tax life is less than the accounting life, ARPL<ADEP so (ARPL-ADEP) is a

deduction that offsets other taxable income. The after tax income is assumed to be returned to the equity holder through either dividends or retained earnings which increase equity value. Hence net (after-tax) income is equal to AEQR. The income tax paid per heliostat TAX is equal to the taxable income times the combined (federal plus state) tax rate.

$$TAX = TI * TAU$$

Another expense category that is allowed for factory profit centers is a one-time cost that represents the costs of factory construction and startup. This cost includes land and factory financing during construction, investment tax credits and excess production costs during startup. Since all HELCAT inputs are in startup year dollars, the real discount rate (corrected for inflation) rather than the nominal discount rate is used to compute the allowance for financing expenditures that occur prior to startup. The real discount rate RR is given by:

$$RR = \frac{1 + RATCC}{1+RI} - 1. \qquad (3.13)$$

If the construction period has length TC and the land is purchased at the beginning of construction, the cost of land financing LNDSU (assuming continuous compounding) is given by:

$$LNDSU = (e^{RR*TC} - 1) * CLNDP. \qquad (3.14)$$

The factor for interest during construction FIDC assumes expenditures follow a sinusoidal trajectory during the construction period. The factor FIDC is the ratio of the present value at startup of this stream of cash flows to the sum of the cash flows.

$$FIDC = \frac{\pi}{2*TC} \quad \frac{1 + e^{RR*TC}}{(RR)^2 + \left(\frac{\pi}{TC}\right)^2} \qquad (3.15)$$

The allowance for interest during construction AIDC is the cost of financing plant construction.

$$AIDC = (FIDC - 1)*(CFACP + CEQPP + CTLP)$$

An investment tax credit TCINV is allowed on tooling and equipment at a rate FITC.

$$TCINV = FITC * (CEQPP + CTLP)$$

C_o = Cost at end of startup period

QSU = Quantity produced during startup

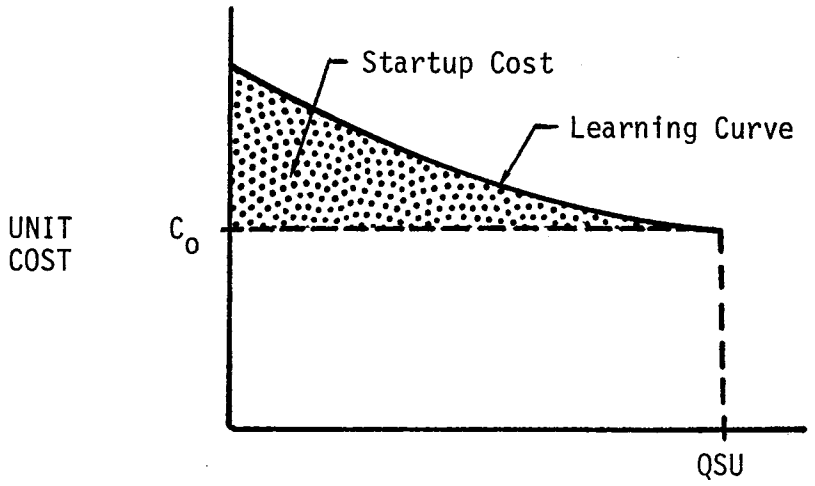


Figure 3-2 Excess Costs During Factory Startup

The change in factory costs during the startup period consisting of QSU units of production is modeled by a learning curve. The excess cost due to startup is illustrated in Figure 3-2 as the shaded area between the learning curve and the C_o cost line. This excess cost during factory startup is given by:

$$FACSU = C_o * QSU * \left[\frac{1}{(K+1)} - 1 \right] \tag{3.16}$$

where

C_o = required revenue (for factory) before taxes at the end of the startup period

C_o = DM + DL + CNM + IND + ARPL + AINT + ATXINS + EGA + AEQR

CRSU = learning (cost reduction) coefficient during startup

$$K = \frac{\ln CRSU}{\ln 2}$$

The total one-time cost OTC is given by:

$$OTC = LNDSU + AIDC + FACSU - TCINV. \tag{3.17}$$

The one-time cost is annualized over the facility lifetime using the methodology described earlier to obtain the annualized one-time cost per heliostat AOTC.

Several other cost categories are included in HELCAT for special applications. Subcontracts and other flow-through expenses can be input and are added directly to the profit center required revenue. Site-retained capital charges are added to site profit center costs when facilities (such as a site assembly building) or equipment are left at the construction site. These costs are allocated as a lump sum over the site heliostats rather than being depreciated. Finally, transportation requirements can be input in terms of pounds or truckloads and an itemized transportation expense will appear in the profit center cost tabulation. HELCAT currently adds these other expenses to the profit center total without applying a further loading factor. Multiplication by an additional loading factor must be done before inputing these expenses into HELCAT if additional loading is appropriate.

3.8 The Effects of Learning

For quantities produced above some reference quantity QL, the direct materials and direct labor costs are allowed to decline along a learning curve. In the learning curve model, costs decline by a factor equal to the cost reduction coefficient CRC each time production doubles above the reference quantity. QCUM is the cumulative number of units produced and FCR is the factor by which the initial (reference) cost is multiplied to obtain the cost of the $QCUM^{th}$ unit.

$$FCR = \begin{cases} 1.0 \quad , & QCUM \leq QL \\ CRC^{p} \quad \text{where } p = \dfrac{1}{\ln 2}\left(\ln \dfrac{QCUM}{QL}\right) \quad , & QCUM > QL \end{cases}$$

Different reference quantities and cost reduction coefficients are permitted for materials and labor and for factory and site profit centers. The set of inputs required to employ the learning model is shown in Table 3-3.

TABLE 3-3
QL, CRC Pairs Employed
in Learning Model

	Factory	Site
Materials	(QL_{FM}, CRC_{FM})	$(QL_{SM}, CRC_{SM}$
Labor	(QL_{FL}, CRC_{FL})	$(QL_{SL}, CRC_{SL}$

4. Nominal Model Parameters for HELCAT

4.1 Role of Nominal Parameters

The validity of the costs derived within HELCAT depends on the degree to which the model parameters reflect the actual production and installation scenario. A default set of model parameters is suggested in this chapter. These values were derived from the available information and are intended to represent a typical heliostat supplier. The actual economic environment faced by specific firms may be significantly different than that described here. However, in the absence of detailed information on the operation of a particular company, the default values should yield reasonable expense levels for all derived components of the profit center required revenue.

The nominal parameters reflect a steady-state, normal business environment. In the early stages of a heliostat market, it is likely that firms will deviate from "normal" pricing for strategic reasons. For example, a firm might price early heliostats well below cost in an attempt to capture a larger share of a growing market. Such strategies are not reflected in the nominal HELCAT scenario.

4.2 Nominal Parameter Values

The set of nominal, default cost parameters used in HELCAT is listed in Table 4-1. The basis for these parameter choices is discussed in Appendix C.

Several caveats should be attached to the nominal parameter set. First, these represent initial values. As more data become available it is expected that both the model structure and parameters will be adjusted accordingly. Second, these parameters should be shifted for very capital-intensive or labor-intensive production scenarios. Appendix C contains suggested shifts for a few parameters. Caution should be exercised when the model is applied to manufacturing environments that are significantly different than that of the second generation heliostat estimates. Finally, care must be taken when applying the model to existing estimates that particular costs are not missed or double counted. For example, many estimates include an allowance for scrap in the direct materials cost. If these costs are used in HELCAT without adjusting the internal scrap fractions to zero, scrap will be double counted in the final price. The same is true, for example, for the plant design and engineering factor that multiplies input capital cost. If an allowance for plant design and engineering during construction has been made in the inputs, the appropriate HELCAT internal factor should be set to zero. Achieving credible results using HELCAT requires a thorough understanding of both the HELCAT model and the estimates being used as a basis for the input.

TABLE 4-1
HELCAT Nominal Cost Model Parameters Values

Parameter	Symbol	Factory	Site	Transportation
Direct Labor Cost ($/hr)*	DLC	9.45	15.00	15.00
Factory Cost ($/sq ft)*	CSQFT	50.	-	-
Land Cost ($/acre)*	CACRE	20000.	-	-
Scrap Fraction (Purchased Mat'l)	FSCPP	.01	.01	.01
Scrap Fraction (Raw Mat'l)	FSCPR	.03	.03	.03
Maintenance Fraction	FMTN	.02	.04	.04
Indirect Fraction-Labor	FINDL	.27	0.3	0.3
Indirect Fraction-Material	FINDM	.0035	0.0	0.0
Indirect Fraction-Capital	FINDC	.006	0.0	0.0
Working Capital Fraction	FWC	.17	0.0	0.0
Property Tax and Insurance	FTXINS	.04	.04	.04
General and Administrative	FGA	.09	0.0	0.0
Inflation Rate	RI	.06	.06	.06
Equity Fraction	FEQ	.8	.8	.8
Return to Bond Holders	RINT	.102	.102	.102
Return to Equity Holders	REQR	.166	.166	.166
Combined Income Tax Rate	TAU	.5	.5	.5
Investment Tax Credit	TCINV	.1	.1	.1
Facility Construction Period (yrs)	TC	3.	-	-
Facility Initial Engineering Fraction	FPLENG	.1	-	-
Facility Startup Quantity	QSU	20000.	-	-
Startup Learning Coefficient	CRSU	.92	-	-
Facility Life (yrs)	LFCA	30.	-	-
Equipment Life (yrs)	LEQA	10.	10.	10.
Tooling Life (yrs)	LTLA	5.	5.	5.
Facility Tax Life (yrs)	LFCT	25.	-	-
Equipment Tax Life (yrs)	LEQT	8.	8.	8.
Tooling Tax Life (yrs)	LTLT	3.	3.	3.

*Labor, factory, and land costs are assumed to be in early 1981 dollars.

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[1] Norris, H. F., "Second Generation Heliostat Cost Review," Sandia Laboratories Report, to be published.

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[3] Chamberlain, R. G., "A Normative Price for a Manufactured Product: The SAMICS Methodology," Jet Propulsion Laboratory, DOE/JPL-1012-79/5, January 1979.

[4] U. S. Department of Labor, "Employment and Earnings, State and Areas, 1939-78," Bulletin 1370-13, November 1979.

[5] Private communication, J. Butterfield, A. D. Little, Inc., July 1981.

[6] "Second Generation Heliostat Development for Solar Central Receiver Systems, Final Report," Northrup, Inc. (ARCO Power Systems), March 1981, SAND81-8178.

[7] "Final Report, Second Generation Heliostat Development for Solar Central Receivers," Boeing Engineering and Construction, March 1981, SAND81-8175.

[8] "Second Generation Heliostat Development, Final Report" Martin Marietta Corporation, April 1981, SAND81-8176.

[9] "Final Report -- Second Generation Heliostat with High Volume Manufacturing Facility Defined by General Motors," McDonnell Douglas Astronautics Co., April 1981, SAND81-8177.

Appendix A
HELCAT Account Structure

Input Cost Accounts

Direct Material - All purchased supplies, parts and materials that are raw stock or component parts of the profit center product. Purchased materials are those that are assembled without further processing. Raw materials undergo one or more manufacturing steps before assembly into the next higher level.

Direct Labor - All production employees whose working time is dedicated to the manufacture of the profit center product or its component parts.

Consumables - All purchased supplies and materials that are necessary in the manufacturing process but do not appear in the finished product. Consumables include utilities, processing supplies and perishable tooling.

Production Facility Land - The improved land on which the heliostat manufacturing facility is sited.

Facility - The structure that houses the heliostat manufacturing operations. Included are heating, air conditioning and other utility systems, provisions for product transportation, and all necessary warehouse and office space.

Equipment, Tooling - Production machinery used in the manufacture of the profit center product. Tooling has a shorter useful life than equipment and can thus be depreciated more rapidly.

Site-retained Capital - Capital facilities and equipment that are used at the site for heliostat installation and then are retained by the site owner. These costs are expensed over the site heliostats rather than being amortized over their useful life.

Subcontracts and Flow-through Expenses - Expenses for manufacturing, transportation or installation services that are purchased rather than performed by the heliostat manufacturer. These expenses are added directly, without further loading, to the profit center required revenue.

Transportation Requirements - HELCAT has the option of computing transportation costs on a simple $/lb or $/truckload basis. If this option is employed, the transportation requirements in pounds or truckloads is a required input.

Profit Center Expense Accounts

Direct Materials (DM) - The direct materials account includes both the input purchased and raw materials as well as an allowance for scrap.

Direct Labor (DL) - Direct labor is a fully loaded direct labor cost including Social Security payments, unemployment insurance, Workmen's Compensation, company contributions to insurance policies and pension funds, vacations, holidays, premiums (overtime, shift, cost of living allowance) and other fringes. Labor productivity is not included in direct labor rates and hence should be included in the number of labor hours required.

Indirect Costs (IND) - This category is subdivided into plant maintenance and engineering (EMTN) and other indirects (INDO).

Plant Maintenance and Engineering (EMTN) - This account includes all labor and material needed to maintain the production facility and to make routine changes in the manufacturing process or equipment.

Other Indirects (INDO) - The other indirects account encompasses all indirect functions except maintenance and plant engineering. These include the following:

Quality Control and Inspectors
Supervision
Production Control and Scheduling
Material Handling
Shipping and Receiving
Purchasing and Accounting
Security
Janitorial
Other (personnel services, medical, cafeteria, etc)

Capital Replacement Allowance (ARPL) - The internal charge assessed for depreciation of capital equipment. This is not necessarily the same depreciation as charged on the corporate income tax return.

General and Administrative Expense (EGA) - This account includes both marketing and administrative expenses. Typical marketing expenses are:

Advertising
Sales Expenses and Promotion
Sales Engineers
Traffic
Billing and Customer Accounting

Administrative expenses include:

Corporate Management
Public Relations
Legal Services
Research and Development
Contingency

Interest and Return to Equity Holders (AINT and AEQR) - Capital investments are financed in HELCAT with a combination of bond and common stock issues. The interest expense is the interest paid to bond holders. The return to equity holders includes both dividends paid and retained earnings used to increase equity value.

One-time Costs (AOTC) - Certain costs associated with the construction and startup of the heliostat production facility are collected as one-time costs and annualized over the entire production run. These costs iclude:

Allowance for land and factory financing during construction
Investment tax credits
Excess factory startup costs

Appendix B
A Review of Second Generation Cost Data

A major role for HELCAT is to provide an independent calculation of derived or burden costs in heliostat production. For the costs to be realistic, the parameters used in the calculations must reflect actual operating practices of heliostat manufacturing firms. One source of comparison data for the burden calculations is the group of second generation cost estimates, [6, 7, 8, 9]. This appendix examines the second generation burden costs and, where possible, identifies comparison data in the HELCAT format.

It is often difficult to infer HELCAT cost model parameters directly from second generation estimates. The large differences in the estimation structures and procedures used by the contractors reflect the diversity of the business practices within the involved organizations. Tables B-1 through B-4 itemize contractor burden cost data. The tables are intended to illustrate the broad range of burden accounts employed and the large differences in detailed burden costs. (For a more complete analysis of heliostat costs see references [1] and [2].) In order to place contractor estimates into the HELCAT format, contractor burden costs would have to be broken down and reallocated within the new cost structure. In most cases, this cannot be achieved with the level of information included in the estimates. The specific contractor burden costs are therefore of limited value in defining HELCAT cost model parameters. Comparing the aggregate burden cost from HELCAT and the second generation estimates is more meaningful than comparing specific burden accounts. Aggregate burden comparisons are done as a part of the general analysis of second generation costs using HELCAT [1].

Some second generation data that are more directly comparable to HELCAT data are tabulated in Table B-5. The data show significant differences in the costs and assumptions used in the contractors estimates. Further discussion of appropriate cost model parameters for HELCAT along with a proposed set of nominal parameters is included in Appendix C.

TABLE B-1
ARCO/NORTHRUP BURDEN COST DETAIL [a]
($/HELIOSTAT)

FACTORY PROFIT CENTERS		
Direct Costs		
Direct Materials		3272.
Direct Labor [b]		118.
Consumables [c]		140.
Burden Costs		
Variable Indirect Labor and Premiums		86.
Fixed Indirect Labor		59.
Depreciation		164.
Property Taxes		24.
Capital Costs		
Land	0.72 M	
Facilities	19.8 M	
Equipment	72.2 M	
SITE PROFIT CENTERS		
Direct Materials [d]		220.
Direct Labor		498.
Indirect Labor		149.
Facilities/Equipment		76.
OTHER EXPENSES (to be allocated over profit centers)		
General and Administrative		300.
Research and Development		100.
Income Taxes		200.
Profit		400.

Notes to Table B-1

[a] Does not include field wiring and HAC.
[b] Direct unloaded labor (no fringes included).
[c] Includes indirect materials and utilities.
[d] Includes subcontracted pile installation.

TABLE B-2
BOEING BURDEN COST DETAIL [a]
($/HELIOSTAT)

FACTORY PROFIT CENTERS		
Direct Costs		
Direct Materials		2921.
Direct Labor [b]		159.
Consumables [c]		6.
Burden Costs		
Variable Burden		396.
Warranty Service		13.
Average one-time Costs		46.
Depreciation		169.
Property Taxes		49.
Insurance		15.
Design Change Administration		3.
General and Administrative		103.
Capital Costs		
Land (Improved)	5.8 M	
Facilities [d]	26.1 M	
Equipment	75.8 M	
SITE PROFIT CENTERS		
Direct Material [e]		618.
Direct Labor		120.
Subcontracts		572.
Site Assembly Building		8.
Equipment Rental		8.
OTHER EXPENSES (to be allocated over profit centers)		
Contingency		169.
Profit		371.

Notes to Table B-2

[a] Does not include HC, HAC, HFC, BCS or field wiring.
[b] Direct unloaded labor (no fringes included).
[c] Includes utilities and maintenance supplies. Perishable tooling and other supplies not included.
[d] Includes utility substation, A&E fees, permits, facility turnover, etc.
[e] Pedestal cost is assumed to be a site material cost.

TABLE B-3
MARTIN MARIETTA BURDEN COST DETAIL
($/HELIOSTAT)

FACTORY PROFIT CENTERS		
Direct Costs		
Direct Material		3292.
Direct Labor [a]		61.
Consumables [b]		114.
Burden Costs		
Direct Labor Fringes [a]		66.
Indirect/Overhead Labor		99.
Scrap		13.
Depreciation [c]		101.
Property Taxes		14.
General and Administrative		22.
Income Taxes		181.
Return to Investors		229.
Capital Costs [c]		
Land	2.5 M	
Facilities	58.3 M	
Equipment	30.3 M	
SITE PROFIT CENTERS		
Direct Costs		
Direct Materials		1018.
Direct Labor [d]		122.
Site Assembly Building		97.
Consumables		8.
Burden Costs		
Equipment and Tooling		45.
Indirect Labor		49.
Income Taxes		10.
Return to Investors		15.

Notes to Table B-3

[a] Direct labor is unloaded cost (at $5.90/hr). Fringes include payroll taxes and insurance, benefits, premiums and absences due to vacations, holidays, etc.
[b] Includes perishable tooling, supplies, and utilities.
[c] Does not include outside tooling.
[d] Fully loaded labor cost.

TABLE B-4
MCDONNELL DOUGLAS BURDEN COST DETAIL
($/HELIOSTAT)

FACTORY PROFIT CENTERS		
Direct Costs		
Direct Materials [a]		3425.
Direct Labor [a,b]		117.
Consumables [c]		88.
Burden Costs [d]		
Labor Fringe		112.
Indirect Labor		55.
Maintenance		34.
Scrap		13.
Depreciation (including special tools)		140.
Property Taxes		31.
Production Engineering (plant startup)		15.
General and Administrative		185.
Capital Costs [d]		
Land	0.8 M	
Facilities	36.0 M	
Equipment/Tooling	47.8 M	
SITE PROFIT CENTERS		
Direct Costs		
Direct Material [a]		227.
Direct Labor [a,e]		299.
Burden Costs		
Components of site burden were not itemized. Burden is assumed by MDAC to be 0.70 of the direct labor cost.		

Notes to Table B-4

[a] Direct costs are first year costs rather than tenth year costs as reported by MDAC.
[b] Partially loaded direct labor cost. Includes $19. for overtime, shift and COLA premiums. The resulting direct rate is $9.64/hr.
[c] Includes supplies, sundry, perishable tooling, utilities.
[d] MDAC increased most burden costs (from GM estimates) by a factor of 1.12 to approximate the effect of heliostat controller fabrication.
[e] Based on a labor rate of $15.12/hr.

TABLE B-5
COMPARISON OF FACTORY COST ASSUMPTIONS

	ARCO	BEC	MMC	MDAC
Direct Labor Cost ($/hr)	4.49[k]	7.50[b]	12.23	9.64[c]
Production Facility Land Cost (K$/acre)	12.	32.	20.	20.
Production Facility Cost ($/sq ft)	30.	50.	75.	138.
Material Scrap ($/heliostat)	n.i.	n.a.	12.60	87.51[i]
Maintenance/Plant Engineering ($/heliostat)	n.a.[h]	n.a.	n.a.	31.04[i]
Other Indirects ($/heliostat)	59.12	n.a.	98.62	49.10[i]
Production Facility Startup ($/heliostat)	n.i.	46.[e]	n.i.	12.[j]
General and Administrative ($/heliostat)	400.[l]	103.	22.	185.
Depreciation Assumptions [f]				
- Facilities	20yr-SL	30yr-DB	33yr-150%DB	40yr-SL
- Equipment	10yr-SL	12yr-DB	15yr-SOYD	10yr-SL
- Tooling	-	-	5yr-SOYD	5yr-SL
Property Tax Rate	.0234	n.a.	.0126	n.a.
Combined Income Tax Rate	n.a.	n.a.	.50	n.a.
Rate of Return to Investors	.20[m]	.06[d]	.175[g]	.15

Notes to Table B-5

[a] n.i. = not included, n.a. = not available. Costs that are "not available" are apparently included in the estimates but are not easily separated from other costs.

[b] Unloaded labor cost. Fringes are included in indirect costs.

[c] Partially loaded labor cost. Loaded with overtime, night shift and COLA premiums only.

[d] BEC also requires an additional 3.2% return on materials and labor.

[e] Total facility startup costs are 24.1 million or approximately 22% of the total facility cost.

[f] DB = Declining Balance, SOYD = Sum-of-the-Years Digits, SL = Straight Line.

[g] Derived from a 0.15 return on debt, 0.20 return on equity, and 0.8 equity fraction.

[h] Maintenance labor included in Indirect Labor.

[i] Taken from GM report. Controller costs not included.

[j] Facility startup costs included under product engineering in GM report.

[k] Unloaded labor is charged at $4.49/hr. If the variable indirects and shift premium are added to approximate the effect of labor loading, the resulting rate is $7.76/hr.

[l] Included in this amount is a $100. allowance for R & D.

[m] A minimum 6% return on sales is also an ARCO requirement.

Appendix C
Derivation of HELCAT Nominal Parameter Set

The cost model parameters used in HELCAT depend on a wide range of factors, many of which are determined by the unique characteristics of the firm, location and production scenario. An accurate representation of all possible applications in a single set of parameters is impossible. However, it is useful to provide a baseline parameter set against which specific estimates can be compared. This appendix derives such a parameter set. The model parameters are discussed individually below and are summarized in Chapter 4 in the text.

One of the major variables affecting cost parameter values is the degree of automation chosen for heliostat production and installation. Where appropriate, parameter sets applicable to capital and labor intensive processes will be dicussed.

Direct Labor Costs

The base wage rate as reported by the US Department of Labor is shown in Table C-1. This rate represents an aggregation of many different job classifications having a range of wage rates. Based on Table C-1 a nominal early 1981 rate of $6.50/hour is used as the HELCAT default value. The industrial wage rate generally declines in labor intensive, assembly operations and increases in capital intensive, automated environments.

TABLE C-1
LABOR RATE DATA [4]

State	Manufacturing Rate ($/hr)*
Arizona	7.24
New Mexico	5.75

*1978 rate escalated by 20% to approximate the impact of inflation.

The variation of wage rate with industry characteristics is illustrated by local wage surveys from Albuquerque and Phoenix. (Sources: Albuquerque Industrial Development Service, Inc. and Arizona Department of Economic Security, July, 1981). The labor intensive electronic assembler job classifications have median rates of $4.50-$5.00/hour while machine/equipment operators in automated industries are in the range of $7.00-$8.50/hour. Hence, HELCAT inputs should be modified as illustrated in Table C-2 as the nature of the production process changes.

TABLE C-2
HELCAT BASE FACTORY LABOR RATES

Labor intensive assembly	$5.00/hour
Nominal	$6.50/hour
Capital intensive assembly	$8.00/hour

The HELCAT model uses a fully loaded labor rate to compute direct labor costs. The adders assumed for loading the base labor rate are shown in Table C-3.

TABLE C-3
LABOR LOADING FACTORS

Fringe Benefits [5]	Nominal (%)	Range (%)
Social Security	6.65	6.65
Unemployment Insurance	4.5	1.5 - 6.0
Workmens' Compensation	1.0	0.5 - 3.5
Payroll Taxes	0.3	0.0 - 1.0
Voluntary Benefits [5]		
Holidays (8 days/year)	3.1	2.3 - 5.0
Vacations (2.5 weeks/year)	4.8	2.0 - 7.7
Health Insurance	2.5	0.0 - 12.
Life Insurance	0.1	0.0 - 0.2
Pension Contribution	4.0	0.0 - 10.
Other	2.0	0.0 - 14.
Premiums		
Overtime	5.0	5.0
Shift Differential	4.0	4.0
Cost of Living Allowance	7.0	7.0
	44.95	28.95 - 82.05

Based on the data of Table C-3 a nominal loading factor of 45% was chosen for HELCAT although factors in the range 25%-85% are possible. The resulting loaded factory rates are shown in Table C-4.

TABLE C-4
HELCAT LOADED FACTORY LABOR RATES

Labor intensive assembly	$ 7.25/hour
Nominal	$ 9.45/hour
Capital intensive assembly	$ 11.60/hour

A nominal estimate of $15.00/hour for the loaded site labor rate is used based on information from the R.S. Means Co. as shown in Table C-5. These data may significantly underestimate labor costs for remote sites since a travel allowance is frequently required.

TABLE C-5
TYPICAL SITE LABOR RATES

City	Rate
Phoenix, AZ	$ 14.85/hour
Albuquerque, NM	$ 12.59/hour

Source: Skilled Trade Average (Jan. 1, 1980) from Means Cost Data, R.S. Means Co., Kingston, Mass.

Facility and Land Costs

Default values of $50/sq ft and $20K/acre are used for facility and improved land costs in HELCAT. These approximate median values from the second generation studies (see Appendix B). As was the case with direct labor costs, facilities designed for capital intensive production processes tend to be more expensive per square foot than those designed for labor intensive processes.

Indirect Costs

The two major categories of indirect costs in HELCAT are maintenance/plant engineering costs and other indirects. HELCAT computes indirect costs as fractions of direct labor, direct materials, or capital costs (facilities plus equipment plus tooling). In order to specify accurately the indirect loading fractions for any manufacturing scenario, the specific number and costs of the personnel associated with each functional area should be identified. An approximate value for indirect costs can be computed in HELCAT using the default indirect fractions shown in Table C-6. For manufacturing concepts that differ widely from the second generation scenario, these fractional loadings may require modifiction.

TABLE C-6
HELCAT INDIRECT LOADING FACTORS [5]

	Nominal Factors
On Direct Labor	
Quality Control/Inspectors	.06
Supervision	.08
Production Control/Scheduling	.03
Material Handling	.10
Total Direct Labor Loading Fraction	.27
On Direct Materials	
Shipping/Receiving	.002
Purchasing/Accounting	.0015
Total Direct Material Loading Fraction	.0035
On Facilities, Equipment, and Tooling	
Security	.002
Janitorial	.004
Total Capital Loading Factor	.006
Maintenance/Plant Engineering Loading Factor	.020

An approximate indirect headcount corresponding to the parameters of Table C-6 applied to a representative factory is shown in Table C-7. The representative factory purchases (50,000)($3000) = $150 million in direct material annually, has 400 direct employees, and has facilities, equipment and tooling with an initial cost of $80 million. The base loaded wage is $9.45/hr and the relative wage is shown in the table. Note that Table C-7 is intended only to illustrate the personnel levels associated with the nominal parameters in Table C-6. HELCAT does not employ the relative wage assumptions or estimate the personnel required as shown in Table C-7.

TABLE C-7
REPRESENTATIVE FACTORY INDIRECT LABOR

Function	Relative Wage	Personnel Required
Quality Control/Inspector	1.1	22
Supervision	1.3	25
Production Control/Scheduling	1.1	11
Material Handling	0.8	50
Shipping/Receiving	0.8	21
Purchasing/Accounting	1.2	10
Security	0.8	11
Janitorial	0.7	26
Maintenance/Plant Engineering	1.2	74

Indirect loading fractions are expected to shift from their nominal values for very capital or labor intensive production processes. Insufficient information is currently available to estimate loading fractions for other production scenarios. The interface between direct and indirect costs must also be examined when applying the nominal loading factors to specific estimates. For example, some material handling is often included as a part of direct labor although the indirect costs also include a significant material handling allowance. Finally, some cost estimation systems apply indirect loading fractions to direct labor charges only. These methodologies are compatible with HELCAT if the nominal labor loading fraction is increased appropriately and the material and capital loading fractions are set to zero.

General and Administrative Expenses

A breakdown of the general and administrative expense category into functional areas having specified costs is impossible with current data. Instead, historical G & A fractions taken from recent annual reports have been used to derive the HELCAT nominal fraction. A summary of sales, general and administrative expense data as a fraction of net sales is shown in Table C-8. The companies in Table C-8 are representative of those in the manufacturing sector whose products (and services) are similar to those of a heliostat manufacturer. However, all of the companies listed have a variety of business products and services, many of which bear little relationship to the "typical" heliostat business.

TABLE C-8
SELLING, GENERAL AND ADMINISTRATIVE EXPENSES
FOR VARIOUS FIRMS (1979)

Firm	Ratio of S,G, & A Expenses to Net Sales
Allis Chalmers	0.148
Bendix Corp	0.135
Caterpillar	0.087
Cincinnati Milacron	0.152
E. Systems	0.113
General Electric	0.165
International Harvester	0.092
Westinghouse Electric	0.156
Whirlpool Corp	0.115

The general and administrative fraction chosen for the nominal HELCAT parameter set is 0.09. While this is relatively low compared to the values of Table C-8, it reflects the small marketing and sales forces that would likely be associated with heliostat manufacturing and installation.

Financial Parameters

The return required to attract investment funds in a competitive financial market depends on the type of financial instrument (e.g. common stock, bonds), the underlying inflation rate and the perceived riskiness of the enterprise. In specifying HELCAT nominal parameters, it is assumed that investors require a fixed real (net of inflation) return on stocks and bonds. Thus, the costs of financing capital investments increases with the inflation rate. The real return required on equity will, under actual market conditions, depend on the risk associated with the firm's future earnings. The nominal HELCAT required rates of return are shown in Table C-9. If the inflation rate were assumed to be 0.12 (more representative of recent economic conditions), the nominal HELCAT parameters would be 0.144 and 0.21 for bonds and equity respectively.

TABLE C-9
HELCAT NOMINAL RATES OF RETURN

Real Rate	Inflation Rate	Nominal Rate
.04 (Bonds)	.06	.102
.10 (Common Equity)	.06	.166

Examples of recent achieved rates of return on equity for various industrial groups and several second generation contractors are shown in Table C-10. These rates illustrate the wide range of returns that can exist across industries. Comparison of the actual rates with the nominal rates (≈ 0.20 for current inflation rates) indicates that the real return required by HELCAT would be sufficient to attract the capital for production facility construction.

TABLE C-10
EXEMPLARY ACHIEVED RETURNS ON EQUITY (1980)
(SOURCE: BUSINESS WEEK, MARCH 16, 1981)

Industries	Return on Equity
General Machinery	0.153
Special Machinery	0.134
Electrical, Electronic Equipment	0.193
Aerospace	0.195
All Manufacturing	0.163
Companies	
Boeing	0.301
McDonnell Douglas	0.103
Martin Marietta	0.186

Other Parameters

A variety of other parameters is required for HELCAT computation of total profit center cost. Some such as the accounting and tax lifetimes or tax rates are relatively uncontroversial and will not be discussed here. Remaining parameters are reviewed briefly below.

Material Scrap - HELCAT assumes that the input direct materials costs do not include a scrap factor. Materials costs are increased within the model by a factor of (1 + FSCPP) for purchased materials and (1 + FSCPR) for raw materials. Purchased materials are assigned a nominal scrap rate of .01 to cover scrapped higher level assemblies that cannot be reworked. Raw materials are assigned a higher nominal rate of .03 that reflects the additional scrap during the manufacturing process.

Working Capital - The working capital fraction is that portion of the yearly expenses (including direct materials, direct labor, consumables, and indirects) that must be financed during heliostat manufacture, transport and installation. It is assumed that progress payments on heliostats installed in the field will be made to the heliostat manufacturer. Hence the working capital financing period will be relatively short. A nominal period of two (2) months is assumed in HELCAT which results in a working capital fraction of 0.17.

Property Tax and Insurance - Property tax rates are expected to be .015-.03 of book value. Insurance rates are expected to be in the .01-.02 range. Hence a nominal capital loading factor of .04 was chosen.

Factory Startup Parameters - The heliostat factory construction period is assumed to be three years. A plant design and engineering surcharge of 10% is added to the input facility, equipment and tooling costs. The factory startup period is assumed to include the production of the first 20,000 heliostats. During the startup period, heliostat costs are assumed to decline along a learning curve with a cost reduction coefficient of 0.92.

Appendix D
Example of HELCAT Input List and Output Charts

The direct inputs used in each profit center price calculation are usually derived from a much larger list of detailed direct inputs. Table D-1 contains a typical input list that is processed in HELCAT to yield the direct inputs. In the case illustrated, only material and labor accounts are broken down into a finer structure. It is also possible to list the specific components that make up the building size, equipment, tooling, and consumables categories.

The detailed cost accounting breakdown within each profit center is reported by a series of charts. The first type of chart provides a breakdown of cost components within a profit center and is illustrated in Table D-2. The second type of chart shows how a particular cost component is allocated over all of the profit centers. Table D-3 illustrates the breakdown of required revenue by profit center. The costs provided in all of the tables in this appendix are exemplary and should not be associated with a particular second generation contractor. The complete computer listing for this generic heliostat is provided in Appendix E on microfiche.

TABLE D-2
EXAMPLE OF THE COST ACCOUNTING BREAKDOWN WITHIN A PROFIT CENTER

4410 - REFLECTIVE ASSEMBLY
FACTORY COSTS PER HELIOSTAT
PRODUCTION YEAR 1

Total Required Revenue		1636.83
Direct Materials		1302.10
Purchased Materials	939.62	
Raw Materials	342.80	
Scrap	19.68	
Direct Labor		26.84
Consumables		.20
Indirect Costs		21.24
Maintenance, Plant Engineering	7.26	
Other Indirects	13.98	
Capital Replacement Allowance		17.13
Property Tax and Insurance		16.61
General & Administrative		125.33
Interest Expense		8.47
Income Taxes		52.89
Return to Equity Holders		55.14
Other Expenses		10.88
Annualized One-Time Costs	10.88	

TABLE D-3
EXAMPLE OF THE INSTALLED HELIOSTAT PRICE BY PROFIT CENTER

TOTAL REQUIRED REVENUE PER HELIOSTAT
PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	Totals by Location
Factory	1636.83	1858.67	0.00	0.00	744.62	0.00	4240.12
Transportation	48.75	22.43	0.00	25.03	92.41		188.62
Site			0.00	689.20		162.07	851.27
Totals by Component	1685.58	1881.10	0.00	714.23	837.03	162.07	

TOTAL REQUIRED REVENUE 5280.01

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C SOURCE:SSNL -HFN/0.92

L 4430CABLE INSTALLATION                     1.065HRS
C SOURCE:SSNL -HFN/0.92
L 4430POWER TRANSFORMER INSTALLATION          .033HRS
C SOURCE:SSNL -HFN/0.92
L 4430CABLE CHECKOUT,CLOSEOUT                 .707HRS
C SOURCE:SSNL -HFN/0.92
Z 4430SITE BURDEN EXPENSE                                      20.10
C SITE BURDEN EXPENSE CANNOT BE COMPUTED INTERNALLY DUE TO LACK OF REQUIRED
C INPUT DATA.  THIS APPROXIMATION TO SITE BURDEN IS OBTAINED USING THE SNL
C OVERHEAD RATE OF $10.50/HR FOR 1.9 HOURS OF DIRECT LABOR.
Q 4430QUANTITY                            5412.   /STE
$
*34440 SNL  - SECOND GENERATION
P 4440REBAR CAGE                                               87.67
C SOURCE:SSNL /0.90, 29% LB, $.30/LB
P 4440TAPERED PIPE                                             35.70
C SOURCE:SSNL /0.90, 3% LB, $.42/LB
P 4440CONCRETE                                                123.42
C SOURCE:SSNL /0.90, 2.32 CU YD, $53.20/CU YD
L 4440SURVEY                                  1.00HRS
C SOURCE:SSNL /0.92
C NOTE:BASED ON OTHER DATA THIS TIME COULD BE REDUCED TO APPROX. 0.25 HR
L 4440DRILLING                                2.99HRS
C SOURCE:SSNL /0.92 , 2 FT DIA BY 15 FT DEEP, 1.75 CU YD
C NOTE:BASED ON OTHER DATA THIS TIME COULD BE REDUCED TO APPROX. 0.25 HR
P 4440FORMS,BRACING                                             5.23
C SOURCE:SSNL /0.90
L 4440PREFAB REBAR,TAPERED PIPE               3.49HRS
C SOURCE:SSNL /0.92
L 4440SET CAGES,FORMS                         1.99HRS
C SOURCE:SSNL /0.92
L 4440POUR AND FINISH                         2.49HRS
C SOURCE:SSNL /0.92
L 4440EQUIPMENT OPERATION                     2.49HRS
C SOURCE:SSNL /0.92
Z 4440SITE BURDEN EXPENSE                                     152.09
C SITE BURDEN EXPENSE CANNOT BE COMPUTED INTERNALLY DUE TO LACK OF REQUIRED
C INPUT DATA.  THIS APPROXIMATION TO SITE BURDEN IS OBTAINED USING THE SNL
C OVERHEAD RATE OF $10.50/HR FOR 14.45 HOURS DIRECT LABOR.
Q 4440QUANTITY                            5412.   /STE
$
*34460 SNL  - SECOND GENERATION
L 4460FIELD SUPPORT LABOR                     1.30HRS
C SOURCE:SSNL -HFN/0.90
L 4460HELIOSTAT INSTALLATION                  3.31HRS
C SOURCE:SSNL -HFN/0.90
L 4460ALIGN HELIOSTATS                         .77HRS
C SOURCE:SSNL HFN/0.90
Z 4460SITE BURDEN EXPENSE                                      57.00
C SITE BURDEN EXPENSE CANNOT BE COMPUTED INTERNALLY DUE TO LACK OF REQUIRED
C INPUT DATA.  THIS APPROXIMATION TO SITE BURDEN IS OBTAINED USING THE SNL
C OVERHEAD RATE OF $10.50/HR FOR 5.380 HOURS DIRECT LABOR.
Q 4460QUANTITY                            5412.   /STE
$
*34430SNL  2ND GENERATION HELIOSTAT
P 4430HELIOSTAT ARRAY CONTROLLER(HAC)                        41.05
C SOURCE-HAL 250000/FIELD,SNL  USED 1E6/167.35(HEL)
```

```
      SUBROUTINE PREPRO(A,AM,FP,SP,TP,CFAC,CLAB,CTRN,ISTAT,P)
C
C THIS ROUTINE GENERATES THE COST INPUT MATRIX BY PROCESSING INPUTS FROM
C IREAD AND PREAD.
C
      DIMENSION A(50),AM(100),FP(30),SP(30),TP(30),CFAC(9),CLAB(9),
     &CTRN(9),ISTAT(20),P(30)
C
C LOAD PARAMETER MATRIX
C
      ITYP=ISTAT(7)
      IF (ITYP-2)10,20,30
   10 DO 11 I=1,30
   11 P(I)=FP(I)
      GO TO 40
   20 DO 21 I=1,30
   21 P(I)=TP(I)
      GO TO 40
   30 DO 31 I=1,30
   31 P(I)=SP(I)
   40 CONTINUE
C
C COMPUTE DIRECT LABOR COST IN $ AND SAVE IN A(2)
C
      A(2)=P(2)*AM(1)
      DO 90 I=1,9
   90 A(2)=A(2) + (CLAB(I)*AM(I+1))
      IF(A(2).EQ.0.)GO TO 91
      WRITE(6,900)A(2)
  900 FORMAT (/*      TOTAL DIRECT LABOR COST=*F10.2* $/HELIOSTAT*)
 91   CONTINUE
C
C COMPUTE FACILITY COST IN $ AND SAVE IN A(5)
C
      A(5)=P(3) * AM(1)
      DO 100 I=1,9
  100 A(5) = A(5) + (CFAC(I)*AM(I+1))
      IF(A(5).EQ.0.)GO TO 101
      WRITE(6,901)A(5)
  901 FORMAT (/*      TOTAL PRODUCTION FACILITY COST=*F12.0*  $*)
101   CONTINUE
C
C COMPUTE ITEMIZED TRANSPORTATION COST AND STORE IN A(9)
C
      A(9)= P(27) * AM(2)
      DO 110 I=1,9
  110 A(9) = A(9) + (CTRN(I)*AM(I+2))
      IF(A(9).EQ.0.)GO TO 111
      WRITE (6,902)A(9)
  902 FORMAT (/*      INPUT (NOT COMPUTED) TRANSPORTATION COST=*F10.2*
     & $*)
111   CONTINUE
C
C SET NONZERO BASIS QUANTITIES
C
      IF (A(8)) 120,120,150
  120 IF (ITYP-2) 125,130,130
```



```
EXTERNALS          TYPE    ARGS         REFERENCES
     ALOG          REAL       1 LIBRARY      2*19       2*21

INLINE FUNCTIONS   TYPE    ARGS         DEF LINE  REFERENCES
     FLOAT         REAL       1  INTRIN                 11

STATISTICS
  PROGRAM LENGTH                  100B      64
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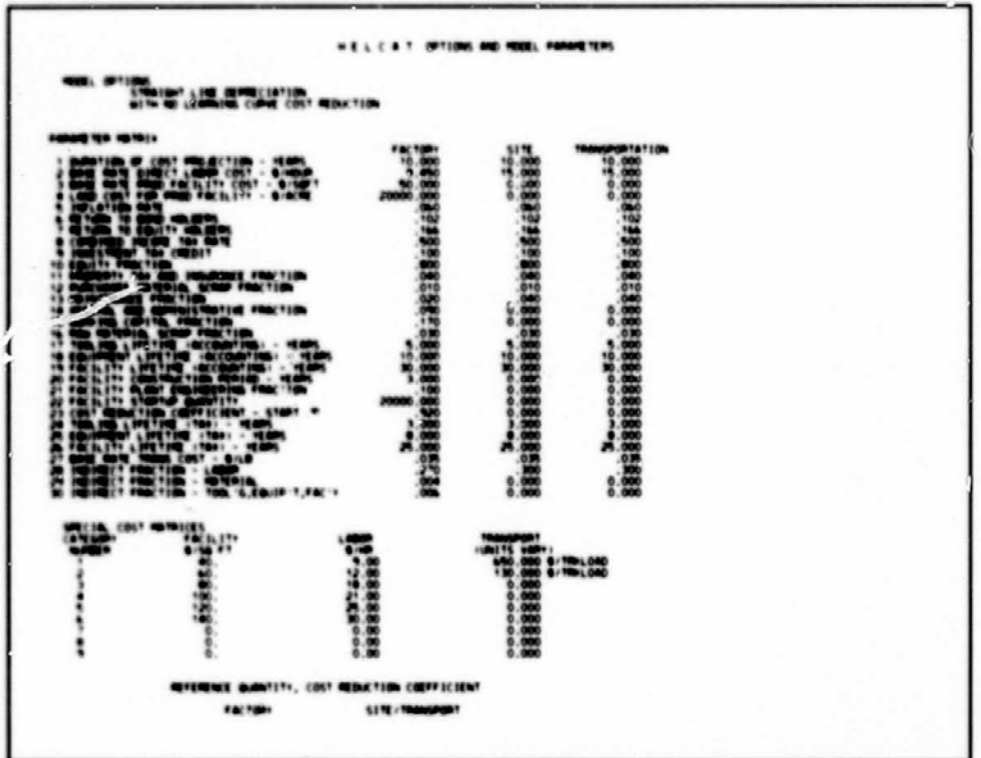
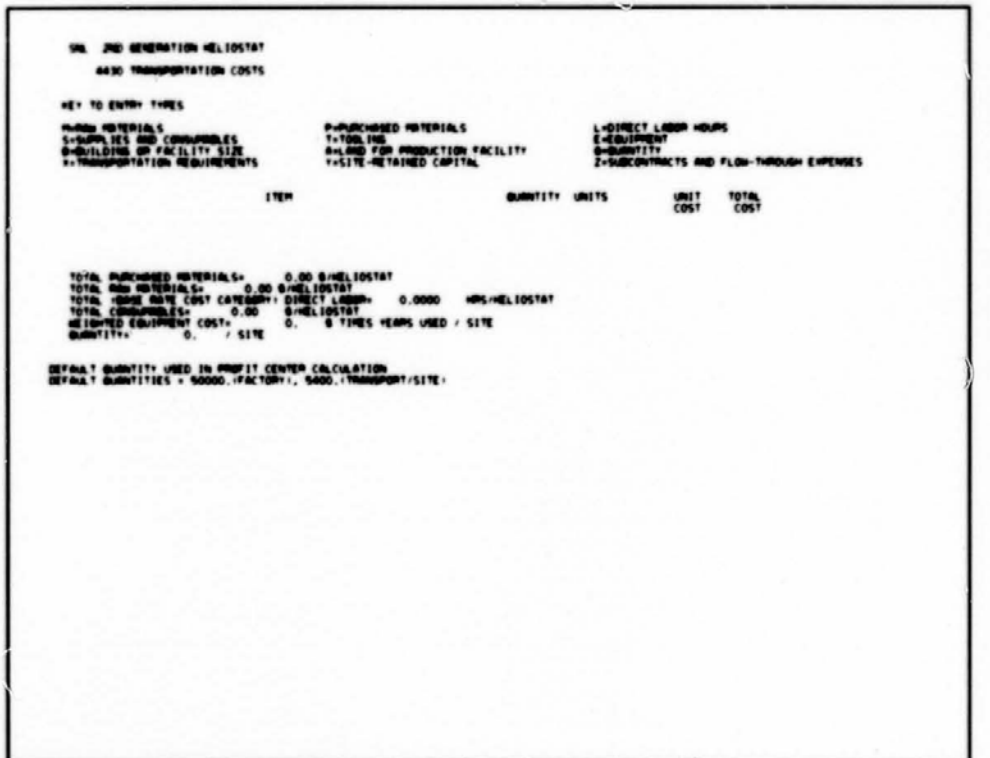




HELIOSTAT COST MODEL
DETAILED BREAKDOWN
SNL - SECOND GENERATION
6410 - CONTROLS
TRANSPORTATION COSTS
PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE		0.00
DIRECT MATERIALS		0.00
PURCHASED MATERIALS	0.00	
RAW MATERIALS	0.00	
SCRAP	0.00	
DIRECT LABOR		0.00
CONSUMABLES		0.00
INDIRECT COSTS		0.00
MAINTENANCE, PLANT ENGINEERING	0.00	
OTHER INDIRECTS	0.00	
CAPITAL REPLACEMENT ALLOWANCE		0.00
PROPERTY TAX AND INSURANCE		0.00
GENERAL & ADMINISTRATIVE		0.00
INTEREST EXPENSE		0.00
INCOME TAXES		0.00
RETURN TO EQUITY HOLDERS		0.00
OTHER EXPENSES		0.00

COST SUMMARY BY PROFIT CENTER
INCOME TAXES

SNL - SECOND GENERATION

PRODUCTION YEAR 1

	6410	6420	6430	6440	6450	6460	TOTALS BY LOCATION
FACTORY	52.89	69.86	0.00	0.00	25.14	0.00	147.89
TRANSPORTATION	0.00	0.00	0.00	0.00	0.00		0.00
SITE			0.00	0.00		0.00	0.00
TOTALS BY COMPONENT	52.89	69.86	0.00	0.00	25.14	0.00	

TOTAL FOR INCOME TAXES 147.89

[redacted]

[redacted]

[redacted]

[redacted]

TRANSPORTATION COSTS

PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE			0.00
DIRECT MATERIALS		0.00	
[redacted]	0.00		
[redacted]	0.00		
SCRAP	0.00		
DIRECT LABOR		0.00	
CONSUMABLES		0.00	
INDIRECT COSTS		0.00	
[redacted], PLANT ENGINEERING	0.00		
OTHER INDIRECTS	0.00		
CAPITAL REPLACEMENT ALLOWANCE		0.00	
PROPERTY TAX AND INSURANCE		0.00	
GENERAL & ADMINISTRATIVE		0.00	
INTEREST EXPENSE		0.00	
INCOME TAXES		0.00	
RETURN TO EQUITY HOLDERS		0.20	
OTHER EXPENSES		0.00	

[redacted]

COST SUMMARY BY PROFIT CENTER

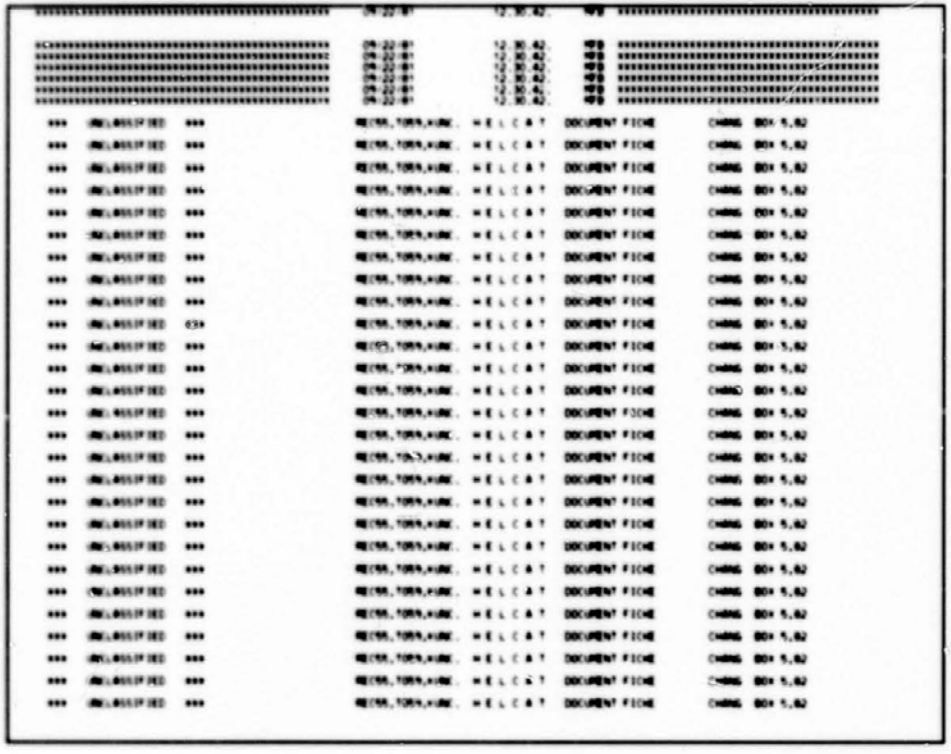
INCOME TAXES

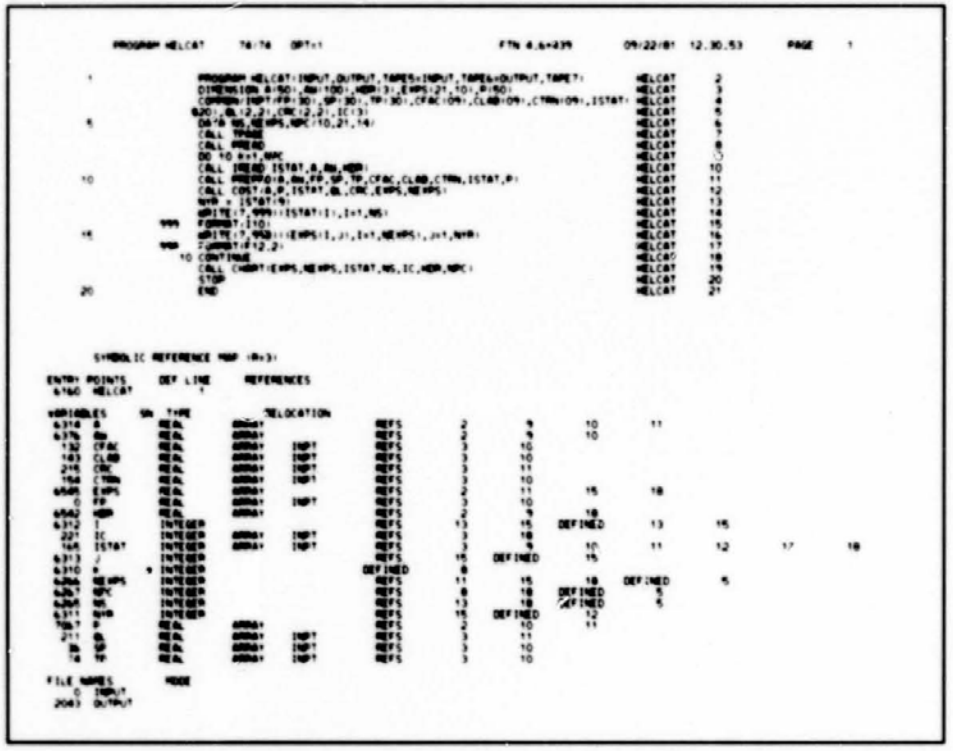
SRL - SECOND GENERATION

PRODUCTION YEAR 1

	6610	6620	6630	6640	6650	6660	TOTALS BY LOCATION
FACTORY	52.89	69.06	0.00	0.00	25.14	0.00	147.09
TRANSPORTATION	0.00	0.00	0.00	0.00	0.00		0.00
SITE			0.00	0.00		0.00	0.00
TOTALS BY COMPONENT	52.89	69.06	0.00	0.00	25.14	0.00	

TOTAL FOR INCOME TAXES 147.09





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SUBROUTINE PREPRO      74/74   OPT=1                          FTN 4.6+439        09/22/81  12.30.53        PAGE    2

            125 A(8)=50000.                                                      PREPRO      59
                GO TO 140                                                        PREPRO      60
            130 A(8)=5400.                                                       PREPRO      61
            140 WRITE (6,903)                                                    PREPRO      62
            903 FORMAT(//*  DEFAULT QUANTITY USED IN PROFIT CENTER CALCULATION*/ PREPRO      63
               8*   DEFAULT QUANTITIES = 50000.(FACTORY), 5400.(TRANSPORT/SITE)*//) PREPRO   64
            150 CONTINUE                                                         PREPRO      65
                RETURN                                                           PREPRO      66
                END                                                              PREPRO      67


     SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS     DEF LINE      REFERENCES
   3 PREPRO          1            65

VARIABLES      SN  TYPE            RELOCATION
   0 A             REAL       ARRAY    F.P.      REFS       6      27      28      29      37      38      39
                                                   47      48      49      56   DEFINED     1      25      27
                                                   35      37      45      47      58      60
   0 BA            REAL       ARRAY    F.P.      REFS       6      25      27      35      37      45      47
                                                DEFINED     1
   0 CFAC          REAL       ARRAY    F.P.      REFS       6      37   DEFINED     1
   0 CLAB          REAL       ARRAY    F.P.      REFS       6      27   DEFINED     1
   0 CTRN          REAL       ARRAY    F.P.      REFS       6      27   DEFINED     1
   0 FF            REAL       ARRAY    F.P.      REFS       6      16   DEFINED     1
 220 I             INTEGER                       REFS    2*14    2*17    2*20    2*27    2*37    2*47
                                                DEFINED    13      16      19      26      36      46
   0 ISTAT         INTEGER    ARRAY    F.P.      REFS       6      11   DEFINED     1
 217 ITYP          INTEGER                       REFS      12      57   DEFINED    11
   0 P             REAL       ARRAY    F.P.      REFS       6      25      35      45   DEFINED     1      14
                                                   17      20
   0 SP            REAL       ARRAY    F.P.      REFS       6      20   DEFINED     1
   0 TP            REAL       ARRAY    F.P.      REFS       6      17   DEFINED     1

FILE NAMES        MODE
   TAPE6          FMT                   WRITES      29      39      49      61

STATEMENT LABELS            DEF LINE    REFERENCES
   0 10           INACTIVE     13           12
   0 11                        14           13
  21 20                        16           12
   0 21                        17           16
  32 30                        19           12
   0 31                        20           19
  42 40                        21           15      18
   0 41                        27           26
  61 50                        31           28
   0 100                       37           36
 100 101                       41           38
   0 110                       47           46
 117 111                       52           48
   0 120          INACTIVE     57           2*56
   0 125          INACTIVE     58           57
```

```
SUBROUTINE CHART       74/74   OPT=1                          FTN 4.6+439        09/22/81  12.30.53        PAGE    1

            SUBROUTINE CHART( EXPS, NEXPS, ISTAT, NS, IC, CTR, NPC)             CHART        2
            DIMENSION EXPS(NEXPS,1), ISTAT(NS), ETOT(12,6,3), ICOST(6,3)         CHART        3
            DIMENSION IC(3), CTR(3), ISUM(25)                                    CHART        4
      C                                                                          CHART        5
      C        IC  CHART SELECTION INDICATOR                                     CHART        6
      C             IC(1) - SELECTS TYPE OF CHART(S)                             CHART        7
      C               1   DO ALL DETAILED BREAKDOWNS                             CHART        8
      C                   IF N .EQ. NPC DO ALL SUMMARIES                         CHART        9
      C               2   IF N .EQ. NPC DO ALL SUMMARIES                         CHART       10
      C               3   DO THE IC(2)-TH DETAILED BREAKDOWN                     CHART       11
      C               4   IF N .EQ. NPC DO THE IC(2)-TH SUMMARY                  CHART       12
      C             IC(2) - THE NUMBER OF THE DETAILED  BREAKDOWN                CHART       13
      C                     OR SUMMARY REQUESTED                                 CHART       14
      C            IF IC(1) = 3                  IF IC(1) = 4                    CHART       15
      C            IC(2)    CODE            IC(2)    CODE                        CHART       16
      C               1     4410 FAC           1    TOTAL REVENUE                CHART       17
      C               2     4410 TRANS         2    DIRECT MATERIALS             CHART       18
      C               3     4420 FAC           3    DIRECT LABOR                 CHART       19
      C               4     4420 TRANS         4    CONSUMABLES                  CHART       20
      C               5     4430 FAC           5    INDIRECT COSTS               CHART       21
      C               6     4430 TRANS         6    CAPITAL REPLACEMENT          CHART       22
      C               7     4430 SITE          7    PROPERTY TAX & INSURANCE     CHART       23
      C               8     4440 FAC           8    G & A EXPENSE                CHART       24
      C               9     4440 TRANS         9    INTEREST EXPENSE             CHART       25
      C              10     4440 SITE         10    INCOME TAX                   CHART       26
      C              11     4450 FAC          11    RETURN TO EQUITY             CHART       27
      C              12     4450 TRANS        12    OTHER EXPENSES               CHART       28
      C              13     4460 FAC                                             CHART       29
      C              14     4460 SITE                                            CHART       30
      C            IC(3) - PRODUCTION YEAR SELECTOR                              CHART       31
      C                    IF NYR .GT. 1 THEN LEARNING MODEL HAS BEEN USED       CHART       32
      C               0    DO ALL PRODUCTION YEARS                               CHART       33
      C            .NE. 0  DO ONLY THE IC(3)-TH PRODUCTION YEAR                  CHART       34
      C                                                                          CHART       35
      C                                                                          CHART       36
      C        N SETS (ISTAT AND EXPS ARRAYS) ARE READ IN.  END-OF-F[illegible] IS  CHART    37
      C        CHECKED FOR.  SUMMARIES ARE GENERATED ONLY IF THERE IS A          CHART       38
      C        COMPLETE SET OF N=NEXPS FILES.                                    CHART       39
      C                                                                          CHART       40
      C        SETS ARE READ IN FROM  --  TAPE 7                                 CHART       41
      C                                                                          CHART       42
      C                                                                          CHART       43
      C        ICOST ARRAY INDICATES FOR WHAT PROFIT CENTERS AND TYPES, COST     CHART       44
      C        ARE COMPUTED                                                      CHART       45
      C         IF ICOST(I,J) = 0 THEN COSTS ARE NOT COMPUTED FOR THE I-TH       CHART       46
      C                           PC AND J-TH TYPE                               CHART       47
      C         IF ICOST(I,J) = 1 THEN COSTS ARE     COMPUTED FOR THE I-TH       CHART       48
      C                           PC AND J-TH TYPE                               CHART       49
      C         ICOST =   1  1  0                                                CHART       50
      C                   1  1  0                                                CHART       51
      C                   1  1  1                                                CHART       52
      C                   1  1  1                                                CHART       53
      C                   1  1  0                                                CHART       54
      C                   1  0  1                                                CHART       55
      C                                                                          CHART       56
            DATA ((ICOST(I,J),I=1,6),J=1,3)/11*1,3*0,2*1,0,1/                    CHART       57
      C                                                                          CHART       58
```

[redacted]

[redacted]

[redacted]

SOL 2ND GENERATION HELIOSTAT
6660 TRANSPORTATION COSTS

KEY TO ENTRY TYPES

[redacted]
S=SUPPLIES AND CONSUMABLES
B=BUILDING OR FACILITY SIZE
T=TRANSPORTATION REQUIREMENTS

P=PURCHASED MATERIALS
T=TOOLING
A=LAND FOR PRODUCTION FACILITY
Y=SITE-RETAINED CAPITAL

L=DIRECT LABOR HOURS
E=EQUIPMENT
O=QUANTITY
Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
ENTRY TYPE=S 6660 FOUND/FED CUSTOM RACK				0.00 / HELIOSTAT
SOURCE- NONE IDENTIFIED				
ENTRY TYPE=T 6660 FOUND/FED TRANSPORT TO SITE	.30906-01	TRUCKLOADS		
SPECIAL TRANSPORTATION COST CATEGORY 1				
SOURCE-SOL .23.00 TOTAL				

TOTAL PURCHASED MATERIALS= 0.00 $/HELIOSTAT
TOTAL [redacted] MATERIALS= 0.00 $/HELIOSTAT
TOTAL [redacted] COST CATEGORY: DIRECT LABOR= 0.0000 HRS/HELIOSTAT
TOTAL CONSUMABLES= 0.00 $/HELIOSTAT
WEIGHTED EQUIPMENT COST= 0. 0 TIMES YEARS USED / SITE
QUANTITY= 0 / SITE
SPECIAL TRANSPORTATION COST CATEGORY 1 = .039 TRUCKLOADS
INPUT NOT COMPUTED: TRANSPORTATION COST 25.03 0

DEFAULT QUANTITY USED IN PROFIT CENTER CALCULATION
DEFAULT QUANTITIES = 50000.(FACTOR), 5400.(TRANSPORT/SITE)

HELIOSTAT COST MODEL

DETAILED BREAKDOWN

SNL - SECOND GENERATION

4440 - FOUNDATION/PEDESTAL

TRANSPORTATION COSTS

PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE			25.03
DIRECT MATERIALS		0.00	
PURCHASED MATERIALS	0.00		
RAW MATERIALS	0.00		
SCRAP	0.00		
DIRECT LABOR		0.00	
CONSUMABLES		0.00	
INDIRECT COSTS		0.00	
MAINTENANCE, PLANT ENGINEERING	0.00		
OTHER INDIRECTS	0.00		
CAPITAL REPLACEMENT ALLOWANCE		0.00	
PROPERTY TAX AND INSURANCE		0.00	
GENERAL & ADMINISTRATIVE		0.00	
INTEREST EXPENSE		0.00	
INCOME TAXES		0.00	
RETURN TO EQUITY HOLDERS)		0.00	
OTHER EXPENSES		25.03	
TRANSPORTATION CHARGE	25.03		

COST SUMMARY BY PROFIT CENTER

RETURN TO EQUITY HOLDERS

SNL - SECOND GENERATION

PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	TOTALS BY LOCATION
FACTORY	55.14	74.40	0.00	0.00	26.01	0.00	156.43
TRANSPORTATION	0.00	0.00	0.00	0.00	0.00		0.00
SITE			0.00	0.00		0.00	0./0
TOTALS BY COMPONENT	55.14	74.40	0.00	0.00	26.01	0.00	

TOTAL FOR RETURN TO EQUITY HOLDERS 156.43

```
***   UNCLASSIFIED   ***                    REISS,TOES,KUNZ.   H E L C A T   DOCUMENT FICHE        CHANG  BOX 5,82

****************************************    09/22/81        12.30.42.    MFB   ************************************
****************************************    09/22/81        12.30.42.    MFB   ************************************
****************************************    09/22/81        12.30.42.    MFB   ************************************
****************************************    09/22/81        12.30.42.    MFB   ************************************
****************************************    09/22/81        12.30.42.    MFB   ************************************
****************************************    09/22/81        12.30.42.    MFB   ************************************
****************************************    09/22/81        12.30.42.    MFB   ************************************
****************************************    09/22/81        12.30.42.    MFB   ************************************
****************************************    09/22/81        12.30.42.    MFB   ************************************
****************************************    09/22/81        12.30.42.    MFB   ************************************
```

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          PROGRAM HELCAT      74/74    OPT=1                          FTN 4.6+439        09/22/81  12.30.53       PAGE     2

FILE NAMES          MODE
    0  TAPE5
 2043  TAPE6
 4106  TAPE7        FMT                    WRITES        13          15

EXTERNALS                TYPE   ARGS         REFERENCES
        CHART                     7              18
        COST                      7              11
        IREAD                     4               9
        PREAD                     0               7
        PREPRO                   10              10
        TPAGE                     0               6

STATEMENT LABELS                DEF LINE   REFERENCES
    0  10                          17           8
 6304  998      FMT                16          15
 6274  999      FMT                14          13

LOOPS  LABEL     INDEX      FROM-TO     LENGTH    PROPERTIES
 6166  10        * K          8 17        35B                   EXT REFS  NOT INNER
 6206            * J         15 15        11B                   EXT REFS

COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
        INPT       148             0 FP       (30)               30 SP      (30)                 60 TP      (30)
                                  90 CFAC     (9)                99 CLAB    (9)                 108 CTRN    (9)
                                 117 ISTAT    (20)              137 GL      (4)                 141 CRC     (4)
                                 145 IC       (3)

STATISTICS
  PROGRAM LENGTH                  1000B       512
  BUFFER LENGTH                   6151B      3177
  CM LABELED COMMON LENGTH         224B       148
```

```
STATEMENT LABELS                    DEF LINE   REFERENCES
  125   130                            60        2457
  127   140                            61          59
  131   150                            64          56
  136   900         FMT                30          29
  151   901         FMT                40          39
  164   902         FMT                50          49
  177   903         FMT                62          61

LOOPS  LABEL      INDEX      FROM-TO     LENGTH     PROPERTIES
   15   11          I         13 14        28B       INSTACK
   26   21          I         16 17        28B       INSTACK
   37   31          I         19 20        28B       INSTACK
   62   90          I         26 27        30B       INSTACK
   77  100          I         36 37        30B       INSTACK
  110  110          I         46 47        30B       INSTACK

STATISTICS
  PROGRAM LENGTH                     221B      145
```



```
      C           ISUM(I) - SUMMARY EXPENSE CHART INDICATOR
      C             IF ISUM(I) = 1, THEN THERE IS A SUMMARY CHART FOR THE
      C                             I-TH EXPENSE
      C             IF ISUM(I) = 0, THEN THERE IS NO SUMMARY CHART FOR THE
      C                             I-TH EXPENSE
      C             IF ISUM(I) = -1, THEN THE I-TH EXPENSE IS PRINTED OUT IN
      C                              THE DETAILED CHART ONLY IS NONZERO
      C
      C           I    ISUM        I    ISUM       I    ISUM
      C           1     1          8     1        15     1
      C           2     1          9     0        16     1
      C           3     0         10     0        17     1
      C           4     0         11     1        18    -1
      C           5     0         12     1        19    -1
      C           6     1         13     1        20    -1
      C           7     1         14     1        21    -1
      C
            DATA (ISUM(I),I=1,21)/1,1,0,0,0,1,1,1,0,0,1,1,1,1,1,1,1,-1,-1,-1,-
           $1/
      C
      C          IYR IS THE PRODUCTION YEAR COUNTER
      C
            IYR = 0
      C
      C          READ FIRST ISTAT ARRAY TO GET NYR
      C
            REWIND 7
            READ(7,999)(ISTAT(I),I=1,NS)
      C
      C          THE CALCULATION IS LOOPED BACK TO 200 IF NYR .GT. 1,  I.E.
      C          THE LEARNING MODEL HAS BEEN USED IN SUBROUTINE COST.
      C
        200 CONTINUE
            IYR = IYR + 1
            NYR = ISTAT(9)
            IF(IC(3) .EQ. 0)GO TO 5
            IF(IYR .NE. IC(3))GO TO 300
          5 CONTINUE
      C
      C          INITIALIZE THE SUMMARY TOTALS
      C
            DO 10 I=1,12
            DO 10 J=1,6
            DO 10 K=1,3
         10 ETOT(I,J,K) = 0.
      C
            REWIND 7
      C
      C          N IS THE FILE COUNTER
      C
            N = 0
        100 CONTINUE
            READ(7,999)(ISTAT(I),I=1,NS)
        999 FORMAT(I10)
            IF(EOF(7))20,30
         30 CONTINUE
      C
```

```
SNL 2ND GENERATION HELIOSTAT

    4410 FACTORY COSTS

KEY TO ENTRY TYPES

M=RAW MATERIALS                  P=PURCHASED MATERIALS               L=DIRECT LABOR HOURS
S=SUPPLIES AND CONSUMABLES       T=TOOLING                           E=EQUIPMENT
B=BUILDING OR FACILITY SIZE      A=LAND FOR PRODUCTION FACILITY      Q=QUANTITY
X=TRANSPORTATION REQUIREMENTS    Y=SITE-RETAINED CAPITAL             Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES

                        ITEM                              QUANTITY  UNITS         UNIT    TOTAL
                                                                                  COST     COST

ENTRY TYPE=P   4410     FUSION GLASS,.060,                     622  SQFT            .45   280.16  / HELIOSTAT
     SOURCE-CORNING, 5X6 FT. LITES
ENTRY TYPE=P   4410     FUSION GLASS,                          622  SQFT            .24   152.00  / HELIOSTAT
     ALLIED TOOLING COST FOR GLASS PLANT
ENTRY TYPE=P   4410     SILVER,COPPER,PAINT,                   622  SQFT            .20   124.52  / HELIOSTAT
     SOURCE-MISC. ESTIMATE (.07/FT**2 POSSIBLE),AG-70MG/SQFT,CU-20MG/SQFT,
     PPG UC44409 GRAY PAINT- 7 TO 9 MG/SQFT
ENTRY TYPE=P   4410     POLYISOBUTYLENE(PIB)                     8  GAL           11.18    89.44  / HELIOSTAT
     SOURCE-3M EC5354
ENTRY TYPE=L   4410     MIRROR FABRICATION              .4000E+00  HRS / HELIOSTAT
     SOURCE-SNL AT 12.23/HR=4.89
ENTRY TYPE=P   4410     PAPER HONEYCOMB-20IP PHENOLIC          617  SQFT            .27   169.15  / HELIOSTAT
     PERFORATED(0.060),.30 V/D
ENTRY TYPE=P   4410     BORDEN MJ-6 EPOXY ADHESIVE               7  GAL            8.84    69.80  / HELIOSTAT
     SOURCE BASED ON BOSTIK
ENTRY TYPE=L   4410     CORE FABRICATION                .2400E+00  HRS / HELIOSTAT
     SOURCE-SNL AT 12.23/HR=2.94
ENTRY TYPE=P   4410     FACE AND BACK SHEETS,.024 STEEL       1256  SQFT            .26   323.90  / HELIOSTAT
     SOURCE-ARMCO 1215 LB AT 0.267/LB, SAE 1010 STEEL
ENTRY TYPE=L   4410     FACE AND BACK SHEET FABRICATION .8000E-01  HRS / HELIOSTAT
     SOURCE-SNL AT 12.23/HR=0.98,SAE1010 STEEL
ENTRY TYPE=L   4410     BONDED ASSEMBLY                 .7200E+00  HRS / HELIOSTAT
     SOURCE-SNL AT 12.23/HR=8.81
ENTRY TYPE=P   4410     EDGE STRIP .024 X 2.3125 X 36/FT        68  LBS             .25    17.19  / HELIOSTAT
     SOURCE-ARMCO 1010 COIL STOCK
ENTRY TYPE=P   4410     PIB                                                                 2.63  / HELIOSTAT
     SOURCE-3M EC5354
ENTRY TYPE=L   4410     EDGE STRIP FABRICATION          .2200E+00  HRS / HELIOSTAT
     SOURCE-SNL AT 12.23/HR=2.69
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SNL  2ND GENERATION HELIOSTAT

    4450 TRANSPORTATION COSTS

KEY TO ENTRY TYPES

M=RAW MATERIALS                  P=PURCHASED MATERIALS               L=DIRECT LABOR HOURS
S=SUPPLIES AND CONSUMABLES       T=TOOLING                           E=EQUIPMENT
B=BUILDING OR FACILITY SIZE      A=LAND FOR PRODUCTIO() FACILITY     Q=QUANTITY
X=TRANSPORTATION REQUIREMENTS    Y=SITE-RETAINED CAPITAL             Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES

                        ITEM                              QUANTITY  UNITS         UNIT    TOTAL
                                                                                  COST     COST

ENTRY TYPE=S   4450     SUPPORT STRUCTURE CUSTOM RACK                                        0.00  / HELIOSTAT
     SOURCE- NONE IDENTIFIED
ENTRY TYPE=X   4450     SUPPORT STRUCTURE XPORT TO SITE      .5300E-01  TRUCKLOADS
      SPECIAL TRANSPORTATION COST CATEGORY   1
     SOURCE-SNL ,33.00 TOTAL

   TOTAL PURCHASED MATERIALS=      0.00 $/HELIOSTAT
   TOTAL RAW MATERIALS=      0.00 $/HELIOSTAT
   TOTAL (BASE RATE COST CATEGORY) DIRECT LABOR=     0.0000    HRS/HELIOSTAT
   TOTAL CONSUMABLES=      0.00    $/HELIOSTAT
   WEIGHTED EQUIPMENT COST=        0.    $ TIMES YEARS USED / SITE
   QUANTITY=         0.     / SITE
    SPECIAL TRANSPORTATION COST CATEGORY  1 =       .054 TRUCKLOADS
   INPUT (NOT COMPUTED) TRANSPORTATION COST      34.97     $

DEFAULT QUANTITY USED IN PROFIT CENTER CALCULATION
DEFAULT QUANTITIES = 50000.(FACTORY), 5400.(TRANSPORT/SITE)

     SOURCE=WFN, $250,000/FIELD ASSUMED

ENTRY TYPE=L   4430     HAC ASSEMBLY                     .1100E+00  HRS / HELIOSTAT
     SOURCE=SNL -WFN/0.92
ENTRY TYPE=L   4430     CABLE INSTALLATION               .1065E+01  HRS / HELIOSTAT
     SOURCE=SNL -WFN/0.92
ENTRY TYPE=L   4430     POWER TRANSFORMER INSTALLATION   .3300E-01  HRS / HELIOSTAT
     SOURCE=SNL -WFN/0.92
ENTRY TYPE=L   4430     CABLE CHECKOUT,CLOSEOUT          .7070E+00  HRS / HELIOSTAT
     SOURCE=SNL -WFN/0.92
ENTRY TYPE=Z   4430     SITE BURDEN EXPENSE                                                20.10  / HELIOSTAT
     SITE BURDEN EXPENSE CANNOT BE COMPUTED INTERNALLY DUE TO LACK OF REQUIRED
     INPUT DATA.  THIS APPROXIMATION TO SITE BURDEN IS OBTAINED USING THE SNL
     OVERHEAD RATE OF $10.58/HR FOR 1.9 HOURS OF DIRECT LABOR.
ENTRY TYPE=Q   4430     QUANTITY                         .5412E+04  /STE
```

HELIOSTAT COST MODEL

DETAILED BREAKDOWN

SNL - SECOND GENERATION

4450 - SUPPORT STRUCTURE

TRANSPORTATION COSTS

PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE			34.97
DIRECT MATERIALS		0.00	
PURCHASED MATERIALS	0.00		
RAW MATERIALS	0.00		
SCRAP	0.00		
DIRECT LABOR		0.00	
CONSUMABLES		0.00	
INDIRECT COSTS		0.00	
MAINTENANCE, PLANT ENGINEERING	0.00		
OTHER INDIRECTS	0.00		
CAPITAL REPLACEMENT ALLOWANCE		0.00	
PROPERTY TAX AND INSURANCE		0.00	
GENERAL & ADMINISTRATIVE		0.00	
INTEREST EXPENSE		0.00	
INCOME TAXES		0.00	
RETURN TO EQUITY HOLDERS		0.00	
OTHER EXPENSES		34.97	
TRANSPORTATION CHARGES	34.97		

COST SUMMARY BY PROFIT CENTER

OTHER EXPENSES

SNL - SECOND GENERATION

PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	TOTALS BY LOCATION
FACTORY	10.88	12.68	0.00	0.00	4.92	0.00	28.48
TRANSPORTATION	48.75	22.43	0.00	25.03	55.07		151.28
SITE			0.00	152.88		57.00	209.88
TOTALS BY COMPONENT	59.63	35.11	0.00	177.91	59.99	57.00	

TOTAL FOR OTHER EXPENSES 389.64

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UNLABELED OLDPL          MODIFICATIONS / CONTROL CARDS          UPDATE 1.2-77028.    09/22/81  12.30.48.     PAGE   1



          CORRECTION IDENTS ARE LISTED IN CHRONOLOGICAL ORDER OF INSERTION

      HELCAT    PREAD    IREAD    PREPRO    COST    CHART    TPAGE

DECKS ARE LISTED IN THE ORDER OF THEIR OCCURRENCE ON A NEW PROGRAM LIBRARY IF ONE IS CREATED BY THIS UPDATE

      YANK$$$   HELCAT    PREAD    IREAD    PREPRO    COST    CHART    TPAGE

      DECKS WRITTEN TO COMPILE FILE
      HELCAT    PREAD    IREAD    PREPRO    COST    CHART    TPAGE

 THIS UPDATE REQUIRED  33700B WORDS OF CORE.
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```
SUBROUTINE PREAD      74/74   OPT=1                         FTN 4.6+439        09/22/81  12.30.53       PAGE     1

            SUBROUTINE PREAD                                                   PREAD      2
      C                                                                        PREAD      3
      C THIS ROUTINE CONTAINS THE DEFAULT VALUES FOR THE COST MODEL PARAMETERS PREAD      4
      C AND READS NEW VALUES FOR PARAMETERS MODIFIED IN THE CURRENT RUN        PREAD      5
      C                                                                        PREAD      6
            COMMON/INPT/FP(30),SP(30),TP(30),CFAC(09),CLAB(09),CTRN(09),ISTAT( PREAD      7
           $20),QL(2,2),CRC(2,2),IC(3)                                         PREAD      8
            DIMENSION L(4,30),LCR(2),LSPT(9),LD(4,3),LRN(4)                    PREAD      9
            NAMELIST/PARAMS/ISTAT,IC,FP,TP,SP,QL,CRC,CFAC,CLAB,CTRN            PREAD     10
            DATA (ISTAT(I),I=1,10)/12,30,21,3,6,0,0,1,0,0/                     PREAD     11
            DATA IC /1,0,1/                                                    PREAD     12
            DATA FP /10.,9.45,50.,20000.,0.06,0.102,0.166,0.50,0.10,           PREAD     13
           $0.80,0.04,0.01,0.02,0.09,0.17,0.03,5.0,10.0,30.0,3.,0.10,20000.,   PREAD     14
           $0.92,3.,8.,25.,.035,0.27,0.0035,0.006/                             PREAD     15
            DATA SP /10.,15.0,0.0,0.0,0.0,0.06,0.102,0.166,0.50,0.10,          PREAD     16
           $0.80,0.04,0.01,0.04,0.00,0.00,0.03,5.0,10.0,30.0,0.00,0.00,0.00,   PREAD     17
           $0.00,3.,8.,25.,.035,0.30,0.00,0.00/                                PREAD     18
            DATA TP /10.,15.0,0.0,0.0,0.0,0.06,0.102,0.166,0.50,0.10,          PREAD     19
           $0.80,0.04,0.01,0.04,0.00,0.00,0.03,5.0,10.0,30.0,0.00,0.00,0.00,   PREAD     20
           $0.00,3.,8.,25.,.035,0.30,0.00,0.00/                                PREAD     21
            DATA CLAB /9.,12.,18.,21.,25.,30.,3*0.00/                          PREAD     22
            DATA CFAC /40.,60.,80.,100.,120.,140.,3*0.00/                      PREAD     23
            DATA CTRN /650.,130.,7*0.00/                                       PREAD     24
            DATA  QL     / 100000.,3*50000./                                   PREAD     25
            DATA  CRC     /0.96,0.94,0.98,0.98/                                PREAD     26
            DATA (L(I,01),I=1,4)/40HDURATION OF COST PROJECTION - YEARS      / PREAD     27
            DATA (L(I,02),I=1,4)/40HBASE RATE DIRECT LABOR COST - $/HOUR     / PREAD     28
            DATA (L(I,03),I=1,4)/40HBASE RATE PROD FACILITY COST - $/SQFT    / PREAD     29
            DATA (L(I,04),I=1,4)/40HLAND COST FOR PROD FACILITY - $/ACRE     / PREAD     30
            DATA (L(I,05),I=1,4)/40HINFLATION RATE                           / PREAD     31
            DATA (L(I,06),I=1,4)/40HRETURN TO BOND HOLDERS                   / PREAD     32
            DATA (L(I,07),I=1,4)/40HRETURN TO EQUITY HOLDERS                 / PREAD     33
            DATA (L(I,08),I=1,4)/40HCOMBINED INCOME TAX RATE                 / PREAD     34
            DATA (L(I,09),I=1,4)/40HINVESTMENT TAX CREDIT                    / PREAD     35
            DATA (L(I,10),I=1,4)/40HEQUITY FRACTION                          / PREAD     36
            DATA (L(I,11),I=1,4)/40HPROPERTY TAX AND INSURANCE FRACTION      / PREAD     37
            DATA (L(I,12),I=1,4)/40HPURCHASED MATERIAL SCRAP FRACTION        / PREAD     38
            DATA (L(I,13),I=1,4)/40HMAINTENANCE FRACTION                     / PREAD     39
            DATA (L(I,14),I=1,4)/40HGENERAL AND ADMINISTRATIVE FRACTION      / PREAD     40
            DATA (L(I,15),I=1,4)/40HWORKING CAPITAL FRACTION                 / PREAD     41
            DATA (L(I,16),I=1,4)/40HRAW MATERIAL SCRAP FRACTION              / PREAD     42
            DATA (L(I,17),I=1,4)/40HTOOLING LIFETIME (ACCOUNTING) - YEARS    / PREAD     43
            DATA (L(I,18),I=1,4)/40HEQUIPMENT LIFETIME (ACCOUNTING) - YEARS  / PREAD     44
            DATA (L(I,19),I=1,4)/40HFACILITY LIFETIME (ACCOUNTING) - YEARS   / PREAD     45
            DATA (L(I,20),I=1,4)/40HFACILITY CONSTRUCTION PERIOD - YEARS     / PREAD     46
            DATA (L(I,21),I=1,4)/40HFACILITY PLANT ENGINEERING FRACTION      / PREAD     47
            DATA (L(I,22),I=1,4)/40HFACILITY STARTUP QUANTITY                / PREAD     48
            DATA (L(I,23),I=1,4)/40HCOST REDUCTION COEFFICIENT - START UP    / PREAD     49
            DATA (L(I,24),I=1,4)/40HTOOLING LIFETIME (TAX) - YEARS           / PREAD     50
            DATA (L(I,25),I=1,4)/40HEQUIPMENT LIFETIME (TAX) - YEARS         / PREAD     51
            DATA (L(I,26),I=1,4)/40HFACILITY LIFETIME (TAX) - YEARS          / PREAD     52
            DATA (L(I,27),I=1,4)/40HBASE RATE TRANS COST - $/LB              / PREAD     53
            DATA (L(I,28),I=1,4)/40HINDIRECT FRACTION - LABOR                / PREAD     54
            DATA (L(I,29),I=1,4)/40HINDIRECT FRACTION - MATERIAL             / PREAD     55
            DATA (L(I,30),I=1,4)/40HINDIRECT FRACTION - TOOL'G,EQUIP'T,FAC'Y/ PREAD     56
            DATA LCR /20HMATERIALS LABOR      /                                PREAD     57
            DATA LSPT(1)/10H[illegible]/TRNLOAD /                              PREAD     58
```

```
      SUBROUTINE COST( A, P, ISTAT, GL, CRC, EXPS, NEXPS)
C
C     ISTAT(1),  I=1,NS    STATUS VECTOR
C           1    NA    NUMBER OF ELEMENTS IN A
C           2    NP    NUMBER OF ELEMENTS IN P
C           3    NEXPS NUMBER OF ITEMIZED EXPENSES, ROWS OF EXPS
C           4    NTYP  NUMBER OF TYPES
C           5    NCOMP NUMBER OF COMPONENTS
C           6    ICOMP CURRENT COMPONENT
C           7    ITYP  CURRENT TYPE
C           8    IDEP  CHOSEN DEPRECIATION MODEL
C           9    NYR   NUMBER OF PRODUCTION YEARS
C          10    ILRN  LEARNING FLAG
C
      REAL LND, LNDSV, IND, INDSV
      DIMENSION A(30), P(30), VBK(50), RM(150), ISTAT(20),
     $ GL(0,1), CRC(2,1), DEP(50), EXPS(NEXPS,1), WC(50)
     $, DT(50), DE(50), DF(50)
C
C        DECODE THE STATUS VECTOR -- ISTAT
C
      ITYP = ISTAT(7)
      IDEP = ISTAT(8)
      NYR = ISTAT(9)
      ILRN = ISTAT(10)
C
C        DECODE THE PROFIT CENTER INPUTS -- A
C
      DMP = A(1)
      DL = A(2)
      CNM = A(3)
      LND = A(4)
      CFAC = A(5)
      CEQP = A(6)
      CL = A(7)
      G = A(8)
      TRIN = A(9)
      DMP = A(10)
      SUBC = A(11)
      STEAM = A(12)
C
C        DECODE THE MODEL PARAMETERS -- P
C
      ILRN = P(1)
      CACRE = P(2)
      RI = P(5)
      XINT = P(6)
      REQR = P(7)
      TAU = P(8)
      FITC = P(9)
      FEQ = P(10)
      FTXINC = P(11)
      FSCPP = P(12)
      FMTN = P(13)
      FGA = P(14)
      FNF = P(15)
      FSCRR = P(16)
```



```
C        DECODE THE NECESSARY STATUS PARAMETERS
C
      NYR = ISTAT(9)
      N = N + 1
      READ(7,998)(EXPS(I,J),I=1,NEXPS),J=1,NYR)
      FORMAT(F12.2)
      IF(IC(1) .NE. 3)CALL DCHART( EXPS(1,IYR), NEXPS, ISTAT, NS, ETOT,
     $ IC, IYR, CTR, ISUM)
      IF(IC(1) .EQ. 3.AND. IC(2) .EQ. N)CALL DCHART( EXPS(1,IYR), NEXPS,
     $ ISTAT, NS, ETOT, IC, IYR, CTR, ISUM)
      GO TO 100
   20 CONTINUE
      IF(N .EQ. 0)WRITE(6,997)
  997 FORMAT(///' ERROR -- NO INFORMATION ON TAPE7 '///)
      IF(N .LT. NPC)GO TO 300
      IF(IC(1) .EQ. 3)GO TO 300
C
C        DO SUMMARIES
C
      DO 50 I=1,NEXPS
      IF(IC(1) .EQ.4 .AND. IC(2) .NE. I) GO TO 50
      CALL SCHART( ETOT, ISTAT, NS, ICOST, I, IYR, CTR, ISUM)
   50 CONTINUE
  300 CONTINUE
      IF(IYR .LT. NYR)GO TO 200
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS DEF LINE REFERENCES
3 CHART 1 140

VARIABLES	SN	TYPE	RELOCATION									
0 CTR		REAL	ARRAY	F.P.	REFS	3	121	123	136	DEFINED	1	
247 ETOT		REAL	ARRAY		REFS	3	121	123	136	DEFINED	102	
0 EXPS		REAL	ARRAY	F.P.	REFS	2	121	123	DEFINED	1	119	
262 I		INTEGER			REFS	85	102	110	119	135	136	
					DEFINED	85	99	110	119	134		
0 IC		INTEGER	ARRAY	F.P.	REFS	3	93	94	2*121	3*123	130	2*135
					DEFINED	1						
617 ICOST		INTEGER	ARRAY		REFS	2	136	DEFINED	56			
0 ISTAT		INTEGER	ARRAY	F.P.	REFS	3	92	117	121	123	136	
					DEFINED	1	85	110				
641 ISUM		INTEGER	ARRAY		REFS	3	121	123	136	DEFINED	75	
261 IYR		INTEGER			REFS	97	94	2*121	2*123	136	139	
					DEFINED	80	91					
264 J		INTEGER			REFS	102	119	DEFINED	100	119		
265 K		INTEGER			REFS	102	DEFINED	101				
266 N		INTEGER			REFS	118	123	127	129	DEFINED	108	118
0 NEXPS		INTEGER		F.P.	REFS	2	119	121	123	134		
					DEFINED	1						
0 NPC		INTEGER		F.P.	REFS	124	DEFINED	1				

ENTRY TYPE=P 4410 CENTER STRIP .024 x 1.625 x 52.2FT 6 LBS .25 1.71 / HELIOSTAT
SOURCE=RAPID 1010 COIL STOCK

ENTRY TYPE=L 4410 CENTER STRIP FABRICATION .6000E-01 HRS / HELIOSTAT
SOURCE=SNL AT 12.23/HR=0.73

ENTRY TYPE=P 4410 SUPPORT DOUBLERS 33 EACH CAST IRON 51 LBS .31 15.96 / HELIOSTAT
SOURCE=SNL ESTIMATE-CAPTIVE FOUNDRY,1.5# LB EACH

ENTRY TYPE=L 4410 SUPPORT DOUBLER FLATTEN,DRILL,TAP .8000E-01 HRS / HELIOSTAT
SOURCE=SNL AT 12.23/HR= 0.98

ENTRY TYPE=P 4410 RTV SEALANT 4.46 / HELIOSTAT
SOURCE=DOW CORCING 795 RTV SILICONE

ENTRY TYPE=P 4410 SELF TAPPING HEX-HEAD SCREWS 33 EACH .03 .82 / HELIOSTAT
SOURCE= A AND E BOLT NO.6 X 7/16 FOR CENTER STRIPS

ENTRY TYPE=P 4410 STAPLES-NOT IN PROD. DESIGN 369 EACH .01 4.43 / HELIOSTAT
SOURCE= A AND E BOLT

ENTRY TYPE=P 4410 SUPPORT ANGLE .024X.75X3X3.3FT 22 LBS .25 5.50 / HELIOSTAT
SOURCE=HAL 22 LB

ENTRY TYPE=P 4410 ACRYLIC ADHESIVE,VERSILOK 204 5 LB 3.90 20.75 / HELIOSTAT
SOURCE=SNL TEL CON
SOURCE=HAL FOR DOUBLERS AND EDGE STRIPS,CENTER STRIPS,SUPPORT ANGLES

ENTRY TYPE=P 4410 POP RIVETS 400 EACH 1/8 AL 400 EACH .01 0.00 / HELIOSTAT
SOURCE=HAL NOM= .01 EACH

ENTRY TYPE=P 4410 PRIME AND FINISH PAINT COAT 1 GAL 20.00 0.00 / HELIOSTAT
SOURCE=HAL NOM=
PRIMER=DOUGLAS PAINT &3110,0005-.001 STRONTIUM CHROMATE
FINISH=DOUGLAS PAINT DA SERIES,COLOR NO.,25&30 FED STD 595A .001-.0015
ACRYLIC WHEATHANE,ONE COAT

ENTRY TYPE=L 4410 MIRROR MODULE ASSEMBLY .1040E+01 HRS / HELIOSTAT
SOURCE=SNL AT 12.23/HR= 12.72

ENTRY TYPE=A 4410 REFLECTIVE ASSEMBLY LAND .4040E+02 ACRE
SOURCE=SNL 95 ACRES X PROD. SPACE RATIO=55#
SNL USES 20000 /ACRE IMPROVED LAND

ENTRY TYPE=B 4410 REFLECTIVE ASSEMBLY FACILITIES .2153E+06 SQFT
SOURCE S. WHITE

ENTRY TYPE=E 4410 REFLECTIVE ASSEMBLY EQUIPMENT 7388400.
SOURCE=MD,INCLUDES TOOLING,

ENTRY TYPE=T 4410 REFLECTIVE ASSEMBLY TOOLING 0.
INCLUDED WITH EQUIPMENT

ENTRY TYPE=S 4410 SUPPLIES .20 / HELIOSTAT

ENTRY TYPE=Q 4410 REFLECTIVE ASSEMBLY QUANTITY/YEAR .5000E+05

TOTAL PURCHASED MATERIALS= 935.62 $/HELIOSTAT

TOTAL PURCHASED MATERIALS= 0.00 $/HELIOSTAT
TOTAL RAW MATERIALS= 0.00 $/HELIOSTAT
TOTAL (BASE RATE COST CATEGORY) DIRECT LABOR= 1.9150 HRS/HELIOSTAT
TOTAL CONSUMABLES= 0.00 $/HELIOSTAT
WEIGHTED EQUIPMENT COST= 0. $ TIMES YEARS USED / SITE
QUANTITY= 5412. / SITE
TOTAL SUBCONTRACTS AND FLOW-THROUGH EXPENSES= 20.10 $/HELIOSTAT

TOTAL DIRECT LABOR COST= 20.73 $/HELIOSTAT

HELIOSTAT COST MODEL

DETAILED BREAKDOWN

SNL - SECOND GENERATION

4450 - SUPPORT STRUCTURE

TRANSPORTATION COSTS

PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE		57.44
DIRECT MATERIALS		0.00
PURCHASED MATERIALS	0.00	
RAW MATERIALS	0.00	
SCRAP	0.00	
DIRECT LABOR		28.73
CONSUMABLES		0.00
INDIRECT COSTS		8.62
MAINTENANCE, PLANT ENGINEERING	0.00	
OTHER INDIRECTS	8.62	
CAPITAL REPLACEMENT ALLOWANCE		0.00
PROPERTY TAX AND INSURANCE		0.00
GENERAL & ADMINISTRATIVE		0.00
INTEREST EXPENSE		0.00
INCOME TAXES		0.00
RETURN TO EQUITY HOLDERS		0.00
OTHER EXPENSES		20.10
SUBCONTRACTS & FLOW-THROUGH	20.10	

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*1441DOE 2ND GENERATION HELIOSTAT                                       INPT     2
P 4410FUSION GLASS, DWO,                622.58SQFT    0.45   280.16    INPT     3
C SOURCE-CORNING, 5AG FT. LITES                                         INPT     4
P 4410FUSION GLASS,                     622.58SQFT   0.244   152.00    INPT     5
C ALLIED TOOLING COST FOR GLASS PLANT                                   INPT     6
P 4410SILVER,COPPER,PAINT,              622.58SQFT    0.20   124.52    INPT     7
C SOURCE-MISC. ESTIMATE (.07/FT**2 POSSIBLE),AG-70MG/SQFT,CU-20MG/SQFT, INPT     8
C PPG UC44409 GRAY PAINT- 7 TO 9 MG/SQFT                                INPT     9
P 4410POLYISOBUTYLENE(PIB)                 8.0 GAL   11.18    89.44    INPT    10
C SOURCE-3M EC5354                                                      INPT    11
L 4410MIRROR FABRICATION                   0.40HRS                     INPT    12
C SOURCE-SAL AT 12.23/HR=4.89                                           INPT    13
P 4410PAPER HONEYCOMB-201P PHENOLIC     617.35SQFT   0.274   169.15    INPT    14
C PERFORATED(0.060),30 Y/O                                              INPT    15
P 4410BOSTICK MJ-6 EPOXY ADHESIVE          7.9GAL     8.84    69.80    INPT    16
C SOURCE BASED ON BOSTIK                                                INPT    17
L 4410CORE FABRICATION                     0.24HRS                     INPT    18
C SOURCE-SAL AT 12.23/HR=2.94                                           INPT    19
M 4410FACE AND BACK SHEETS,.024 STEEL   1294.0 SQFT  0.250   323.50    INPT    20
C SOURCE-ARMCO 1215 LB AT 0.267/LB, SAE 1010 STEEL                      INPT    21
L 4410FACE AND BACK SHEET FABRICATION      0.08 HRS                    INPT    22
C SOURCE-SAL AT 12.23/HR=0.98,SAE1010 STEEL                             INPT    23
L 4410BONDED ASSEMBLY                      0.72HRS                     INPT    24
C SOURCE-SAL AT 12.23/HR=8.81                                           INPT    25
M 4410EDGE STRIP .024 X 2.3125 X 36FT     68.8 LBS    0.25    17.19    INPT    26
C SOURCE-ARMCO 1010 COIL STOCK                                          INPT    27
P 4410PIB                                  0.24GAL   11.18     2.63    INPT    28
C SOURCE-3M EC5354                                                      INPT    29
L 4410EDGE STRIP FABRICATION               0.22HRS                     INPT    30
C SOURCE-SAL AT 12.23/HR=2.69                                           INPT    31
M 4410CENTER STRIP .024 X 1.625 X 52.2FT   6.84LBS    0.25     1.71    INPT    32
C SOURCE-ARMCO 1010 COIL STOCK                                          INPT    33
L 4410CENTER STRIP FABRICATION             0.06HRS                     INPT    34
C SOURCE-SAL AT 12.23/HR=0.73                                           INPT    35
P 4410SUPPORT DOUBLERS 33 EACH CAST IRON  51.48LBS    0.31    15.96    INPT    36
C SOURCE-SAL ESTIMATE-CAPTIVE FOUNDRY,1.56 LB EACH                      INPT    37
L 4410SUPPORT DOUBLER FLATTEN,DRILL,TAP    0.08HRS                     INPT    38
C SOURCE-SAL AT 12.23/HR= 0.98                                          INPT    39
P 4410RTV SEALANT                          0.42GAL   10.62     4.46    INPT    40
C SOURCE-DOW CORNING 795 RTV SILICONE                                   INPT    41
P 4410SELF TAPPING HEX-HEAD SCREWS         33. EACH  0.025     0.82    INPT    42
C SOURCE- A AND E BOLT  NO.6 X 7/16 FOR CENTER STRIPS                   INPT    43
P 4410STAPLES-NOT IN PROD. DESIGN         369.EACH   0.012     4.43    INPT    44
C SOURCE- A AND E BOLT                                                  INPT    45
P 4410SUPPORT ANGLE .024X.75X3X3.3FT      22.0LBS     0.25     5.50    INPT    46
C SOURCE-ASL        22 LB                                               INPT    47
P 4410ACRYLIC ADHESIVE,VERSILOK 204        5.32LB     3.90    20.75    INPT    48
C SOURCE-SAL TEL CON                                                    INPT    49
C SOURCE-ASL        FOR DOUBLERS AND EDGE STRIPS,CENTER STRIPS,SUPPORT ANGLES INPT 50
P 4410POP RIVETS 400 EACH 1/8 AL          400.EACH    0.01             INPT    51
C SOURCE-ASL ROM .01 EACH                                               INPT    52
P 4410PRIME AND FINISH PAINT COAT          1.25GAL    20.0             INPT    53
C SOURCE-ASL ROM                                                        INPT    54
C PRIMER=KANSAS PAINT 63Y18,0005-.001 STRONTIUM CHROMATE                 INPT    55
C FINISH=KANSAS PAINT 84 SERIES,COLOR NO.25630 FED STD 595A .001-.0015  INPT    56
C ACRYLIC HYPERTHANE,ONE COAT                                           INPT    57
L 4410MIRROR MODULE ASSEMBLY               1.04 HRS                    INPT    58
C SOURCE-SAL AT 12.23/HR= 12.72                                         INPT    59
A 4410REFLECTIVE ASSEMBLY LAND            40.4ACRE                     INPT    60
C SOURCE-SAL 95 ACRES X PROD. SPACE RATIO(55%)                          INPT    61
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        SUBROUTINE PREAD      74/74   OPT=1                     FTN 4.6+439       09/22/81  12.30.53       PAGE     3

VARIABLES     SN  TYPE            RELOCATION
                                                      54          55
   530  LCR        INTEGER    ARRAY                   REFS         8           86   DEFINED      56
   543  LD         INTEGER    ARRAY                   REFS         8           69   DEFINED      60         61         62
   557  LRN        INTEGER    ARRAY                   REFS         8           69   DEFINED      63         64         65
   532  LSPT       INTEGER    ARRAY                   REFS         8           81   DEFINED      57         58         59
   211  QL         REAL       ARRAY      INPT         REFS         6            9         2*86   DEFINED      24
    36  SP         REAL       ARRAY      INPT         REFS         6            9           75   DEFINED      15
    74  TP         REAL       ARRAY      INPT         REFS         6            9           75   DEFINED      18

FILE NAMES        MODE
      TAPE5       NAME                   READS        66
      TAPE6       FMT                    WRITES       67          69          73          75          79          81          94          86

NAMELISTS          DEF LINE      REFERENCES
      PARAMS           9             66

STATEMENT LABELS               DEF LINE     REFERENCES
   175  98        FMT              70            69
   157  99        FMT              68            67
   202  100       FMT              71            73
   216  101       FMT              74            75
   233  102       FMT              76            79
   257  103       FMT              80            81
   276  104       FMT              82            84
   314  105       FMT              85            86

LOOPS  LABEL       INDEX         FROM-TO        LENGTH      PROPERTIES
   17              * I            69 69          10B                   EXT REFS
   35              * I            75 75          15B                   EXT REFS
   60              * I            81 81          13B                   EXT REFS
  101              * I            86 86          15B                   EXT REFS

COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
      INPT          148                0 FP       (30)              30 SP      (30)                60 TP      (30)
                                      90 CFAC     (9)               99 CLAB    (9)                108 CTRN    (9)
                                     117 ISTAT    (20)             137 QL      (4)                141 CRC     (4)
                                     145 IC       (3)

STATISTICS
  PROGRAM LENGTH                    563B      371
  CM LABELED COMMON LENGTH          224B      148
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```
                  INDD = FINDL * DL + FINDM * DM + FINDC * (CTL + CEQP + CFAC) / Q      COST   116
                  IND = EMTN * INDD                                                     COST   117
C                                                                                       COST   118
C                 CALCULATE THE ANNUAL OPERATING EXPENSES                               COST   119
                  OMM = DM + DL + CMM + IND                                             COST   120
C                                                                                       COST   121
C                 COMPUTE THE DISCOUNT RATE                                             COST   122
C                                                                                       COST   123
                  RATCC = (1.-TAU) * (1.-FEQ) * RINT + FEQ * REQP                       COST   124
C                                                                                       COST   125
C                 COMPUTE THE WORKING CAPITAL                                           COST   126
C                                                                                       COST   127
                  DO 5 IT=1,LFCA                                                        COST   128
                5 WC(IT) = FWC * OMM * (1.+RI)**(IT-1)                                  COST   129
C                                                                                       COST   130
C                 COMPUTE THE BOOK VALUE AND REPLACEMENT TRAJECTORIES                   COST   131
C                                                                                       COST   132
                  DO 10 IT = 1,LFCA                                                     COST   133
                  NT = (IT-1)/LTLA                                                      COST   134
                  NE = (IT-1)/LEQA                                                      COST   135
                  ITT = IT - NT * LTLA                                                  COST   136
                  ITE = IT - NE * LEQA                                                  COST   137
                  VBK(IT) = CLNEP * WC(IT) + CTLP * (1.+RI)**(INTALTLA)*                COST   138
                . (1.-FLOAT(ITT)/XLTLA) + CEQPP * (1.+RI)**(NEWLEQA) *                  COST   139
                . (1.-FLOAT(ITE)/XLEQA) + CFACP * (1.-FLOAT(IT)/XLFCA)                  COST   140
                  RPL(IT) = CTLP * (1.+RI)**(INTALTLA)/XLTLA                            COST   141
                .     + CEQPP * (1.+RI)**(NEWLEQA)/XLEQA                              COST   142
                .     + CFACP/XLFCA                                                   COST   143
               10 CONTINUE                                                              COST   144
C                                                                                       COST   145
C                 ANNUALIZE                                                             COST   146
C                                                                                       COST   147
                  CALL APV( VBK, LFCA, LFCA, RATCC, RI, AVBK)                           COST   148
                  CALL APV( RPL, LFCA, LFCA, RATCC, RI, ARPL)                           COST   149
C                                                                                       COST   150
C                 COMPUTE OTHER CAPITAL RELATED EXPENSES                                COST   151
C                                                                                       COST   152
                  ATXING = (FTXING * AVBK)                                              COST   153
                  AINT = (1.-FEQ) * RINT * AVBK                                         COST   154
                  AEQR = (FEQ * REQR * AVBK)                                            COST   155
C                                                                                       COST   156
C                 COMPUTE THE G AND A EXPENSE                                           COST   157
C                                                                                       COST   158
                  EGA = FGA * (DM + DL + CMM + IND + ARPL + AINT + ATXING)              COST   159
C                                                                                       COST   160
C                 COMPUTE START UP OR INITIAL ONE-TIME COSTS                            COST   161
C                 THERE ARE NO START UP COSTS FOR SITE OR TRANSPORTATION                COST   162
C                                                                                       COST   163
                  ADTC = 0.                                                             COST   164
                  RR = (1.+BATC(1))**(-RI) - 1.                                         COST   165
                  IF(ITYP .NE. 1)GO TO 70                                               COST   166
                  LNDSU = (EXP(RR*TC) -1.) * CACRE * LND                                COST   167
                  PI = ACOS(-1.)                                                        COST   168
                  FIDC = .5 * (PI/TC)**2 + 1. * EXP(RR*TC)/RR                           COST   169
                . **2 + (PI/TC)**2)                                                     COST   170
                  AIDC = (FIDC-1.) * (CFAC + CTL + CEQP) * (1.+FPLENG)                  COST   171
                                                                                        COST   172
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                  SUBROUTINE DCHART( EXPS,NEXPS,ISTAT,NS,ETOT,IC,IYR,CTR,ISUM)          CHART  143
                  DIMENSION EXPS(NEXPS,1), ISTAT(NS), ISUM(25)                          CHART  144
                  DIMENSION CTR(3), LPC(3,6), LTYP(3,3)                                 CHART  145
                  DIMENSION ETOT(12,6,3), IC(3)                                         CHART  146
                  COMMON /LABEL/ L(3,2)                                                 CHART  147
                  DATA ((LPC(I,J),I=1,3)/3HM410  -  REFLECTIVE ASSEMBLY  /              CHART  148
                  DATA ((LPC(I,2),I=1,3)/3HM420  -  DRIVES                /             CHART  149
                  DATA ((LPC(I,3),I=1,3)/3HM430  -  CONTROLS              /             CHART  150
                  DATA ((LPC(I,4),I=1,3)/3HM440  -  FOUNDATION/PEDESTAL   /             CHART  151
                  DATA ((LPC(I,5),I=1,3)/3HM450  -  SUPPORT STRUCTURE     /             CHART  152
                  DATA ((LPC(I,6),I=1,3)/3HM460  -  ASSEMBLY/INSTALLATION/              CHART  153
                  DATA ((LTYP(I,1),I=1,3)/3HFACTORY COSTS                 /             CHART  154
                  DATA ((LTYP(I,3),I=1,3)/3HSITE COSTS                    /             CHART  155
                  DATA ((LTYP(I,2),I=1,3)/3HTRANSPORTATION COSTS          /             CHART  156
                  DATA ((L(I,1),I=1,3)/3HTOTAL REQUIRED REVENUE           /             CHART  157
                  DATA ((L(I,2),I=1,3)/3HDIRECT MATERIALS                 /             CHART  158
                  DATA ((L(I,3),I=1,3)/3HPURCHASED MATERIALS              /             CHART  159
                  DATA ((L(I,4),I=1,3)/3HRAW MATERIALS                    /             CHART  160
                  DATA ((L(I,5),I=1,3)/3HSCRAP                            /             CHART  161
                  DATA ((L(I,6),I=1,3)/3HDIRECT LABOR                     /             CHART  162
                  DATA ((L(I,7),I=1,3)/3HCONSUMABLES                      /             CHART  163
                  DATA ((L(I,8),I=1,3)/3HINDIRECT COSTS                   /             CHART  164
                  DATA ((L(I,9),I=1,3)/3HMAINTENANCE, PLANT ENGINEERING/                CHART  165
                  DATA ((L(I,10),I=1,3)/3HOTHER INDIRECTS                 /             CHART  166
                  DATA ((L(I,11),I=1,3)/3HCAPITAL REPLACEMENT ALLOWANCE   /             CHART  167
                  DATA ((L(I,12),I=1,3)/3HPROPERTY TAX AND INSURANCE      /             CHART  168
                  DATA ((L(I,13),I=1,3)/3HGENERAL & ADMINISTRATIVE        /             CHART  169
                  DATA ((L(I,14),I=1,3)/3HINTEREST EXPENSE                /             CHART  170
                  DATA ((L(I,15),I=1,3)/3HINCOME TAXES                    /             CHART  171
                  DATA ((L(I,16),I=1,3)/3HRETURN TO EQUITY HOLDERS        /             CHART  172
                  DATA ((L(I,17),I=1,3)/3HOTHER EXPENSES                  /             CHART  173
                  DATA ((L(I,18),I=1,3)/3HAMRALIZED ONE-TIME COSTS        /             CHART  174
                  DATA ((L(I,19),I=1,3)/3HSUBCONTRACTS & FLOW-THROUGH     /             CHART  175
                  DATA ((L(I,20),I=1,3)/3HSITE-RETAINED CAPITAL           /             CHART  176
                  DATA ((L(I,21),I=1,3)/3HTRANSPORTATION CHARGES          /             CHART  177
C                                                                                       CHART  178
C                 DECODE ISTAT ARRAY                                                    CHART  179
C                                                                                       CHART  180
                  ICOMP = ISTAT(6)                                                      CHART  181
                  ITYP = ISTAT(7)                                                       CHART  182
                  NYR = ISTAT(9)                                                        CHART  183
C                                                                                       CHART  184
C                                                                                       CHART  185
C                 ADD QUANTITIES TO RUNNING SUM AND RETURN IF IC INDICATES              CHART  186
C                 THAT NO DETAILED BREAKDOWNS ARE REQUESTED                             CHART  187
C                                                                                       CHART  188
                  II = 0                                                                CHART  189
                  DO 5 I=1,NEXPS                                                        CHART  190
                  IF(ISUM(I).NE.1)GO TO 5                                               CHART  191
                  II = II + 1                                                           CHART  192
                  ETOT(II,ICOMP,ITYP) = ETOT(II,ICOMP,ITYP) + EXPS(I)                   CHART  193
                5 CONTINUE                                                              CHART  194
                  IF(IC(1) .EQ. 2 .OR. IC(1) .EQ. 4) RETURN                             CHART  195
                  WRITE(6,10)                                                           CHART  196
               10 FORMAT(1H1,T40,*HELIOSTAT COST MODEL*//T40,*DETAILED BREAKDOWN*//)    CHART  197
                  WRITE(6,20)(CTR(I),I=1,3)                                             CHART  198
               20 FORMAT(T39,3A10//)                                                    CHART  199
```

SNL 2ND GENERATION HELIOSTAT

4420 FACTORY COSTS

KEY TO ENTRY TYPES

M=RAW MATERIALS
S=SUPPLIES AND CONSUMABLES
B=BUILDING OR FACILITY SIZE
X=TRANSPORTATION REQUIREMENTS

P=PURCHASED MATERIALS
T=TOOLING
A=LAND FOR PRODUCTION FACILITY
I=SITE-RETAINED CAPITAL

L=DIRECT LABOR HOURS
E=EQUIPMENT
Q=QUANTITY
Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
ENTRY TYPE=M 4420 AZIMUTH/ELEVATION DRIVE PARTS:				196.32 / HELIOSTAT
SOURCE-TELEPHONE QUOTES AND CATALOGS				
BEARINGS,GREASE,SCREWS,WASHERS,KEYS,SEALS,PINS,GASKETS,PAINT				
ENTRY TYPE=M 4420 CAST IRON PARTS				207.17 / HELIOSTAT
SOURCE-ESTIMATE CAPTIVE FOUNDRY,0.31/LB				
AZ SHAFT,EL COVER,OPEN CAP,CLOSED CAP,MOTOR BRACKET,GEAR HOUSING,ENCODER				
SHAFT MOUNT,AZ COVER, SLIDE TABLE				
ENTRY TYPE=M 4420 FORGED GEARS,0.80/LB AZ/EL	2	EACH	52.00	104.00 / HELIOSTAT
SOURCE-TELEPHONE QUOTES,130 LB, 8620 STEEL				
ENTRY TYPE=M 4420 INTERMEDIATE GEAR CASTING	2	EACH	7.20	14.40 / HELIOSTAT
SOURCE-SNL,14.0 LB,0.80/LB,76% BRONZE,				
SAE C86L3				
ENTRY TYPE=M 4420 BAR STK, .42/LB AVG .40-.53 RGE				101.89 / HELIOSTAT
SOURCE-TELEPHONE QUOTES, 243 LBS				
EL SHAFT,WORM GEAR,INT. PINION,STOW SLIDE				
ENTRY TYPE=P 4420 AZ AND EL MOTORS,DC WITH 120-1 RED				252.00 / HELIOSTAT
SOURCE-GODINE TEL. QUOTE				
ENTRY TYPE=P 4420 AZ ENCODER				157.20 / HELIOSTAT
SOURCE-TEL QUOTE,BALDWIN ELECTRONICS,SERVOPETER,A+C BOLT				
ENTRY TYPE=M 4420 AZ ENCODER COUPLING FROM STEEL STK				1.75 / HELIOSTAT
SOURCE-JORGENSEN TEL QUOTE				
ENTRY TYPE=P 4420 EL ENCODER				157.08 / HELIOSTAT
SOURCE-TEL QUOTE,BALDWIN ELECTRONICS,SERVOPETER,A AND E BOLT				
ENTRY TYPE=M 4420 EL ENCODER COUPLING FROM STEEL				1.50 / HELIOSTAT
SOURCE-GORGENSEN TEL QUOTE				
ENTRY TYPE=P 4420 ELECTRICAL POWER HARNESS				44.34 / HELIOSTAT
SOURCE-TEL QUOTE,CATALOG,CANNON,BURNDY CORP,RAYCHEM,AMP,T AND B,CONS-ELECT				
INCLUDES 22.84 CONTRACTED LABOR				
ENTRY TYPE=P 4420 EL/AZ LOCK LIMIT SWITCH				32.70 / HELIOSTAT
SOURCE-TEL QUOTE,CATALOG,CANNON,CONS-ELECT,MICROSWITCH,T AND B				
INCLUDES 10.00 CONTRACTED LABOR				

TOTAL RAW MATERIALS= 0.00 $/HELIOSTAT

TOTAL (BASE RATE COST CATEGORY) DIRECT LABOR= 14.4500 HRS/HELIOSTAT
TOTAL CONSUMABLES= 0.00 $/HELIOSTAT
WEIGHTED EQUIPMENT COST= 0. $ TIMES YEARS USED / SITE
QUANTITY= 5412. / SITE
TOTAL SUBCONTRACTS AND FLOW-THROUGH EXPENSES= 152.88 $/HELIOSTAT

TOTAL DIRECT LABOR COST= 216.75 $/HELIOSTAT

HELIOSTAT COST MODEL

DETAILED BREAKDOWN

SNL - SECOND GENERATION

4460 - ASSEMBLY/INSTALLATION

SITE COSTS

PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE		162.07
DIRECT MATERIALS		0.00
PURCHASED MATERIALS	0.00	
RAW MATERIALS	0.00	
SCRAP	0.00	
DIRECT LABOR		80.82
CONSUMABLES		0.00
INDIRECT COSTS		24.25
MAINTENANCE, PLANT ENGINEERING	0.00	
OTHER INDIRECTS	24.25	
CAPITAL REPLACEMENT ALLOWANCE		0.00
PROPERTY TAX AND INSURANCE		0.00
GENERAL & ADMINISTRATIVE		0.00
INTEREST EXPENSE		0.00
INCOME TAXES		0.00
RETURN TO EQUITY HOLDERS		0.00
OTHER EXPENSES		57.00
SUBCONTRACTS & FLOW-THROUGH	57.00	

```
C  SAL USES 20000 /ACRE IMPROVED LAND                                          INPT   62

@ 4410REFLECTIVE ASSEMBLY FACILITIES      215339.SQFT                          INPT   63
C  SOURCE 5, WHITE                                                            INPT   64
E 4410REFLECTIVE ASSEMBLY EQUIPMENT                          7.3884E6         INPT   65
C     SOURCEWD, INCLUDES TOOLING,                                            INPT   66
E 4410REFLECTIVE ASSEMBLY TOOLING                                 0.         INPT   67
C   INCLUDED WITH EQUIPMENT                                                  INPT   68
@ 4410DRIVES                                                 0.20             INPT   69
@ 4410REFLECTIVE ASSEMBLY QUANTITY/YEAR  50000.                               INPT   70
@ 4410                                                                        INPT   71
*4420HAL 2ND GENERATION HELIOSTAT                                             INPT   72
P 4420AJ/ELEVATION DRIVE PARTS                                  196.32        INPT   73
C SOURCE - TELEPHONE QUOTES AND CATALOGS                                      INPT   74
C GEARINGS,GREASE,SCREWS,WASHERS,NUTS,SEALS,PINS,GASKETS,PAINT                INPT   75
M 4420CAST IRON PARTS                                           207.17        INPT   76
C SOURCE-ESTIMATE CAPTIVE FOUNDRY,0.31/LB                                     INPT   77
C AZ SHAFT,EL COVER,GREEN CAP,CLOSED CAP,MOTOR BRACKET,GEAR HOUSING,ENCODER   INPT   78
C  SHAFT HOUSE AZ COVER  SLIDE TABLE                                          INPT   79
M 4420FORGED GEARS,0.60/LB  AZ/EL     2.0    EACH    52.00  104.00           INPT   80
C SOURCE-TELEPHONE QUOTES,130 LB, 8620 STEEL                                  INPT   81
M 4420 INTERMEDIATE GEAR CASTING      2.0    EACH     7.20   14.40           INPT   82
C SOURCE-SAL,14.0 LB,0.80/LB,MN BRONZE,                                       INPT   83
C  SAE (SAL)                                                                 INPT   84
M 4420BEAM STK   .42/LB AVG  40-.53 AGE                         101.89        INPT   85
C SOURCE-TELEPHONE QUOTES, 243 LBS                                            INPT   86
C EL SHAFT,HIGH GEAR,INT. PINION,STOW SLIDE                                   INPT   87
P 4420AJ AND EL MOTORS,DC WITH 120-1 RED                        252.00        INPT   88
C SOURCE-ADDITIVE TEL. QUOTE                                                  INPT   89
P 4420AJ ENCODER                                                157.20        INPT   90
C SOURCE-TEL QUOTE,BALDWIN ELECTRONICS,SERVOMETER,A+E BOLT                     INPT   91
M 4420AJ ENCODER COUPLING FROM STEEL STK                          1.75        INPT   92
C SOURCE-ADDENDUM TEL QUOTE                                                   INPT   93
P 4420EL ENCODER                                                157.08        INPT   94
C SOURCE-TEL QUOTE,BALDWIN ELECTRONICS,SERVOMETER,A AND E BOLT                 INPT   95
M 4420EL ENCODER COUPLING FROM STEEL                              1.50        INPT   96
C SOURCE-ADDENDUM TEL QUOTE                                                   INPT   97
P 4420ELECTRICAL POWER HARNESS                                   44.28        INPT   98
C SOURCE - TEL. QUOTE CATALOG, CAMDEN,BURNDY CORP,RAYCHEM,AMP,T AND B,CONS-ELECT INPT  99
C INCLUDES 22.00 CONTRACTED LABOR                                             INPT  100
M 4420EL/AZ LOCK LIMIT SWITCH                                    32.70        INPT  101
C SOURCE - TEL. QUOTE CATALOG, CAMDEN,CONS-ELECT,MICROSWITCH,T AND B          INPT  102
C INCLUDES 10.00 CONTRACTED LABOR                                             INPT  103
M 4420EL/AZ LIMIT SWITCH                                         34.90        INPT  104
C SOURCE - TEL. QUOTE CATALOG, CAMDEN,CONS-ELECT,MICROSWITCH,T AND B          INPT  105
C INCLUDES 10.00 CONTRACTED LABOR                                             INPT  106
M 4420PAINT, 12% GAL                  0.125 GAL    30.00    3.75            INPT  107
C SOURCE - PREVIOUS ESTIMATE                    1.7848HRS                     INPT  108
L 4420CAST IRON FABRICATION                                                   INPT  109
C SOURCE -SAL, AT 12.23/HR=21.83                                              INPT  110
L 4420FORGED GEAR FABRICATION                   0.586 HRS                     INPT  111
C SOURCE -SAL, AT 12.23/HR=7.16                                               INPT  112
L 4420BEAM STOCK FABRICATION                    0.88  HRS                     INPT  113
C SOURCE -SAL, AT 12.23/HR=10.75                                              INPT  114
L 4420AJ AND EL ENCODER FABRICATION               .04 HRS                     INPT  115
C SOURCE -SAL, AT 12.23/HR=5.40                                               INPT  116
L 4420ASSEMBLY AND PAINT OF DRIVE               1.92 HRS                     INPT  117
C SOURCE -SAL, AT 12.23/HR=23.48                                              INPT  118
@ 4420DRIVE ASSEMBLY LAND                         43.4ACRE                    INPT  119
C SOURCE -SAL, 90 ACRES + PROD. SPACE RATIO=55%                               INPT  120
C SAL USES 20000 /ACRE IMPROVED LAND                                          INPT  121
@ 4420DRIVE ASSEMBLY FACILITIES        2316194.SQFT                           INPT  122
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      74/74  OPT=1                FTN 4.6+439        09/22/81  12.30.53     PAGE     1

      1       SUBROUTINE IREAD(ISTAT,A,AW,HDR)                                IREAD    2
      C THIS ROUTINE READS THE INPUTS FOR EACH PROFIT CENTER CALCULATION. INPU IREAD    3
      C LISTED AS READ. THE DATA READ HERE IS UNIQUE FOR EACH PROFIT CENTER.  IREAD    4
      C                                                                       IREAD    5
      5 C THE READING ROUTINE USED HERE REQUIRES 10 CHARACTER WORD LENGTHS AND IREAD    6
      C EMPLOYS A DECODE ROUTINE THAT MAY NOT BE COMPATIBLE WITH NON-CDC SOFTW IREAD    7
      C                                                                       IREAD    8
      C THE ARRAY A CONTAINS INPUTS USED IN THE COST ROUTINE.  DEFINITIONS    IREAD    9
      C OF THE ELEMENTS OF ARRAY A ARE                                        IREAD   10
     10 C      A(1) = RAW MATERIAL COST (DOLLARS PER HELIOSTAT)               IREAD   11
      C      A(2) = DIRECT LABOR COST - COMPUTED IN SUBROUTINE PREPRO         IREAD   12
      C      A(3) = CONSUMABLES AND SUPPLIES (DOLLARS PER HELIOSTAT)          IREAD   13
      C      A(4) = PRODUCTION FACILITY LAND REQUIREMENTS (ACRES)             IREAD   14
      C      A(5) = PRODUCTION FACILITY COST - COMPUTED IN SUBROUTINE PREPRO   IREAD   15
     15 C      A(6) = EQUIPMENT COSTS (DOLLARS)                               IREAD   16
      C      A(7) = TOOLING COSTS (DOLLARS)                                   IREAD   17
      C      A(8) = SITE QUANTITY OR ANNUAL PRODUCTION QUANTITY               IREAD   18
      C      A(9) = TRANSPORTATION COST - COMPUTED IN SUBROUTINE PREPRO        IREAD   19
      C      A(10)= PURCHASED MATERIAL COST (DOLLARS PER HELIOSTAT)           IREAD   20
     20 C      A(11)= SUBCONTRACTS AND DIRECT, FLOW-THROUGH EXPENSES            IREAD   21
      C           (DOLLARS PER HELIOSTAT)                                     IREAD   22
      C      A(12)= SITE-RETAINED FACILITIES AND EQUIPMENT (DOLLARS)          IREAD   23
      C                                                                       IREAD   24
      C THE WORK ARRAY AW CONTAINS INPUTS USED BY SUBROUTINE PREPRO TO        IREAD   25
     25 C COMPUTE A(2), A(5), AND A(9).  THE WORK ARRAY CONTAINS INPUTS THAT   IREAD   26
      C ARE ASSOCIATED WITH THE SPECIAL COST CATEGORIES.  DEFINITIONS         IREAD   27
      C OF THE ARRAY ELEMENTS ARE                                             IREAD   28
      C      AW( 1) THROUGH AW(10) = INPUT DIRECT LABOR (HOURS PER HELIOSTAT) IREAD   29
      C      AW(11) THROUGH AW(20) = PRODUCTION FACILITY SIZE (SQUARE FEET)   IREAD   30
     30 C      AW(21) THROUGH AW(30) = TRANSPORTATION QUANTITY (UNITS VARY)    IREAD   31
      C                                                                       IREAD   32
      C                                                                       IREAD   33
            DIMENSION A(50),AW(100),ISTAT(20),HDR(3)                          IREAD   34
            DIMENSION IA(8),IC(8),XI(10),LT(10),LPC(3,6)                      IREAD   35
     35     DATA LT(1)/10LOCAL      /                                        IREAD   36
            DATA LT(2)/10NTRUCKLOADS/                                         IREAD   37
            DATA LT(3)/10NTRUCKLOADS/                                         IREAD   38
            DATA ((LPC(I,1),I=1,3)/30HREFLECTIVE ASSEMBLY          /          IREAD   39
            DATA ((LPC(I,2),I=1,3)/30HDRIVES                       /          IREAD   40
     40     DATA ((LPC(I,3),I=1,3)/30HCONTROLS                     /          IREAD   41
            DATA ((LPC(I,4),I=1,3)/30HFOUNDATION/PEDESTAL          /          IREAD   42
            DATA ((LPC(I,5),I=1,3)/30HSUPPORT STRUCTURE            /          IREAD   43
            DATA ((LPC(I,6),I=1,3)/30HASSEMBLY/INSTALLATION        /          IREAD   44
      C                                                                       IREAD   45
     45 C INITIALIZE INPUT AND WORK ARRAYS                                    IREAD   46
      C                                                                       IREAD   47
            DO 10 I=1,50                                                      IREAD   48
         10 A(I)=0.0                                                          IREAD   49
            DO 11 I=1,100                                                     IREAD   50
     50  11 AW(I)=0.0                                                         IREAD   51
      C                                                                       IREAD   52
      C ***************************************************************       IREAD   53
      C                                                                       IREAD   54
      C READ A NEW DATA ENTRY. ENTRY TYPE IS CODED IN THE FIRST COLUMN.       IREAD   55
     55 C                                                                     IREAD   56
         20 CONTINUE                                                          IREAD   57
            READ (5,900)IA                                                    IREAD   58
```

```
      TCINV = FITC * (CTL + CEQP) * (1.+FPLENG)
C
C         CO IS THE BEFORE TAX REQUIRED REVENUE (FOR FACTORY) AT THE
C         END OF THE STARTUP PERIOD.
C
      CO = DMD + DLO + IND + CNM + AMPL + EGA + ATXINS + AINT + AEQR
      CAVGSU = CO / (ALOG(CMSU)/ALOG(2.) + 1.)
      FACSU = QSU * (CAVGSU - CO)
C
      OTC = (LNDSU + AIDC + FACSU) - TCINV
C
C         ANNUALIZE
C
      CALL ATT(OTC,1,LFCA,RATCC,RI,AOTC)
C
C         CALCULATE THE PER HELIOSTAT COST
C
      AOTC = AOTC / Q
   70 CONTINUE
C
C         CALCULATE OTHER EXPENSES
C
      STCAPP = STCAP / Q
      OTHEXP = AOTC + SUBC + STCAPP + TRIN
C
C         CALCULATE DEPRECIATION ACCORDING TO IDEP
C
C           IDEP = 1.   STRAIGHT LINE DEPRECIATION
C                  2.   SUM OF THE YEARS' DIGITS
C                  3.   DOUBLE DECLINING BALANCE
C
      IF(IDEP .NE. 1)GO TO 20
C
C         STRAIGHT LINE DEPRECIATION
C
      DO 21 IT=1,LFCA
      NT = IT/LTLA
      NE = IT/LEQA
      ITT = IT - NT*LTLA
      ITE = IT - NE*LEQA
      IF(ITT.GT.LTLT.OR.ITT.LE.0.)DT(IT) = 0.
      IF(ITT.LE.LTLT.AND.ITT.GT.0.)DT(IT)=CTLP*((1.+RI)**(NT*LTLA))/XLTL
     $T
      IF(ITE.GE.LEQT.OR.ITE.LE.0.)DE(IT)=0.
      IF(ITE.LE.LEQT.AND.ITE.GT.0.)DE(IT)=CEQPP*((1.+RI)**(NE*LEQA))/XLE
     $QT
      IF(IT.GT.LFCT)DF(IT)=0.
      IF(IT.LE.LFCT)DF(IT)=CFACP/XLFCT
      DEP(IT) = DT(IT) + DE(IT) + DF(IT)
   21 CONTINUE
      GO TO 50
   20 IF(IDEP .NE. 2)GO TO 30
C
C         SUM OF THE YEARS' DIGITS DEPRECIATION
C
      DO 31 IT=1,LFCA
C
```



```
      WRITE(6,30)((LPC(I,ICOMP),I=1,3),(LTYP(I,ITYP),I=1,3),IYR
   30 FORMAT(T40,3A10//T40,3A10,//,T40,*PRODUCTION YEAR *,I2,////)
      WRITE(6,40)((L(I,1),I=1,3),EXPS(1)
   40 FORMAT(10X,3A10,T80,F12.2//)
      WRITE(6,50)(L(I,2),I=1,3),EXPS(2)
   50 FORMAT(/,20X,3A10,T70,F12.2)
      WRITE(6,60)((L(I,J),I=1,3),EXPS(J),J=3,5)
   60 FORMAT(30X,3A10,T61,F12.2)
   70 FORMAT(/)
      WRITE(6,50)((L(I,J),I=1,3),EXPS(J),J=6,7)
      WRITE(6,70)
      WRITE(6,50)(L(I,8),I=1,3),EXPS(8)
      WRITE(6,60)((L(I,J),I=1,3),EXPS(J),J=9,10)
      WRITE(6,50)((L(I,J),I=1,3),EXPS(J),J=11,12)
      WRITE(6,70)
      WRITE(6,50)((L(I,J),I=1,3),EXPS(J),J=13,16)
      WRITE(6,70)
      WRITE(6,50)(L(I,17),I=1,3),EXPS(17)
      DO 100 J=18,21
      IF(EXPS(J).GT.0.)WRITE(6,60)(L(I,J),I=1,3),EXPS(J)
  100 CONTINUE
      RETURN
      END
```

```
     SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE     REFERENCES
   3 DCHART           1          53        79

VARIABLES       SN  TYPE             RELOCATION
    0 CTR           REAL     ARRAY     F.P.     REFS       3      56  DEFINED       1
    0 ETOT          REAL     ARRAY     F.P.     REFS       4      51  DEFINED       1      51
    0 EXPS          REAL     ARRAY     F.P.     REFS       2      51       60      62      64      67      69
                                                  70      71      73       75    2*77 DEFINED       1
  455 I             INTEGER                     REFS      49      51       56    2*58      60      62      64
                                                  67      69      70       71      73      75      77
                                               DEFINED    48      56     2*58      60      62      64      67
                                                  69      70      71       73      75      77
    0 IC            INTEGER  ARRAY     F.P.     REFS       4    2*53  DEFINED       1
  451 ICOMP         INTEGER                     REFS    2*51      58  DEFINED      39
  454 II            INTEGER                     REFS      50    2*51  DEFINED      47      50
    0 ISTAT         INTEGER  ARRAY     F.P.     REFS       2      39       40      41 DEFINED       1
    0 ISUM          INTEGER  ARRAY     F.P.     REFS       2      49  DEFINED       1
  452 ITYP          INTEGER                     REFS    2*51      58  DEFINED      40
    0 IYR           INTEGER            F.P.     REFS      58 DEFINED        1
  456 J             INTEGER                     REFS    2*64    2*67     2*70    2*71    2*73    3*77
                                               DEFINED    64      67       70      71      73      76
    0 L             INTEGER  ARRAY     LABEL    REFS       5      60       62      64      67      69      70
                                                  71      73      75       77 DEFINED      15      16      17
                                                  18      19      20       21      22      23      24      25
                                                  26      27      28       29      30      31      32      33
                                                  34      35
  457 LPC           INTEGER  ARRAY              REFS       3      58  DEFINED       6       7       8       9
```

```
ENTRY TYPE=P   4420      EL/AZ LIMIT SWITCH                                          34.90  / HELIOSTAT
     SOURCE-TEL QUOTE,CATALOG,CANNON,CONS-ELECT,MICROSWITCH,T AND B
     INCLUDES 10.00 CONTRACTED LABOR

ENTRY TYPE=P   4420      PAINT,.125 GAL                                               3.75  / HELIOSTAT
     SOURCE- PREVIOUS ESTIMATE

ENTRY TYPE=L   4420      CAST IRON FABRICATION              .1785E+01  HRS / HELIOSTAT
     SOURCE-SNL AT 12.23/HR=21.83

ENTRY TYPE=L   4420      FORGED GEAR FABRICATION            .5860E+00  HRS / HELIOSTAT
     SOURCE-SNL AT 12.23/HR=7.16

ENTRY TYPE=L   4420      BAR STOCK FABRICATION              .8800E+00  HRS / HELIOSTAT
     SOURCE-SNL AT 12.23/HR=10.75

ENTRY TYPE=L   4420      AZ AND EL ENCODER FABRICATION      .4400E+00  HRS / HELIOSTAT
     SOURCE-SNL AT 12.23/HR=5.40

ENTRY TYPE=L   4420      ASSEMBLY AND PAINT OF DRIVE        .1920E+01  HRS / HELIOSTAT
     SOURCE-SNL AT 12.23/HR=23.48

ENTRY TYPE=A   4420      DRIVE ASSEMBLY LAND                .4340E+02  ACRE
     SOURCE-SNL 95 ACRES X PROD. SPACE RATIO(5SM)
     SNL USES 20000./ACRE IMPROVED LAND

ENTRY TYPE=B   4420      DRIVE ASSEMBLY FACILITIES          .2317E+06  SQFT

ENTRY TYPE=E   4420      DRIVE ASSEMBLY EQUIPMENT                                 19498000.
     SOURCE=DD,INCLUDES TOOLING

ENTRY TYPE=T   4420      DRIVE ASSEMBLY TOOLING                                       0.
     INCLUDED WITH EQUIPMENT

ENTRY TYPE=S   4420      DRIVE ASSEMBLY SUPPLIES                                     70.60  / HELIOSTAT

ENTRY TYPE=Q   4920      DRIVE ASSEMBLY QUANTITY/YEAR       .5000E+05  YR


   TOTAL PURCHASED MATERIALS=     870.29 $/HELIOSTAT
   TOTAL RAW MATERIALS=           430.71 $/HELIOSTAT
   TOTAL LABOR RATE COST CATEGORY: DIRECT LABOR=    5.6100   HRS/HELIOSTAT
   TOTAL CONSUMABLES=              70.60   $/HELIOSTAT
   LAND REQUIRED=          43.4000     ACRES
   PRODUCTION FACILITY LABOR RATE COST CATEGORY: SIZE=   231694.    SQ FT
   TOTAL EQUIPMENT COST= 19498000.     $
   TOTAL TOOLING COST=           0.    $
   QUANTITY=     50000.    / YEAR

   TOTAL DIRECT LABOR COST=      53.02 $/HELIOSTAT
   TOTAL PRODUCTION FACILITY COST   11584700.  $
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   SNL  - SECOND GENERATION

      4460 SITE COSTS

   KEY TO ENTRY TYPES

   M=RAW MATERIALS                P=PURCHASED MATERIALS          L=DIRECT LABOR HOURS
   S=SUPPLIES AND CONSUMABLES     T=TOOLING                      E=EQUIPMENT
   B=BUILDING OR FACILITY SIZE    A=LAND FOR PRODUCTION FACILITY Q=QUANTITY
   X=TRANSPORTATION REQUIREMENTS  Y=SITE-RETAINED CAPITAL        Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES

                          ITEM                                  QUANTITY  UNITS      UNIT     TOTAL
                                                                                       COST     COST

ENTRY TYPE=L   4460      FIELD SUPPORT LABOR                .1300E+01  HRS / HELIOSTAT
     SOURCE=SNL -HFN/0.90

ENTRY TYPE=L   4460      HELIOSTAT INSTALLATION             .3310E+01  HRS / HELIOSTAT
     SOURCE=SNL -HFN/0.90

ENTRY TYPE=L   4460      ALIGN HELIOSTATS                   .7780E+00  HRS / HELIOSTAT
     SOURCE=SNFN/0.90

ENTRY TYPE=Z   4460      SITE BURDEN EXPENSE                                              57.00  / HELIOSTAT
     SITE BURDEN EXPENSE CANNOT BE COMPUTED INTERNALLY DUE TO LACK OF REQUIRED
     INPUT DATA.  THIS APPROXIMATION TO SITE BURDEN IS OBTAINED USING THE SNL
     OVERHEAD RATE OF $10.58/HR FOR 5.388 HOURS DIRECT LABOR.

ENTRY TYPE=Q   4460      QUANTITY                           .5412E+04  /STE


   TOTAL PURCHASED MATERIALS=       0.00 $/HELIOSTAT
   TOTAL RAW MATERIALS=       0.00 $/HELIOSTAT
   TOTAL LABOR RATE COST CATEGORY: DIRECT LABOR=    5.3880   HRS/HELIOSTAT
   TOTAL CONSUMABLES=       0.00   $/HELIOSTAT
   WEIGHTED EQUIPMENT COST=    0.    $ TIMES YEARS USED / SITE
   QUANTITY=     5412.    / SITE
   TOTAL SUBCONTRACTS AND FLOW-THROUGH EXPENSES=      57.00   $/HELIOSTAT

   TOTAL DIRECT LABOR COST=      80.82 $/HELIOSTAT
```

COST SUMMARY BY PROFIT CENTER

TOTAL REQUIRED REVENUE

SNL - SECOND GENERATION

PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	TOTALS BY LOCATION
FACTORY	1636.83	1858.67	0.00	0.00	744.62	0.00	4240.12
TRANSPORTATION	48.75	22.43	0.00	25.03	92.41		188.62
SITE			0.00	689.20		162.07	851.27
TOTALS BY COMPONENT	1685.58	1881.10	0.00	714.23	837.03	162.07	

TOTAL FOR TOTAL REQUIRED REVENUE 5280.01

```
C                                                                    INPT  123

E 4420DRIVE ASSEMBLY EQUIPMENT                        19.498E6       INPT  124
C     SOURCE=SWD,INCLUDES TOOLING                                    INPT  125
T 4420DRIVE ASSEMBLY TOOLING                                         INPT  126
C     INCLUDED WITH EQUIPMENT                                        INPT  127
S 4420DRIVE ASSEMBLY SUPPLIES                            70.60       INPT  128
C                                                                    INPT  129
Q 4420DRIVE ASSEMBLY QUANTITY/YEAR      50000. 1YR                   INPT  130
$ 4420                                                               INPT  131
*14430SWL 2ND GENERATION HELIOSTAT                                   INPT  132
P 4430WE                                                  0.0        INPT  133
C SOURCE-NONE                                                        INPT  134
P 4430WFC                                                 0.0        INPT  135
C SOURCE-NONE                                                        INPT  136
A 4420CONTROLS LAND                        0.0 ACRE                  INPT  137
C SOURCE-NONE                                                        INPT  138
B 4420CONTROLS FACILITIES                  0.0 SQFT                  INPT  139
C SOURCE-NONE                                                        INPT  140
E 4420CONTROLS EQUIPMENT                                  0.0        INPT  141
C SOURCE-NONE                                                        INPT  142
S 4420SUPPLIES                                                       INPT  143
Q 4430CONTROLS QUANTITY/YEAR                                         INPT  144
$                                                                    INPT  145
*14440SWL 2ND GENERATION HELIOSTAT                                   INPT  146
$ 4440                                                               INPT  147
*14450SWL 2ND GENERATION HELIOSTAT                                   INPT  148
M 4450CENTER TORQUE TUBE,100 LB.          100.  LBS   0.32   32.00   INPT  149
C SOURCE-SWL, 0.32/LB                                                INPT  150
L 4450CENTER TORQUE TUBE FABRICATION      0.07HRS                    INPT  151
C SOURCE-SWL,0.50 AT 7.50/HR                                         INPT  152
M 4450OUTBOARD FLANGES(2)                                21.74       INPT  153
C SOURCE-SWL                                                         INPT  154
L 4450OUTBOARD FLANGE FABRICATION          .15HRS                    INPT  155
C SOURCE-SWL,1.15 AT 7.50/HR                                         INPT  156
M 4450ELEVATION ARM ADAPTER RINGS(2)                     21.74       INPT  157
C SOURCE-SWL,MODULAR IRON                                           INPT  158
L 4450EL ARM ADPT RINGS FABRICATION        .15HRS                    INPT  159
C SOURCE-SWL,1.15 AT 7.50/HR                                         INPT  160
M 4450ELEVATION ARM ASSY(10 GA STEEL)                    39.44       INPT  161
C SOURCE-SWL,0.1382 INCH                                             INPT  162
L 4450EL ARM ASSY FABRICATION             0.46HRS                    INPT  163
C SOURCE-SWL,3.47 AT 7.50/HR                                         INPT  164
L 4450CENTER TORQUE TUBE ASSEMBLY LABOR   0.75HRS                    INPT  165
C SOURCE-SWL-5.63 AT 7.50/HR, 185 LB                                 INPT  166
M 4450CONTINGENCY,0.01 X 159.40=1.59                      0.00       INPT  167
C SOURCE-SWL                                                         INPT  168
P 4450Z-FRAMES,4 EACH,14 GA(.0785)        740.  LBS     0.34 253.60  INPT  169
C SOURCE-SWL,SHIPPED DIRECT TO SITE                                  INPT  170
P 4450Z-FRAME TRANSPORTATION                             70.00       INPT  171
C SOURCE-SWL FROM BETHLEHEM STEEL,LACKAWANNA,NY                      INPT  172
M 4450STRUTS AND BARS,STRUTS 36 LB.        50.  LBS     0.23  11.48  INPT  173
C SOURCE-SWL,BARS    LB, 8 EACH,                                     INPT  174
C STRUT,2 X .125X63.9                                                INPT  175
L 4450STRUTS/BARS FABRICATION             0.34HRS                    INPT  176
C SOURCE-SWL,2.58 AT 7.50/HR                                         INPT  177
M 4450ANGLES,24 EACH,2 X .125X19 STEEL     32.  LBS     0.24   7.64  INPT  178
C SOURCE-SWL, 2-FRAME STIFFENERS                                     INPT  179
L 4450ANGLE FABRICATION                   0.1 HRS                    INPT  180
C SOURCE-SWL,0.76 AT 7.50/HR                                         INPT  181
M 4450TORQUE TUBES,OUTBOARD(2)            176.  LBS     0.32  55.88  INPT  182
C SOURCE-SWL,16. OD X .105 WALL X60 IN                               INPT  183
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SUBROUTINE IREAD      74/74   OPT=1                  FTN 4.6+439       09/22/81  12.30.53       PAGE     2

          900 FORMAT(8A10)                                                        IREAD       59
              DECODE(1,901,IA)ISW                                                 IREAD       60
          901 FORMAT(A1)                                                          IREAD       61
          902 FORMAT(A1,I1,A4,3A10,A4,F8.0,A4,2F8.0,3F4.0)                        IREAD       62
              IF (ISW.EQ.1H$)GO TO 500                                            IREAD       63
              IF (ISW.EQ.1H*)GO TO 100                                            IREAD       64
              IF (ISW.EQ.1HC)GO TO 110                                            IREAD       65
              DECODE (80,902,IA)ICLS,ISUB,(IC(J),J=1,5),X(1),IC(6),(X(I),I=2,6)   IREAD       66
              IF (ISW.EQ.1HM)GO TO 117                                            IREAD       67
              IF (ISW.EQ.1HP)GO TO 115                                            IREAD       68
              IF (ISW.EQ.1HL)GO TO 140                                            IREAD       69
              IF (ISW.EQ.1HA)GO TO 160                                            IREAD       70
              IF (ISW.EQ.1HB)GO TO 170                                            IREAD       71
              IF (ISW.EQ.1HE)GO TO 180                                            IREAD       72
              IF (ISW.EQ.1HT)GO TO 200                                            IREAD       73
              IF (ISW.EQ.1HS)GO TO 220                                            IREAD       74
              IF (ISW.EQ.1HQ)GO TO 240                                            IREAD       75
              IF (ISW.EQ.1HX)GO TO 260                                            IREAD       76
              IF (ISW.EQ.1HZ)GO TO 270                                            IREAD       77
              IF (ISW.EQ.1HY)GO TO 280                                            IREAD       78
              WRITE (6,905)                                                       IREAD       79
          905 FORMAT(////* UNRECOGNIZABLE DATA *)                                 IREAD       80
              STOP                                                                IREAD       81
        C                                                                         IREAD       82
        C ************************************************************************IREAD       83
        C                                                                         IREAD       84
        C THIS SECTION PRINTS EACH DATA ENTRY AS IT APPEARS AND UPDATES           IREAD       85
        C THE A AND AW ARRAYS.                                                    IREAD       86
        C                                                                         IREAD       87
        C                                                                         IREAD       88
        C PRINT PROFIT CENTER TITLE AND HEADING                                   IREAD       89
        C                                                                         IREAD       90
          100 CONTINUE                                                            IREAD       91
          903 FORMAT (A1,I1,I4,3A10)                                              IREAD       92
              DECODE (80,903,IA)IJK,ITYP,ICOMP,(HDR(J),J=1,3)                     IREAD       93
              ISTAT(6)= (ICOMP - 4400)/10                                         IREAD       94
              ISTAT(7)= ITYP                                                      IREAD       95
              IF (ITYP-2)101,102,103                                              IREAD       96
          101 WRITE (6,935)(HDR(J),J=1,3),ICOMP                                   IREAD       97
          935 FORMAT (1H1,5X,3A10,//,10X,I4,* FACTORY COSTS*)                     IREAD       98
              GO TO 104                                                           IREAD       99
          102 WRITE (6,936)(HDR(J),J=1,3),ICOMP                                   IREAD      100
          936 FORMAT (1H1,5X,3A10,//,10X,I4,* TRANSPORTATION COSTS*)              IREAD      101
              GO TO 104                                                           IREAD      102
          103 WRITE (6,937)(HDR(J),J=1,3),ICOMP                                   IREAD      103
          937 FORMAT (1H1,5X,3A10,//,10X,I4,* SITE COSTS*)                        IREAD      104
          104 CONTINUE                                                            IREAD      105
              WRITE (6,939)                                                       IREAD      106
          939 FORMAT (//,5X,*KEY TO ENTRY TYPES*//5X,*M=RAW MATERIALS*,T45,       IREAD      107
             $*P=PURCHASED MATERIALS*,T85,*L=DIRECT LABOR HOURS*,/5X,             IREAD      108
             $*S=SUPPLIES AND CONSUMABLES*,T45,*T=TOOLING*,T85,                   IREAD      109
             $*E=EQUIPMENT*,/5X,*B=BUILDING OR FACILITY SIZE*,T45,                IREAD      110
             $*A=LAND FOR PRODUCTION FACILITY*,T85,*Q=QUANTITY*,/5X,              IREAD      111
             $*X=TRANSPORTATION REQUIREMENTS*,T45,                                IREAD      112
             $*Y=SITE-RETAINED CAPITAL*,T85,                                      IREAD      113
             $*Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES*)                         IREAD      114
              WRITE (6,904)                                                       IREAD      115
```

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SUBROUTINE COST       74/74   OPT=1                    FTN 4.6+439       09/22/81  12.30.53        PAGE    5

      C        NT AND NE ARE THE CYCLE NUMBERS OF THE TOOLING AND EQUIPMENT
      C
            NT = IT / LTLA
            NE = IT / LEGA
      C
      C        ITT, ITE AND ITF ARE THE YEAR NUMBERS OF  IT  WITHIN
      C        THE TOOLING, EQUIPMENT AND FACILITY CYCLES, RESP.
      C
            ITT = MINO(IT-NT*LTLA,LTLT+1)
            IF(ITT.LE.0)ITT=LTLT+1
            ITE = MINO(IT-NE*LEGA,LEGT+1)
            IF(ITE.LE.0)ITE=LEGT+1
            ITF = MINO(IT,LFCT+1)
            IF(ITT .EQ. 0) ITT = LTLT+1
            IF(ITE .EQ. 0) ITE = LEGT+1
            DT(IT) = CTLP * (1.+RI)**(NT*LTLA) * 2. * FLOAT(LTLT-ITT+1) /
           $  FLOAT(LTLT*(LTLT+1))
            DE(IT) = CEQPP * (1.+RI)**(NE*LEGA) * 2. * FLOAT(LEGT-ITE+1) /
           $  FLOAT(LEGT*(LEGT+1))
            DF(IT) = CFACP * 2. * FLOAT(LFCT-ITF+1) / FLOAT(LFCT*(LFCT+1))
            DEP(IT) = DT(IT) + DE(IT) + DF(IT)
         31 CONTINUE
            GO TO 50
         30 CONTINUE
      C
      C        DOUBLE DECLINING BALANCE
      C
            DO 41 IT=1,LFCA
            NT = IT / LTLA
            NE = IT / LEGA
            ITT = IT - NT*LTLA
            ITE = IT - NE*LEGA
            KT = LTLT + NT*LTLA
            KE = LEGT + NE*LEGA
            DT(IT) = 0.
            DE(IT) = 0.
            DF(IT) = 0.
            IF(ITT.GT. 0 .AND. IT .LT. KT) DT(IT)= CTLP * (1.+RI)**(NT*LTLA) *
           $  (1.-2./XLTLT)**(ITT-1) * (2./XLTLT)
            IF(IT .EQ. KT) DT(IT)= CTLP * (1.+RI)**(NT*LTLA) * (1.-2./XLTLT)
           $ **(LTLT-1)
            IF(ITE.GT. 0 .AND. IT .LT. KE)DE(IT) = CEQPP * (1.+RI)**(NE*LEGA)*
           $  (1.-2./XLEGT)**(ITE-1) * (2./XLEGT)
            IF(IT .EQ. KE)DE(IT) = CEQPP * (1.+RI)**(NE*LEGA) * (1.-2./XLEGT)
           $ **(LEGT-1)
            IF(IT .GT. 0 .AND. IT .LT. LFCT)DF(IT) = CFACP * (1.-2./XLFCT)**
           $  (IT-1)*(2./XLFCT)
            IF(IT .EQ. LFCT)DF(IT) = CFACP * (1.-2./XLFCT)**(LFCT-1)
            DEP(IT) = DT(IT) + DE(IT) + DF(IT)
         41 CONTINUE
         50 CONTINUE
      C
      C        ANNUALIZE THE DEPRECIATION
      C
            CALL APV(DEP,LFCA, LFCA,RATCC,RI,ADEP)
      C
      C        CALCULATE THE INCOME TAXES
```

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     SUBROUTINE DCHART     74/74   OPT=1                   FTN 4.6+439      09/22/81  12.30.53       PAGE     3

VARIABLES     SN  TYPE          RELOCATION
                                                   10          11
  501  LTYP        INTEGER    ARRAY           REFS           3          58  DEFINED      12        13        14
    0  NEXPS       INTEGER            F.P.    REFS           2          48  DEFINED       1
    0  NS          INTEGER            F.P.    REFS           2   DEFINED         1
  453  NYR       * INTEGER                 DEFINED          41

FILE NAMES        MODE
       TAPE6      FMT                 WRITES        54          56          58        60        62        64        6'        68
                                          69        70          71          72        73        74        75        77

STATEMENT LABELS             DEF LINE   REFERENCES
   42  5                          52         48        49
  267  10         FMT             55         54
  303  20         FMT             57         56
  314  30         FMT             59         58
  330  40         FMT             61         60
  341  50         FMT             63         62        67          69          71        73        75
  354  60         FMT             65         64        70          77
  357  70         FMT             66         68        72          74
    0  100                        78         76

LOOPS  LABEL     INDEX      FROM-TO     LENGTH    PROPERTIES
   36  5           I        48 52         58B      INSTACK
   73            * J        64 64        208B                EXT REFS  NOT INNER
   74            * I        64 64        118B                EXT REFS
  117            * J        67 67        208B                EXT REFS  NOT INNER
  120            * I        67 67        118B                EXT REFS
  147            * J        70 70        208B                EXT REFS  NOT INNER
  150            * I        70 70        118B                EXT REFS
  173            * J        71 71        208B                EXT REFS  NOT INNER
  174            * I        71 71        118B                EXT REFS
  221            * J        73 73        208B                EXT REFS  NOT INNER
  222            * I        73 73        118B                EXT REFS
  247  100       * J        76 78        140B                EXT REFS

COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
       LABEL         63                   0 L       (63)

STATISTICS
  PROGRAM LENGTH                 542B      354
  CM LABELED COMMON LENGTH        77B       63
```

SNL 2ND GENERATION HELIOSTAT

4430 FACTORY COSTS

KEY TO ENTRY TYPES

M=Raw MATERIALS
S=SUPPLIES AND CONSUMABLES
B=BUILDING OR FACILITY SIZE
X=TRANSPORTATION REQUIREMENTS

P=PURCHASED MATERIALS
T=TOOLING
A=LAND FOR PRODUCTION FACILITY
Y=SITE-RETAINED CAPITAL

L=DIRECT LABOR HOURS
E=EQUIPMENT
Q=QUANTITY
Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES

ITEM		QUANTITY	UNITS	UNIT COST	TOTAL COST
ENTRY TYPE=P 4410 SOURCE=NONE	HC				0.00 / HELIOSTAT
ENTRY TYPE=P 4430 SOURCE=NONE	HFC				0.00 / HELIOSTAT
ENTRY TYPE=A 4420 SOURCE=NONE	CONTROLS LAND	0.	ACRE		
ENTRY TYPE=B 4420 SOURCE=NONE	CONTROLS FACILITIES	0.	SQFT		
ENTRY TYPE=E 4420 SOURCE=NONE	CONTROLS EQUIPMENT				0.
ENTRY TYPE=S 4420	SUPPLIES				0.00 / HELIOSTAT
ENTRY TYPE=Q 4430	CONTROLS QUANTITY/YEAR	0.			

TOTAL PURCHASED MATERIALS= 0.00 $/HELIOSTAT
TOTAL RAW MATERIALS= 0.00 $/HELIOSTAT
TOTAL LABOR RATE COST CATEGORY: DIRECT LABOR= 0.0000 HRS/HELIOSTAT
TOTAL CONSUMABLES= 0.00 $/HELIOSTAT
LAND REQUIRED= 0.0000 ACRES
PRODUCTION FACILITY (BASE RATE COST CATEGORY): SIZE= 0. SQ FT
TOTAL EQUIPMENT COST= 0. $
TOTAL TOOLING COST= 0. $
QUANTITY= 0. / YEAR

DEFAULT QUANTITY USED IN PROFIT CENTER CALCULATION
DEFAULT QUANTITIES = 52000.(FACTORY), 5400.(TRANSPORT/SITE)

HELIOSTAT COST MODEL

DETAILED BREAKDOWN

SNL - SECOND GENERATION

4410 - REFLECTIVE ASSEMBLY

FACTORY COSTS

PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE		1636.03
DIRECT MATERIALS		1302.10
PURCHASED MATERIALS	939.62	
RAW MATERIALS	342.90	
SCRAP	19.68	
DIRECT LABOR		26.04
CONSUMABLES		.20
INDIRECT COSTS		21.24
MAINTENANCE, PLANT ENGINEERING	7.26	
OTHER INDIRECTS	13.98	
CAPITAL REPLACEMENT ALLOWANCE		17.13
PROPERTY TAX AND INSURANCE		16.61
GENERAL & ADMINISTRATIVE		125.33
INTEREST EXPENSE		8.47
INCOME TAXES		52.89
RETURN TO EQUITY HOLDERS		55.14
OTHER EXPENSES		10.88
ANNUALIZED ONE-TIME COSTS	10.88	

COST SUMMARY BY PROFIT CENTER

DIRECT MATERIALS

SNL - SECOND GENERATION

PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	TOTALS BY LOCATION
FACTORY	1302.10	1330.70	0.00	0.00	567.24	0.00	3200.04
TRANSPORTATION	0.00	0.00	0.00	0.00	0.00		0.00
SITE			0.00	254.54		0.00	254.54
TOTALS BY COMPONENT	1302.10	1330.70	0.00	254.54	567.24	0.00	

TOTAL FOR DIRECT MATERIALS 3454.58

```
L 4450TORQUE TUBE OUTED FABRICATION        0.11HRS                              INPT  184

C SOURCE-SNL,0.86 AT 7.50/HR                                                    INPT  185
M 4450OUTBOARD FLANGES(2)                                  21.74                INPT  186
C SOURCE-SNL                                                                    INPT  187
L 4450OUTBOARD FLANGE FABRICATION          0.21HRS                              INPT  188
C SOURCE-SNL,1.58 AT 7.50/HR                                                    INPT  189
M 4450INBOARD FLANGES(2)                                   21.74                INPT  190
C SOURCE-SNL                                                                    INPT  191
L 4450INBOARD FLANGE FABRICATION           0.15HRS                              INPT  192
C SOURCE-SNL,1.15 AT 7.50/HR                                                    INPT  193
L 4450TORQUE TUBE OUTED ASSEMBLY LABOR      .10HRS                              INPT  194
C SOURCE-SNL,0.75 AT 7.50/HR (2 EACH)                                           INPT  195
M 4450SUPPORT STRUCTURE PROFIT                               0.0                INPT  196
C SOURCE-SNL,0.032 X 683.38= 21.87                                              INPT  197
M 4450FRAME ASSY CONTINGENCY                                 J.0                INPT  198
C SOURCE-SNL,0.03 X 523.98=15.72                                                INPT  199
A 4450SUPPORT STRUCTURE LAND               11.6 ACRE                            INPT  200
C SOURCE-                                                                       INPT  201
B 4450SUPPORT STRUCTURE FACILITIES      .0929E6SQFT                             INPT  202
C SOURCE-                                                                       INPT  203
E 4450SUPPORT STRUCTURE EQUIPMENT                          2.5015E6             INPT  204
C SOURCE-SNL TABLE B-1                                                          INPT  205
E 4450PRODUCTION SUPPORT EQUIPMENT                         2.0063E6             INPT  206
C SOURCE-SNL TABLE B-1                                                          INPT  207
T 4450 SUPPORT STRUCTURE TOOLING                           931000.              INPT  208
C SOURCE-SNL TABLE B-1                                                          INPT  209
S 4450                                                                          INPT  210
Q 4450SUPPORT STRUCTURE QUANTITY/YEAR    50000. /YR                             INPT  211
$                                                                               INPT  212
*1440 SNL  - SECOND GENERATION                                                  INPT  213
$                                                                               INPT  214
*244100SNL  2ND GENERATION HELIOSTAT                                            INPT  215
S 4410[illegible] MODULE CUSTOM RACKS                       0.0                 INPT  216
C SOURCE- NONE IDENTIFIED                                                       INPT  217
X14410[illegible] MODULES TRANSPORT TO SITE   0.075TKLD                         INPT  218
C SOURCE-SNL ,46.00 TOTAL                                                       INPT  219
$                                                                               INPT  220
*244200SNL  2ND GENERATION HELIOSTAT                                            INPT  221
S 4420DRIVE ASSEMBLY CUSTOM RACK                            0.0                 INPT  222
C SOURCE- NONE IDENTIFIED                                                       INPT  223
X14420DRIVE ASSEMBLY TRANSPORT TO SITE    0.0345TKLD                            INPT  224
C SOURCE-SNL ,17.00 TOTAL                                                       INPT  225
$                                                                               INPT  226
*244300SNL  2ND GENERATION HELIOSTAT                                            INPT  227
$                                                                               INPT  228
*244400SNL  2ND GENERATION HELIOSTAT                                            INPT  229
S 4440FOUNDATION/PED CUSTOM RACK                            0.0                 INPT  230
C SOURCE- NONE IDENTIFIED                                                       INPT  231
X14440FOUNDATION/PED TRANSPORT TO SITE    0.0385TKLD                            INPT  232
C SOURCE-SNL ,23.00 TOTAL                                                       INPT  233
$                                                                               INPT  234
*244500SNL  2ND GENERATION HELIOSTAT                                            INPT  235
S 4450SUPPORT STRUCTURE CUSTOM RACK                         0.0                 INPT  236
C SOURCE- NONE IDENTIFIED                                                       INPT  237
X14450SUPPORT STRUCTURE [illegible] TO SITE  0.[illegible]TKLD                  INPT  238
C SOURCE-SNL ,33.00 TOTAL                                                       INPT  239
$                                                                               INPT  240
C SOURCE[illegible], $250,000/FIELD ASSUMED                                     INPT  241
L 4430[illegible] ASSEMBLY                  0.11HRS                             INPT  242
C SOURCE[illegible] -[illegible]/0.[illegible]                                  INPT  243
L 4430CABLE INSTALLATION                  1.065HRS                              INPT  244
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SUBROUTINE IREAD      74/74   OPT=1                   FTN 4.6+439        09/22/81  12.30.53      PAGE    3

      904 FORMAT (//,35X*ITEM*32X*QUANTITY*2X*UNITS*10X*UNIT*4X*TOTAL*/       IREAD    116
         1 96X*COST*5X*COST*//)                                                IREAD    117
          GO TO 20                                                             IREAD    118
C                                                                              IREAD    119
C PRINT COMMENT CARD                                                           IREAD    120
C                                                                              IREAD    121
      110 CONTINUE                                                             IREAD    122
      934 FORMAT (A1,7A10,A9)                                                  IREAD    123
          DECODE (80,934,IA(I,M)1,(IC(J),J=1,8)                                IREAD    124
          WRITE (6,907) (IC(J),J=1,8)                                          IREAD    125
      907 FORMAT(*          *8A10)                                             IREAD    126
          GO TO 20                                                             IREAD    127
C                                                                              IREAD    128
C PRINT AND SUM MATERIALS COSTS / HELIOSTAT                                    IREAD    129
C                                                                              IREAD    130
      115 A(10)=A(10) + X(3)                                                   IREAD    131
          GO TO 120                                                            IREAD    132
      117 A(1)=A(1) + X(3)                                                     IREAD    133
      120 CONTINUE                                                             IREAD    134
          IPT=IFIX(X(1))                                                       IREAD    135
          IF (IPT.GT.0) GO TO 122                                              IREAD    136
          WRITE (6,922)ICLS,(IC(J),J=1,5),X(3)                                 IREAD    137
      922 FORMAT (/*   ENTRY TYPE=*A2*  *5A10,32X,F10.2*  / HELIOSTAT*)        IREAD    138
          GO TO 20                                                             IREAD    139
      122 WRITE (6,923)ICLS,(IC(J),J=1,5),IPT,IC(6),X(2),X(3)                  IREAD    140
      923 FORMAT (/*   ENTRY TYPE=*A2*  *5A10,I10,*  *A10,2F10.2*  / HELIOST   IREAD    141
         1AT*)                                                                 IREAD    142
          GO TO 20                                                             IREAD    143
C                                                                              IREAD    144
C PRINT AND SUM LABOR HOURS / HELIOSTAT. BASE RATE APPLIES TO AH(1).           IREAD    145
C SPECIAL RATES APPLY TO AH(2) TO AH(10).                                      IREAD    146
C                                                                              IREAD    147
      140 AH(ISUB+1)=AH(ISUB+1) + X(1)                                         IREAD    148
          WRITE (6,924)ICLS,(IC(J),J=1,5),X(1)                                 IREAD    149
      924 FORMAT (/*   ENTRY TYPE=*A2*  *5A10,E10.4,*  HRS / HELIOSTAT*)       IREAD    150
          IF (ISUB.LT.1) GO TO 20                                              IREAD    151
          WRITE (6,926)ISUB                                                    IREAD    152
      926 FORMAT (*          SPECIAL LABOR COST CATEGORY NUMBER*I4)            IREAD    153
          GO TO 20                                                             IREAD    154
C                                                                              IREAD    155
C PRINT PRODUCTION FACILITY LAND REQUIREMENTS (ACRES)                          IREAD    156
C                                                                              IREAD    157
                                                                               IREAD    158
      160 A(4)=X(1)                                                            IREAD    159
          WRITE (6,909)ICLS,(IC(J),J=1,5),X(1),IC(6)                           IREAD    160
      909 FORMAT (/*   ENTRY TYPE=*A2*  *5A10,E10.4,*  *A10)                   IREAD    161
          GO TO 20                                                             IREAD    162
C                                                                              IREAD    163
C PRINT AND SUM PRODUCTION FACILITY SIZE. BASE RATE APPLIES TO AH(11).         IREAD    164
C SPECIAL RATES APPLY TO AH(12) TO AH(20).                                     IREAD    165
C                                                                              IREAD    166
      170 AH(ISUB+11) = AH(ISUB+11) + X(1)                                     IREAD    167
          WRITE (6,909)ICLS,(IC(J),J=1,5),X(1),IC(6)                           IREAD    168
          IF (ISUB.LT.1) GO TO 20                                              IREAD    169
          WRITE (6,927)ISUB                                                    IREAD    170
      927 FORMAT (*          SPECIAL FACILITY COST CATEGORY NUMBER*I4)         IREAD    171
          GO TO 20                                                             IREAD    172
```

```
      C
            TI = (ARPL + AEGR - ADEP) / (1. - TAU)
            TAX = TAU * TI
      C
      C     COMPUTE THE REVENUE FOR ONE YEAR
      C
            REV = DM + DL + CNM + IND + ARPL + ATXINS + EGA + OTHEXP
           $ + AINT + AEGR + TAX
      C
      C     PACK COMPUTED QUANTITES INTO  EXPS  ,THE OUTPUT ARRAY
      C
            EXPS(1,NYR)  = REV
            EXPS(2,NYR)  = DM
            EXPS(3,NYR)  = DMP
            EXPS(4,NYR)  = DMR
            EXPS(5,NYR)  = ESCP
            EXPS(6,NYR)  = DL
            EXPS(7,NYR)  = CNM
            EXPS(8,NYR)  = IND
            EXPS(9,NYR)  = EMTN
            EXPS(10,NYR) = INDO
            EXPS(11,NYR) = ARPL
            EXPS(12,NYR) = ATXINS
            EXPS(13,NYR) = EGA
            EXPS(14,NYR) = AINT
            EXPS(15,NYR) = TAX
            EXPS(16,NYR) = AEGR
            EXPS(17,NYR) = OTHEXP
            EXPS(18,NYR) = AOTC
            EXPS(19,NYR) = SUBC
            EXPS(20,NYR) = STCAPP
            EXPS(21,NYR) = TRIN
      C
      C     DETERMINE IF LEARNING MODEL IS TO BE USED
      C
            IF(ILRN .EQ. 0)RETURN
            CALL LEARN(DMO,DLO,Q,QL,CRC,ISTAT,EXPS(3,NYR),EXPS(4,NYR))
            DM = EXPS(3,NYR)
            DL = EXPS(4,NYR)
            IF(NYR.GE.LAN)RETURN
            GO TO 100
            END
```

```
SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS     DEF LINE     REFERENCES
   3 COST            1          321      325

VARIABLES     SN  TYPE            RELOCATION
    0 A           REAL       ARRAY      F.P.     REFS      16    29    30    31    32    33    34
                                                           35    36    37    38    39    40
                                                 DEFINED    1
 1242 ADEP        REAL                           REFS     263   287
```



```
            SUBROUTINE SCHART( ETOT, ISTAT, NS, ICOST, IS, IYR, CTR, ISUM)
            DIMENSION ETOT(12,6,3), ISTAT(NS), ICOST(6,3),
           $ LTYP(2,4), LPC(6), LL(7,4), TL(3), TP(6), CTR(3), ISUM(25)
            COMMON /LABEL/ L(3,21)
      C
      C     SCHART GENERATES THE ISUM-TH SUMMARY CHART OF THE FORM
      C
      C             4410    4420    4430    4440    4450    4460   TOTAL
      C     FACTORY ____    ____    ____    ____    ____    ____   _____
      C     TRANSP  ____    ____    ____    ____    ____           _____
      C     SITE                    ____    ____            ____   _____
      C      TOTAL  ____    ____    ____    ____    ____    ____   _____
      C
            DATA (LTYP(I,1),I=1,2)/20HFACTORY              /
            DATA (LTYP(I,3),I=1,2)/20HSITE                 /
            DATA (LTYP(I,2),I=1,2)/20HTRANSPORTATION       /
            DATA (LTYP(I,4),I=1,2)/20HTOTALS BY COMPONENT /
            DATA (LPC(I),I=1,6)/4HH4410,4HH4420,4HH430,4HH4440,4HH4450,4HH4460/
            NCOMP = ISTAT(5)
            NTYP = ISTAT(4)
            IF(ISUM(IS).NE.1)RETURN
            IETOT = 0
            DO 5 I=1,IS
            IF(ISUM(I).NE.1)GO TO 5
            IETOT = IETOT + 1
        5   CONTINUE
            DO 10 I=1,NCOMP
            DO 10 J=1,NTYP
            IF(ICOST(I,J) .EQ. 1)ENCODE(10,999,LL(I,J))ETOT(IETOT,I,J)
      999   FORMAT(F10.2)
            IF(ICOST(I,J) .NE. 1)ENCODE(10,998,LL(I,J))
      998   FORMAT(10H          )
       10   CONTINUE
      C
      C     CALCULATE TOTALS BY LOCATION,  SUM OVER PC'S
      C
            DO 20 I=1,NTYP
            TL(I) = 0.
            DO 20 J=1,NCOMP
            TL(I) = TL(I) + ETOT(IETOT,J,I)
       20   CONTINUE
      C
      C     CALCULATE TOTALS BY PROFIT CENTERS,  SUM OVER TYPES
      C
            DO 30 I=1,NCOMP
            TP(I) = 0.
            DO 30 J=1,NTYP
            TP(I) = TP(I) + ETOT(IETOT,I,J)
       30   CONTINUE
      C
      C     CALCULATE GRAND AND LINE TOTALS
      C
            TOTAL = 0.
            DO 40 I=1,NTYP
            TOTAL = TOTAL + TL(I)
       40   ENCODE(10,999,LL(7,I))TL(I)
            DO 50 I=1,NCOMP
```

SNL 2ND GENERATION HELIOSTAT

4440 FACTORY COSTS

KEY TO ENTRY TYPES

M=RAW MATERIALS	P=PURCHASED MATERIALS	L=DIRECT LABOR HOURS
S=SUPPLIES AND CONSUMABLES	T=TOOLING	E=EQUIPMENT
B=BUILDING OR FACILITY SIZE	A=LAND FOR PRODUCTION FACILITY	Q=QUANTITY
X=TRANSPORTATION REQUIREMENTS	Y=SITE-RETAINED CAPITAL	Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST

TOTAL PURCHASED MATERIALS= 0.00 $/HELIOSTAT
TOTAL RAW MATERIALS= 0.00 $/HELIOSTAT
TOTAL (BASE RATE COST CATEGORY) DIRECT LABOR= 0.0000 HRS/HELIOSTAT
TOTAL CONSUMABLES= 0.00 $/HELIOSTAT
LAND REQUIRED= 0.0205 ACRES
PRODUCTION FACILITY (BASE RATE COST CATEGORY) SIZE= 0. SQ FT
TOTAL EQUIPMENT COST= 0. $
TOTAL TOOLING COST= 0. $
QUANTITY= 0. / YEAR

DEFAULT QUANTITY USED IN PROFIT CENTER CALC. 1
DEFAULT QUANTITIES = 50000.(FACTORY), 5400.(TRANSPORT/SITE)

HELIOSTAT COST MODEL
DETAILED BREAKDOWN
SNL - SECOND GENERATION
4420 - DRIVES
FACTORY COSTS
PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE		1050.67
DIRECT MATERIALS		1330.70
PURCHASED MATERIALS	878.29	
RAW MATERIALS	430.71	
SCRAP	21.70	
DIRECT LABOR		53.02
CONSUMABLES		70.60
INDIRECT COSTS		35.14
MAINTENANCE, PLANT ENGINEERING	12.43	
OTHER INDIRECTS	22.70	
CAPITAL REPLACEMENT ALLOWANCE		37.80
PROPERTY TAX AND INSURANCE		22.43
GENERAL & ADMINISTRATIVE		140.50
INTEREST EXPENSE		11.44
INCOME TAXES		69.86
RETURN TO EQUITY HOLDERS		74.48
OTHER EXPENSES		12.68
ANNUALIZED ONE-TIME COSTS	12.68	

COST SUMMARY BY PROFIT CENTER

DIRECT LABOR

SNL - SECOND GENERATION

PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	TOTALS BY LOCATION
FACTORY	26.84	53.02	0.00	0.00	24.57	0.00	104.43
TRANSPORTATION	0.00	0.00	0.00	0.00	28.73		29.73
SITE			0.00	216.75		80.82	297.57
TOTALS BY COMPONENT	26.84	53.02	0.00	216.75	53.30	80.82	

TOTAL FOR DIRECT LABOR 430.73

```
C SOURCEISNL -HFN/0.92

L 4430POWER TRANSFORMER INSTALLATION        .033HRS
C SOURCEISNL -HFN/0.92
L 4430CABLE CHECKOUT,CLOSEOUT               .707HRS
C SOURCEISNL -HFN/0.92
Z 4430SITE BURDEN EXPENSE                                  20.10
C SITE BURDEN EXPENSE CANNOT BE COMPUTED INTERNALLY DUE TO LACK OF REQUIRED
C INPUT DATA.  THIS APPROXIMATION TO SITE BURDEN IS OBTAINED USING THE SNL
C OVERHEAD RATE OF $10.58/HR FOR 1.9 HOURS OF DIRECT LABOR.
Q 4430QUANTITY                          5412.    /STE
$
*34440 SNL  - SECOND GENERATION
P 4440REBAR CAGE                                           87.67
C SOURCEISNL /0.90, 2% LB, 0.30/LB
P 4440TAPERED PIPE                                         35.70
C SOURCEISNL /0.90, 86 LB, $.42/LB
P 4440CONCRETE                                            123.42
C SOURCEISNL /0.90, 2.32 CU YD, $53.20/CU YD
L 4440SURVEY                                1.00HRS
C SOURCEISNL /0.92
C NOTE BASED ON OTHER DATA THIS TIME COULD BE REDUCED TO APPROX. 0.25 HR
L 4440DRILLING                              2.99HRS
C SOURCEISNL /0.92 , 2 FT DIA BY 15 FT DEEP, 1.75 CU YD
C NOTE BASED ON OTHER DATA THIS TIME COULD BE REDUCED TO APPROX. 0.25 HR
P 4440FORMS,BRACING                                         5.23
C SOURCEISNL /0.90
L 4440PREFAB REBAR,TAPERED PIPE             3.49HRS
C SOURCEISNL /0.92
L 4440SET CAGES,FORMS                       1.99HRS
C SOURCEISNL /0.92
L 4440POUR AND FINISH                       2.49HRS
C SOURCEISNL /0.92
L 4440EQUIPMENT OPERATION                   2.49HRS
C SOURCEISNL /0.92
Z 4440SITE BURDEN EXPENSE                                 152.88
C SITE BURDEN EXPENSE CANNOT BE COMPUTED INTERNALLY DUE TO LACK OF REQUIRED
C INPUT DATA.  THIS APPROXIMATION TO SITE BURDEN IS OBTAINED USING THE SNL
C OVERHEAD RATE OF $10.58/HR FOR 14.45 HOURS DIRECT LABOR.
Q 4440QUANTITY                          5412.    /STE
$
*34460 SNL  - SECOND GENERATION
L 4460FIELD SUPPORT LABOR                   1.30HRS
C SOURCEISNL -HFN/0.90
L 4460HELIOSTAT INSTALLATION                3.31HRS
C SOURCEISNL -HFN/0.90
L 4460ALIGN HELIOSTATS                      .770HRS
C SOURCEIHFN/0.90
Z 4460SITE BURDEN EXPENSE                                  57.00
C SITE BURDEN EXPENSE CANNOT BE COMPUTED INTERNALLY DUE TO LACK OF REQUIRED
C INPUT DATA.  THIS APPROXIMATION TO SITE BURDEN IS OBTAINED USING THE SNL
C OVERHEAD RATE OF $10.58/HR FOR 5.368 HOURS DIRECT LABOR.
Q 4460QUANTITY                          5412.    /STE
$
*34430SNL  2ND GENERATION HELIOSTAT
P 4430HELIOSTAT ARRAY CONTROLLER(HAC)                     41.85
C SOURCE-HAL 250000/FIELD,SNL  USED 1E6/(167.39/HEL)
```



```
C
C PRINT AND SUM EQUIPMENT COSTS.
C
  180 IF (ITYP.GT.1)GO TO 185
      A(6)=A(6) + X(3)
      WRITE (6,920)ICLS,(IC(J),J=1,5),X(3)
  920 FORMAT (/*   ENTRY TYPE=*A2*  *5A10,32X,F10.0)
      GO TO 20
C FOR SITE/TRANSPORT APPLICATIONS, EQUIPMENT COST MUST BE WEIGHTED BY
C USE PERIOD.
  185 A(6)= A(6) + (X(1)*X(3))
      WRITE (6,925)ICLS,(IC(J),J=1,5),X(1),IC(6),X(3)
  925 FORMAT (/*   ENTRY TYPE=*A2*  *5A10,E10.4,*  *A10,10X,F10.0)
      GO TO 20
C
C PRINT AND SUM TOOLING COSTS.
C
  200 IF (ITYP.GT.1)GO TO 205
      A(7)= A(7) + X(3)
      WRITE (6,920)ICLS,(IC(J),J=1,5),X(3)
      GO TO 20
C FOR SITE/TRANSPORT APPLICATIONS, TOOLING COST MUST BE WEIGHTED BY
C USE PERIOD.
  205 A(7)= A(7) + (X(1)*X(3))
      WRITE (6,925)ICLS,(IC(J),J=1,5),X(1),IC(6),X(3)
      GO TO 20
C
C PRINT AND SUM CONSUMABLES AND SUPPLIES.
C
  220 A(3)=A(3)+X(3)
      WRITE (6,921)ICLS,(IC(J),J=1,5),X(3)
  921 FORMAT (/*   ENTRY TYPE=*A2*  *5A10,32X,F10.2*  / HELIOSTAT*)
      GO TO 20
C
C PRINT SITE QUANTITY OR ANNUAL PRODUCTION QUANTITY.
C
  240 A(8)=X(1)
      WRITE (6,909)ICLS,(IC(J),J=1,5),X(1),IC(6)
      GO TO 20
C
C PRINT AND SUM TRANSPORTATION COSTS.
C
  260 AA(ISUB+21)=AA(ISUB+21) + X(1)
  930 FORMAT (/*   ENTRY TYPE=*A2*  *5A10,E10.4,2X,A10)
      WRITE (6,930)ICLS,(IC(J),J=1,5),X(1),LT(ISUB+1)
      IF (ISUB.LT.1)GO TO 20
      WRITE (6,931)ISUB
  931 FORMAT (*          SPECIAL TRANSPORTATION COST CATEGORY*I4)
      GO TO 20
C
C PRINT AND SUM SUBCONTRACTS AND DIRECT, FLOW-THROUGH EXPENSES
C
  270 A(11)=A(11) + X(3)
      WRITE (6,922) ICLS,(IC(J),J=1,5),X(3)
      GO TO 20
C
C PRINT AND SUM SITE-RETAINED FACILITIES AND EQUIPMENT.
```

```
      SUBROUTINE COST        74/74   OPT=1                         FTN 4.6+439        09/22/81  12.30.53        PAGE     7

VARIABLES       SN  TYPE              RELOCATION
  1221  AEGP        REAL                           REFS         177      207       292       312   DEFINED      155
  1227  AIDC        REAL                           REFS         181   DEFINED      171
  1220  AINT        REAL                           REFS         159      177       292       310   DEFINED      154
  1223  AOTC        REAL                           REFS         165      189       195       314   DEFINED      164        189
  1216  APPL        REAL                           REFS         145      159       177       287       292      307
  1217  ATXINS      REAL                           REFS         159      177       292       308   DEFINED      153
  1215  AVGP        REAL                           REFS         148      153       154       155
  1134  CACRE       REAL                           REFS          92      167   DEFINED        45
  1232  CAVGSU      REAL                           REFS         179   DEFINED      178
  1124  CEGP        REAL                           REFS          94      114       115       171       172
                                                DEFINED          34
  1201  CEGPP       REAL                           REFS         138      141       216       246       270      272
                                                DEFINED          94
  1123  CFAC        REAL                           REFS          95      114       115       171   DEFINED       33
  1202  CFACP       REAL                           REFS         138      141       219       248       274      276
                                                DEFINED          95
  1177  CLNEP       REAL                           REFS         138   DEFINED       92
  1122  CNM         REAL                           REFS         120      159       177       292       303
                                                DEFINED          31
     0  CRC         REAL      ARRAY      F.P.      REFS          16      322   DEFINED         1
  1157  CRSU        REAL                           REFS         178   DEFINED       64
  1125  CTL         REAL                           REFS          91      114       115       171       172
                                                DEFINED          31
  1200  CTLP        REAL                           REFS         138      141       213       244       266      268
                                                DEFINED          93
  1231  CO          REAL                           REFS         178      179   DEFINED       177
  1640  DE          REAL      ARRAY                REFS          16      220       249       277   DEFINED      215        216
                                                    246         264      270       272
  1412  DEP         REAL      ARRAY                REFS          16      203   DEFINED       220       249      277
  1722  DF          REAL      ARRAY                REFS          16      220       249       277   DEFINED      218        219
                                                    248         265      274       276
  1121  GL          REAL                           REFS         104      115       120       159       292      302
                                                DEFINED          30      324
  1204  DLO         REAL                           REFS         177      322   DEFINED       104
  1176  DM          REAL                           REFS         107      115       120       159       292      298
                                                DEFINED          84      323
  1130  DMP         REAL                           REFS          85       86       299   DEFINED        38
  1120  DMR         REAL                           REFS          85       86       300   DEFINED        29
  1203  DMO         REAL                           REFS         177      322   DEFINED       103
  1556  DT          REAL      ARRAY                REFS          16      220       249       277   DEFINED      212        213
                                                    244         263      264       268
  1222  EGA         REAL                           REFS         177      292       309   DEFINED       159
  1205  EMTN        REAL                           REFS         116      305   DEFINED       114
  1175  ESCP        REAL                           REFS          86      301   DEFINED        85
     0  EXPS        REAL      ARRAY      F.P.      REFS          16    2*322       323       324   DEFINED        1        297
                                                    298         299      300       301       302       303      304        305
                                                    306         307      308       309       310       311      312        313
                                                    314         315      316       317
  1233  FACSU       REAL                           REFS         181   DEFINED      179
  1142  FEG         REAL                           REFS       2*124      154       155   DEFINED        51
  1146  FGA         REAL                           REFS         159   DEFINED       55
  1226  FIDC        REAL                           REFS         171   DEFINED      169
  1165  FINDC       REAL                           REFS         115   DEFINED       70
  1163  FINDL       REAL                           REFS         115   DEFINED       68
  1164  FINDM       REAL                           REFS         115   DEFINED       69
  1141  FITC        REAL                           REFS         172   DEFINED       50
  1145  FMTN        REAL                           REFS         114   DEFINED       54
```

```
      SUBROUTINE SCHART      74/74   OPT=1                         FTN 4.6+439        09/22/81  12.30.53        PAGE     2

            50     ENCODE(10,999,LL(I,4))TP(I)                                  CHART      280
                   ENCODE(10,998,LL(7,4))                                       CHART      281
            C                                                                   CHART      282
            C           WRITE OUT HEADING                                       CHART      283
            C                                                                   CHART      284
                   WRITE(6,800)((L(I,IS),I=1,3),(CTR(I),I=1,3),IYR              CHART      285
            800    FORMAT(1H1,T50,*COST SUMMARY BY PROFIT CENTER*//T50,3A10///  CHART      286
                  $ T49,3A10,///,                                               CHART      287
                  $ T50,*PRODUCTION YEAR *,I2,//////)                           CHART      288
            C                                                                   CHART      289
            C           WRITE OUT CHART                                         CHART      290
            C                                                                   CHART      291
                   WRITE(6,801)(LPC(I),I=1,NCOMP)                               CHART      292
            801    FORMAT(21X,6(6X,A4,4X),10X,*TOTALS BY LOCATION*////)         CHART      293
                   DO 60 I=1,4                                                  CHART      294
                   IF(I .EQ. 4)WRITE(6,803)                                     CHART      295
            803    FORMAT(////)                                                 CHART      296
                   WRITE(6,802)(LTYP(J,I),J=1,2),(LL(J,I),J=1,7)                CHART      297
            802    FORMAT(/,1X,2A10,6(A10,4X),13X,A10)                          CHART      298
            60     CONTINUE                                                     CHART      299
                   WRITE(6,804)(L(I,IS),I=1,3),TOTAL                            CHART      300
            804    FORMAT(//////T50,*TOTAL FOR *,3A10,F12.2)                    CHART      301
                   RETURN                                                       CHART      302
                   END                                                          CHART      303
```

```
      SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS       DEF LINE      REFERENCES
    3  SCHART           1            21        80

VARIABLES      SN   TYPE            RELOCATION
     0  CTR         REAL      ARRAY      F.P.      REFS       2       63   DEFINED        1
     0  ETOT        REAL      ARRAY      F.P.      REFS       2       29        40       48   DEFINED       1
   350  I           INTEGER                        REFS      24     3*29      2*31       38      3*40      46     3*48
                                                             55     2*56      2*58     2*63        70      73     2*75      78
                                                DEFINED      23       27        37       45        54      57     2*63
                                                             70       72        78
     0  ICOST       INTEGER   ARRAY      F.P.      REFS       2       29        31   DEFINED        1
   347  IETOT       INTEGER                        REFS      25       29        40       48   DEFINED      22      25
     0  IS          INTEGER              F.P.      REFS      21       23        63       78   DEFINED       1
     0  ISTAT       INTEGER   ARRAY      F.P.      REFS       2       19        20   DEFINED        1
     0  ISUM        INTEGER   ARRAY      F.P.      REFS       2       21        24   DEFINED        1
     0  IYR         INTEGER              F.P.      REFS      63   DEFINED        1
   351  J           INTEGER                        REFS    3*29     2*31        40       48      2*75
                                                DEFINED      28       39        47     2*75
     0  L           INTEGER   ARRAY      LABEL     REFS       4       63        78
   371  LL          INTEGER   ARRAY                REFS       2       75   DEFINED       29        31      56      58
                                                             59
   363  LPC         INTEGER   ARRAY                REFS       2       70   DEFINED       18
   353  LTYP        INTEGER   ARRAY                REFS       2       75   DEFINED       14        15      16      17
   345  NCOMP       INTEGER                        REFS      27       39        45       57        70
                                                DEFINED      19
     0  NS          INTEGER              F.P.      REFS       2   DEFINED        1
```

SNL 2ND GENERATION HELIOSTAT

4450 FACTORY COSTS

KEY TO ENTRY TYPES

M=RAW MATERIALS
S=SUPPLIES AND CONSUMABLES
B=BUILDING OR FACILITY SIZE
X=TRANSPORTATION REQUIREMENTS

P=PURCHASED MATERIALS
T=TOOLING
A=LAND FOR PRODUCTION FACILITY
Y=SITE-RETAINED CAPITAL

L=DIRECT LABOR HOURS
E=EQUIPMENT
Q=QUANTITY
Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST	
ENTRY TYPE=M 4450 CENTER TORQUE TUBE,100 LB. SOURCE-SNL, 0.32/LB	100	LBS	.32	32.00	/ HELIOSTAT
ENTRY TYPE=L 4450 CENTER TORQUE TUBE FABRICATION SOURCE-SNL,0.50 AT 7.50/HR	.7000E-01	HRS / HELIOSTAT			
ENTRY TYPE=M 4450 OUTBOARD FLANGES(2) SOURCE-SNL				21.74	/ HELIOSTAT
ENTRY TYPE=L 4450 OUTBOARD FLANGE FABRICATION SOURCE-SNL,1.15 AT 7.50/HR	.1500E+00	HRS / HELIOSTAT			
ENTRY TYPE=M 4450 ELEVATION ARM ADAPTER RINGS(2) SOURCE-SNL,NODULAR IRON				21.74	/ HELIOSTAT
ENTRY TYPE=L 4450 EL ARM ADPT RINGS FABRICATION SOURCE-SNL,1.15 AT 7.50/HR	.1500E+00	HRS / HELIOSTAT			
ENTRY TYPE=M 4450 ELEVATION ARM ASSY(10 GA STEEL) SOURCE-SNL,0.1382 INCH				37.44	/ HELIOSTAT
ENTRY TYPE=L 4450 EL ARM ASSY FABRICATION SOURCE-CSL,3.47 AT 7.50/HR	.4700E+00	HRS / HELIOSTAT			
ENTRY TYPE=L 4450 CENTER TORQUE TUBE ASSEMBLY LABOR SOURCE-SNL,5.63 AT 7.50/HR, 185 LB	.7500E+00	HRS / HELIOSTAT			
ENTRY TYPE=M 4450 CONTINGENCY,0.01 X 159.40=1.59 SOURCE-SNL				0.00	/ HELIOSTAT
ENTRY TYPE=P 4450 Z-FRAMES,4 EACH,14 GA(.0785) SOURCE-SNL,SHIPPED DIRECT TO SITE	740	LBS	.34	253.60	/ HELIOSTAT
ENTRY TYPE=P 4450 Z-FRAME TRANSPORTATION SOURCE-CSL FROM BETHLEHEM STEEL,LACKAWANNA,NY				70.00	/ HELIOSTAT
ENTRY TYPE=M 4450 STRUTS AND BARS,STRUTS 36 LB, SOURCE-SNL,BARS LB, 8 EACH, STRUT,2.0,.154&3.9	50	LBS	.23	11.48	/ HELIOSTAT
ENTRY TYPE=L 4450 STRUTS/BARS FABRICATION SOURCE-SNL,2.58 AT 7.50/HR	.3400E+00	HRS / HELIOSTAT			

HELIOSTAT COST MODEL

DETAILED BREAKDOWN

SNL - SECOND GENERATION

4430 - CONTROLS

FACTORY COSTS

PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE		0.00
DIRECT MATERIALS		0.00
PURCHASED MATERIALS	0.00	
RAW MATERIALS	0.00	
SCRAP	0.00	
DIRECT LABOR		0.00
CONSUMABLES		0.00
INDIRECT COSTS		0.00
MAINTENANCE, PLANT ENGINEERING	0.00	
OTHER INDIRECTS	0.00	
CAPITAL REPLACEMENT ALLOWANCE		0.00
PROPERTY TAX AND INSURANCE		0.00
GENERAL & ADMINISTRATIVE		0.00
INTEREST EXPENSE		0.00
INCOME TAXES		0.00
RETURN TO EQUITY HOLDERS		0.00
OTHER EXPENSES		0.00

COST SUMMARY BY PROFIT CENTER

CONSUMABLES

SML - SECOND GENERATION

PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	TOTALS BY LOCATION
FACTORY	.20	70.60	0.00	0.00	0.00	0.00	70.80
TRANSPORTATION	0.00	0.00	0.00	0.00	0.00		0.00
SITE			0.00	0.00		0.00	0.00
TOTALS BY COMPONENT	.20	70.60	0.00	0.00	0.00	0.00	

TOTAL FOR CONSUMABLES 70.80

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UNLABELLED OLDPL              IDENT   A                    UPDATE 1.2-77020.   09/22/81  12.30.51.     PAGE   1

*****   *IDENT A
*****   *BEFORE  INPT.1
         DPARAMS
         $

        MODIFICATIONS  /  CONTROL CARDS

1A0/000   DPARAMS                                          A          1      |
1A0/000   $                                                A          2      |



              CORRECTION IDENTS ARE LISTED IN CHRONOLOGICAL ORDER OF INSERTION

        INPT      A


DECKS ARE LISTED IN THE ORDER OF THEIR OCCURRENCE ON A NEW PROGRAM LIBRARY IF ONE IS CREATED BY THIS UPDATE

        1A0/000   INPT


        DECKS WRITTEN TO COMPILE FILE

        INPT


 THIS UPDATE REQUIRED  337000 WORDS OF CORE.
```

```
   SUBROUTINE IREAD      74/74   OPT=1                FTN 4.6+439      09/22/81  12.30.53     PAGE   5

C                                                                                              IREAD  230
230         200 A(12)=A(12) + X(3)                                                             IREAD  231
              WRITE (6,920) ICLS,(IC(J),J=1,5),X(3)                                            IREAD  232
              IF (ITYP.EQ.3) GO TO 201                                                         IREAD  233
              WRITE (6,940)                                                                    IREAD  234
            940 FORMAT (10H **** CAUTION **** ,/,*THIS CATEGORY INTENDED FOR SITE*             IREAD  235
235           $* PROFIT CENTERS ONLY.*)                                                        IREAD  236
            201 CONTINUE                                                                       IREAD  237
              GO TO 20                                                                         IREAD  238
C                                                                                              IREAD  239
C ***************************************************************                            IREAD  240
240 C                                                                                          IREAD  241
C                                                                                              IREAD  242
C PRINT INPUT SUMMARY                                                                          IREAD  243
C                                                                                              IREAD  244
            500 CONTINUE                                                                       IREAD  245
245         911 FORMAT(*       TOTAL (BASE RATE COST CATEGORY) DIRECT LABOR=*F10.4*           IREAD  246
              $    MMS/HELIOSTAT*)                                                            IREAD  247
            912 FORMAT(*       TOTAL CONSUMABLES=*F10.2*     $/HELIOSTAT*)                    IREAD  248
            913 FORMAT(*       LAND REQUIRED=*F10.4*          ACRES*)                         IREAD  249
            914 FORMAT(*       PRODUCTION FACILITY (BASE RATE COST CATEGORY) SIZE=*           IREAD  250
250           $F10.0*     $0 FT*)                                                            IREAD  251
            915 FORMAT(*       TOTAL EQUIPMENT COST=*F10.0*     $*)                           IREAD  252
            916 FORMAT(*       WEIGHTED EQUIPMENT COST=*F10.0*     $ TIMES YEARS USE         IREAD  253
              $D / SITE*)                                                                      IREAD  254
            917 FORMAT(*       TOTAL TOOLING COST=*F10.0*     $*)                             IREAD  255
255         918 FORMAT(*       QUANTITY=*F10.0*     / YEAR*)                                  IREAD  256
            919 FORMAT(*       QUANTITY=*F10.0*     / SITE*)                                  IREAD  257
            932 FORMAT (*       TRANSPORTATION (BASE RATE CATEGORY) =*F10.3*  LBS*)          IREAD  258
            938 FORMAT(///*       TOTAL PURCHASED MATERIALS=*,F10.2,* $/HELIOSTAT*/            IREAD  259
              $*       TOTAL RAW MATERIALS=*,F10.2,* $/HELIOSTAT*)                           IREAD  260
260           WRITE (6,938)A(10),A(1)                                                          IREAD  261
              WRITE (6,911)AW(1)                                                               IREAD  262
              DO 330 I=1,9                                                                     IREAD  263
              IF (AW(I+1).EQ.0.0)GO TO 330                                                     IREAD  264
              WRITE (6,928)I,AW(I+1)                                                           IREAD  265
265         928 FORMAT (*                SPECIAL DIRECT LABOR COST CATEGORY*I3* = *F10.4       IREAD  266
              $*    MMS/HELIOSTAT*)                                                          IREAD  267
            330 CONTINUE                                                                       IREAD  268
              WRITE (6,912)A(2)                                                                IREAD  269
              IF (ITYP.GT.1)GO TO 320                                                          IREAD  270
270           WRITE (6,913)A(4)                                                                IREAD  271
              WRITE (6,914)AW(11)                                                              IREAD  272
              DO 335 I=1,9                                                                     IREAD  273
              IF (AW(I+11).EQ.0.0)GO TO 335                                                    IREAD  274
              WRITE (6,929)I,AW(I+11)                                                          IREAD  275
275         929 FORMAT (*                SPECIAL FACILITIES COST CATEGORY*I3* = *F10.0*       IREAD  276
              $   $0 FT*)                                                                      IREAD  277
            335 CONTINUE                                                                       IREAD  278
              WRITE (6,915)A(6)                                                                IREAD  279
              WRITE (6,917)A(7)                                                                IREAD  280
280           WRITE (6,918)A(8)                                                                IREAD  281
              GO TO 340                                                                        IREAD  282
            320 WRITE (6,916)A(6)                                                              IREAD  283
              WRITE (6,919)A(8)                                                                IREAD  284
            340 CONTINUE                                                                       IREAD  285
285           IF (AW(21).EQ.0.0) GO TO 344                                                     IREAD  286
```

VARIABLES SN TYPE RELOCATION

1155	FPLENG		REAL			REFS	93	94	95	171	172		
						DEFINED	62						
1144	FSCPP		REAL			REFS	85	DEFINED	53				
1150	FSCPN		REAL			REFS	85	DEFINED	57				
1143	FTXING		REAL			REFS	153	DEFINED	52				
1147	FXE		REAL			REFS	129	DEFINED	56				
1115	IDEP		INTEGER			REFS	203	223	DEFINED	23			
1117	ILRN		INTEGER			REFS	321	DEFINED	25				
1112	IND		REAL			REFS	15	120	159	177	292	304	
						DEFINED	116						
1113	INDD		REAL			REFS	15	116	306	DEFINED	115		
0	ISTAT		INTEGER	ARRAY	F.P.	REFS	16	22	23	24	25	322	
						DEFINED	1	110					
1210	IT		INTEGER			REFS	2+129	134	135	136	137	3+138	141
							209	209	210	211	212	213	215	216	
							2+218	2+219	4+220	231	232	237	239	241	
							244	246	248	4+249	257	258	259	260	
							263	264	265	2+266	2+268	2+270	2+272	4+274	
							2+276	4+277	DEFINED	128	133	207	227	266	
1214	ITE		INTEGER			REFS	138	2+215	2+216	240	243	246	2+270		
						DEFINED	137	211	239	240	243	260			
1237	ITF		INTEGER			REFS	248	DEFINED	241						
1213	ITT		INTEGER			REFS	138	2+212	2+213	238	242	244	2+266		
						DEFINED	136	210	237	238	242	259			
1116	ITYP		INTEGER			REFS	166	DEFINED	22						
1241	KE		INTEGER			REFS	270	272	DEFINED	262					
1240	KT		INTEGER			REFS	266	268	DEFINED	261					
1167	LEQA		INTEGER			REFS	135	137	138	141	209	211	216		
							232	239	246	258	260	262	270	272	
						DEFINED	75								
1172	LEQT		INTEGER			REFS	215	216	239	240	243	3+245	262		
							272	DEFINED	78						
1170	LFCA		INTEGER			REFS	129	133	2+148	2+149	185	207	227		
							256	2+283	DEFINED	76					
1173	LFCT		INTEGER			REFS	218	219	241	3+248	274	2+276			
						DEFINED	79								
1110	LNQ		REAL			REFS	15	92	167	DEFINED	32				
1111	LNQSU		REAL			REFS	15	181	DEFINED	167					
1176	LRN		INTEGER			REFS	325	DEFINED	80						
1166	LTLA		INTEGER			REFS	134	136	138	141	208	210	213		
							231	237	244	257	259	261	266	268	
						DEFINED	74								
1171	LTLT		INTEGER			REFS	212	213	237	238	242	3+244	261		
							268	DEFINED	77						
1212	NE		INTEGER			REFS	137	138	141	211	216	239	246		
							260	262	270	272	DEFINED	135	209	232	
							258								
0	NEXPS		INTEGER		F.P.	REFS	16	DEFINED	1						
1211	NT		INTEGER			REFS	136	138	141	210	213	237	244		
							259	261	266	268	DEFINED	134	208	231	
							257								
1176	NYR		INTEGER			REFS	109	110	297	298	299	300	301		
							302	303	304	305	306	307	308	309	
							310	311	312	313	314	315	316	317	
							2+322	323	324	325	DEFINED	24	99	109	
1206	OPR		REAL			REFS	129	DEFINED	120						
1234	OTC		REAL			REFS	185	DEFINED	181						

VARIABLES SN TYPE RELOCATION

346	NTYP		INTEGER			REFS	28	37	47	54	DEFINED	20	
425	TL		REAL	ARRAY		REFS	2	40	55	56	DEFINED	38	40
342	TOTAL		REAL			REFS	55	78	DEFINED	51	55		
430	TP		REAL	ARRAY		REFS	2	48	58	DEFINED	46	48	

FILE NAMES MODE

TAPE6	FMT	WRITES	63	70	73	75	78

STATEMENT LABELS DEF LINE REFERENCES

34	5		26	23	24
0	10		33	27	28
0	20		41	37	39
0	30		49	45	47
0	40		56	54	
0	50		58	57	
0	60		77	72	
267	801	FMT	64	63	
306	801	FMT	71	70	
326	802	FMT	76	75	
317	803	FMT	74	73	
337	804	FMT	79	78	
240	998	FMT	32	31	
232	999	FMT	30	29	59
					58

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES	
31	5		I	23 26	48	INSTACK	
37	10	*	I	27 33	338	EXT REFS	NOT INNER
40	10	*	J	28 33	308	EXT REFS	
73	20	*	I	37 41	178	NOT INNER	
104	20		J	39 41	38	INSTACK	
113	30	*	I	45 49	178	NOT INNER	
124	30		J	47 49	38	INSTACK	
134	40	*	I	54 56	138	EXT REFS	
150	50	*	I	57 58	108	EXT REFS	
176	60	*	I	72 77	178	EXT REFS	

COMMON BLOCKS LENGTH MEMBERS - BIAS NAME(LENGTH)
LABEL 63 0 L 1631

STATISTICS
PROGRAM LENGTH 4618 305
CM LABELED COMMON LENGTH 778 63

```
ENTRY TYPE=M   4450      ANGLES,24 EACH,2 X.125X19 STEEL          32  LBS          /4      7.64  / HELIOSTAT
     SOURCE-SNL, 2-FRAME STIFFENERS

ENTRY TYPE=L   4450      ANGLE FABRICATION                  .1000E+00  HRS / HELIOSTAT
     SOURCE-SNL,0.1% AT 7.50/HR

ENTRY TYPE=M   4450      TORQUE TUBES,OUTBOARD(2)                 17%  LBS          .32    55.88  / HELIOSTAT
     SOURCE-SNL,1%. OD X .105 WALL R&D IN

ENTRY TYPE=L   4450      TORQUE TUBE OUTBD FABRICATION      .1100E+00  HRS / HELIOSTAT
     SOURCE-SNL,0.8% AT 7.50/HR

ENTRY TYPE=M   4450      OUTBOARD FLANGES(2)                                                21.74  / HELIOSTAT
     SOURCE-SNL

ENTRY TYPE=L   4450      OUTBOARD FLANGE FABRICATION        .2100E+00  HRS / HELIOSTAT
     SOURCE-SNL,1.5% AT 7.50/HR)

ENTRY TYPE=M   4450      INBOARD FLANGES(2)                                                 21.74  / HELIOSTAT
     SOURCE-SNL

ENTRY TYPE=L   4450      INBOARD FLANGE FABRICATION         .1500E+00  HRS / HELIOSTAT
     SOURCE-SNL,1.1% AT 7.50/HR

ENTRY TYPE=L   4450      TORQUE TUBE OUTBD ASSEMBLY LABOR   .1000E+00  HRS / HELIOSTAT
     SOURCE-SNL,0.7% AT 7.50/HR (2 EACH)

ENTRY TYPE=M   4450      SUPPORT STRUCTURE PROFIT                                           0.00  / HELIOSTAT
     SOURCE-SNL,0.032 X 683.38= 21.87

ENTRY TYPE=M   4450      FRAME ASSY CONTINGENCY                                             0.00  / HELIOSTAT
     SOURCE-SNL,0.03 X 523.98=15.72

ENTRY TYPE=A   4450      SUPPORT STRUCTURE LAND             .1160E+02  ACRE
     SOURCE-

ENTRY TYPE=B   4450      SUPPORT STRUCTURE FACILITIES       .9296E+05  SQFT
     SOURCE-

ENTRY TYPE=E   4450      SUPPORT STRUCTURE EQUIPMENT                                     2501500.
     SOURCE-SNL TABLE B-1

ENTRY TYPE=E   4450      PRODUCTION SUPPORT EQUIPMENT                                    2006300.
     SOURCE-SNL TABLE B-1

ENTRY TYPE=T   4450      SUPPORT STRUCTURE TOOLING                                        931000.
     SOURCE-SNL TABLE B-1

ENTRY TYPE=S   4450                                                                        0.00  / HELIOSTAT

ENTRY TYPE=Q   4450      SUPPORT STRUCTURE QUANTITY/YEAR    .5000E+05  /YR


   TOTAL PURCHASED MATERIALS=    323.60 $/HELIOSTAT
   TOTAL R&M MATERIALS=          233.40 $/HELIOSTAT
   TOTAL (BASE RATE COST CATEGORY) DIRECT LABOR=    2.6000    HRS/HELIOSTAT
   TOTAL CONSUMABLES=              0.00 $/HELIOSTAT
  LAND REQUIRED=  11.6000   ACRES
  PRODUCTION FACILITY (BASE RATE COST CATEGORY) SIZE=   9296.   SQ FT
```

HELIOSTAT COST MODEL
DETAILED BREAKDOWN
SNL - SECOND GENERATION
4440 - FOUNDATION/PEDESTAL
FACTORY COSTS
PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE		0.00
DIRECT MATERIALS		0.00
PURCHASED MATERIALS	0.00	
R&M MATERIALS	0.00	
SCRAP	0.00	
DIRECT LABOR		0.00
CONSUMABLES		0.00
INDIRECT COSTS		0.00
MAINTENANCE, PLANT ENGINEERING	0.00	
OTHER INDIRECTS	0.00	
CAPITAL REPLACEMENT ALLOWANCE		0.00
PROPERTY TAX AND INSURANCE		0.00
GENERAL & ADMINISTRATIVE		0.00
INTEREST EXPENSE		0.00
INCOME TAXES		0.00
RETURN TO EQUITY HOLDERS		0.00
OTHER EXPENSES		0.00

COST SUMMARY BY PROFIT CENTER

INDIRECT COSTS

SNL - SECOND GENERATION

PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	TOTALS BY LOCATION
FACTORY	21.24	35.14	0.00	0.00	13.86	0.00	70.24
TRANSPORTATION	0.00	0.00	0.00	0.00	8.62		8.62
SITE			0.00	65.02		24.25	89.27
TOTALS BY COMPONENT	21.24	35.14	0.00	65.02	22.48	24.25	

TOTAL FOR INDIRECT COSTS 168.13

```
graham5
$
*1441OSNL 2ND GENERATION HELIOSTAT
P 4410FUSION GLASS,.060,                     622.58SQFT   0.45  280.16
C SOURCE-CORNING, 5X6 FT. LITES
P 4410FUSION GLASS,                          622.58SQFT   0.244 152.00
C ALLIED TOOLING COST FOR GLASS PLANT
P 4410SILVER,COPPER,PAINT,                   622.58SQFT   0.20  124.52
C SOURCE-MISC. ESTIMATE (.07/FT*2 POSSIBLE),AG-70MG/SQFT,CU-20MG/SQFT,
C PPG UC44009 GRAY PAINT- 7 TO 9 MG/SQFT
P 4410POLYISOBUTYLENE(PIB)                     8.0 GAL   11.18   89.44
C SOURCE-3M EC5354
L 4410MIRROR FABRICATION                       0.40HRS
C SOURCE-SNL AT 12.23/HR=4.89
P 4210PAPER HONEYCOMB-2DIP PHENOLIC          617.35SQFT   0.274 169.15
C PERFORATED(0.060),30 V/0
P 4410GORPREEN MJ-6 EPOXY ADHESIVE             7.9GAL     8.84   69.80
C SOURCE BASED ON BOSTIK
L 4410CORE FABRICATION                         0.24HRS
C SOURCE-SNL AT 12.23/HR=2.94
M 4410FACE AND BACK SHEETS, .024 STEEL    1256.0 SQFT    0.258  323.90
C SOURCE-ARMCO 1215 LB AT 0.267/LB, SAE 1010 STEEL
L 4410FACE AND BACK SHEET FABRICATION      0.08 HRS
C SOURCE-SNL AT 12.23/HR=0.98,SAE1010 STEEL
L 4410BONDED ASSEMBLY                          0.72HRS
C SOURCE-SNL AT 12.23/HR=8.81
M 4410EDGE STRIP .024 X 2.3125 X 36FT        68.8 LBS    0.25    17.19
C SOURCE-ARMCO 1010 COIL STOCK
P 4410PIB                                      0.24GAL   11.18    2.63
C SOURCE-3M EC5354
L 4410EDGE STRIP FABRICATION                   0.22HRS
C SOURCE-SNL AT 12.23/HR=2.69
M 4410CENTER STRIP .024 X 1.625 X 52.2FT      6.84LBS    0.25     1.71
C SOURCE-ARMCO 1010 COIL STOCK
L 4410CENTER STRIP FABRICATION                 0.06HRS
C SOURCE-SNL AT 12.23/HR=0.73
P 4410SUPPORT DOUBLERS 33 EACH CAST IRON     51.48LBS    0.31    15.96
C SOURCE-SNL ESTIMATE-CAPTIVE FOUNDRY,1.56 LB EACH
L 4410SUPPORT DOUBLER FLATTEN,DRILL,TAP        0.08HRS
C SOURCE-SNL AT 12.23/HR= 0.98
P 4410RTV SEALANT                              0.42GAL   10.62    4.46
C SOURCE-DOW CORNING 795 RTV SILICONE
P 4410SELF TAPPING HEX-HEAD SCREWS            33. EACH   0.025    0.82
C SOURCE- A AND E BOLT  NO.6 X 7/16 FOR CENTER STRIPS
P 4410STAPLES-NOT IN PROD. DESIGN            369.EACH    0.012    4.43
C SOURCE- A AND E BOLT
P 4410SUPPORT ANGLE .024X.75X363.3FT          22.0LBS     0.25    5.50
C SOURCE-HDL        22 LB
P 4410ACRYLIC ADHESIVE,VERSILOK 204           5.32LB     3.90    20.75
C SOURCE-SNL TEL CON
C SOURCE-HDL           FOR DOUBLERS AND EDGE STRIPS,CENTER STRIPS,SUPPORT ANGLES
P 4410POP RIVETS 400 EACH 1/8 AL             400.EACH    0.01
C SOURCE-HDL ROM= .01 EACH
P 4410PRIME AND FINISH PAINT COAT              1.25GAL   20.0
C SOURCE-HDL ROM=
C PRIMER-KAUSES PAINT 63Y18,0005-.001 STRONTIUM CHROMATE
C FINISH-KAUSAG PAINT 84 SERIES,COLOR #E.25630 FED STD 595A .001-.0015
C ACRYLIC HYPERTHANE,ONE COAT
L 4410MIRROR MODULE ASSEMBLY                   1.04 HRS
C SOURCE-SNL AT 12.23/HR= 12.72
```



```
              WRITE (6,932)AM(21)                                        IREAD
          344 CONTINUE                                                   IREAD
              DO 345 I=1,9                                               IREAD
              IF (AM(I+21).EQ.0.00)GO TO 345                             IREAD
          933 FORMAT (*        SPECIAL TRANSPORTATION COST CATEGORY*I3* = *  IREAD
             $F10.3,1X,A10)                                              IREAD
              WRITE (6,933) I,AM(I+21),LT(I+1)                           IREAD
          345 CONTINUE                                                   IREAD
              IF (A(11).EQ.0.0) GO TO 350                                IREAD
              WRITE (6,945) A(11)                                        IREAD
          945 FORMAT (*      TOTAL SUBCONTRACTS AND FLOW-THROUGH EXPENSES=*, IREAD
             $F10.2,*    $/HELIOSTAT*)                                   IREAD
          350 CONTINUE                                                   IREAD
              IF (A(12).EQ.0.0) GO TO 355                                IREAD
              WRITE (6,946) A(12)                                        IREAD
          946 FORMAT (*      TOTAL SITE-RETAINED CAPITAL=*,F10.2,*   $*)     IREAD
          355 CONTINUE                                                   IREAD
              RETURN                                                     IREAD
              END                                                        IREAD
```

```
SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
   3  IREAD            1           303

VARIABLES       SN  TYPE              RELOCATION
    0  A            REAL       ARRAY      F.P.      REFS       33      130      132      176      182      190      195
                                                     201      224      230    2*260      268      270      278      279
                                                     280      282      283      294      295      299      300
                                                 DEFINED        1       48      130      132      158      176      182
                                                     190      195      201      208      224      230
    0  AM           REAL       ARRAY      F.P.      REFS       33      147      166      214      261      263      264
                                                     271      273      274      285      286      289      292
                                                 DEFINED        1       50      147      166      214
    0  KDR          REAL       ARRAY      F.P.      REFS       33       96       99      102  DEFINED        1       92
 1452  I            INTEGER                         REFS       48       50       65      263    2*264      273    2*274
                                                     289    3*292  DEFINED       47       49       65      262      272
                                                     288
 1464  IA           INTEGER    ARRAY                REFS       34       59       65       92      123
                                                 DEFINED       57
 1474  IC           INTEGER    ARRAY                REFS       34      124      136    2*139      148    2*159    2*167
                                                     177    2*183      191    2*196      202    2*209      216      225
                                                     231  DEFINED    2*65      123
 1454  ICLS         INTEGER                         REFS      136      139      148      159      167      177      183
                                                     191      196      202      209      216      225      231
                                                 DEFINED       65
 1461  ICOMP        INTEGER                         REFS       93       96       99      102  DEFINED       92
 1457  IJK        * INTEGER                      DEFINED       92
 1462  IJK1       * INTEGER                      DEFINED      123
 1463  IPT          INTEGER                         REFS      135      139  DEFINED      134
    0  ISTAT        INTEGER    ARRAY      F.P.      REFS       33  DEFINED        1       93       94
 1455  ISUB         INTEGER                         REFS    2*147      150      151    2*166      168      169    2*214
                                                     216      217      218  DEFINED       65
```

```
      SUBROUTINE COST      74/74  OPT=1                    FTN 4.6+439     09/22/81  12.30.53     PAGE   9

VARIABLES     SN  TYPE              RELOCATION
1236  OTHEXP      REAL                          REFS      292     313   DEFINED   195
   0  P           REAL      ARRAY   F.P.        REFS       16      44        45    46      47      48      49
                                                 50       51      52        53    54      55      56      57
                                                 58       59      60        61    62      63      64      65
                                                 66       67      68        69    70   DEFINED     1
1225  P1          REAL                          REFS    2+169   DEFINED     168
1126  Q           REAL                          REFS       92      93        94    95     114     115     189
                                                194      322   DEFINED      36
   0  QA          REAL      ARRAY   F.P.        REFS       16      322   DEFINED       1
  36  QSU         REAL                          REFS      179   DEFINED      63
1207  RATCC       REAL                          REFS      148       149       165   185     203
                                              DEFINED     124
1137  REQA        REAL                          REFS      124       155   DEFINED      48
1245  REV         REAL                          REFS      297   DEFINED      292
1135  RI          REAL                          REFS      129     2+138     2+141   148     149     165     185
                                                213       216       244       246   266     268     270     272
                                                283   DEFINED      46
1136  RINT        REAL                          REFS      124       154   DEFINED      47
1330  RPL         REAL      ARRAY               REFS       16       149   DEFINED     141
1224  SN          REAL                          REFS      167     2+169   DEFINED     165
1132  STCAP       REAL                          REFS      194   DEFINED      40
1235  STCAPP      REAL                          REFS      195       315   DEFINED     194
1131  SWRC        REAL                          REFS      195       315   DEFINED      39
1140  TAU         REAL                          REFS      124       287       288   DEFINED      49
1244  TAX         REAL                          REFS      292       311   DEFINED     288
1154  TC          REAL                          REFS      167     3+169   DEFINED      61
1230  TCINV       REAL                          REFS      181   DEFINED     172
1243  TI          REAL                          REFS      200   DEFINED     287
1133  TLRN        REAL                          REFS       80   DEFINED      44
1127  TRIN        REAL                          REFS      195       317   DEFINED      37
1246  WBR         REAL      ARRAY               REFS       16       148   DEFINED     138
1474  WC          REAL      ARRAY               REFS       16       138   DEFINED     129
1152  XLEBA       REAL                          REFS       75       138       141   DEFINED      59
1161  XLEBT       REAL                          REFS       78       216     2+270     272   DEFINED      66
1153  XLFCA       REAL                          REFS       76       138       141   DEFINED      60
1162  XLFCT       REAL                          REFS       79       219     2+274     276   DEFINED      67
1151  XLTLA       REAL                          REFS       74       138       141   DEFINED      58
1160  XLTLT       REAL                          REFS       77       213     2+266     268   DEFINED      65

EXTERNALS         TYPE      ARGS      REFERENCES
      ACOS        REAL      1 LIBRARY     168
      ALOG        REAL      1 LIBRARY   2+178
      APK                   6             148       149       185     203
      EXP         REAL      1 LIBRARY     167       169
      LEARN                 8             322

INLINE FUNCTIONS  TYPE      ARGS      DEF LINE  REFERENCES
      FLOAT       REAL      1 INTRIN              3+138     2+244   2+256   2+260
      INT         INTEGER   1 INTRIN                 74        75      76      77      78      79      80
      MIN0        INTEGER   0 INTRIN                237       239     241

STATEMENT LABELS          DEF LINE  REFERENCES
      0  9                    120       138
      0  10                   144       133
    463  20                   223       203
      0  21                   221       207
    557  30                   252       223
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      SUBROUTINE TPAGE     74/74  OPT=1                    FTN 4.6+439     09/22/81  12.30.53     PAGE   1

                                                                                                    TPAGE   2
      1           SUBROUTINE TPAGE                                                                  TPAGE   3
                  C                                                                                 TPAGE   4
                  C     THIS SUBROUTINE PRINTS OUT A TITLE PAGE WITH THE VERSION                    TPAGE   5
                  C     NUMBER AND EDITION DATE.                                                    TPAGE   6
      5           C                                                                                 TPAGE   7
                        WRITE(6,999)                                                                TPAGE   8
                  999   FORMAT(30(/),60X,4H E L C A T+)                                             TPAGE   9
                        WRITE(6,998)                                                                TPAGE  10
                  998   FORMAT(5(/),51X,+A HELIOSTAT COST ANALYSIS TOOL+)                           TPAGE  11
     10                 WRITE(6,997)                                                                TPAGE  12
                  997   FORMAT(5(/),60X,+VERSION 1.0+)                                              TPAGE  13
                        WRITE(6,996)                                                                TPAGE  14
                  996   FORMAT(5(/),51X,+EDITION DATE  AUGUST  13, 1981+)                           TPAGE  15
                        WRITE(6,995)                                                                TPAGE  16
     15           995   FORMAT(  /,51X,+REVISION  SEPTEMBER  22, 1981+)                             TPAGE  17
                        RETURN                                                                      TPAGE  18
                        END


      SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE    REFERENCES
    1 TPAGE            1          16

FILE NAMES        MODE
      TAPE6       FMT                    WRITES      6       8       10      12      14

STATEMENT LABELS          DEF LINE  REFERENCES
     60  995  FMT              15        14
     47  996  FMT              13        12
     40  997  FMT              11        10
     27  998  FMT               9         8
     20  999  FMT               7         6

STATISTICS
  PROGRAM LENGTH              650        53
```

TOTAL EQUIPMENT COST= 4507600. $

TOTAL TOOLING COST= 931000. $
QUANTITY= 50000. / YEAR

TOTAL DIRECT LABOR COST= 24.57 $/HELIOSTAT
TOTAL PRODUCTION FACILITY COST 4640000. $

HELIOSTAT COST MODEL
DETAILED BREAKDOWN
SML - SECOND GENERATION
4450 - SUPPORT STRUCTURE
FACTORY COSTS
PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE		744.62
DIRECT MATERIALS		567.24
PURCHASED MATERIALS	323.60	
RAW MATERIALS	233.40	
SCRAP	10.24	
DIRECT LABOR		24.57
CONSUMABLES		0.00
INDIRECT COSTS		13.86
MAINTENANCE, PLANT ENGINEERING	4.03	
OTHER INDIRECTS	9.83	
CAPITAL REPLACEMENT ALLOWANCE		13.09
PROPERTY TAX AND INSURANCE		8.08
GENERAL & ADMINISTRATIVE		56.79
INTEREST EXPENSE		4.12
INCOME TAXES		25.14
RETURN TO EQUITY HOLDERS		26.81
OTHER EXPENSES		4.92
ANNUALIZED ONE-TIME COSTS	4.92	

COST SUMMARY BY PROFIT CENTER

CAPITAL REPLACEMENT ALLOWANCE

SNL - SECOND GENERATION

PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	TOTALS BY LOCATION
FACTORY	17.13	37.80	0.00	0.00	13.09	0.00	68.02
TRANSPORTATION	0.00	0.00	0.00	0.00	0.00		0.00
SITE			0.00	0.00		0.00	0.00
TOTALS BY COMPONENT	17.13	37.80	0.00	0.00	13.09	0.00	

TOTAL FOR CAPITAL REPLACEMENT ALLOWANCE 68.02

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A 4410REFLECTIVE ASSEMBLY LAND              40.4ACRE

C SOURCE-SNL 95 ACRES X PROD. SPACE RATIO(SSH)
C SNL USES 20000./ACRE IMPROVED LAND
B 4410REFLECTIVE ASSEMBLY FACILITIES      215339.SQFT
C SOURCE S. WHITE
E 4410REFLECTIVE ASSEMBLY EQUIPMENT                          7.3894E6
C     SOURCEBID,INCLUDES TOOLING,
T 4410REFLECTIVE ASSEMBLY TOOLING                                  0.
C     INCLUDED WITH EQUIPMENT
S 4410SUPPLIES                                               0.20
Q 4410REFLECTIVE ASSEMBLY QUANTITY/YEAR  50000.
C 4410
*14420SNL 2ND GENERATION HELIOSTAT
P 4420AZIMUTH/ELEVATION DRIVE PARTS                           196.32
C SOURCE-TELEPHONE QUOTES AND CATALOGS
C BEARINGS,GREASE,SCREWS,WASHERS,NUTS,SEALS,PINS,GASKETS,PAINT
M 4420CAST IRON PARTS                                         207.17
C SOURCE-ESTIMATE CAPTIVE FOUNDRY,0.31/LB
C AZ SHAFT,EL COVER,OPEN CAP,CLOSED CAP,MOTOR BRACKET,GEAR HOUSING,ENCODER
C SHAFT MOUNT,AZ COVER, SLIDE TABLE
M 4420FORGED GEARS,0.80/LB  AZ/EL        2.0     EACH   52.00  104.00
C SOURCE-TELEPHONE QUOTES,130 LB. 8620 STEEL
M 4420 INTERMEDIATE GEAR CASTING         2.0     EACH    7.20   14.40
C SOURCE-SNL,14.0 LB,0.80/LB,MN BRONZE,
C SEE CARD3
M 4420BAR STK, .42/LB AVG .40-.53 AGE                        101.89
C SOURCE-TELEPHONE QUOTES, 243 LBS
C EL SHAFT,WORM GEAR,INT. PINION,STOW SLIDE
P 4420AZ AND EL MOTORS,DC WITH 120-1 RED                      252.00
C SOURCE-BODINE TEL. QUOTE
P 4420AZ ENCODER                                              157.20
C SOURCE-TEL QUOTE,BALDWIN ELECTRONICS,SERVOMETER,A+E BOLT
M 4420AZ ENCODER COUPLING FROM STEEL STK                        1.75
C SOURCE-JORGENSEN TEL QUOTE
P 4420EL ENCODER                                              157.08
C SOURCE-TEL QUOTE,BALDWIN ELECTRONICS,SERVOMETER,A AND E BOLT
M 4420EL ENCODER COUPLING FROM STEEL                            1.50
C SOURCE-JORGENSEN TEL QUOTE
P 4420ELECTRICAL POWER HARNESS                                 44.34
C SOURCE-TEL QUOTE,CATALOG,CANNON,BURNDY CORP,RAYCHEM,AMP,T AND B,CONS-ELECT
C INCLUDES 22.84 CONTRACTED LABOR
P 4420EL/AZ LOCK LIMIT SWITCH                                  32.70
C SOURCE-TEL QUOTE,CATALOG,CANNON,CONS-ELECT,MICROSWITCH,T AND B
C INCLUDES 10.00 CONTRACTED LABOR
P 4420EL/AZ LIMIT SWITCH                                       34.90
C SOURCE-TEL QUOTE,CATALOG,CANNON,CONS-ELECT,MICROSWITCH,T AND B
C INCLUDES 10.00 CONTRACTED LABOR
P 4420PAINT, .125 GAL                    0.125 GAL    30.00     3.75
C SOURCE- PREVIOUS ESTIMATE
L 4420CAST IRON FABRICATION              1.784HRS
C SOURCE-SNL AT 12.23/HR=21.83
L 4420FORGED GEAR FABRICATION            0.586 HRS
C SOURCE-SNL AT 12.23/HR=7.16
L 4420BAR STOCK FABRICATION              0.88  HRS
C SOURCE-SNL AT 12.23/HR=10.75
L 4420AZ AND EL ENCODER FABRICATION       .44 HRS
C SOURCE-SNL AT 12.23/HR=5.40
L 4420ASSEMBLY AND PAINT OF DRIVE        1.92 HRS
C SOURCE-SNL AT 12.23/HR=23.48
A 4420DRIVE ASSEMBLY LAND                43.4ACRE
C SOURCE-SNL 95 ACRES X PROD. SPACE RATIO(SSH)
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      SUBROUTINE IREAD      74/74   OPT=1                  FTN 4.6+439      09/22/81  12.30.53      PAGE     7

VARIABLES      SN  TYPE          RELOCATION
 1453  ISW         INTEGER                       REFS      62      63       64      66       67      68      69
                                                   70      71      72       73      74       75      76      77
                                                DEFINED    59
 1460  ITYP        INTEGER                       REFS      94      95      175     189      232     269
                                                DEFINED    92
 1456  J           INTEGER                       REFS      65      92       96      99      102     123     124
                                                  136     139     148      159     167      177     183     191
                                                  196     202     209      216     225      231
                                                DEFINED    65      92       96      99      102     123     124
                                                  136     139     148      159     167      177     183     191
                                                  196     202     209      216     225      231
 1530  LPC         INTEGER     ARRAY             REFS      34   DEFINED     38      39       40      41      42
                                                   43
 1516  LT          INTEGER     ARRAY             REFS      34     213      292   DEFINED     35      36      37
 1504  X           REAL        ARRAY             REFS      34     130      132     134      136   2*139     147
                                                  148     158     159      166     167      176     177   2*182
                                                2*183     190     191    2*195   2*196      201     202     208
                                                  209     214     216      224     225      230     231
                                                DEFINED  2*65

FILE NAMES          MODE
       TAPE5        FMT                READS       57
       TAPE6        FMT               WRITES       78      96       99     102      105     114     124     136
                                                  139     148     151      159     167      169     177     183     191
                                                  196     202     209      216     218      225     231     233     260
                                                  261     264     268      270     271      274     278     279     280
                                                  282     283     286      292     295      300

INLINE FUNCTIONS    TYPE    ARGS          DEF LINE   REFERENCES
       IFIX         INTEGER   1   INTRIN                134

STATEMENT LABELS                DEF LINE    REFERENCES
    0  10                          48          47
    0  11                          50          49
   32  20                          56         117     126     138     142     150     153     161     168     171
                                              179     185     192     197     204     210     217     220     226
                                              237
   72  100                         90          63
    0  101          INACTIVE       96          95
  106  102                         99          95
  111  103                        102          95
  113  104                        104          98     101
  120  110                        121          64
  125  115                        130          67
  130  117                        132          66
  132  120                        133         131
  137  122                        139         135
  142  140                        147          68
  154  160                        158          69
  161  170                        166          70
  173  180                        175          71
  202  185                        182         175
  210  200                        189          72
  217  205                        195         189
  225  220                        201          73
  232  240                        208          74
  237  260                        214          75
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STATEMENT LABELS		DEF LINE	REFERENCES	
0	31	260	227	
0	41	278	256	
720	50	279	222	251
371	70	190	166	
147	100	109	326	

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
176	9	* 17	128 129	108	EXT REFS
207	10	* 17	133 144	958	EXT REFS
401	21	* 17	207 221	628	EXT REFS
886	31	* 17	227 250	708	EXT REFS
560	41	* 17	256 278	1408	EXT REFS

STATISTICS

PROGRAM LENGTH 20048 1028

FWA OF THE LOAD 111
LWA+1 OF THE LOAD 33164

TRANSFER ADDRESS -- HELCAT 6515

PROGRAM AND BLOCK ASSIGNMENTS.

BLOCK	ADDRESS	LENGTH	FILE	DATE	PROCSSR	VER LEVEL	HARDWARE	COMMENTS
/INPT/	111	224						
HELCAT	335	7151	LGO	09/22/81	FTN	4.6 439	666X I	OPT=1
PREAD	7526	563	LGO	09/22/81	FTN	4.6 439	666X I	OPT=1
IREAD	10271	1567	LGO	09/22/81	FTN	4.6 439	666X I	OPT=1
PREPRO	12060	221	LGO	09/22/81	FTN	4.6 439	666X I	OPT=1
COST	12301	2004	LGO	09/22/81	FTN	4.6 439	666X I	OPT=1
APV	14305	70	LGO	09/22/81	FTN	4.6 439	666X I	OPT=1
LEARN	14375	100	LGO	09/22/81	FTN	4.6 439	666X I	OPT=1
CHART	14475	710	LGO	09/22/81	FTN	4.6 439	666X I	OPT=1
/LABEL/	15405	77						
DCHART	15504	542	LGO	09/22/81	FTN	4.6 439	666X I	OPT=1
SCHART	16246	461	LGO	09/22/81	FTN	4.6 439	666X I	OPT=1
TPAGE	16727	65	LGO	09/22/81	FTN	4.6 439	666X I	OPT=1
/STP_END/	17014	1						
/FCL_C_/	17015	23						
/BB_IO_/	17040	142						
QENTRY=	17202	0	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		FCL INITILALIZATION ROUTINE.
COMIO=	17202	100	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		COMMON CODED I/O ROUTINES AND CONSTANTS.63-CHA
DECODE=	17302	73	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		FORMATTED READ FROM CORE.
FECMSK=	17375	41	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		INITIALIZE CONSTANTS.
FLTOUT=	17436	311	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		COMMON FLOATING OUTPUT CODE
FORSYS=	17747	693	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		FORTRAN OBJECT LIBRARY UTILITIES.
INCOM=	20552	302	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		COMMON INPUT FORMATTING CODE
INPC=	21054	160	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		FORMATTED READ FORTRAN RECORD.
KODER=	21234	456	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		OUTPUT FORMAT INTERPRETER.
OUTCOM=	21712	154	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		COMMON OUTPUT CODE
REWIND=	22066	41	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		POSITION FILE AT BEGINNING-OF-INFORMATION.
ACOSIN=	22127	71	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		COMPUTE THE INVERSE SINE OR COSINE OF X.
SYS=1ST	22220	62	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		MATH LIBRARY LINK TO ERROR MESSAGE PROCESSOR.
XTOI=	22302	10	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		REAL TO INTEGER EXPONENTIATION.
XTOY=	22312	7	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		REAL TO REAL EXPONENTIATION.
ENCODE=	22321	125	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		FORMATTED WRITE INTO CORE.
EOF	22446	16	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		TEST FOR END OF FILE STATUS.
FLTIN=	22464	156	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		COMMON FLOATING INPUT CONVERTER.
FNTAP=	22642	352	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		CRACK NAMLIST AND FORMAT FOR KODER/KRAKER.
FOPUTL=	23214	16	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		FCL MISC. UTILITIES.
GETFIT=	23232	42	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		LOCATE AN FIT GIVEN A FILE NAME.
KRAKER=	23274	371	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		PROCESS FORMATTED FORTRAN INPUT.
NAMIN=	23665	523	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		NAMELIST INPUT ROUTINE.
OUTC=	24410	175	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		FORMATTED WRITE FORTRAN RECORD.
ALOG	24605	73	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		COMPUTE COMMON AND NATURAL LOGARITHMS. OPT=ALL
EXP	24700	75	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		EXPONENTIAL FUNCTION. E TO POWER x. OPT=ALL.
SYSAID=	24775	1	SL-FORTRAN	01/20/77	COMPASS	3. 3-439		LINK BETWEEN SYS=AID AND INITIALIZATION CODE.
SYS_RM	24776	37	SL-SYSIO	01/13/77	COMPASS	3. 3-439		PROCESS SYSTEM REQUEST.
/CON_RM/	25035	6						

SNL - SECOND GENERATION

4460 FACTORY COSTS

KEY TO ENTRY TYPES

M=RAW MATERIALS
S=SUPPLIES AND CONSUMABLES
B=BUILDING OR FACILITY SIZE
X=TRANSPORTATION REQUIREMENTS

P=PURCHASED MATERIALS
T=TOOLING
A=LAND FOR PRODUCTION FACILITY
Y=SITE-RETAINED CAPITAL

L=DIRECT LABOR HOURS
E=EQUIPMENT
Q=QUANTITY
Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST

TOTAL PURCHASED MATERIALS= 0.00 $/HELIOSTAT
TOTAL RAW MATERIALS= 0.00 $/HELIOSTAT
TOTAL (BASE RATE COST CATEGORY) DIRECT LABOR= 0.0000 HRS/HELIOSTAT
TOTAL CONSUMABLES= 0.00 $/HELIOSTAT
LAND REQUIRED= 0.0000 ACRES
PRODUCTION FACILITY (BASE RATE COST CATEGORY) SIZE= 0. 50 FT
TOTAL EQUIPMENT COST= 0. $
TOTAL TOOLING COST= 0. $
QUANTITY= 0. / YEAR

DEFAULT QUANTITY USED IN PROFIT CENTER CALCULATION
DEFAULT QUANTITIES = 50000.(FACTORY), 5400.(TRANSPORT/SITE)

HELIOSTAT COST MODEL

DETAILED BREAKDOWN

SNL - SECOND GENERATION

4460 - ASSEMBLY/INSTALLATION

FACTORY COSTS

PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE		0.00
DIRECT MATERIALS		0.00
PURCHASED MATERIALS	0.00	
RAW MATERIALS	0.00	
SCRAP	0.00	
DIRECT LABOR		0.00
CONSUMABLES		0.00
INDIRECT COSTS		0.00
MAINTENANCE, PLANT ENGINEERING	0.00	
OTHER INDIRECTS	0.00	
CAPITAL REPLACEMENT ALLOWANCE		0.00
PROPERTY TAX AND INSURANCE		0.00
GENERAL & ADMINISTRATIVE		0.00
INTEREST EXPENSE		0.00
INCOME TAXES		0.00
RETURN TO EQUITY HOLDERS		0.00
OTHER EXPENSES		0.00

COST SUMMARY BY PROFIT CENTER

PROPERTY TAX AND INSURANCE

SML - SECOND GENERATION

PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	TOTALS BY LOCATION
FACTORY	16.61	22.43	0.00	0.00	8.08	0.00	47.12
TRANSPORTATION	0.00	0.00	0.00	0.00	0.00		0.00
SITE			0.00	0.00		0.00	0.00
TOTALS BY COMPONENT	16.61	22.43	0.00	0.00	8.08	0.00	

TOTAL FOR PROPERTY TAX AND INSURANCE 47.12

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C SNL USES 20000./ACRE IMPROVED LAND

B 4420DRIVE ASSEMBLY FACILITIES          2316/94.SQFT
C
E 4420DRIVE ASSEMBLY EQUIPMENT                          19.498E6
C    SOURCE=SNL,INCLUDES TOOLING
T 4420DRIVE ASSEMBLY TOOLING
C    INCLUDED WITH EQUIPMENT
S 4420DRIVE ASSEMBLY SUPPLIES                           70.60
C
Q 4420DRIVE ASSEMBLY QUANTITY/YEAR       50000. 1YR
$ 4420
+1443OSNL 2ND GENERATION HELIOSTAT
P 4430HC                                                 0.0
C SOURCE=NONE
P 4430HFC                                                0.0
C SOURCE=NONE
A 4420CONTROLS LAND                        0.0 ACRE
C SOURCE=NONE
B 4420CONTROLS FACILITIES                  0.0 SQFT
C SOURCE=NONE
E 4420CONTROLS EQUIPMENT                                 0.0
C SOURCE=NONE
S 4420SUPPLIES
Q 4430CONTROLS QUANTITY/YEAR
$
+1444OSNL 2ND GENERATION HELIOSTAT
$ 4440
+1445OSNL 2ND GENERATION HELIOSTAT
M 4450CENTER TORQUE TUBE,100 LB,      100. LBS   0.32     32.00
C SOURCE=SNL, 0.32/LB
L 4450CENTER TORQUE TUBE FABRICATION      0.07HRS
C SOURCE=SNL,0.50 AT 7.50/HR
M 4450D/TOGARD FLANGES(2)                                21.74
C SOURCE=SNL
L 4450D/TOGARD FLANGE FABRICATION          .15HRS
C SOURCE=SNL,1.15 AT 7.50/HR
M 4450ELEVATION ARM ADAPTER RINGS(2)                     21.74
C SOURCE=SNL,MEDALAR IRON
L 4450EL ARM ADPT RINGS FABRICATION        .15HRS
C SOURCE=SNL,1.15 AT 7.50/HR
M 4450ELEVATION ARM ASSY(10 GA STEEL)                    39.44
C SOURCE=SNL,0.136/ INCH
L 4450EL ARM ASSY FABRICATION             0.47HRS
C SOURCE=SNL,3.47 AT 7.50/HR
L 4450CENTER TORQUE TUBE ASSEMBLY LABOR   0.75HRS
C SOURCE=SNL,5.63 AT 7.50/HR, 10% LB
M 4450CONTINGENCY,0.01 X 159.40+1.59                     0.00
C SOURCE=SNL
P 44502-FRAMES,4 EACH,14 SAI.0788(      740. LBS   0.34   253.60
C SOURCE=SNL,SHIPPED DIRECT TO SITE
P 44502-FRAME TRANSPORTATION                            70.00
C SOURCE=SNL, FROM BETHLEHEM STEEL,LACKAWANNA,NY
M 4450STRUTS AND BARS,STRUTS 3% LB,    50. LBS   0.23    11.48
C SOURCE=SNL,BARS    LB, 8 EACH,
C STRUT,2 X 125X63.5
L 4450STRUTS/BARS FABRICATION             0.34HRS
C SOURCE=SNL,2.50 AT 7.50/HR
M 4450ANGLES,24 EACH,2 L 125X19 STEEL     32. LBS   0.24     7.64
C SOURCE=SNL, 2-FRAME STIFFENERS
L 4450ANGLE FABRICATION                   0.1 HRS
C SOURCE=SNL,0.% AT 7.50/HR
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      SUBROUTINE IREAD     74/74   OPT=1                    FTN 4.6+439     09/22/81  12.30.53     PAGE     8

STATEMENT LABELS          DEF LINE   REFERENCES
  253  270                    224        76
  260  280                    230        77
  270  281                    236       232
  334  320                    282       269
  303  330                    267       262       263
  323  335                    277       272       273
  340  340                    284       281
  343  344                    287       285
  353  345                    293       288       289
  361  350                    298       294
  364  355                    302       299
  271  500                    244        62
  373  900    FMT             58        57
  402  901    FMT             60        59
  404  902    FMT             61        65
  433  903    FMT             91        92
  563  904    FMT            115       114
  426  905    FMT             79        70
  612  907    FMT            125       124
  714  909    FMT            160       159       167       209
 1122  911    FMT            245       251
 1134  912    FMT            247       268
 1143  913    FMT            248       270
 1151  914    FMT            249       271
 1163  915    FMT            261       278
 1171  916    FMT            262       282
 1202  917    FMT            254       279
 1210  918    FMT            255       280
 1215  919    FMT            256       283
  752  920    FMT            178       177       191       231
 1023  921    FMT            203       202
  623  922    FMT            137       136       225
  643  923    FMT            140       139
  662  924    FMT            149       148
  770  925    FMT            184       183       196
  676  926    FMT            152       151
  735  927    FMT            170       169
 1265  928    FMT            265       264
 1320  929    FMT            275       274
 1041  930    FMT            215       216
 1062  931    FMT            219       218
 1222  932    FMT            257       288
 1361  933    FMT            290       292
  575  934    FMT            122       123
  453  935    FMT             97        96
  465  936    FMT            100        99
  500  937    FMT            103       102
 1232  938    FMT            258       260
  510  939    FMT            106       105
 1110  940    FMT            234       233
 1403  945    FMT            296       295
 1421  946    FMT            301       300

LOOPS  LABEL     INDEX   FROM-TO   LENGTH   PROPERTIES
   21   10         I       47  48       28   INSTACK
   27   11         I       49  50       28   INSTACK
  276  330     *  I      262 267      108              EXT REFS
```

```
SUBROUTINE APV        74/74   OPT=1                    FTN 4.6+439      09/22/81  12.30.53      PAGE   1

  1                     SUBROUTINE APV( C, LC, L, RATCC, RI, AC)                                  COST     329
                        DIMENSION C(1)                                                            COST     330
                        IF(LC .NE. 1) GO TO 100                                                   COST     331
                  C                                                                               COST     332
  5               C           SIMPLE ANNUALIZING                                                  COST     333
                  C                                                                               COST     334
                        AC = C(1)                                                                 COST     335
                        GO TO 200                                                                 COST     336
                  100   CONTINUE                                                                  COST     337
 10                     AC = 0.                                                                   COST     338
                        DO 10 I=1,L                                                               COST     339
                        AC = AC + C(I) / ((1.+RATCC)**I)                                          COST     340
                  10    CONTINUE                                                                  COST     341
                  200   CONTINUE                                                                  COST     342
 15                     RAT = (1.+RI) / (1.+RATCC)                                                COST     343
                        PVFAC = RAT * (RAT**L - 1.)/(RAT-1.)                                      COST     344
                        AC = AC/PVFAC                                                             COST     345
                        RETURN                                                                    COST     346
                        END                                                                       COST     347


      SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
   3  APV              1          18

VARIABLES    SN  TYPE          RELOCATION
   0  AC          REAL              F.P.      REFS      12        17      DEFINED      1          7         10         12
                                                 17

   0  C           REAL        ARRAY F.P.      REFS       2         7         12      DEFINED      1
  51  I           INTEGER           F.P.      REFS     2+12   DEFINED        11
   0  L           INTEGER           F.P.      REFS      11        16      DEFINED      1
   0  LC          INTEGER           F.P.      REFS       3   DEFINED         1
  53  PVFAC       REAL                        REFS      17   DEFINED        16
  52  RAT         REAL                        REFS    3+16   DEFINED        15
   0  RATCC       REAL              F.P.      REFS      12        15      DEFINED      1
   0  RI          REAL              F.P.      REFS      15   DEFINED         1

STATEMENT LABELS          DEF LINE   REFERENCES
   0  10                      13         11
  21  100                      9          3
  34  200                     14          8

LOOPS  LABEL    INDEX     FROM-TO    LENGTH     PROPERTIES
  24   10       I           11 13       108          EXT REFS

STATISTICS
  PROGRAM LENGTH              708       56
```

```
LOAD MAP - HELCAT                                  CYBER LOADER 1.2-439      09/22/81  12.31.19.      PAGE   2

CIO.RM          25043     40 SL-SYSIO    03/18/77 COMPASS  3. 3-439
/AOB.RM/        25103     10
MOVE.RM         25113     64 SL-SYSIO    03/18/77 COMPASS  3. 3-439
MCT.RM          25177    233 SL-SYSIO    03/18/77 COMPASS  3. 3-439
/.XPS.RM/       25432     11
/REMC.RM/       25443      3
/OPES.FO/       25446      1
/OPEN.FO/       25447      7
OPEN.RM         25456    237 SL-SYSIO    03/18/77 COMPASS  3. 3-439
/TERM.RM/       25715      1
/PUT.FO/        25716      7
PUT.SO          25725   1413 SL-SYSIO    03/18/77 COMPASS  3. 3-439
WAR.SO          27340    260 SL-SYSIO    03/18/77 COMPASS  3. 3-439
/CLSF.FO/       27620      7
CLSF.RM         27627     22 SL-SYSIO    03/18/77 COMPASS  3. 3-439
/GET.RT/        27651      5
BTRY.SO         27656    115 SL-SYSIO    03/18/77 COMPASS  3. 3-439
MEOX.SO         27773    150 SL-SYSIO    03/18/77 COMPASS  3. 3-439
/SKFL.FO/       30143      7
SKFL.SO         30152     51 SL-SYSIO    03/18/77 COMPASS  3. 3-439
ERR.RM          30223    406 SL-SYSIO    03/18/77 COMPASS  3. 3-439
CHAR.SO         30631      7 SL-SYSIO    03/18/77 COMPASS  3. 3-439
OSUB.RM         30640     71 SL-SYSIO    03/18/77 COMPASS  3. 3-439
OPEN.SO         30731    257 SL-SYSIO    03/18/77 COMPASS  3. 3-439
OPEX.SO         31210     14 SL-SYSIO    03/18/77 COMPASS  3. 3-439
/PUT.RT/        31224     11
RLEG.RM         31235     42 SL-SYSIO    03/18/77 COMPASS  3. 3-439
CLSF.SO         31277    134 SL-SYSIO    03/18/77 COMPASS  3. 3-439
/CLSV.FO/       31433      7
CLSV.SO         31442    137 SL-SYSIO    03/18/77 COMPASS  3. 3-439
/REM.FO/        31601      7
REM.SO          31610     42 SL-SYSIO    03/18/77 COMPASS  3. 3-439
/GET.FO/        31652      7
/RPAR.XX/       31661      1
/GET.RT/        31662     11
GET.SO          31673   1062 SL-SYSIO    03/18/77 COMPASS  3. 3-439
Z.SO            32755    101 SL-SYSIO    03/18/77 COMPASS  3. 3-439
FSU.SO          33056    106 SL-SYSIO    03/18/77 COMPASS  3. 3-439


   .909 CP SECONDS              467008 CM STORAGE USED                    60 TABLE MOVES
```

SNL 2ND GENERATION HELIOSTAT

4410 TRANSPORTATION COSTS

KEY TO ENTRY TYPES

M=RAW MATERIALS
S=SUPPLIES AND CONSUMABLES
B=BUILDING OR FACILITY SIZE
X=TRANSPORTATION REQUIREMENTS

P=PURCHASED MATERIALS
T=TOOLING
A=LAND FOR PRODUCTION FACILITY
Y=SITE-RETAINED CAPITAL

L=DIRECT LABOR HOURS
E=EQUIPMENT
Q=QUANTITY
Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST

ENTRY TYPE=S 4410 MIRROR MODULE CUSTOM RACKS 0.00 / HELIOSTAT
SOURCE- NONE IDENTIFIED

ENTRY TYPE=X 4410 MIRROR MODULES TRANSPORT TO SITE .7500E-01 TRUCKLOADS
SPECIAL TRANSPORTATION COST CATEGORY 1
SOURCE-SNL ,46.00 TOTAL

TOTAL PURCHASED MATERIALS= 0.00 $/HELIOSTAT
TOTAL RAW MATERIALS= 0.00 $/HELIOSTAT
TOTAL (BASE RATE COST CATEGORY) DIRECT LABOR= 0.0000 HRS/HELIOSTAT
TOTAL CONSUMABLES= 0.00 $/HELIOSTAT
WEIGHTED EQUIPMENT COST= 0. $ TIMES YEARS USED / SITE
QUANTITY= 0. / SITE
SPECIAL TRANSPORTATION COST CATEGORY 1 = .075 TRUCKLOADS
INPUT (NOT COMPUTED) TRANSPORTATION COST 48.75 $

DEFAULT QUANTITY USED IN PROFIT CENTER CALCULATION
DEFAULT QUANTITIES = 50000.(FACTORY), 5400.(TRANSPORT/SITE)

HELIOSTAT COST MODEL

DETAILED BREAKDOWN

SNL - SECOND GENERATION

4410 - REFLECTIVE ASSEMBLY

TRANSPORTATION COSTS

PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE		48.75
DIRECT MATERIALS		0.00
PURCHASED MATERIALS	0.00	
RAW MATERIALS	0.00	
SCRAP	0.00	
DIRECT LABOR		0.00
CONSUMABLES		0.00
INDIRECT COSTS		0.00
MAINTENANCE, PLANT ENGINEERING	0.00	
OTHER INDIRECTS	0.00	
CAPITAL REPLACEMENT ALLOWANCE		0.00
PROPERTY TAX AND INSURANCE		0.00
GENERAL & ADMINISTRATIVE		0.00
INTEREST EXPENSE		0.00
INCOME TAXES		0.00
RETURN TO EQUITY HOLDERS		0.00
OTHER EXPENSES		48.75
TRANSPORTATION CHARGES	48.75	

COST SUMMARY BY PROFIT CENTER

GENERAL & ADMINISTRATIVE

SNL - SECOND GENERATION

PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	TOTALS BY LOCATION
FACTORY	125.33	140.50	0.00	0.00	56.79	0.00	322.62
TRANSPORTATION	0.00	0.00	0.00	0.00	0.00		0.00
SITE			0.00	0.00		0.00	0.00
TOTALS BY COMPONENT	125.33	140.50	0.00	0.00	56.79	0.00	

TOTAL FOR GENERAL & ADMINISTRATIVE 322.62

```
M 4450TORQUE TUBES,OUTBOARD(2)            176.  LBS     0.32   55.88


C SOURCE-SNL,16. OD X .105 WALL X60 IN
L 4450TORQUE TUBE OUTBD FABRICATION        0.11HRS
C SOURCE-SNL,0.86 AT 7.50/HR
M 4450OUTBOARD FLANGES(2)                                21.74
C SOURCE-SNL
L 4450OUTBOARD FLANGE FABRICATION          0.21HRS
C SOURCE-SNL,1.58 AT 7.50/HR
M 4450INBOARD FLANGES(2)                                 21.74
C SOURCE-SNL
L 4450INBOARD FLANGE FABRICATION           0.15HRS
C SOURCE-SNL,1.15 AT 7.50/HR
L 4450TORQUE TUBE OUTBD ASSEMBLY LABOR      .10HRS
C SOURCE-SNL,0.75 AT 7.50/HR (2 EACH)
M 4450SUPPORT STRUCTURE PROFIT                              0.0
C SOURCE-SNL,0.032 X 683.38= 21.87
M 4450FRAME ASSY CONTINGENCY                                0.0
C SOURCE-SNL,0.03 X 523.98=15.72
A 4450SUPPORT STRUCTURE LAND               11.6 ACRE
C SOURCE-
B 4450SUPPORT STRUCTURE FACILITIES       .0929E6SQFT
C SOURCE-
E 4450SUPPORT STRUCTURE EQUIPMENT                        2.5015E6
C SOURCE-SNL TABLE B-1
E 4450PRODUCTION SUPPORT EQUIPMENT                       2.0063E6
C SOURCE-SNL TABLE B-1
T 4450 SUPPORT STRUCTURE TOOLING                         931000.
C SOURCE-SNL TABLE B-1
S 4450
Q C450SUPPORT STRUCTURE QUANTITY/YEAR    50000. /YR
$
*14460 SNL  - SECOND GENERATION
$
*24410SNL  2ND GENERATION HELIOSTAT
S 4410MIRROR MODULE CUSTOM RACKS                            0.0
C SOURCE- NONE IDENTIFIED
X14410MIRROR MODULES TRANSPORT TO SITE    0.079TKLD
C SOURCE-SNL ,46.00 TOTAL
$
*24420SNL  2ND GENERATION HELIOSTAT
S 4420DRIVE ASSEMBLY CUSTOM RACK                            0.0
C SOURCE- NONE IDENTIFIED
X14420DRIVE ASSEMBLY TRANSPORT TO SITE   0.0345TKLD
C SOURCE-SNL ,17.00 TOTAL
$
*24430SNL  2ND GENERATION HELIOSTAT
$
*24440SNL  2ND GENERATION HELIOSTAT
S 4440FOUND/PED CUSTOM RACK                                 0.0
C SOURCE- NONE IDENTIFIED
X14440FOUND/PED TRANSPORT TO SITE        0.0385TKLD
C SOURCE-SNL ,23.00 TOTAL
$
*24450SNL  2ND GENERATION HELIOSTAT
S 4450SUPPORT STRUCTURE CUSTOM RACK                         0.0
C SOURCE- NONE IDENTIFIED
X14450SUPPORT STRUCTURE XPORT TO SITE    0.0538TKLD
C SOURCE-SNL ,33.00 TOTAL
$
C SOURCE=MFN, $250,000/FIELD ASSUMED
L Q430HAC ASSEMBLY                         0.11HRS
```

```
      SUBROUTINE IREAD       74/74   OPT=1                         FTN 4.6+439        09/22/81  12.30.53       PAGE     9

LOOPS  LABEL    INDEX      FROM-TO    LENGTH    PROPERTIES
  316  335     * I         272 277      10B               EXT REFS
  344  345     * I         288 293      12B               EXT REFS

STATISTICS
  PROGRAM LENGTH              1567B     887
```

```
      SUBROUTINE LEARN      74/74    OPT=1                    FTN 4.6+439        09/22/81  12.30.53        PAGE     1

                    SUBROUTINE LEARN( DM, DL, Q, QL, CRC, ISTAT, DML, DLL)             COST     348
                    DIMENSION ISTAT(1), QL(2,2), CRC(2,2)                              COST     349
              C                                                                        COST     350
              C          PICK OUT NECESSARY STATUS PARAMETERS                          COST     351
              C                                                                        COST     352
                    ITYP = ISTAT(7)                                                    COST     353
                    NYR = ISTAT(9)                                                     COST     354
              C                                                                        COST     355
              C          CALCULATE CUMULATIVE PRODUCTION                               COST     356
              C                                                                        COST     357
                    QCUM = FLOAT(NYR) * Q                                              COST     358
                    IF(ITYP .EQ. 1)IS=1                                                COST     359
                    IF(ITYP .NE. 1)IS=2                                                COST     360
                    QLM = QL(1,IS)                                                     COST     361
                    QLL = QL(2,IS)                                                     COST     362
                    CRCM = CRC(1,IS)                                                   COST     363
                    CRCL = CRC(2,IS)                                                   COST     364
                    IF(QCUM .LE. QLM) FRCM = 1.                                        COST     365
                    IF(QCUM .GT. QLM) FRCM = CRCM**(ALOG(QCUM/QLM)/ALOG(2.))           COST     366
                    IF(QCUM .LE. QLL) FRCL = 1.                                        COST     367
                    IF(QCUM .GT. QLL) FRCL = CRCL**(ALOG(QCUM/QLL)/ALOG(2.))           COST     368
                    DML = DM * FRCM                                                    COST     369
                    DLL = DL * FRCL                                                    COST     370
                    RETURN                                                             COST     371
                    END                                                                COST     372


      SYMBOLIC REFERENCE MAP (R=3)

  ENTRY POINTS      DEF LINE      REFERENCES
     3 LEARN            1            24

  VARIABLES     SN  TYPE              RELOCATION
      0 CRC         REAL       ARRAY      F.P.        REFS        2       16       17     DEFINED       1
     75 CRCL        REAL                              REFS       21   DEFINED     17
     74 CRCM        REAL                              REFS       19   DEFINED     16
      0 DL          REAL                  F.P.        REFS       23   DEFINED      1
      0 DLL         REAL                  F.P.     DEFINED        1       23
      0 DM          REAL                  F.P.        REFS       22   DEFINED      1
      0 DML         REAL                  F.P.     DEFINED        1       22
     77 FRCL        REAL                              REFS       23   DEFINED     20       21
     76 FRCM        REAL                              REFS       22   DEFINED     18       19
     71 IS          INTEGER                           REFS       14       15       16       17    DEFINED      12      13
      0 ISTAT       INTEGER    ARRAY      F.P.        REFS        2        6        7     DEFINED       1
     66 ITYP        INTEGER                           REFS       12       13   DEFINED       6
     67 NYR         INTEGER                           REFS       11   DEFINED      7
      0 Q           REAL                  F.P.        REFS       11   DEFINED      1
     70 QCUM        REAL                              REFS       18     2*19       20     2*21    DEFINED      11
      0 QL          REAL       ARRAY      F.P.        REFS        2       14       15     DEFINED       1
     73 QLL         REAL                              REFS       20     2*21   DEFINED     15
     72 QLM         REAL                              REFS       18     2*19   DEFINED     14
```

H E L C A T

A HELIOSTAT COST ANALYSIS TOOL

VERSION 1.0

EDITION DATE AUGUST 13, 1981

REVISION SEPTEMBER 22, 1981

SNL 2ND GENERATION HELIOSTAT

4420 TRANSPORTATION COSTS

KEY TO ENTRY TYPES

M=RAW MATERIALS
S=SUPPLIES AND CONSUMABLES
B=BUILDING OR FACILITY SIZE
X=TRANSPORTATION REQUIREMENTS

P=PURCHASED MATERIALS
T=TOOLING
A=LAND FOR PRODUCTION FACILITY
Y=SITE-RETAINED CAPITAL

L=DIRECT LABOR HOURS
E=EQUIPMENT
Q=QUANTITY
Z=SUBCONTRACTS AND FLOW-THROUGH EXPENSES

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
ENTRY TYPE=S 4420 DRIVE ASSEMBLY CUSTOM RACK				0.00 / HELIOSTAT
SOURCE- NONE IDENTIFIED				
ENTRY TYPE=X 4420 DRIVE ASSEMBLY TRANSPORT TO SITE	.3450E-01	TRUCKLOADS		
SPECIAL TRANSPORTATION COST CATEGORY 1				
SOURCE=SNL ,17.00 TOTAL				

TOTAL PURCHASED MATERIALS= 0.00 $/HELIOSTAT
TOTAL RAW MATERIALS= 0.00 $/HELIOSTAT
TOTAL (BASE RATE COST CATEGORY) DIRECT LABOR= 0.0000 HRS/HELIOSTAT
TOTAL CONSUMABLES= 0.00 $/HELIOSTAT
WEIGHTED EQUIPMENT COST= 0. $ TIMES YEARS USED / SITE
QUANTITY= 0 / SITE
SPECIAL TRANSPORTATION COST CATEGORY 1 = .035 TRUCKLOADS
INPUT (NOT COMPUTED) TRANSPORTATION COST 22.43 $

DEFAULT QUANTITY USED IN PROFIT CENTER CALCULATION
DEFAULT QUANTITIES = 50000.(FACTORY), 5400.(TRANSPORT/SITE)

HELIOSTAT COST MODEL
DETAILED BREAKDOWN
SNL - SECOND GENERATION
4420 - DRIVES
TRANSPORTATION COSTS
PRODUCTION YEAR 1

TOTAL REQUIRED REVENUE		22.43
DIRECT MATERIALS		0.00
PURCHASED MATERIALS	0.00	
RAW MATERIALS	0.00	
SCRAP	0.00	
DIRECT LABOR		0.00
CONSUMABLES		0.00
INDIRECT COSTS		0.00
MAINTENANCE, PLANT ENGINEERING	0.00	
OTHER INDIRECTS	0.00	
CAPITAL REPLACEMENT ALLOWANCE		0.00
PROPERTY TAX AND INSURANCE		0.00
GENERAL & ADMINISTRATIVE		0.00
INTEREST EXPENSE		0.00
INCOME TAXES		0.00
RETURN TO EQUITY HOLDERS		0.00
OTHER EXPENSES		22.43
TRANSPORTATION CHARGES	22.43	

COST SUMMARY BY PROFIT CENTER

INTEREST EXPENSE

SNL - SECOND GENERATION

PRODUCTION YEAR 1

	4410	4420	4430	4440	4450	4460	TOTALS BY LOCATION
FACTORY	8.47	11.44	0.00	0.00	4.12	0.00	24.03
TRANSPORTATION	0.00	0.00	0.00	0.00	0.00		0.00
SITE			0.00	0.00		0.00	0.00
TOTALS BY COMPONENT	8.47	11.44	0.00	0.00	4.12	0.00	

TOTAL FOR INTEREST EXPENSE 24.03