AESC

SPACE STATION THERMAL CONTROL SURFACES

C. R. Maag
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FINAL REPORT

PREPARED FOR NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MARSHALL SPACE FLIGHT CENTER, ALABAMA 35812

CONTRACT NAS 8-32637

Report 5836 April 1979

AEROJET ELECTROSYSTEMS COMPANY

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FOREWORD

This report describes results of an eighteen-month study on Contract NAS 8-32637, "Space Station Thermal Control Surfaces." The contract was initiated on 4 August 1977 to assess the deficiencies between the state of the art in thermal-control surface technology and that which would be required for both a 25-kW power module and a 25-year-mission space station.

This report covers the period of 4 August 1977 to 21 February 1979. The literature search and survey portion of this study are contained in Volume II of AESC Report 5666 which was submitted as part of an Interim Report in March 1978.

This study was performed by personnel of Aerojet ElectroSystems Company, for the Space Sciences Laboratory of NASA-Marshall Flight Center.

Study Manager for the program was Carl R. Maag. Principal contributors to the program were C. R. Maag, J. M. Millard, M. T. Grenier, J. A. Jeffery and R. R. Scott. The NASA technical monitor for the study is Mr. Donald Wilkes. Mr. Raoul Lopez acted as technical advisor for the 25-kW power module. Both Messrs. Wilkes and Lopez made significant contributions to the study through enlightening discussions with the author. Their interest and assistance are greatly appreciated.

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Section 1

INTRODUCTION AND PROGRAM DESCRIPTION

1.1 INTRODUCTION

The U.S. space program goals for long-duration manned missions place particular demands on thermal-control systems. NASA's plans for space stations in low earth orbit (LEO) and geosynchronous earth orbit (GEO) will require performance from these systems far beyond their presently proven capabilities. These systems will be used in the integral and staging support of such important missions as space power generation, space industrialization, solar systems explorations, search for extraterrestrial intelligence, and global service systems operations. The importance of these efforts points up the need for assuring that the thermal-control technology will be available when the design of these stations is maturing.

NASA plans for a space power module to be operational in the 1980s. In order to provide energy for functions such as life support, space manufacturing, experimentation, and communications, as well as power transmission to other space vehicles and stations, this first-generation space power station would have to rely upon existing technology to meet schedule restraints. Operation would be relatively simple, with a solar array (perhaps in the 20 to 100 kW class) providing energy as electricity directly, or in stored form available through docking. Operations would be in LEO, and might involve a fleet of power platforms. Fixed, oversized radiators would probably be used for thermal control on these stations.

In the 1990s, advanced space power stations in the 100s of kilowatts range could be realized. Power-generation systems in these stations would probably include very large solar arrays, or, possibly, solar thermal techniques with rotating machinery using the Brayton cycle. The thermal-control systems might be implemented with radiators having long-life coatings or panels that could be easily replaced when required. Toward the end of the century, as more long-term (25 years) habitats become feasible, thermal-control technology will have to make corresponding advancements.

1.2 PROGRAM DESCRIPTION

1.2.1 Objectives

This study program will develop plans which are based on the present thermal-control technology, and which will assure that this vital field keeps pace with the other space program elements. The plans provide for the development, as they are required, of thermal-control surfaces meeting the full range of expected environments. Good systems management and funding constraints, however, dictate that the number of different future thermal-control systems be kept to a minimum. This goal can be accomplished if the plans promote commonality between systems, and flexibility to accommodate variations in payload design. The approach undertaken to meet the objectives was to perform three technical tasks: requirements analysis, technology assessment, and program planning.

1.2.2 Program Tasks

a. Task 1 -- Requirements Analysis

This task has three objectives: (1) to define the thermal-control-surface requirements for both space station and 25-kW power module, (2) to analyze the missions, and (3) to determine the thermal-control-surface technology needed to satisfy both sets of requirements.

Utilizing mission planning documents, the radiator design and thermal-control-surface requirements will be analyzed, taking into consideration parameters such as thermal-coating degradation, vehicle attitude, self eclipsing, variation in solar constant, albedo, and earth emission. After determining the requirements for realistic environmental control, a technology roadmap will be developed which satisfies these requirements.

b. <u>Task 2 — Technology Assessment</u>

This task also has three objectives: (1) to perform a literature/industry survey on thermal-control surfaces, (2) to compare current technology with the requirements developed in Task 1, and (3) to determine what technology advancements are required for both the space station and the 25-kW power module.

Both a literature search and an industry survey will be conducted. The literature search will include a comprehensive review of the relevant literature published after 1 January 1964, and will be conducted using the most up-to-date techniques. The literature search will be for material identifying and defining thermal-coatings research and development, contamination control, and in-orbit servicing under a space environment. Primary concentration will be on programs proposed for NASA missions, although, as time permits, the experiences of other Federal Government Agencies (in particular the Department of Defense) will be added for completeness.

To supplement the search, an industry survey will be conducted using two modes of data collection: (1) direct telephone contact, and (2) personal visits. The following sources of information will be contacted: (1) NASA centers, (2) principal investigators, (3) members of the academic and scientific community who have been major contributors and advisors on past NASA programs, and (4) other scientific and aerospace companies whose major business is supplying state-of-the-art thermal-control surfaces for spaceborne NASA missions. Within budget and schedule limits, decision makers at key installations in the Department of Defense will also be contacted to broaden the survey base and make it as comprehensive as possible.

In addition, the current state-of-the-art technologies of passive thermal-control surfaces will be compared to determine what additional technologies are required for the space station and (as a first priority) the 25-kW power module.

c. <u>Task 3 -- Degradation Analysis</u>

This task also has three objectives: (a) to perform a detailed degradation analysis of the 25-kW power module, (b) to analyze the effects of the natural space environment on the 25-kW power module thermal control surfaces, and (c) to investigate the usefulness of the 25-kW power module thermal control surfaces.

Utilizing the preliminary design and present mission parameters, a detailed contamination analysis of the 25-kW power module will be performed. This shall include self-contamination, and interaction with the shuttle and its payloads, including all docking maneuvers. After determining the degradation due to contamination, an analysis of the subsequent effects of the natural space environment will be conducted. Candidate thermal control surfaces for the 25-kW power module will also be investigated as to their stability, contamination susceptibility, ease of application, maintainability, and suitability.

d. <u>Task 4 -- Program Planning</u>

Advanced development plans will be formulated that define new initiatives and/or program augmentations for development and testing areas required to provide the proper environmental control for the space station and the 25-kW power module.

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Section 2

DETAILED FINAL REPORT

2.1 REQUIREMENTS ANALYSIS

The analysis portion of this study has dealt with analysis of surface materials in defining, sizing, and evaluating active, thermal-control radiator systems for space stations in the low earth orbit (LEO) and geosynchronous (GEO) environments. This includes evaluation of their degraded performance with time and end-of-life (EOL) thermal considerations. The study has been multiphase in nature, following general proposed program directions and specific directives reached as a result of discussions with project office technical personnel and technical interchange meetings.

Initially, this study has resulted in a definition of heat-rejection requirements, geometry, orbital constraints, potential degradation effects, and environmental considerations. In addition, four computer programs have been developed which provide preliminary design and evaluation tools for active radiator systems in LEO and GEO. Two programs were developed as a general program for space station analysis. The other two programs were specifically tailored to provide an analysis tool for the 25-kW power module. The power module programs have been subsequently used in degradation (EOL) and radiator sizing analyses for the module.

This report will present the results of the study including general conclusions regarding space station active thermal-control radiator system environments and constraints, details of the computer programs developed including operation and listing, and the results of computer analyses performed.

2.1.1 Analysis

In the beginning of the study it was necessary to find a set of constraints to work within with respect to thermal orbital considerations such as dissipative heat loads, orientations, altitudes, inclinations, radiator geometry, degradation, and fluid systems. This would allow a meaningful direction to be taken with respect to actual radiator analysis. Researching References 1 through 6 provided the necessary insight to develop a general definition of thermal constraints and ranges on pertinent parameters. This would allow a realistic approach to analysis of space station active radiator requirements and environment. Before discussing these considerations, it should be noted that these initial findings provided the basis for the decision to develop analytical tools such as computer programs instead of conducting a general study of parameters affecting radiator design. Because of the number and range of parameters involved, such a study would be enormous. Insufficient detail would be provided for many parameters, making the results of little probable practical use. Rigorous computer programs, however, could provide sufficient meaningful detail in any area of interest and would be of great practical use as an analytical tool.

2.1.2 Definition of Thermal Orbital Considerations

Based upon the researching of space station thermal-design considerations from previous studies, and AESC's experience in passive radiator design, it was felt that a set of general, active-radiator design constraints should be adopted, recommended, and utilized in development of the LEO and GEO computer programs. Constraints or parameter ranges have been specified with respect to fluid control systems, altitude, orbit inclination, geometry, orientation, dissipative loads, and degradation. All constraints or ranges discussed below have been incorporated into the computer programs.

The fluid-control system chosen for both the LEO and GEO general space station and power module programs is the bypass type used on the Space Transportation System (STS) and 25-kW power module (References 5 and 6). There are sufficient advantages to such a system, from a functional point of view, to merit its use as a general system approach to the flow problem. Figure 2-1 (Reference 7) presents a schematic of such a flow system.

Temperature control of the coolant is accomplished by simple bypass of the radiators. A flow-control valve diverts some of the hot flow from the

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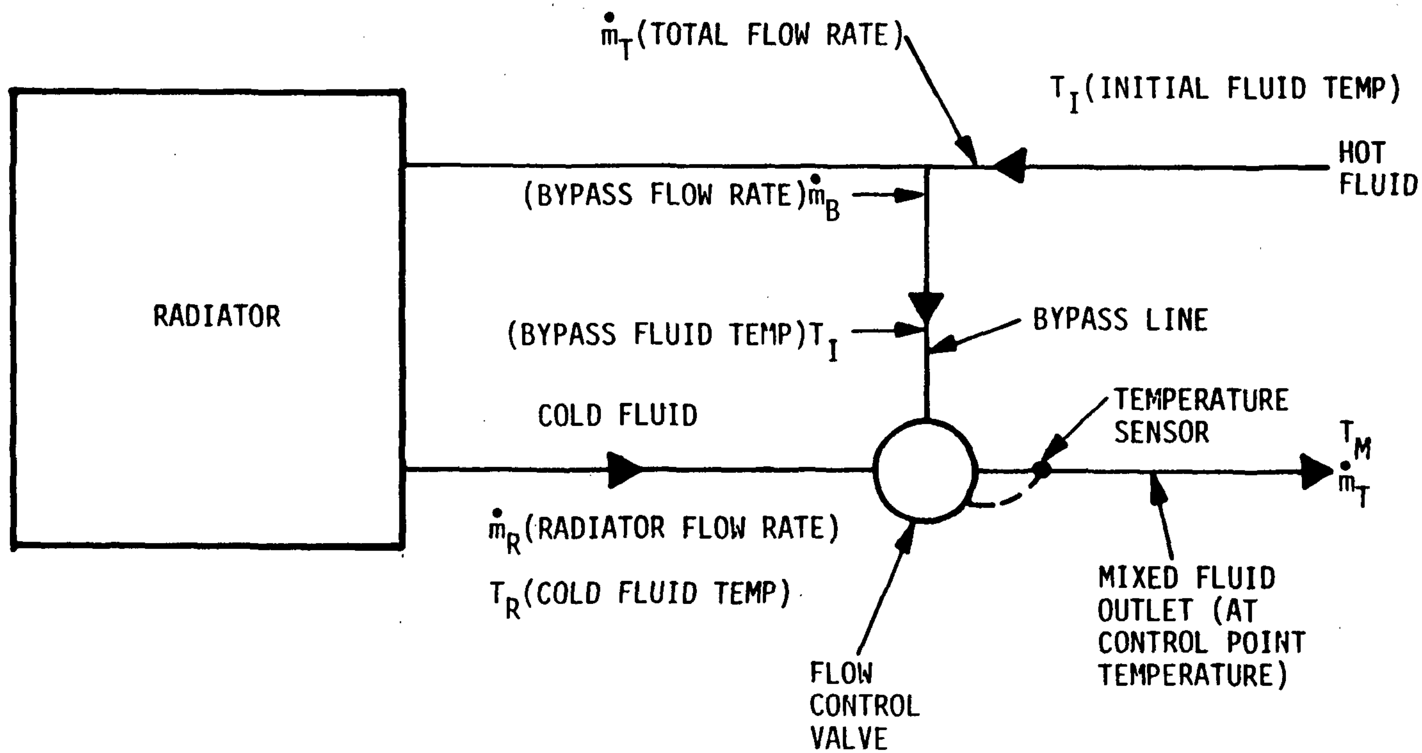

FIGURE 2-1 RADIATOR TEMPERATURE CONTROL SYSTEM

system to mix with cold flow returned from the radiators. The temperature of the mixed flow is monitored by an electronic controller which commands the valve to regulate the flow to maintain the desired mix temperature. Mathematically, the control concept is by conservation of mass and energy:

$$\dot{m}_T h_M = \dot{m}_R h_R + \dot{m}_B h_B \tag{1}$$

$$\dot{m}_T = \dot{m}_R + \dot{m}_B \tag{2}$$

$$h = \int Cp \; dT \tag{3}$$

Assuming Cp is a constant over the temperature range considered, the following relationship holds:

$$T_M = \frac{\dot{m}_R T_R + \dot{m}_B T_I}{\dot{m}_T} \tag{4}$$

where

T_I = initial hot-fluid temperature

T_R = radiator-outlet temperature

T_M = mixed-outlet temperature

$\dot{m}_R$ = radiator mass flow rate

$\dot{m}_B$ = bypass mass flow rate

$\dot{m}_T$ = total mass flow rate

h = fluid enthalpy

Cp = fluid specific heat

This type of system allows a T_M to be chosen and maintained to ensure there is no potential danger to the system by a varying outlet temperature. Also, the pump may be selected for a single operating speed, allowing it to operate with maximum efficiency at design speed. Choosing a T_M and T_I based upon environmental constraints, and knowing the required heat load to dissipate, the total mass flow rate can be determined for preliminary design from the expression:

$$\dot{m}_T = D/C_p(T_I - T_M)$$

where

D = total heat load to be dissipated from fluid by radiator.

Such a system can operate and maintain a given T_M until radiator heat loads are such that the radiator outlet fluid temperature rises above the T_M value, thus stressing the importance on the degradation of solar absorptance (α_s) on radiator life.

LEO constraints on altitude and orbit inclination (beta angle) cannot be applied because of the variety of primary mission orbits considered for various tasks. All beta angles (β) between 0 and $\pm$ 90 degrees must be considered and the limit on altitude is only restricted to LEO conditions. It was decided to consider altitudes between 100 and 1000 nautical miles. Although most planned mission orbits are between 200 and 300 nautical miles, some possible missions range to higher altitudes. This makes 1000 nautical miles a safe upper limit for possible missions and for LEO limitations, allowing use of mean orbital heat-load shape factors for external heat-load calculations.

The assumption made for LEO conditions is that mean orbital temperatures computed from mean orbital heat loads are representative of entire orbital temperatures because of the short orbital periods involved. This assumption would not be valid at synchronous altitude where orbital periods are far longer. Thus, assuming LEO conditions, steady-state solutions can be obtained.

The angle β refers to the inclination of the orbital plane from the solar vector. This angle should not be confused by the term "inclination," which usually refers to the inclined angle of the orbit with respect to the equator. The angle β will be used in this report as it relates most directly to solar external heat loads.

GEO constraints on altitude and beta angle are, of course, restricted to the geosynchronous orbit. The altitude is therefore a constant and a value of 19,370 nautical miles has been used in this report. The beta angle for such an orbit will vary only between $\pm$ 23.5^{o}, sweeping through a complete cycle once a year.

For GEO conditions complete orbital solutions must be found. Due to the large orbit period involved, mean orbital solutions for temperatures and flow rates are not indicative of total orbit behavior. In order to simplify the procedure for finding a complete orbital solution it has been assumed the radiators have no thermal capacitance. This is a good assumption for long orbit periods as efficient radiators by nature are low thermal capacitance devices designed to reject heat rather than store it. Such an assumption allows a solution to be found at any position in orbit by a steady-state technique, thus greatly simplifying the solution process. If a transient solution were used capacitance values would have to be assumed and a lumped parameter nodal model created. This would not only prevent generalization but would greatly increase computer cost and limit analyses which could be conducted in an expedient fashion. While this is the proper approach for a final design effort, the zero capacitance assumption allows for the generalization, versatility and quick computer response needed for preliminary design.

In both the LEO and GEO space environment, use must be made of all required and available area which is thermally favorable for radiators. If area is available on module surfaces for radiators, it should be used. In space station studies, extended-platform double-sided radiators are used for modules which do not have available surface area, or where the area is insufficient. When module area is sufficient to attach a radiator, one-sided wrap-around radiators are used for additional dissipation requirements (Reference 1). Thus, when station construction begins with just a power module, for example, extended radiators are used. When inhabited modules are added, additional dissipation is controlled by wrap-around radiators using the available module area.

From studies, it appears that this change from extended to wrap-around radiators may not occur until up to approximately 35 kW need to be dissipated. This "break point" in radiator design has been made a variable in the LEO and GEO general space station computer programs, but such high heat-load capabilities may be needed from extended radiators in space. Studies indicate total dissipative heat loads may exceed 100 kW for space power generating stations. Thus, radiator systems composed of extended and wrap-around radiators must be able to accommodate such total dissipative loads.

All such active radiator systems must be designed to handle not only required dissipative loads but also external heat loads. Under LEO conditions, earthshine (earth radiation) and albedo (solar flux reflected off the earth) must be considered in addition to direct solar input. All three of these external heat inputs are orbit and orientation dependent. Under LEO conditions, earthshine and albedo can be the dominant external heat inputs. Being dependent upon the radiator's view of the earth, care must be taken to orient radiators to minimize these inputs whenever possible. Orientations for radiators can often be used which minimize all three external heat inputs, or at least minimize earthshine and albedo without severely increasing direct solar inputs. Minimizing the combination of earthshine and albedo should be given equal weight under LEO conditions, with direct solar input if necessary, because of the relative magnitudes attainable at low altitudes. As an example, a flat, extendable radiator which looks directly at the earth in LEO conditions may not be able to operate properly within any realistic environmental temperature ranges because of earthshine input alone. Studies (References 5 and 6) conducted on the 25 kW power module have resulted in such conclusions already.

Generally in the GEO environment direct solar external heat loads dominate over the combined influence of earthshine and albedo due to the altitude of the orbit. For many applications both earthshine and albedo can be neglected for GEO considerations. The GEO computer programs presented in this report consider earthshine and albedo in order to provide a more accurate solution; however, their role is minor and direct solar provides the GEO dominant external heat load.

For both LEO and GEO orienting extendable flat radiators in the orbital plane tends to minimize all three external inputs at moderate β angles and provides minimal earthshine and albedo for all β angles. Orienting cylindrical wrap-around radiators with the axis pointing toward the earth minimizes albedo and earthshine, while not accentuating direct solar input and provides a minimal solar input for a realistic orientation for moderate β angles. It is recommended that these orientations be used as capable and realistic optimal radiator orientations for all β angles in the LEO environment, as the main consideration in LEO is to minimize albedo and earthshine as much as direct solar external heat inputs. These orientations are recommended for GEO also as they tend to minimize direct solar input for moderate β angles (below $\pm 45^{\circ}$) which include GEO maximum values of $\pm 23.5^{\circ}$. The optimum orientation is a solar inertial one at high β values but is unacceptable for attitude control reasons.

These orientations have been incorporated into the LEO computer programs while external heat flux tables defining orientation must be input to the GEO programs. This distinction has been made due to the nature of the shading problem. In LEO mean orbital shading coefficients are sufficient as inputs while for GEO shading must be a function of orbit position and therefore must be included in tabular form (combined in external heat flux tables as a convenient method).

The degradation of radiator surfaces because of radiation damage and potential contamination is of prime importance in radiator design. Degradation of a surface causes an increase in α_s with time while essentially leaving the emittance (ϵ) a constant. Thus, direct solar and albedo external heat inputs increase with time causing an ever increasing total heat load for the radiator to accommodate. As this process continues, an ever-increasing percentage of coolant flow is diverted through the radiator in order to maintain the mix temperature. Once the external loads have increased to where the radiator has the total coolant flow through it, further degradation will cause a failure of the system to maintain the proper mix temperature. This point in time represents the end-of-life (EOL) condition, and the absorptance value associated with it determines the amount of degradation a radiator can withstand. The EOL limit on α_s which a radiator can accommodate depends largely on orientation and radiator area. The time on orbit to arrive at an EOL α_s value depends on the rate of degradation (change in absorptance per month).

It is clear that for the LEO environment this EOL condition represents final EOL, as the mix temperature cannot be maintained virtually throughout the orbit due to the short orbit period. While the same EOL condition has been applied to GEO also, for large orbit periods it should be understood that it may represent only a small portion of the orbit at first. As the degradation continues, the portion of the orbit that would be "out of spec" will increase with time. Therefore, it may be necessary to cut back on dissipation and total flow rate over portions of the GEO orbit in order to maintain the mix temperature with the bypass closed and fluid flowing through the radiator exiting at the mix value. Thus, while EOL is comprehensive in the LEO case due to short orbit periods, it may only include part of the GEO orbit initially but will continue to increase with time.

Another consideration which must be taken into account is an upper limit α_s for which infinite radiator area is required to provide "in spec" cooling because of the high heat fluxes incident. This value is largely dependent upon the thermal requirements of the coolant loop and the orientation of the radiators; the external heat fluxes are largely a function of orientation. This value provides an upper limit to the EOL α_s acceptable for many orientations (α_s for infinite area may be 1.0 for some orientation, β combinations).

An EOL α_s value is the key parameter in radiator design as it determines the life of a radiator system and platform area required. The larger the EOL α_s, the larger the radiator required and the longer it will last.

If the desired EOL α_s value turns out to be larger than the α_s value for infinite area, either the orientation must be changed or the task of refurbishing the radiator surface materials on-orbit must be considered.

The most difficult part of determining EOL is determining the rate of degradation. It is straightforward to determine an EOL α_s, but to determine EOL itself is dependent on the rate of degradation. Rates of α_s degradation may vary from 0.0015 (Reference 9) to over 0.01 $\Delta\alpha_s$/month (considered a safe upper limit value) depending on material, exposure to the space radiation environment and volatile condensible material (VCM) contaminants. Contamination is a major contributor to surface degradation.

Coarse estimates on rates of degradation, based upon low-contamination long-term satellite flight experience (Reference 9), can be made if no engine firings occur within the vicinity of the space station. However, a station which is STS tended adds to the analysis complexity by major contamination exposure caused by thruster plumes from the engines. These plumes can easily engulf a large space station. The best way to handle such a problem is to perform a complete contamination analysis on a space station. Such an analysis determines the contributing contaminants and computes their mass deposition rates on all station surfaces as a function of time, taking into account surface source emission, surface re-emission, and thruster plume and vent emission (Reference 11). These mass deposition rates must then be correlated with changes in α_s to determine rates of degradation on surfaces, particularly on radiators.

One of the functions of all the computer programs presented is to provide a solution to the radiator-flow problem as a function of degradation. Changes in radiator and flow performance are computed as a function of time after launch, allowing EOL α_s values to be determined and EOL as a function of degradation rate. Values for α_s for infinite radiator area are also presented and checked against EOL α_s by the programs.

With the above definition of thermal parameters, two general space station computer programs were developed (LEO and GEO) to be used as a design tool for the preliminary design of active thermal-control radiators. In addition to this, two additional programs, similar in nature to the general programs, were developed especially for the 25-kW power module to be used as a preliminary design and evaluation tool for its radiator system. These programs will be presented and discussed in detail later in this report. Using the 25-kW power module programs, studies have been conducted to evaluate the EOL conditions for the module configuration as a function of degradation rate and orientation and the determination of area required to maintain proper thermal operation for five years. The LEO study will be presented first, followed by the GEO study.

The LEO study was conducted in two phases at different times with a complete study conducted for each phase. The only differences between the two phases are the dissipation required to reject the total mass flow rate for the system and the primary mission β angles. For the first phase these values were 12 kW, 3000 lbm/hr and $\pm$ 78.5°, respectively while for the second phase these values were 20 kW and 5000 lbm/hr and $\pm$ 52 and 78.5°, respectively. Both phases of the study will be presented as two separate studies to avoid confusion.

For both the LEO and GEO studies the module configuration agreed upon for analysis was the one with the two radiators in the same plane and not the triple radiator system.

2.1.3 LEO Power Module EOL Degradation and Area Requirement Study - Phase One

As a result of the technical interchange meeting and subsequent discussions with the project office technical personnel, a study has been performed to evaluate the EOL conditions for the present 25-kW power module configuration as a function of degradation rate (linear rate of α_s increasing with time). In addition, an evaluation of the area required to sustain "in spec" operating conditions for five years has been completed.

The study was conducted evaluating a white paint (zinc orthotitamate; initial α_s = 0.15, ϵ = 0.88) and silvered Teflon (2 mil, initial α_s = 0.07, ϵ = 0.76) as radiator materials. Orbital parameters chosen were those of primary mission, with $\beta = 78.5^{\circ}$ and altitude equal to 235 nautical miles. The radiator control system was to maintain a mix temperature of $40^{\circ}F$, a mass flow rate of 3000 lbm/hr, and an inlet temperature of $95^{\circ}F$ while dissipating 12 kW as a heat load. It was assumed all four radiators were used, with a combined area of 634 ft^2. The coolant assumed was Freon 21, with a specific heat of 0.25 BTU/lbm-$^{\circ}R$ (References 5 and 7). Tending by the STS was assumed to minimize heat rejection capability to space (view blockage) while increasing dissipation load to a worst case. Orientations considered were the ZPOP XLV (X local vertical) and the ZPOP YPSL (Y perpendicular to the sun line). These orientations were considered because they are the most favorable from a thermal standpoint of realistic orientations and therefore would provide the longest EOL time on orbit. A solar inertial orientation (XSI) would be favorable for high β values but has attitude control problems associated with it.

Figure 2-2 provides a picture of the axis system of the STS and the STS orientations considered for this study, with the module attached. The term "POP" means perpendicular to the orbit plane.

Studies were conducted for rates of degradation ranging from 0.0015 $\Delta\alpha_s$/month to 0.01 $\Delta\alpha_s$/month as an upper bound, considering potential contamination effects.

The key results of the study are presented in Table 2-1.

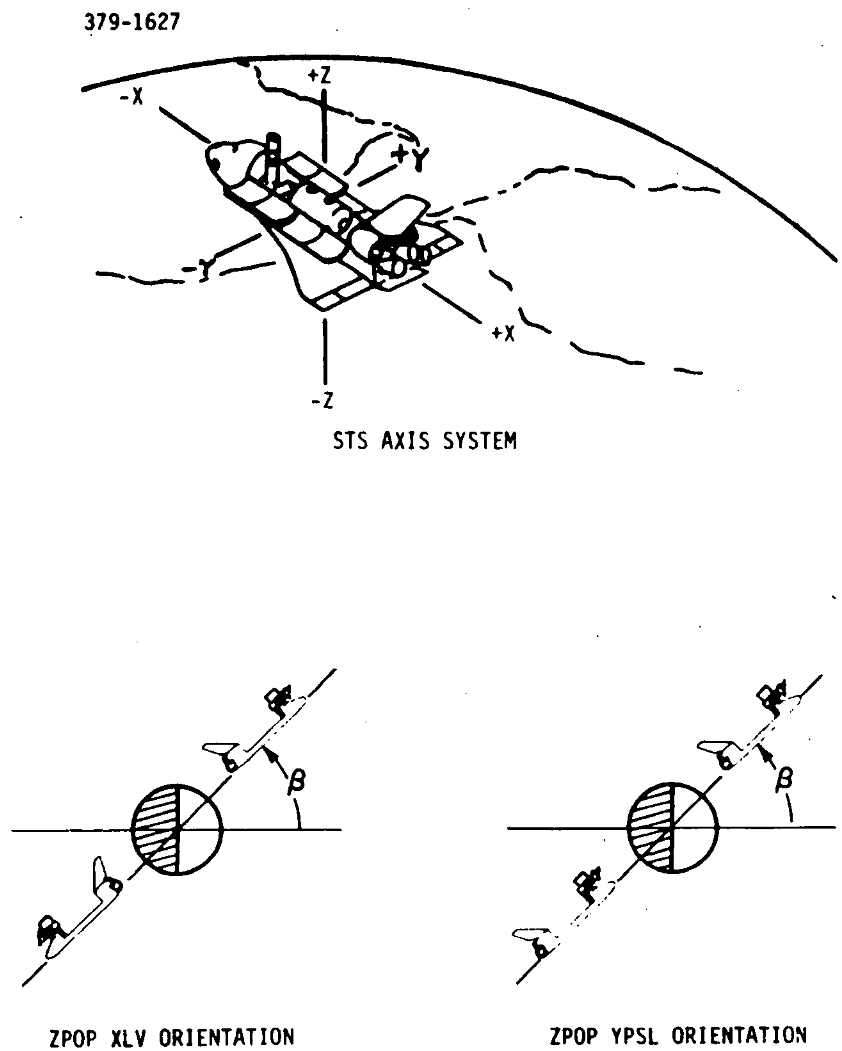

FIGURE 2-2 STS AXIS SYSTEM AND POWER MODULE PRIMARY ORIENTATIONS CONSIDERED

TABLE 2-1 **POWER MODULE EOL DEGRADATION AND AREA REQUIREMENT STUDY RESULTS**

Material	Orientation	Maximum Degradation Rate For Five Year Life ($\Delta\alpha_s$/Month)	α_s Value Requiring Infinite Radiator Platform Area
White Paint $\alpha_s = 0.15$ $\varepsilon = 0.88$	ZPOP XLV	0.0024	0.3780
	ZPOP YPSL	0.0019	0.3415
Silvered Teflon $\alpha_s = 0.07$ $\varepsilon = 0.76$	ZPOP XLV	0.0027	0.3264
	ZPOP YPSL	0.0023	0.2949

The results in the table are presented for the materials considered, the orientations, and the primary mission considerations discussed in the previous paragraphs. The α_s values presented are maximum values allowable. At these values infinite radiator area is required to keep the thermal-control system "in spec"; thus, they define an upper limit to EOL α_s values. These values are largely a function of orbit and orientation. The maximum degradation rates presented are the largest rates allowable to remain "in spec" for five years under the primary mission constraints presented.

Detailed plots of study results for area requirements and radiator lifetime for present area considerations as a function of degradation rate are presented in Figures 2-3 through 2-10. Figures 2-3 through 2-6 provide charts of radiator life as a function of degradation rate for the materials and orientations considered. Figures 2-7 through 2-10 present required radiator platform area for five-year operation (with primary mission constraints) as a function of α_s value at five years. It is clear from these plots that an upper limit α_s

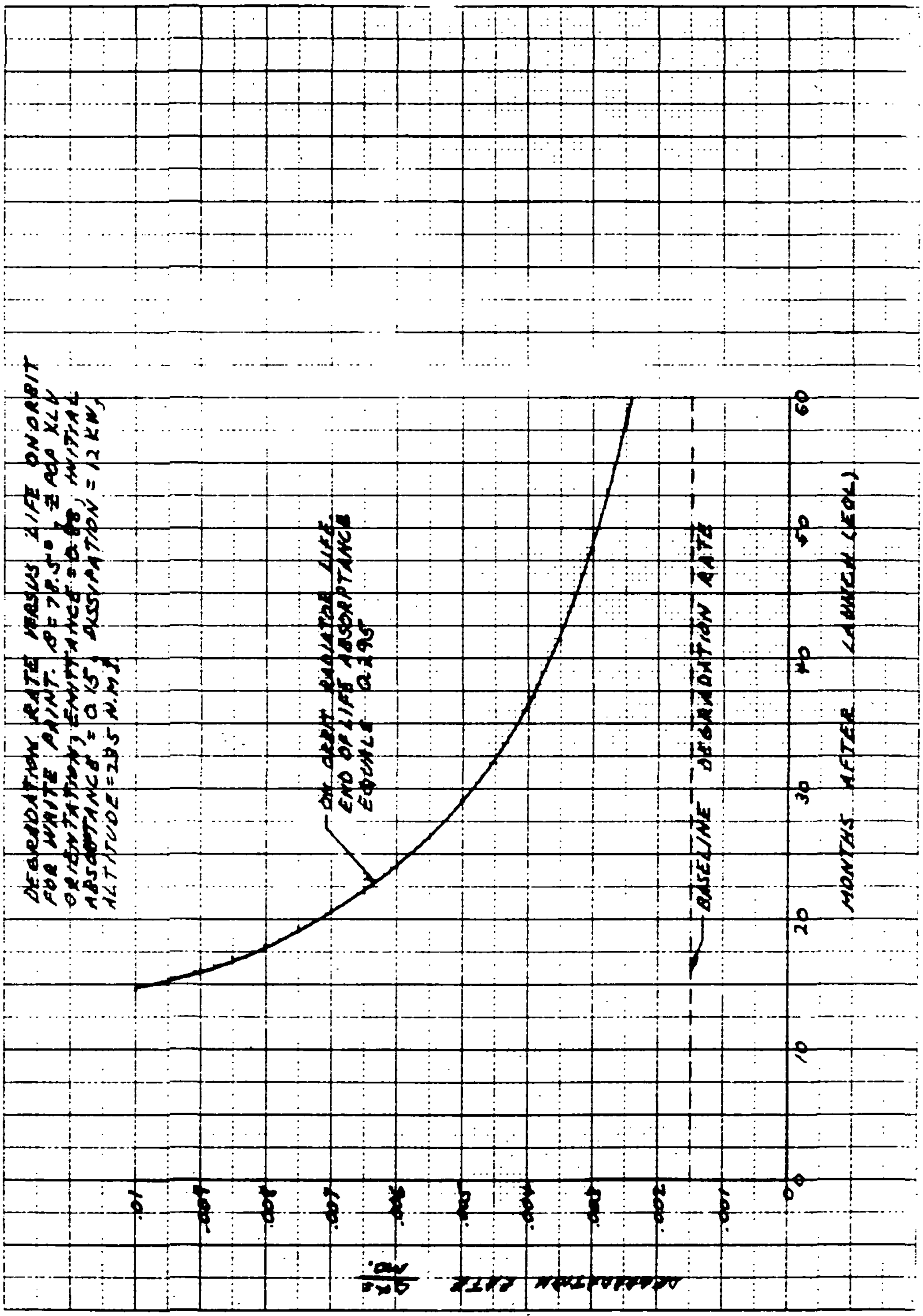

FIGURE 2-3 DEGRADATION RATE VERSUS LIFE ON ORBIT FOR WHITE PAINT, BETA = 78.5°; ZPOP XLV ORIENTATION

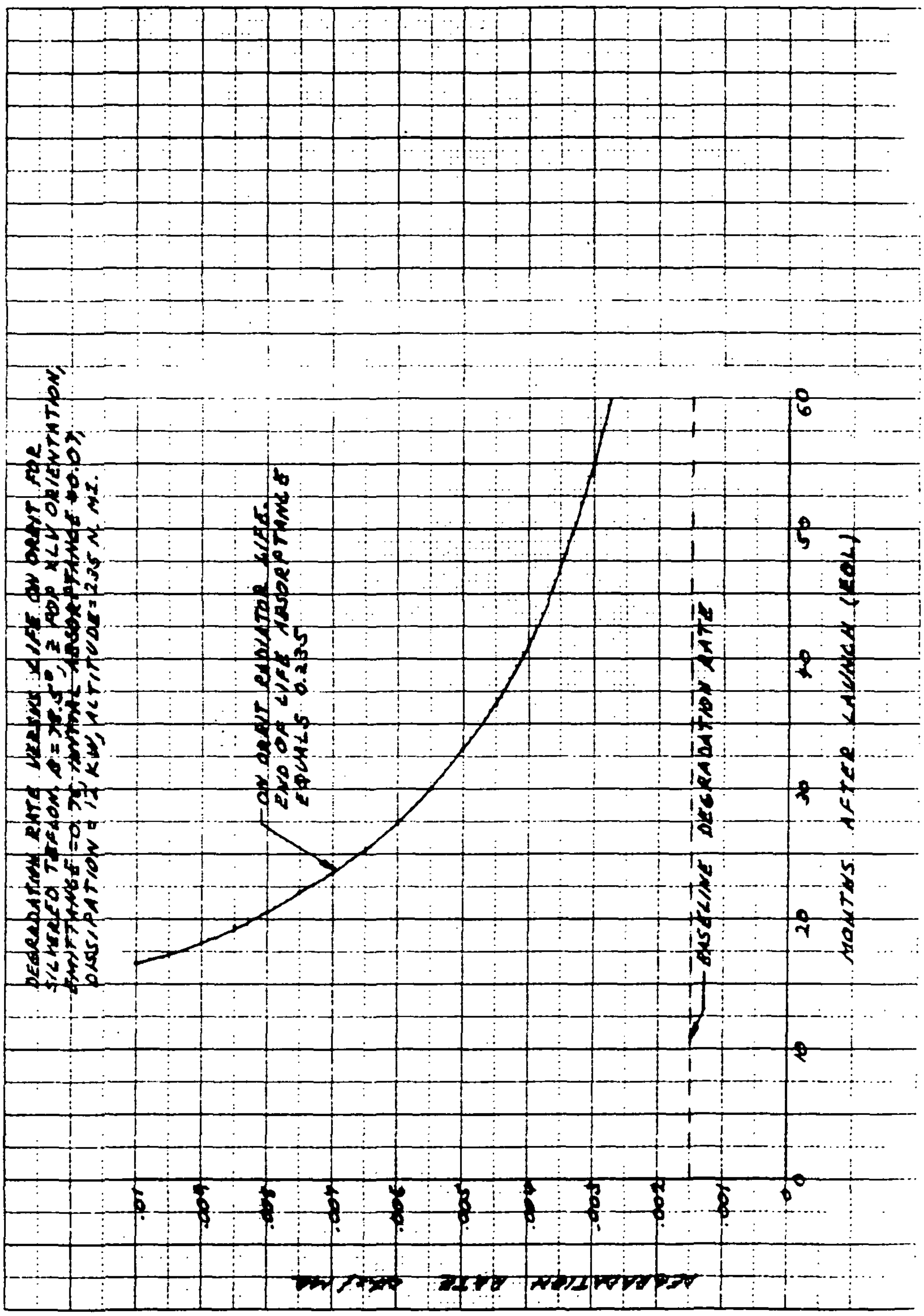

FIGURE 2-4 DEGRADATION RATE VERSUS LIFE ON ORBIT FOR SILVERED TEFLON, BETA = 78.5°; ZPOP XLV ORIENTATION

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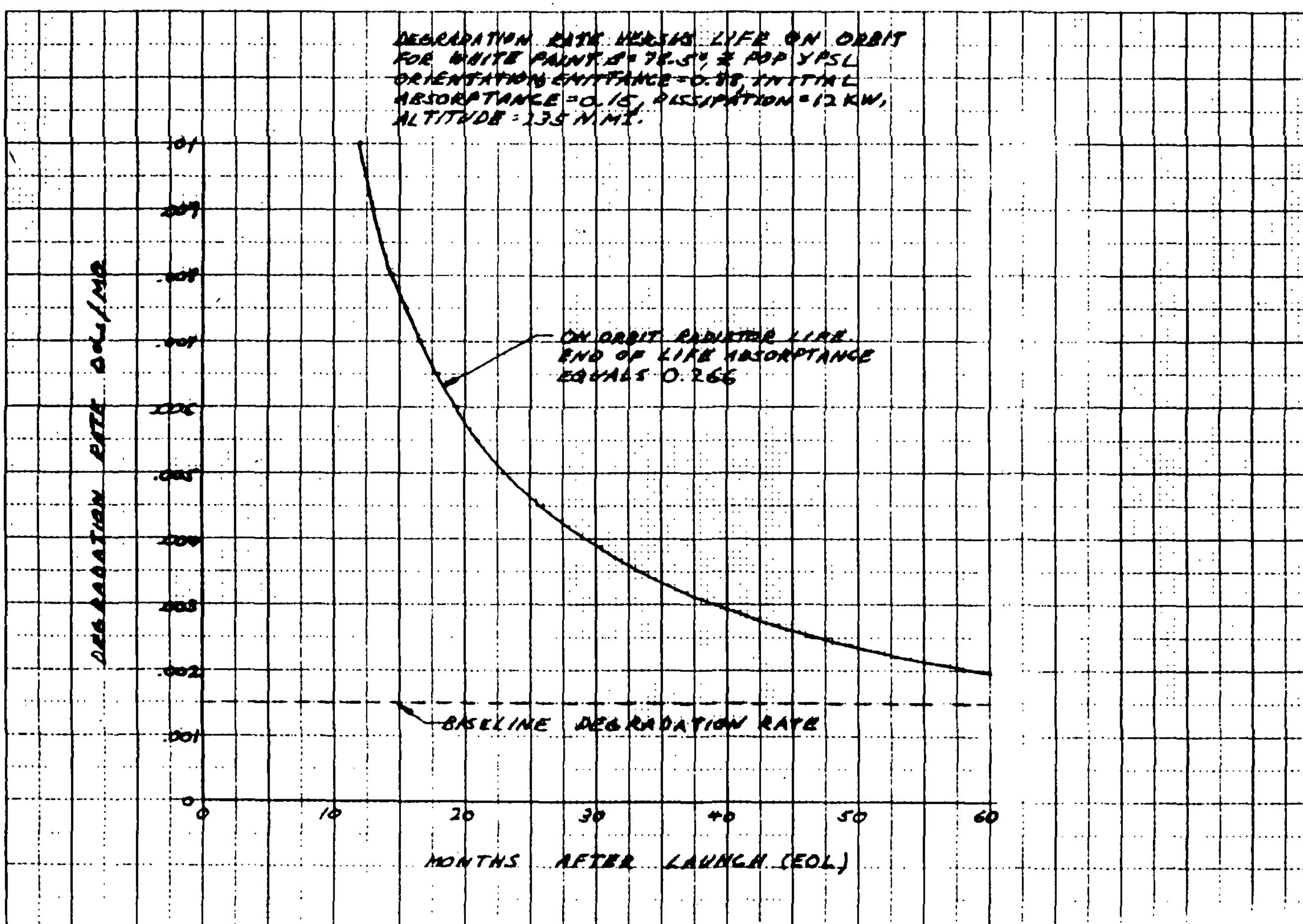

FIGURE 2-5 DEGRADATION RATE VERSUS LIFE ON ORBIT FOR WHITE PAINT, BETA = 78.5°; ZPOP YPSL ORIENTATION

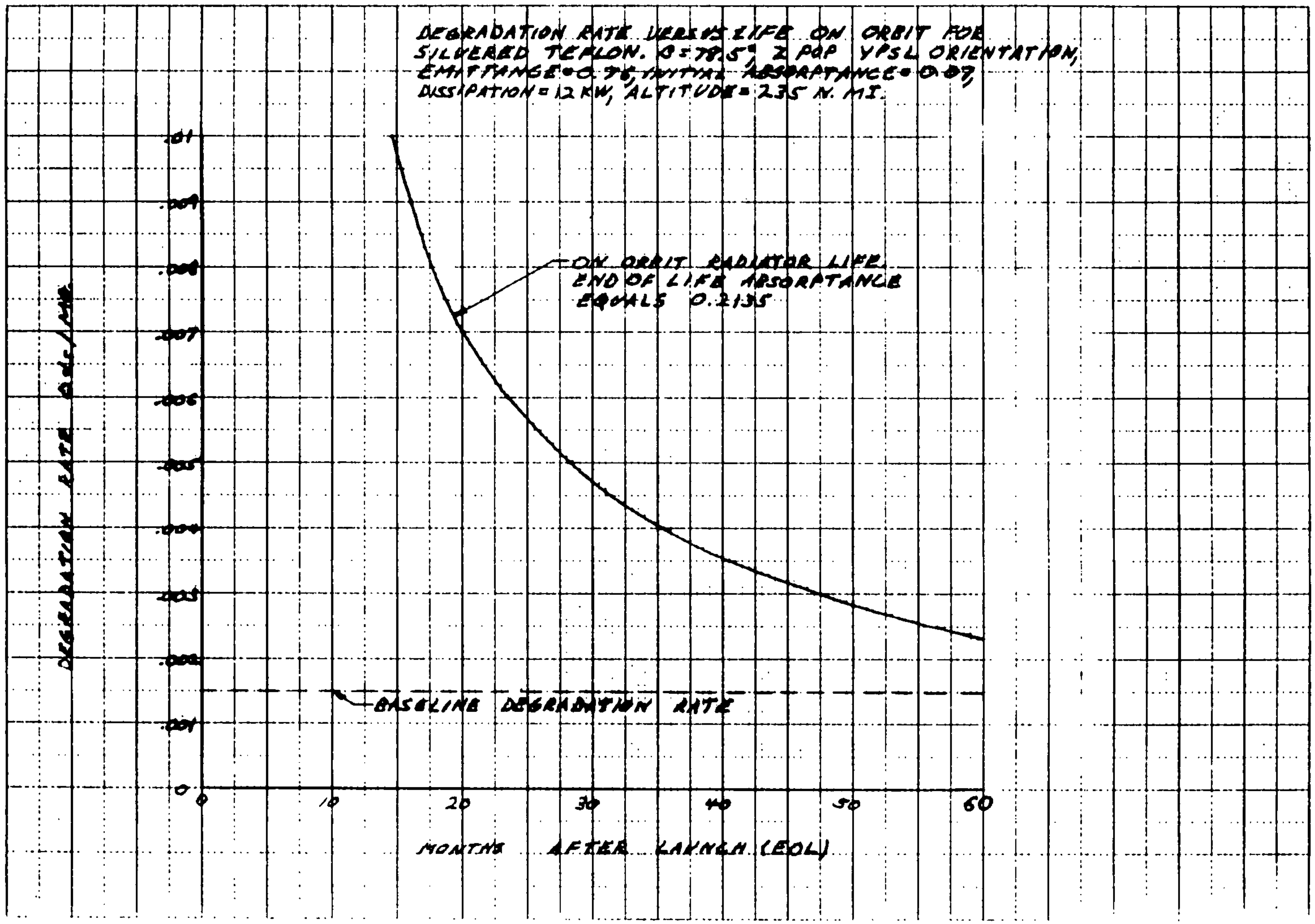

FIGURE 2-6 DEGRADATION RATE VERSUS LIFE ON ORBIT FOR SILVERED TEFLON, BETA = 78.5°; ZPOP YPSL ORIENTATION

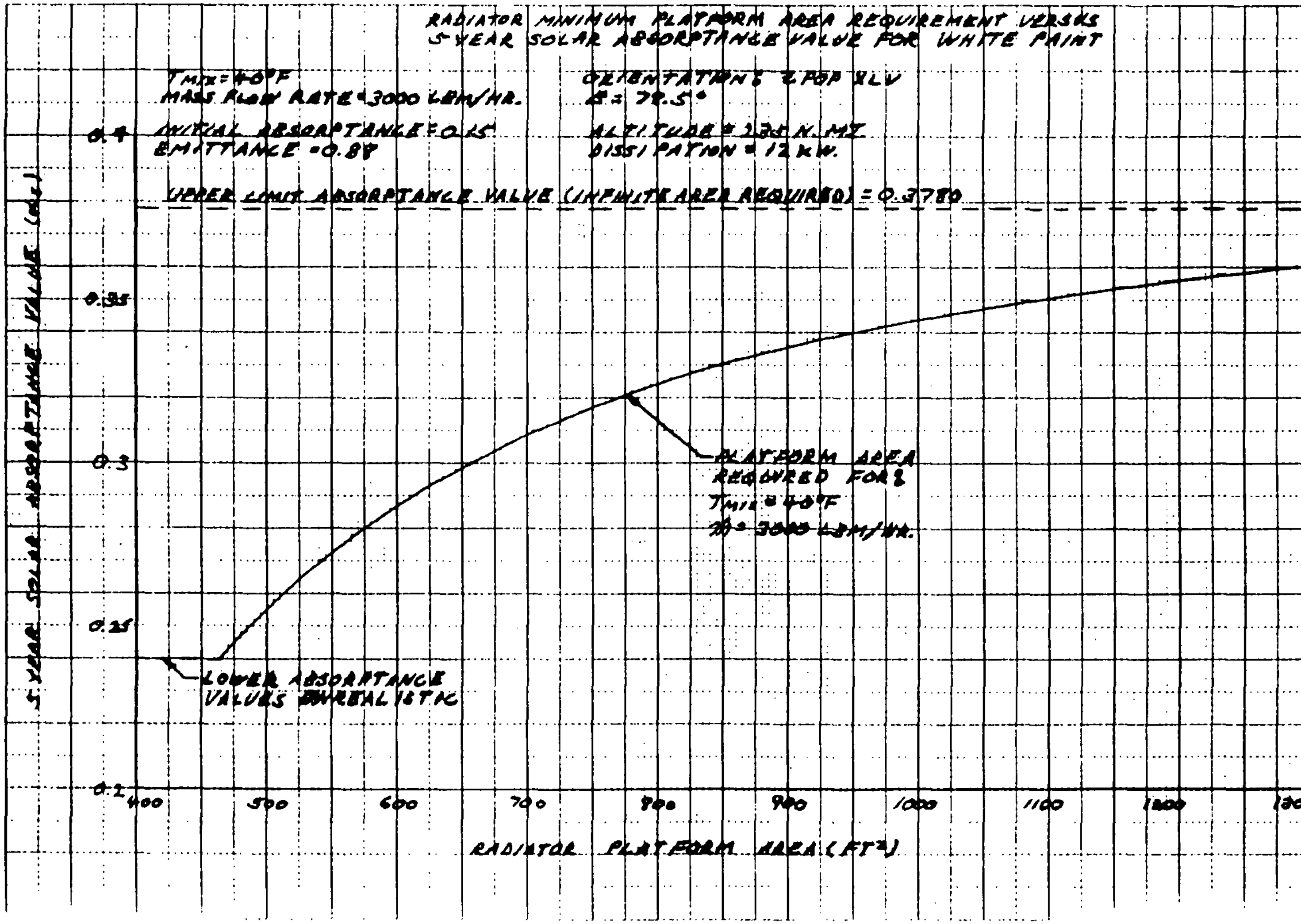

FIGURE 2-7 RADIATOR MINIMUM PLATFORM AREA REQUIREMENT VERSUS FIVE-YEAR SOLAR ABSORPTANCE VALUE FOR WHITE PAINT

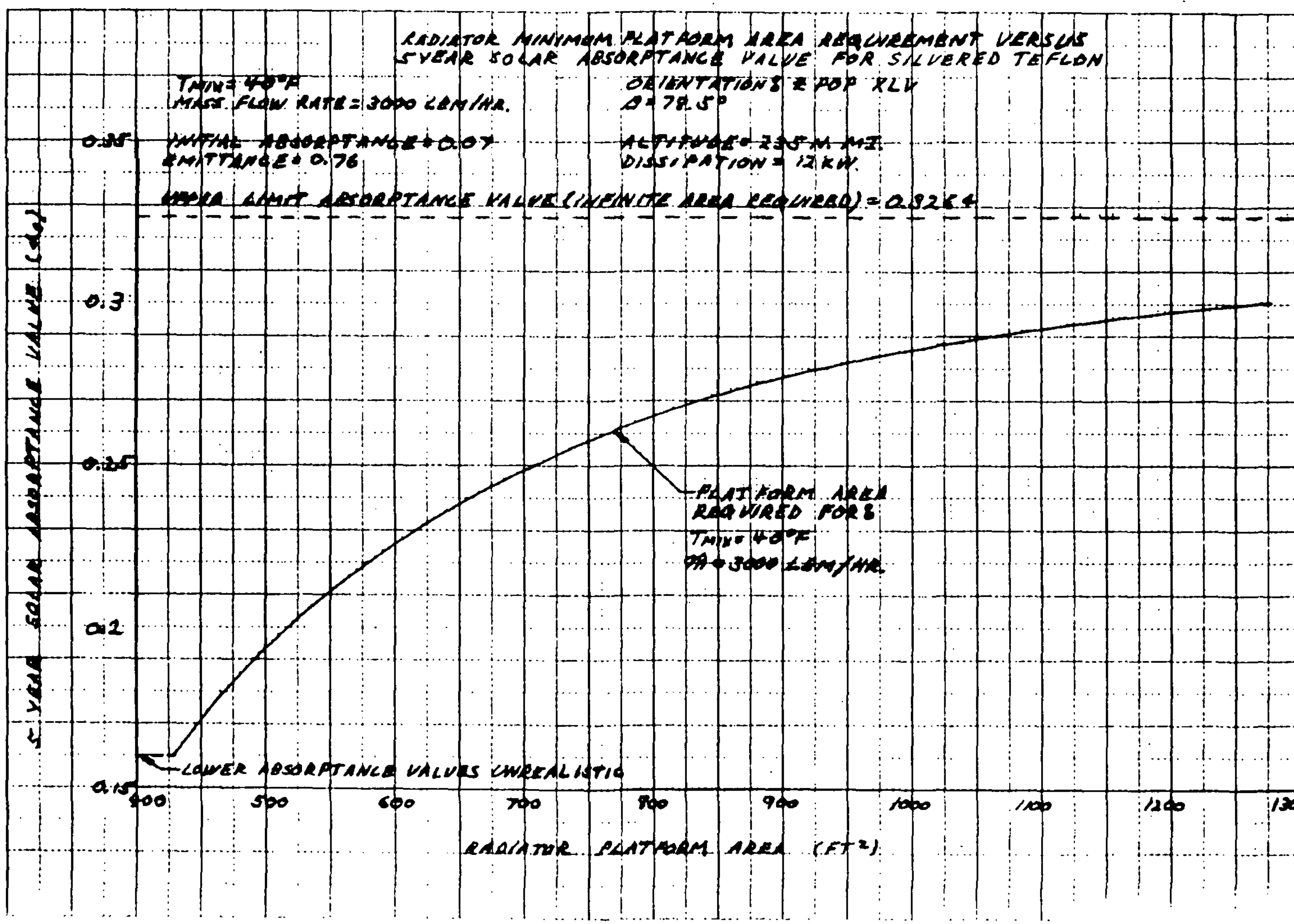

FIGURE 2-8 RADIATOR MINIMUM PLATFORM AREA REQUIREMENT VERSUS FIVE-YEAR SOLAR ABSORPTANCE VALUE FOR SILVERED TEFLON

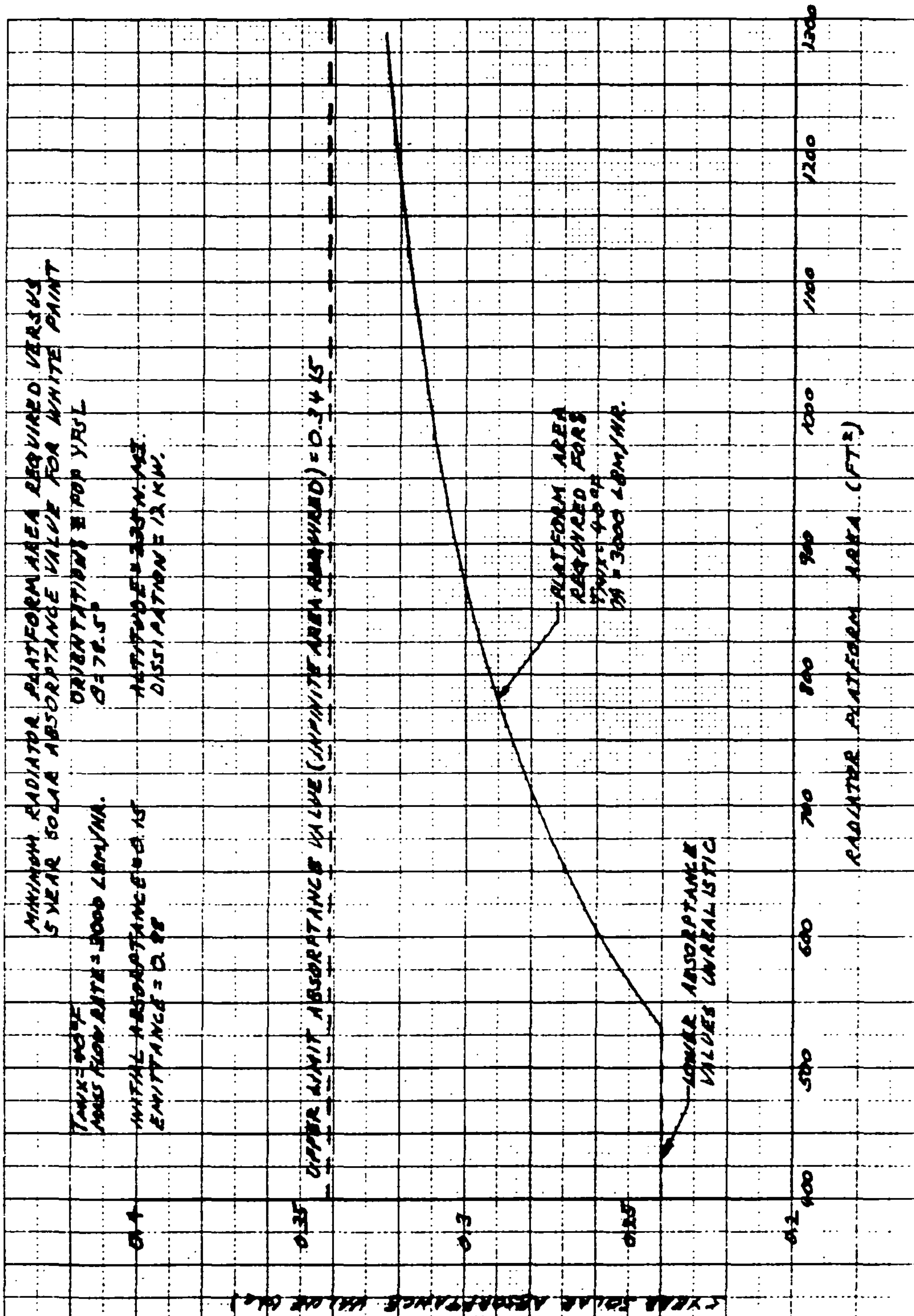

FIGURE 2-9 MINIMUM RADIATOR PLATFORM AREA REQUIRED VERSUS FIVE-YEAR SOLAR ABSORPTANCE VALUE FOR WHITE PAINT

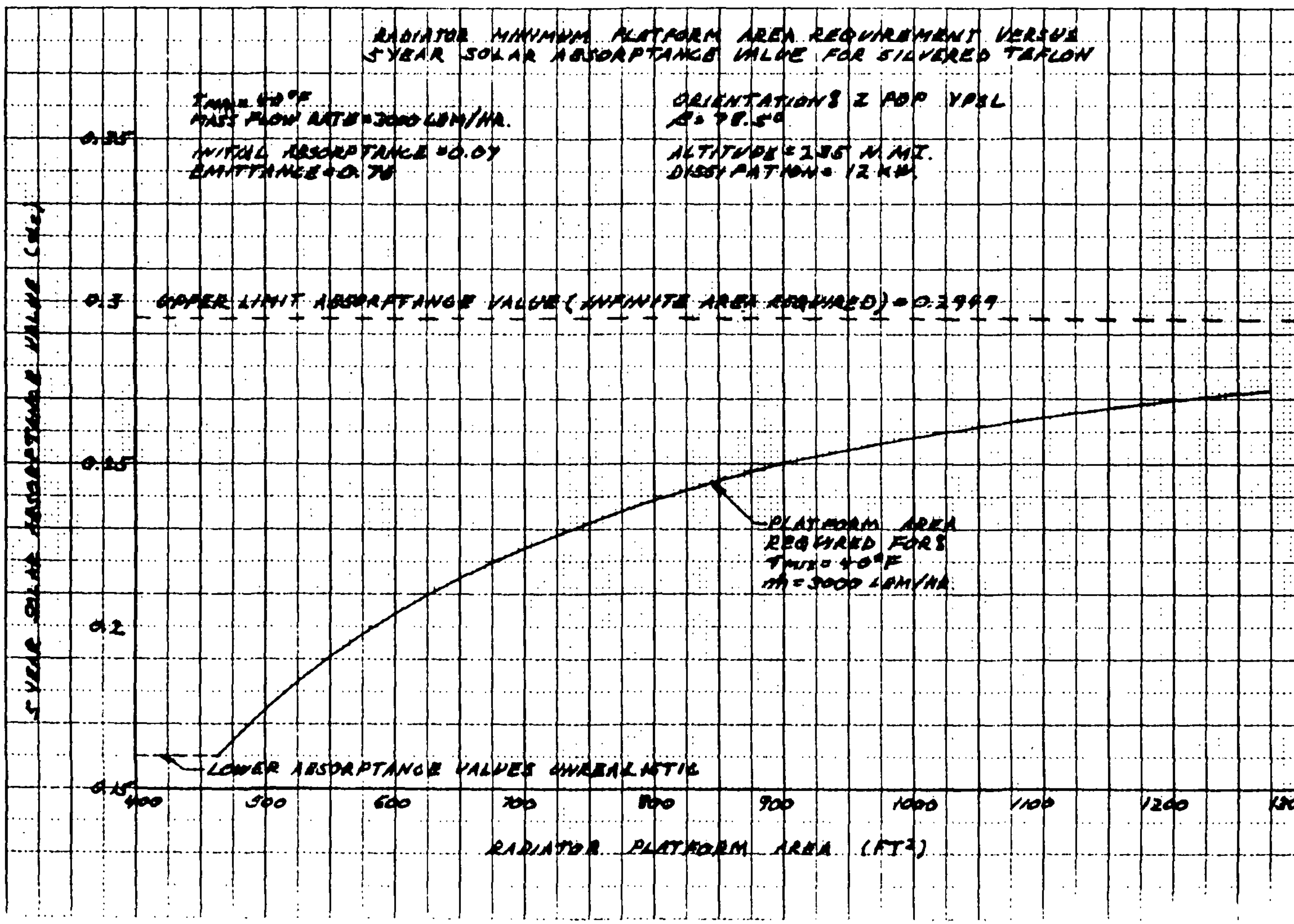

FIGURE 2-10 RADIATOR MINIMUM PLATFORM AREA REQUIREMENT VERSUS FIVE-YEAR SOLAR ABSORPTANCE VALUE FOR SILVERED TEFLON

value exists for which infinite area is inadequate because of the size of external loads. Thus, for a given orientation, there is a maximum α_s value for which the radiator can maintain proper operation because of the influence of direct solar and albedo heat loads.

Because of the low degradation rates (values below 0.0027 $\Delta\alpha_s$/month) required to provide five-year life with current area constraints, and the low maximum α_s values acceptable because of orientation constraints, it appears refurbishment will be required within the five-year period if current orbital considerations and orientations remain unchanged (even if increased area were provided).

The radiator orientations are favorable thermally, and only a movable radiator system could slightly improve their orientation. However, lowering the high β value for the primary mission could greatly increase the upper limit on maximum α_s for EOL conditions.

The only alternative to radiator refurbishment for a five-year module life appears to be a lowering of primary mission β angle. In order to provide data for such an alternative, a study has been conducted with the current constraints and present platform area for the system with primary mission altitude, as in the previously discussed study, with the exception of β being a variable. The same materials and orientations were considered. These results are presented in Figures 2-11 through 2-15.

Figures 2-11 through 2-14 show the life the present system can expect to have (remain "in spec") as a function of degradation rate and β angle. These charts show how, for a given rate of degradation, time until EOL increases as β is lowered; they also show what level of degradation can be sustained for five years as a function of β. Figure 2-15 shows how β affects the α_s value for the infinite radiator area requirement and how this α_s value, which provides an upper limit, increases as β decreases.

For an altitude of 235 nautical miles, eclipsing by the earth begins at approximately 69.5 degrees. The figures show that no significant

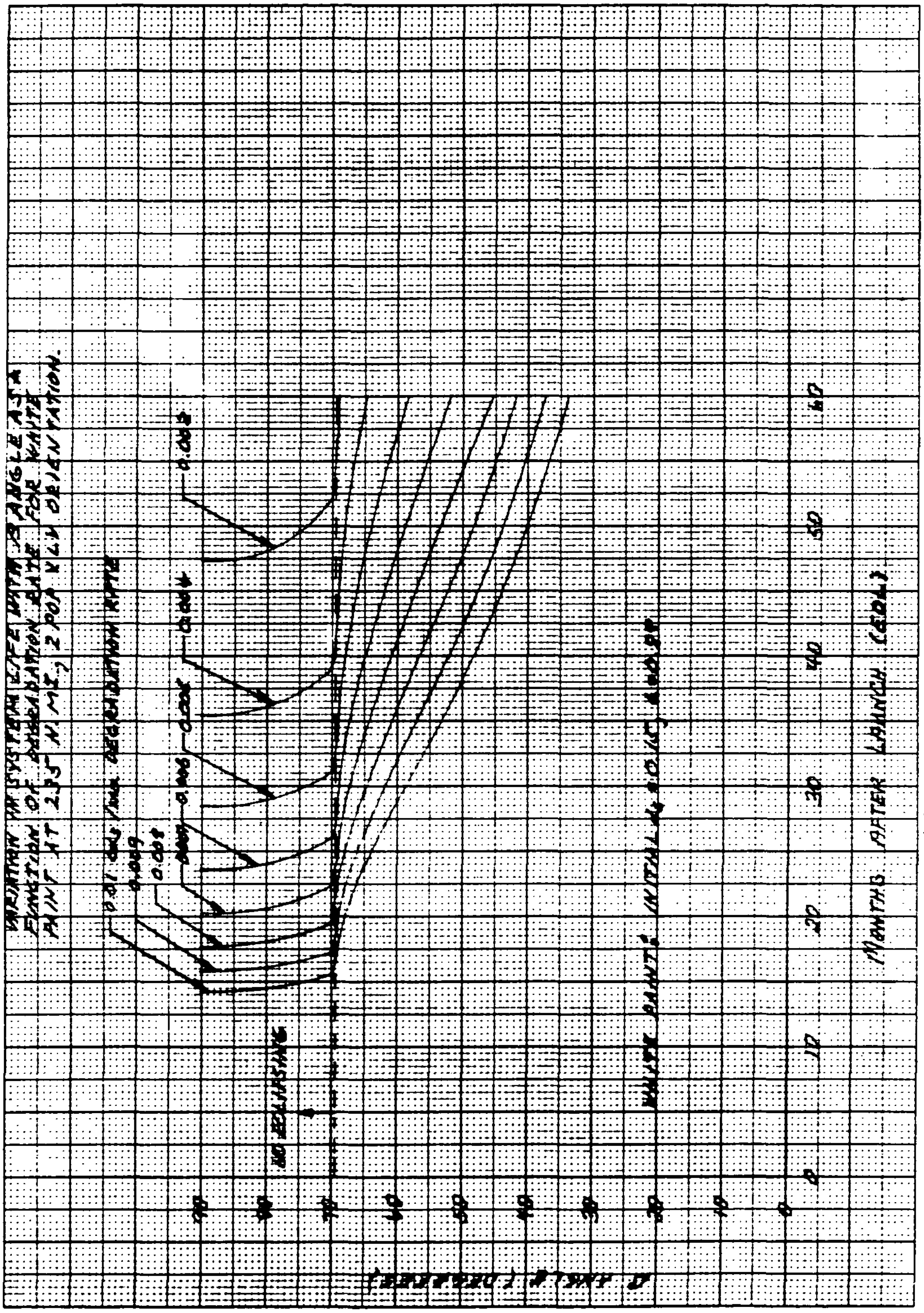

FIGURE 2-11 VARIATION IN SYSTEM LIFE WITH BETA ANGLE AS A FUNCTION OF DEGRADATION RATE FOR WHITE PAINT AT 235 NMI, ZPOP XLV ORIENTATION

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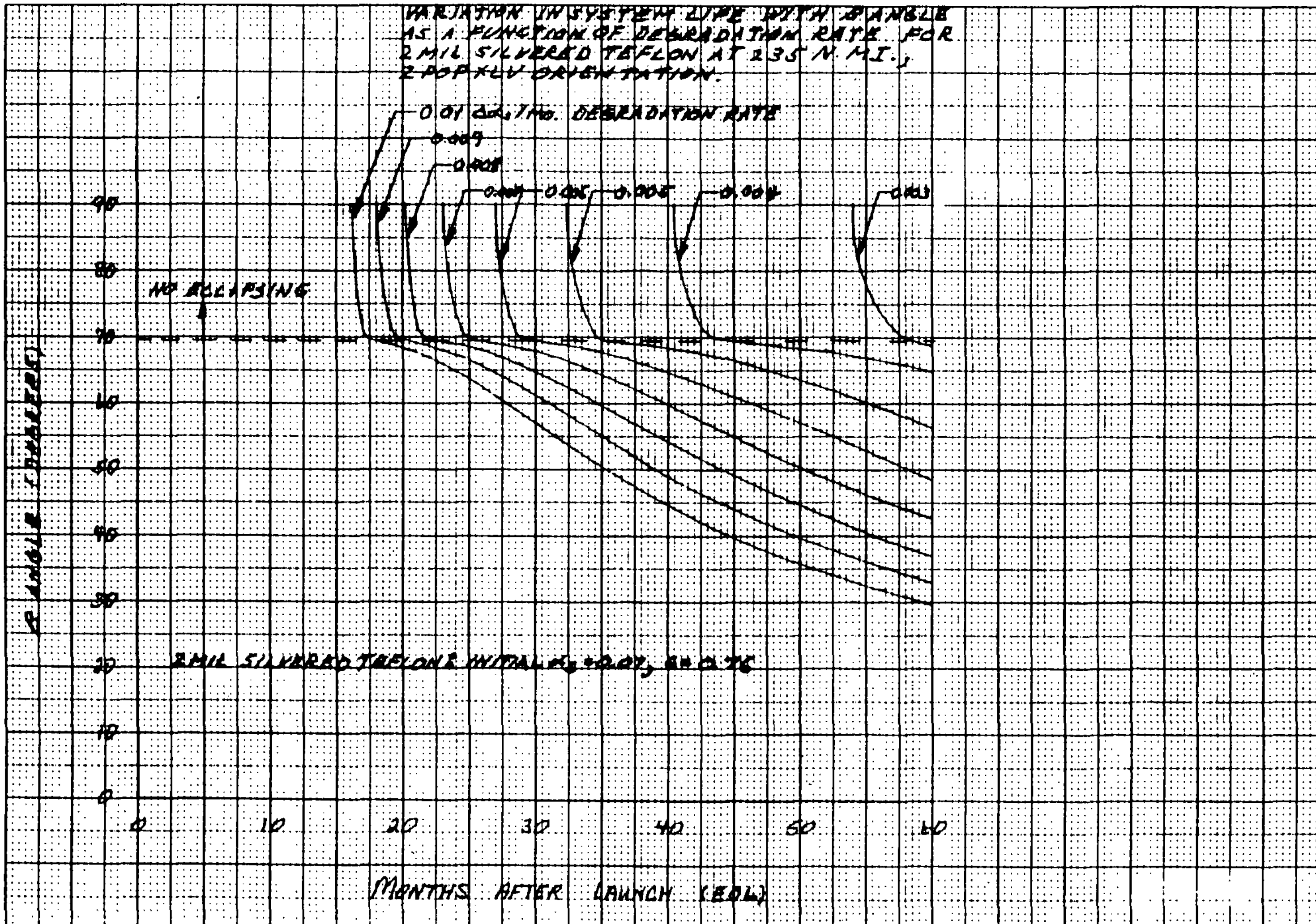

FIGURE 2-12 VARIATION IN SYSTEM LIFE WITH BETA ANGLE AS A FUNCTION OF DEGRADATION RATE FOR SILVERED TEFLON AT 235 NMI, ZPOP XLV ORIENTATION

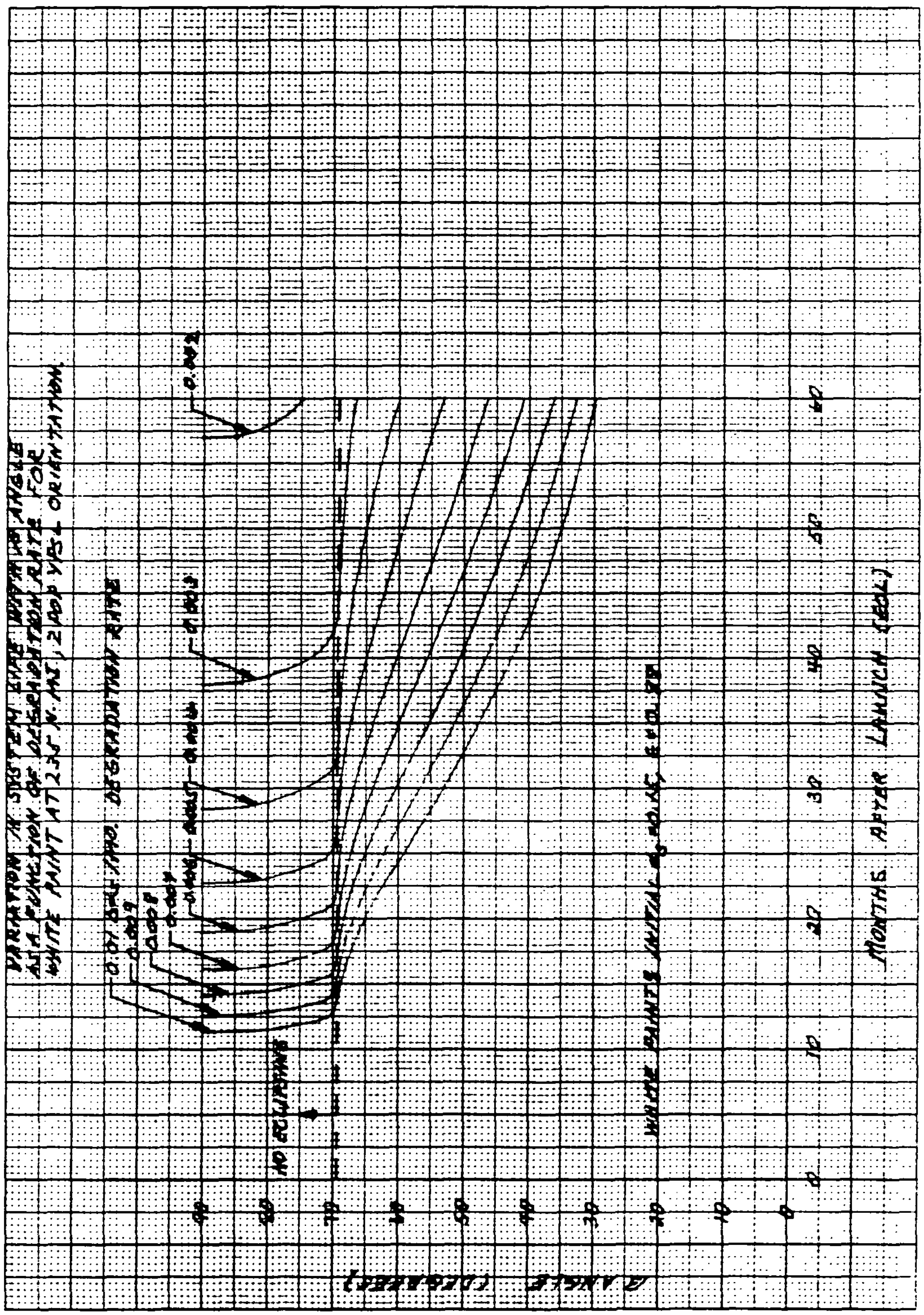

FIGURE 2-13 VARIATION IN SYSTEM LIFE WITH BETA ANGLE AS A FUNCTION OF DEGRADATION RATE FOR WHITE PAINT AT 235 NMI, ZPOP YPSL ORIENTATION

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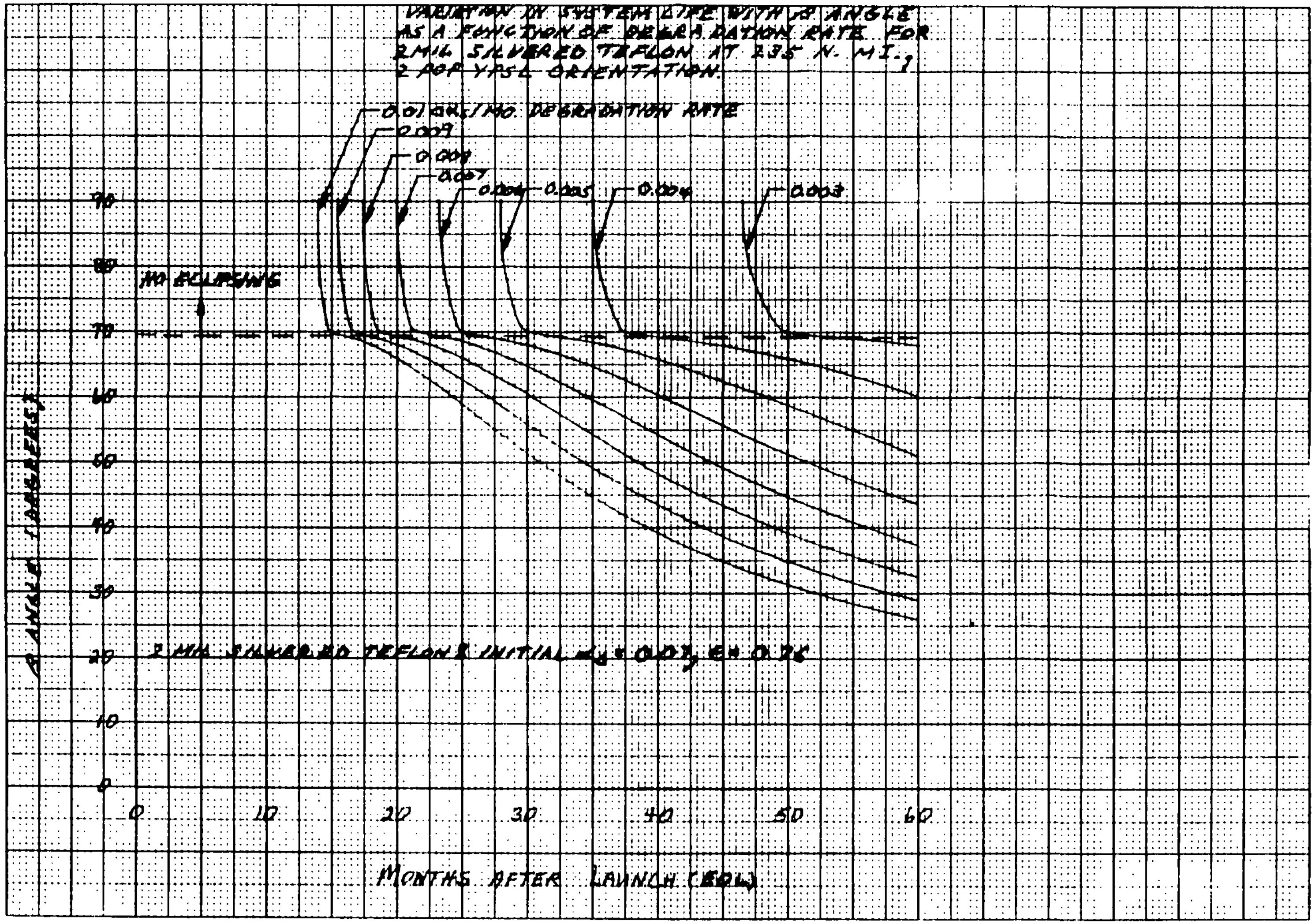

FIGURE 2-14 VARIATION IN SYSTEM LIFE WITH BETA ANGLE AS A FUNCTION OF DEGRADATION RATE FOR 2 MIL SILVERED TEFLON AT 235 NMI, ZPOP YPSL ORIENTATION

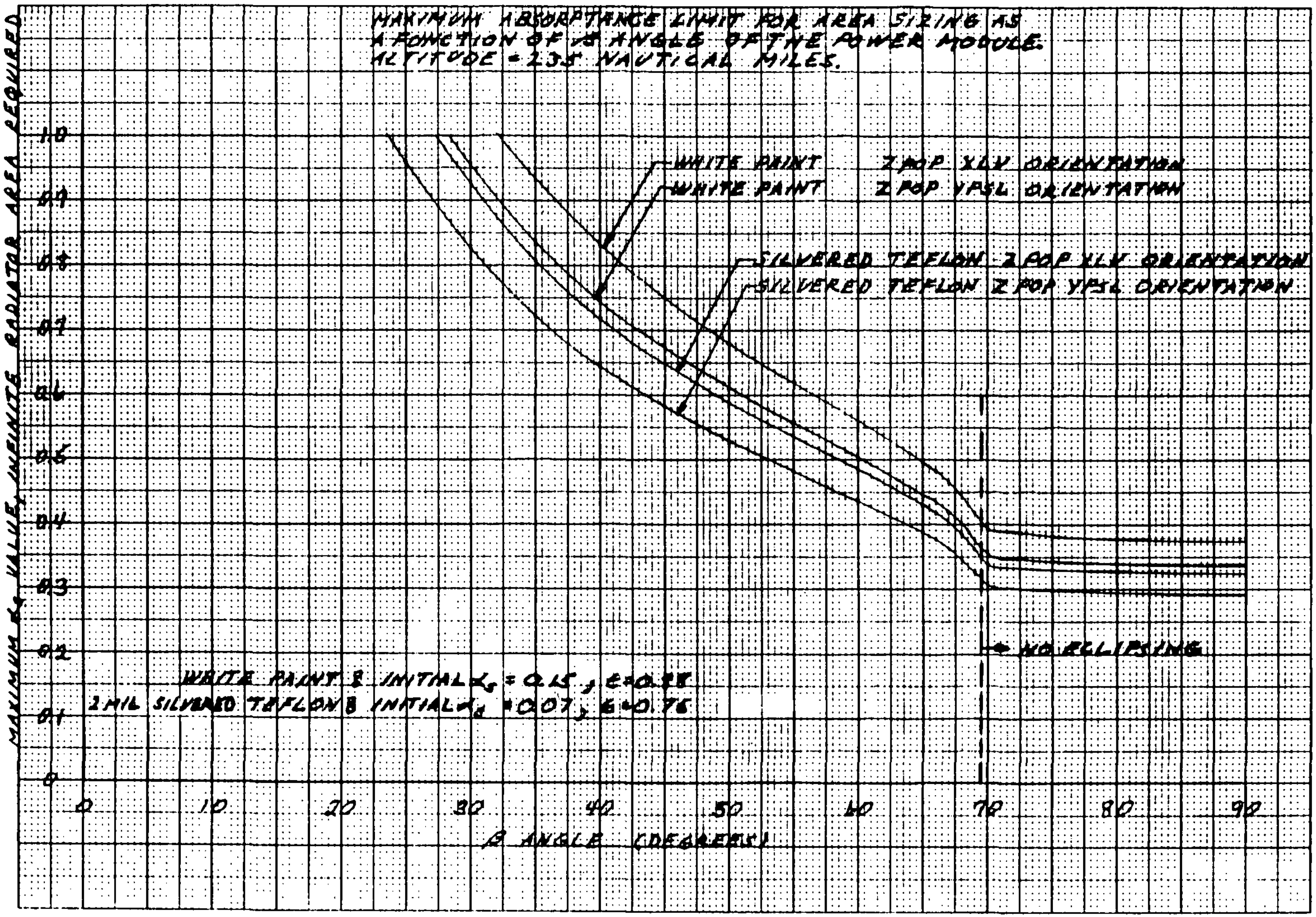

FIGURE 2-15 MAXIMUM ABSORPTANCE LIMIT FOR AREA SIZING AS A FUNCTION OF BETA ANGLE OF THE POWER MODULE

increase in system life can be attained unless the β angle is lowered below this level. For reasonable degradation rates on the order of 0.005 $\Delta\alpha_s$/month as estimated (Skylab results from NASA/MSFC), and with the current system design, it appears mission β angle may have to be lowered to a value of ≃ 51 degrees to ensure five-year life at 235 nautical miles.

Accurate determination of the rates of degradation that will actually be encountered can only be achieved by a detailed contamination study. However, reasonable rough estimates of the degradation rates anticipated indicate the present 25-kW power module design for the thermal-control system cannot survive "in spec" for a five-year period (even with the most favorable orientations) without lowering the primary mission β angle considerably, gimbal of radiators, or refurbishing radiators on-orbit at least once in the five-year period. With the present system and primary mission orbit, studies indicate proper operational system life will be approximately 2 to 2.5 years without refurbishment or orbit change required.

2.1.4 LEO Power Module EOL Degradation and Area Requirement Study - Phase Two

The second phase was also a study to evaluate the end of life (EOL) for the 25 kW power module radiators as a function of degradation rate, primary mission β, and for most favorable thermal orientations in low earth orbit (LEO). In addition, an evaluation of the platform area required to sustain "in spec" operation for five years was conducted. To remain "in spec" means the radiator is able to reject a full dissipation heat load and maintain the proper mix temperature.

Since the phase one study, the evolution of the power module has required parameters regarding primary mission orbit inclination (Beta angle, β), total mass flow rate and required dissipation to be redefined (Reference 6). These changes have brought about the need to perform these studies once again under more recent power module specifications.

This recent study was conducted evaluating a white paint (zinc orthotitanate; initial $\alpha_s = 0.15$, $\epsilon = 0.88$) and silvered Teflon (2 mil, initial $\alpha_s = 0.07$, $\epsilon = 0.76$) as radiator materials. Orbital parameters chosen were those of primary missions in LEO with β equaling 52 and 78.5 degrees and an altitude equal to 235 nautical miles. The radiator control system maintained a mix temperature of $40^{o}F$, a total mass flow rate of 5000 lbm/hr and an inlet temperature of $95^{o}F$ while dissipating 20 kW as a heat load. It was assumed all four radiator segments were used, with a combined platform area of 634 ft^2. The coolant used was Freon 21, with a specific heat of 0.25 BTU/lbm-^{0}R assumed constant. Tending by the STS was assumed to minimize heat rejection capability to space (view blockage) while increasing dissipating load to a worst case. Orientations considered were the ZPOP XLV (X local vertical) and ZPOP YPSL (Y perpendicular to solar line). These orientations were considered because they are the most favorable from a capable thermal standpoint and therefore would provide the longest EOL time on orbit. A solar inertial orientation (XSI) may be more favorable but not attitude achievable. The radiator system evaluated consisted of two radiators, each in the orbit plane and each consisting of two segments.

For this study, rates of degradation (linear rise in solar absorptance) were varied from 0.0008 to 0.01 $\Delta\alpha_s$/month while β was varied from 52 to 84 degrees to include primary mission values.

A degradation rate of 0.0015 $\Delta\alpha_s$/month is still considered a lower bound realistic limit for degradation. Using values as low as 0.0008 $\Delta\alpha_s$/month, however, allowed the graphical results to be presented in a more complete fashion.

The key results of this study are presented in Table 2-2.

The maximum degradation rates presented represent the largest rates allowable to remain "in spec" for five years under the primary mission constraints presented.

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TABLE 2-2 LEO PHASE TWO POWER MODULE EOL DEGRADATION AND AREA REQUIREMENT STUDY RESULTS

Material	Orientation	Primary Mission Beta (Degrees)	Maximum Degradation Rate for Five-Year Life ($\Delta\alpha_s$/Mo.)	α_s Value Requiring Infinite Radiator Platform Area	Operational Life for a Degradation Rate of 0.005 $\Delta\alpha_s$/Mo. (MO.)	Required Platform Area for Five-Year Life With 0.005 $\Delta\alpha_s$/Mo. Degradation Rate (Ft.^{2})
White Paint Initial α_s = 0.15 ε = 0.88	Z POP XLV	52.0	0.0025	0.594	30.4	998.0
		78.5	0.0008	0.378	8.7	∞
	Z POP YPSL	52.0	0.0020	0.534	24.2	1270.0
		78.5	0.0004	0.342	4.8	∞
Silvered Teflon (2 mil) Initial α_s = 0.07 ε = 0.76	Z POP XLV	52.0	0.0022	0.513	26.8	1062.0
		78.5	0.0010	0.327	12.1	∞
	Z POP YPSL	52.0	0.0019	0.461	22.5	1300.0
		78.5	0.0008	0.295	9.4	∞

The solar absorptance values presented for requiring infinite radiator platform area represent an upper limit to the acceptable degraded absorptance values when sizing the radiators for the primary missions given. These absorptances represent values which correspond to external heat fluxes sufficiently large such that infinite radiator area would be required for "in spec" operation. If these values are so low that realistic rates of degradation would cause absorptance values to exceed or come close to them during the life of the vehicle, then primary mission parameters should be re-examined. As an example the values for β = 78.5 degrees are much too low requiring degradation rates considerably below 0.005 $\Delta\alpha_s$/month to stay "in spec." Such a rate as 0.005 $\Delta\alpha_s$/month is reasonable based on Skylab results from NASA/MSFC.

Using the 0.005 $\Delta\alpha_s$/month rate as a reasonable estimate for radiator degradation on the power module, Table 2-2 lists the expected operational "in spec" life or EOL value based upon this rate. It is clear from these results the present system cannot sustain "in spec" operation for five years for the primary mission constraints currently specified with such a degradation rate.

The last column in Table 2-2 presents the required platform area to remain "in spec" for five years at a degradation rate of 0.005 $\Delta\alpha_s$/month. These results indicate approximately 50 to 100 percent increases in platform area are required depending on primary mission parameters.

All of these data are presented in greater detail as graphs of parametric studies in the remaining figures included in this report. Figures 2-16 through 2-19 present degradation rates versus life (in spec) after launch (EOL) as a function of β for the four combinations of materials and orientations. Figures 2-20 through 2-23 present five year solar absorptance values versus required platform area as a function of β for the four combinations of materials and orientations. Figure 2-24 presents the maximum solar absorptance value (requiring infinite radiator area) versus β for the four combinations of materials and orientations.

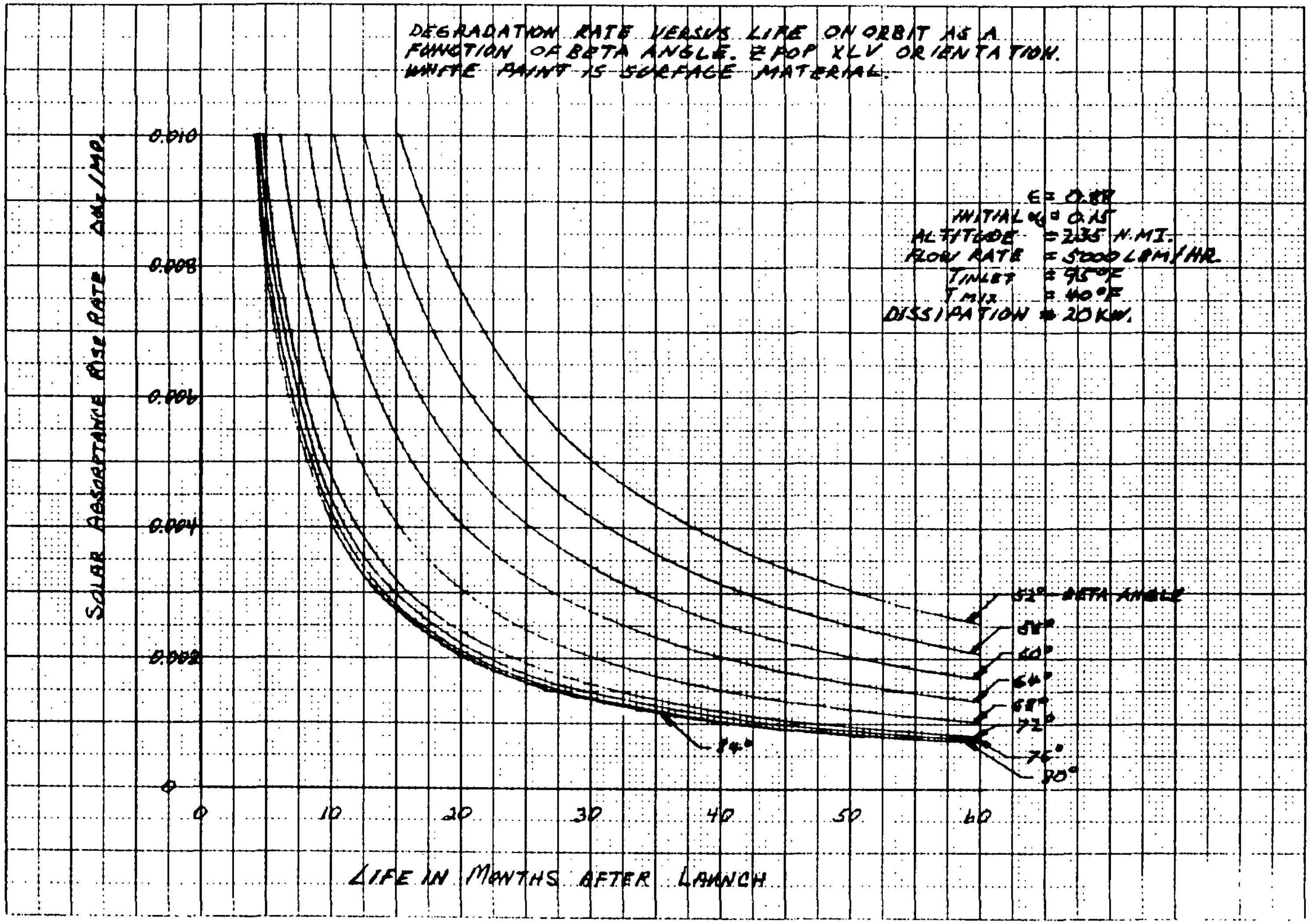

FIGURE 2-16 DEGRADATION RATE VERSUS LIFE ON ORBIT AS A FUNCTION OF BETA ANGLE, ZPOP XLV ORIENTATION

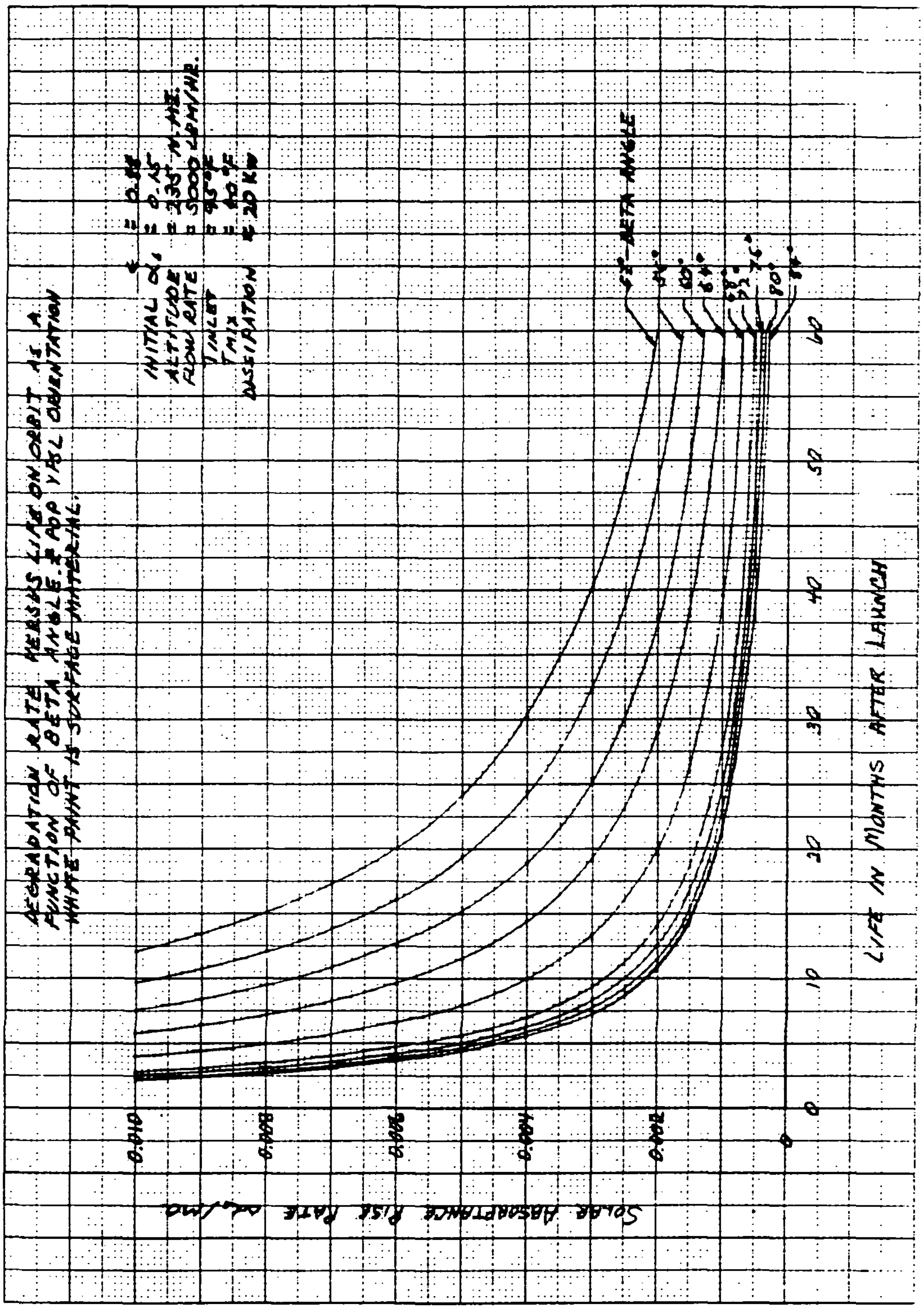

FIGURE 2-17 DEGRADATION RATE VERSUS LIFE ON ORBIT AS A FUNCTION OF BETA ANGLE, ZPOP YPSL ORIENTATION, WHITE PAINT SURFACE

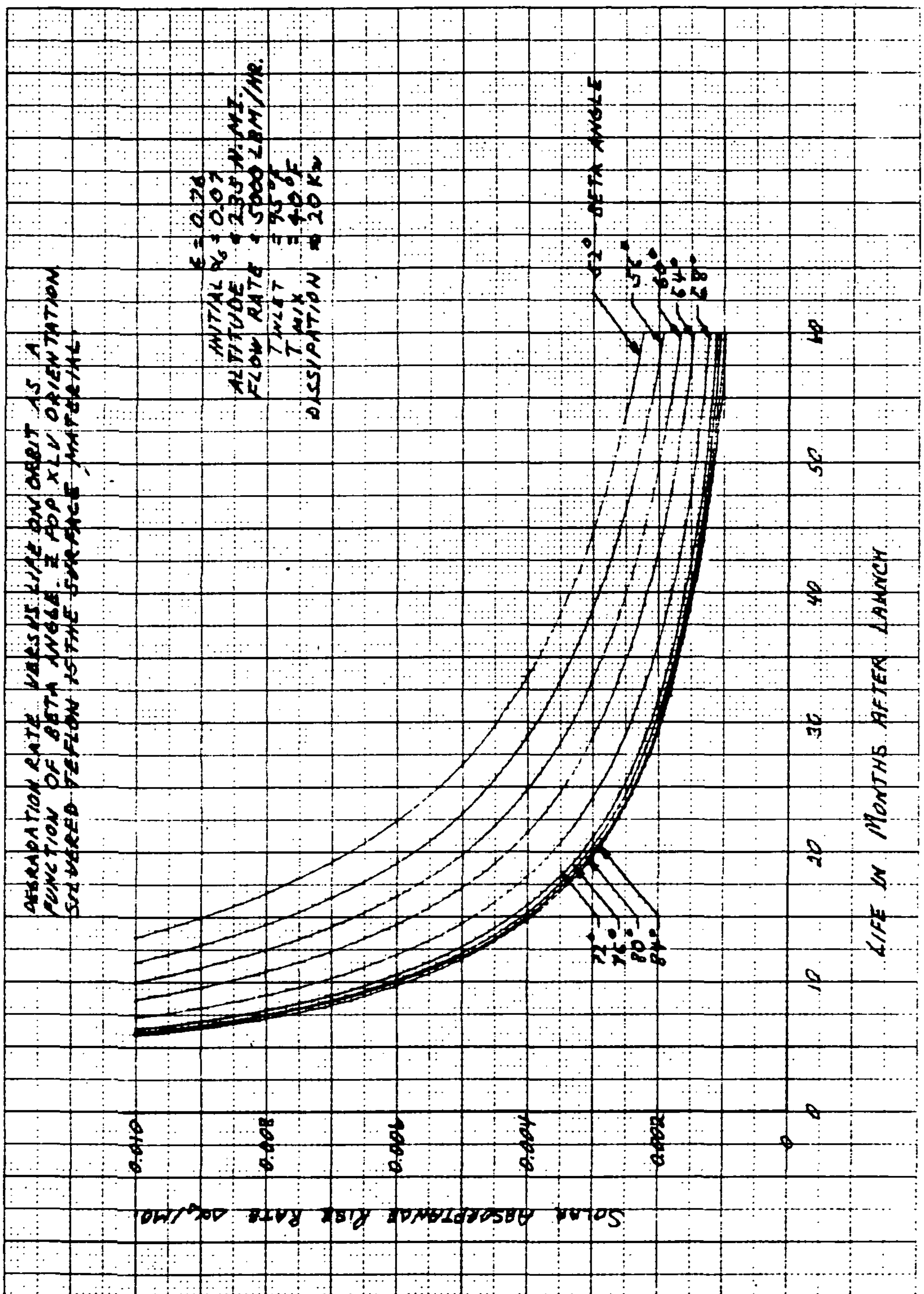

FIGURE 2-18 DEGRADATION RATE VERSUS LIFE ON ORBIT AS A FUNCTION OF BETA ANGLE, ZPOP XLV ORIENTATION

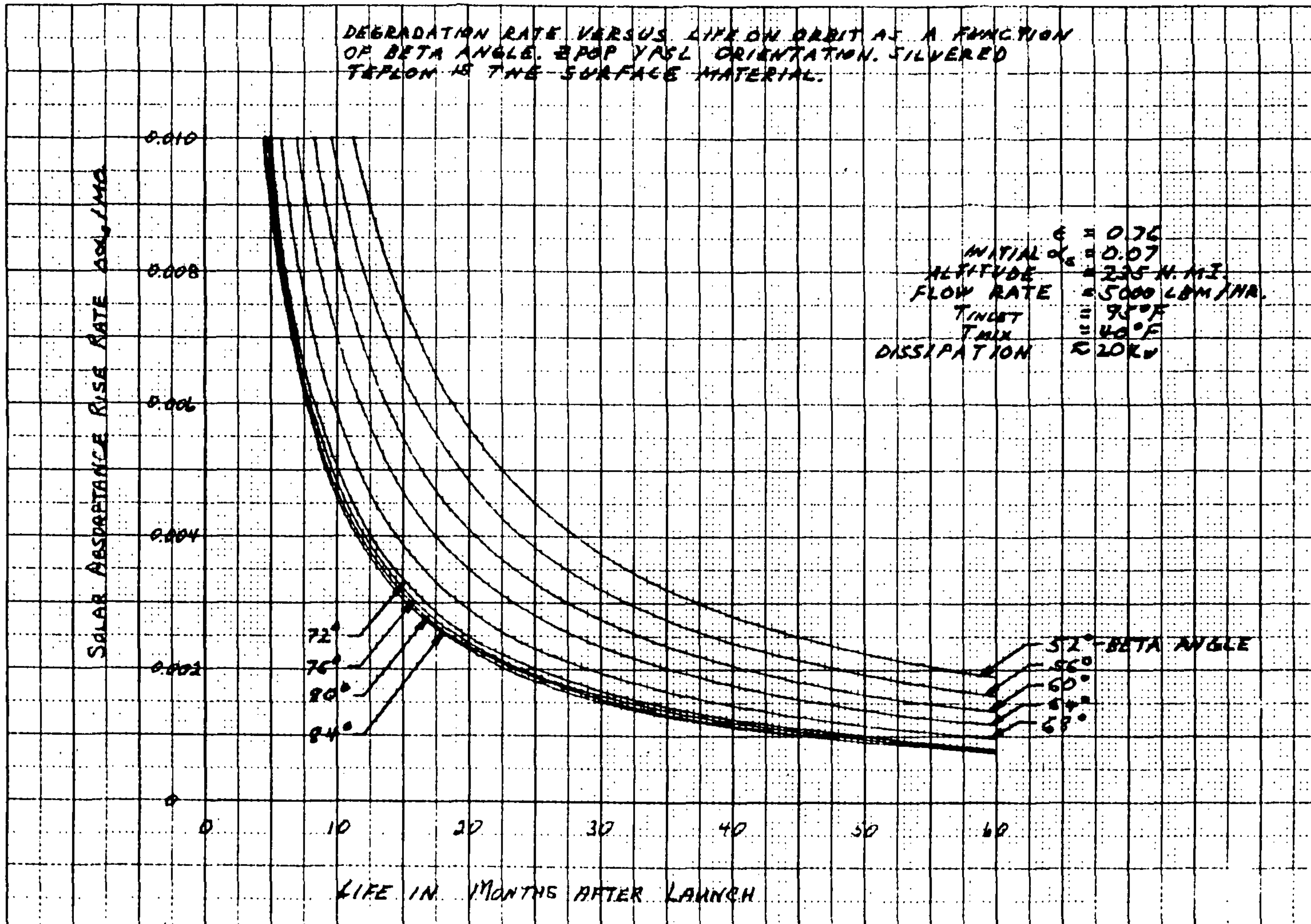

FIGURE 2-19 DEGRADATION RATE VERSUS LIFE ON ORBIT AS A FUNCTION OF BETA ANGLE, ZPOP YPSL ORIENTATION, SILVERED TEFLON SURFACE

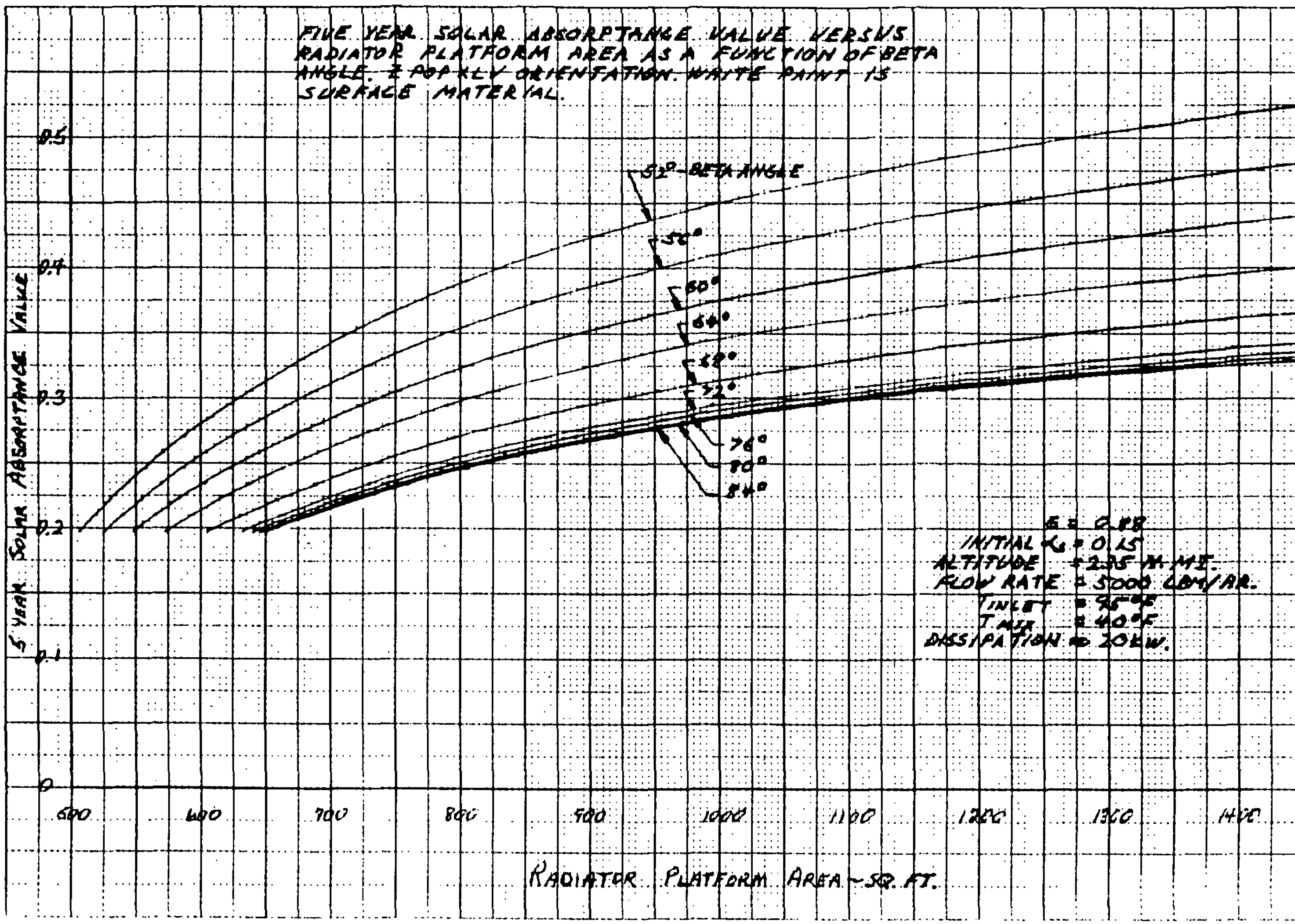

FIGURE 2-20 FIVE-YEAR SOLAR ABSORPTANCE VALUE VERSUS RADIATOR PLATFORM AREA AS A FUNCTION OF BETA ANGLE, ZPOP XLV ORIENTATION, WHITE PAINT SURFACE

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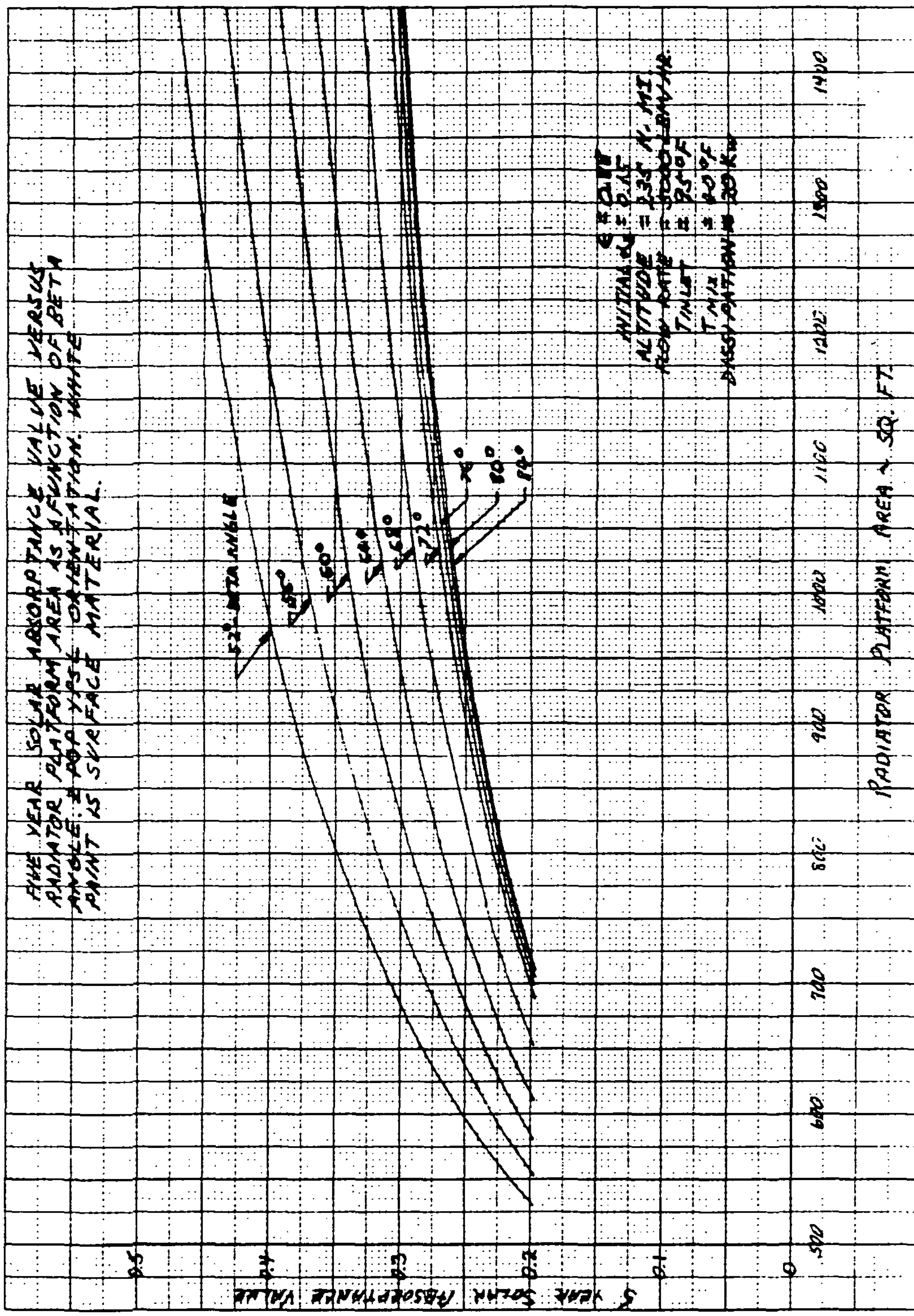

FIGURE 2-21 FIVE-YEAR SOLAR ABSORPTANCE VALUE VERSUS RADIATOR PLATFORM AREA AS A FUNCTION OF BETA ANGLE, ZPOP YPSL ORIENTATION

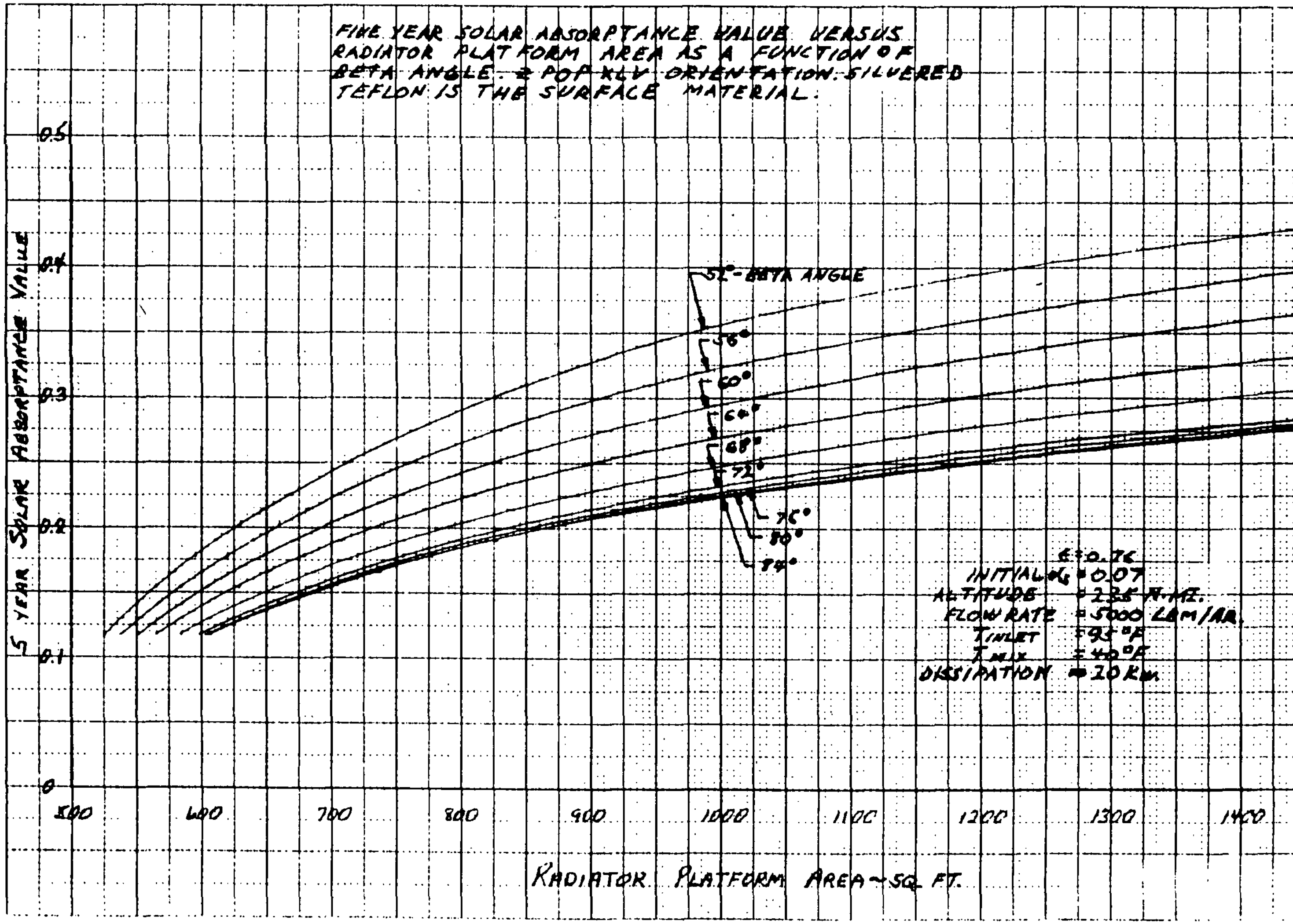

FIGURE 2-22 FIVE-YEAR SOLAR ABSORPTANCE VALUES VERSUS RADIATOR PLATFORM AREA AS A FUNCTION OF BETA ANGLE, ZPOP XLV ORIENTATION, SILVERED TEFLON SURFACE

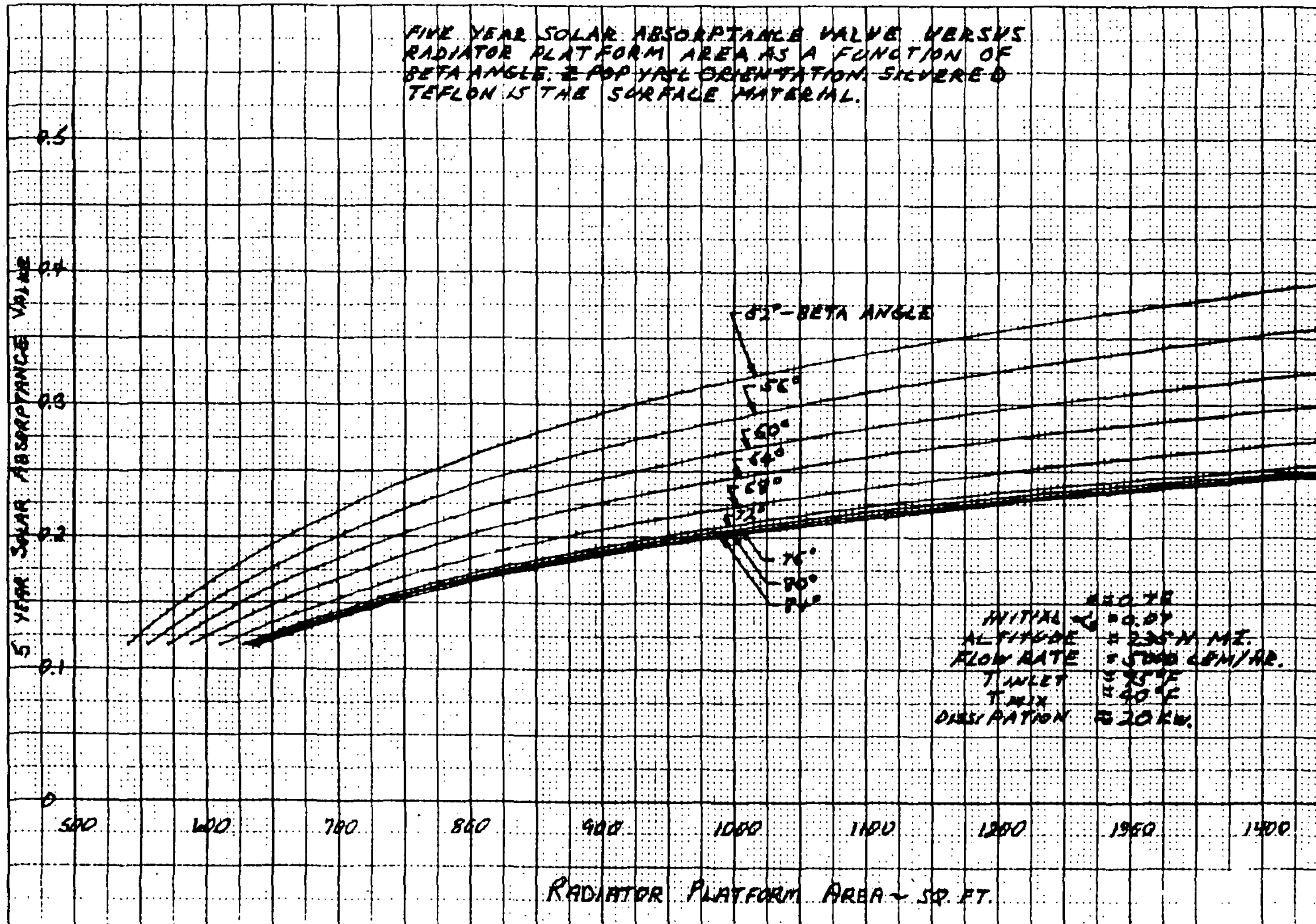

FIGURE 2-23 FIVE-YEAR SOLAR ABSORPTANCE VALUES VERSUS RADIATOR PLATFORM AREA AS A FUNCTION OF BETA ANGLE, ZPOP YPSL ORIENTATION

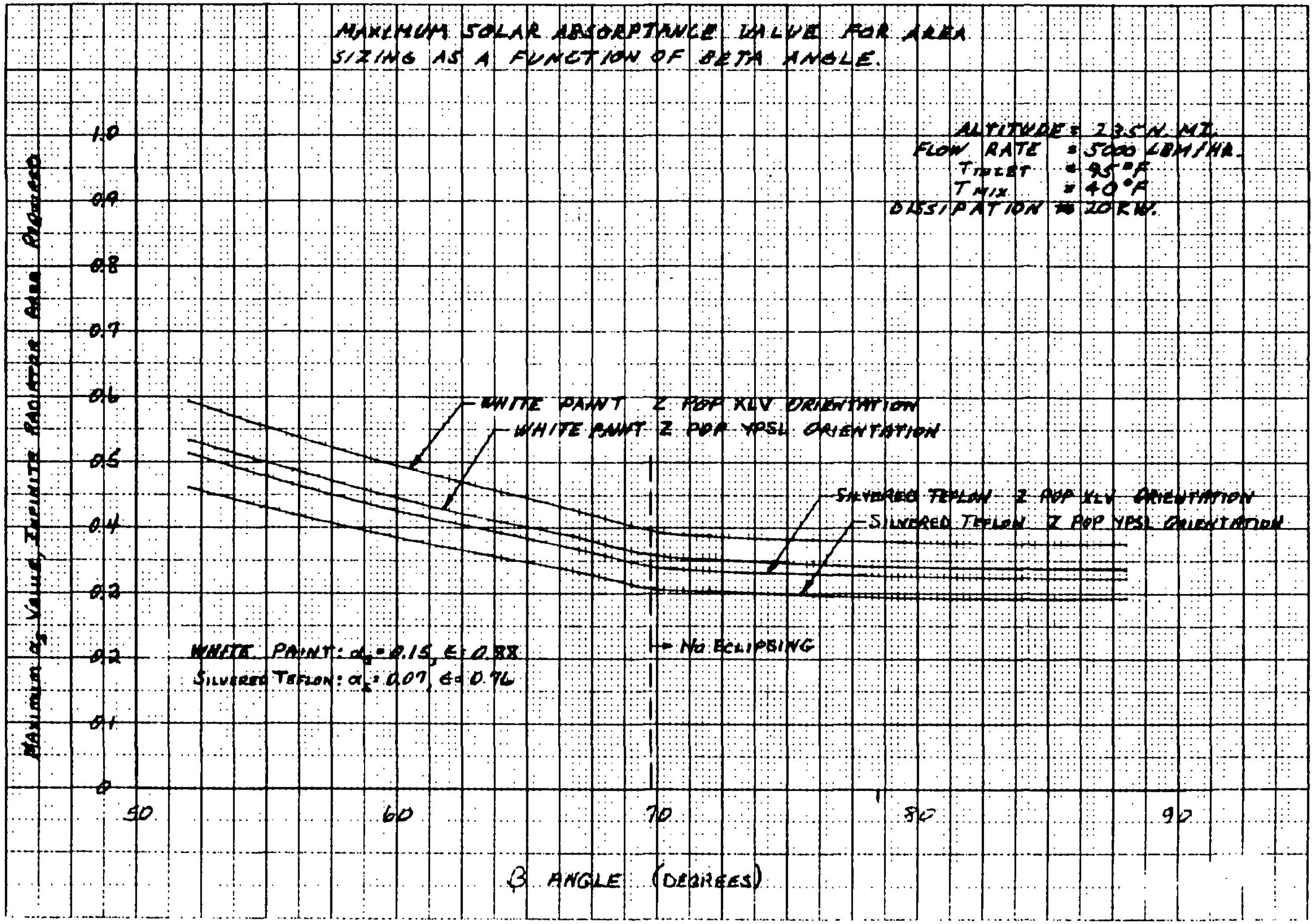

FIGURE 2-24 MAXIMUM SOLAR ABSORPTANCE VALUE FOR AREA SIZING AS A FUNCTION OF THE BETA ANGLE

Because of the low degradation rates required to provide five-year life with current area constraints and the low maximum α_s acceptable because of primary mission constraints, it appears refurbishment will be required within the five-year period if current constraints remain unchanged. With increased platform area, primary mission for β = 52 degrees may be feasible for five years without refurbishment if radiator platform area is increased as Table 2-2 indicates; for β = 78.5 degrees even increased platform area would not allow five-year life.

The radiator orientations examined are favorable thermally. A deviation toward a radiator solar inertial orientation via a movable radiator system or reorientation may reduce the external heat loads at such high β values, however, this would require a gimbal system. In LEO, therefore, no modifications of orientation are expected to provide significantly improved life over the orientations examined. Only a lowering of β angle can significantly reduce the external heat fluxes values thus extending radiator operational life, however, that is an understandably unacceptable alternative.

Reasonable estimates of the degradation rates anticipated indicate the present module design for the thermal control system cannot remain "in spec" for a five year period (even with the most favorable orientations) without lowering primary mission β, gimbal of radiators, or refurbishing the radiators on-orbit at least once in the five year period. It appears increasing radiator platform area is the only way to partially alleviate these constraints.

2.1.5 GEO Power Module EOL Degradation and Area Requirement Study

A GEO environment study has also been conducted to evaluate the end of life (EOL) for the 25-kW power module radiators as a function of degradation rate, β angle, and orientation at GEO altitude. As a part of this study an evaluation has been made of the platform area required to remain "in spec" for a five-year operational life. To remain "in spec" means the radiator is able to reject a full dissipation load and maintain the proper mix temperature.

The time of EOL has been defined, for this study, to be that time on-orbit for which "in spec" operation first becomes impossible during any portion of the orbit due to excessive external head loads. In other words, the time in vehicle life at which external loads first become excessive, resulting in radiator inability to reject the full dissipation load and provide an exit fluid temperature equal to or below the mix value.

Unlike LEO conditions, this EOL definition does not mean the system cannot provide "in spec" operations during the entire orbit. Instead, it simply means EOL occurs when it cannot provide "in spec" operation over the entire orbit any longer due to growing excessive external head loads. After the EOL point in GEO has occurred, typically "in spec" operation will be possible during portions of the orbit and during the other portion of the orbit dissipation and total flow rate will have to be cut back to maintain the proper mix temperature coming out of the radiator (the bypass will be close during this portion of operation). This reduced performance capability will continue to become an ever increasing portion of the orbit as excessive external heat loads continue to increase with time. The EOL definition for this study is then, that point in time of the vehicle life at which this reduced performance is first required.

This study has been conducted evaluating a white paint (zinc orthotitanate; initial $\alpha_s = 0.15$, $\epsilon = 0.88$) and silvered Teflon (2 mil, initial $\alpha_s = 0.07$, $\epsilon = 0.76$) as radiator materials. Orbital parameters chosen where those of a GEO altitude of 19,370 nautical miles and a β angle ranging from zero to 23.5 degrees at 5 degree increments. The radiator control system parameters are mix and inlet temperatures of 40°F and 95°F, respectively, and a total mass flow rate of 5000 lbm/hr. The radiator configuration used was that of two radiators in the same plane consisting of all four segments and a combined platform area of 634 ft^2. The coolant considered was Freon 21, with a specific heat of 0.25 BTU/lbm-$^\circ$R assumed constant. Tending by the STS has been assumed to minimize heat rejection capability to space (view blockage) while increasing dissipation to a worst case of 20 kW.

Both hot and thermally favorable orientations have been considered due to possible earth-oriented missions which might be considered in GEO. These orientations both are shown in Figure 2-25. ZPOP (thermally favorable) and XPOP (hot case) missions have been considered with the possibility of an XSI (thermally favorable) orientation. The XSI orientation is thermally favorable in the GEO environment also, but has attitude control problems associated with it. The XSI case, however, for GEO is virtually the same (thermally) as the ZPOP YPSL at a $\beta = 0$ condition and therefore was not evaluated as a separate orientation consideration. Although, XLV, ZLV, and YPSL orientations are considered for the ZPOP and XPOP orientations the EOL values are indistinguishable between XLV and YPSL for the ZPOP orientation and between ZLV and YPSL for the ZPOP orientation. This result is not true for the entire orbit as a whole, but is true for the position in orbit at which EOL first occurs. Therefore, an XPOP ZLV and a ZPOP YPSL orientation were chosen as representative orientations. The ZPOP orientation, being the thermally favorable orientation at low β values should provide the longest EOL time on orbit and the XPOP orientation, being a hot orientation, should provide a minimal EOL time on orbit.

For this study, rates of degradation (linear rise in solar absorptance) were varied from 0.001 to 0.015 $\Delta\alpha_s$/month (an upper limit of 0.006 for the XPOP cases due to infinite area required at and above this value for five year life). A degradation rate of 0.0015 $\Delta\alpha_s$/month is still considered a minimal realistic limit and 0.01 $\Delta\alpha_s$/month is still considered a reasonable upper limit (based upon data available), however, expanding the range of values considered allows the results to be presented in a more complete manner.

The key results of this study are presented in Table 2-3. For the table only β values of zero and 23.5 degrees are presented which bracket the solutions. More detailed plots of the results can be found in figures referenced below.

The maximum degradation rates presented in the first data column represent the largest rates allowable to remain "in spec" for five years.

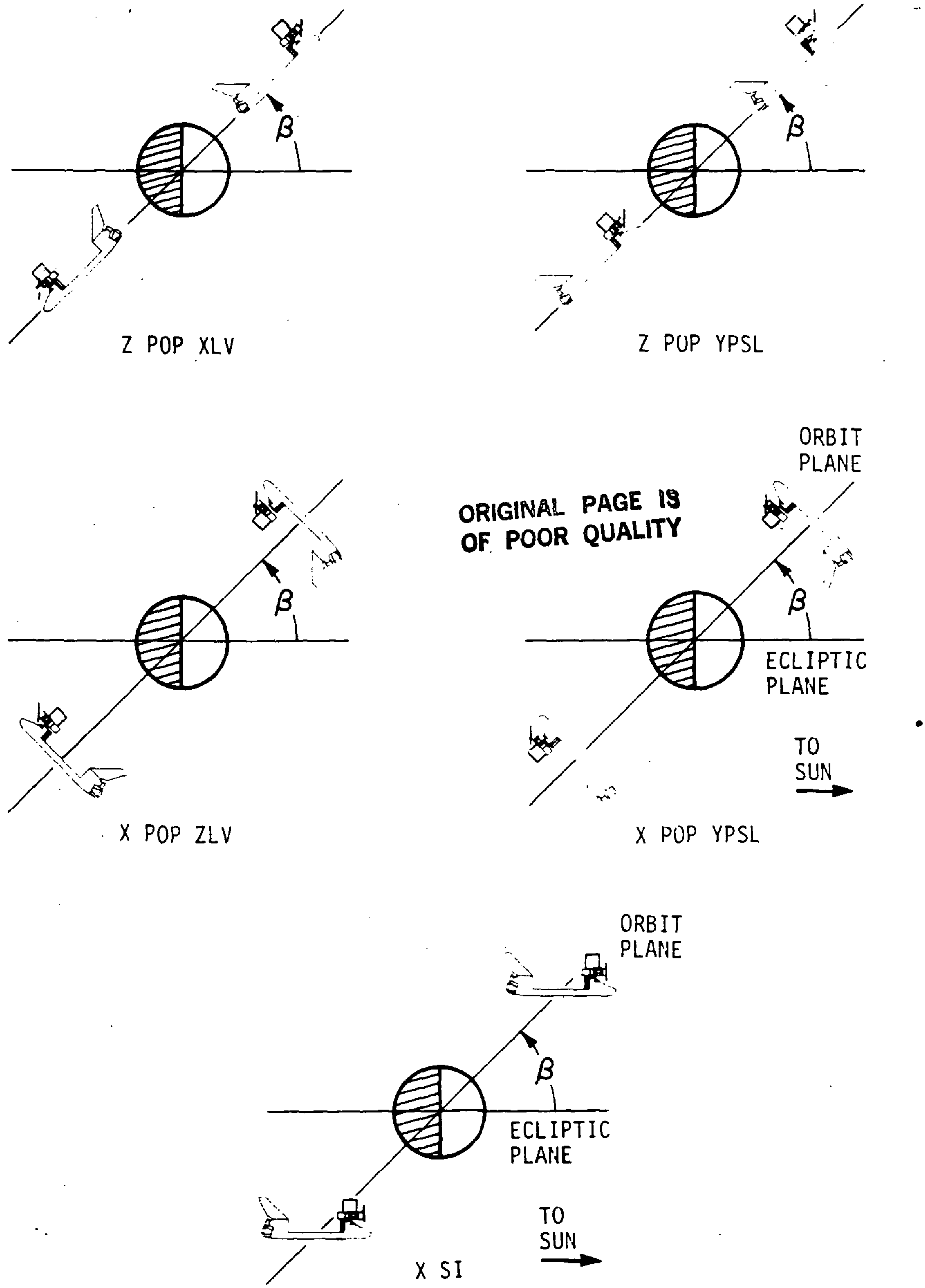

FIGURE 2-25 GEO POWER MODULE ORIENTATION CONSIDERED

TABLE 2-3 POWER MODULE EOL DEGRADATION AND AREA REQUIREMENT STUDY RESULTS

Material	Orientation	β Angle (Degrees)	Maximum Degradation Rate for Five-Year Life ($\Delta\alpha_s$/Mo.)	α_s Value Requiring Infinite Radiator Platform Area	Operational Life for a Degradation Rate of 0.005 $\Delta\alpha_s$/Mo. (Mo.)	Required Platform Area for Five-Year Life With 0.005 $\Delta\alpha_s$/Mo. Degradation Rate (Ft.^{2})
White Paint Initial $\alpha_s = 0.15$ $\varepsilon = 0.88$	Z POP	(X SI) 0	above 0.015	none	60 +	294.0
		23.5	0.0089	none	60 +	452.0
	X POP	0	0.0020	0.423	23.8	∞
		23.5	0.0024	0.462	28.7	2317.0
Silvered Teflon (2 mil) Initial $\alpha_s = 0.07$ $\varepsilon = 0.76$	Z POP	(X SI) 0	above 0.015	none	60 +	340.0
		23.5	0.0074	0.928	60 +	508.0
	X POP	0	0.0022	0.365	26.1	∞
		23.5	0.0025	0.399	29.9	1798.0

It can be seen the only non-critical values are for the ZPOP orientations. The values for the XPOP orientations are well below the 0.005 $\Delta\alpha_s$/month (NASA/MSFC) value considered most reasonable to date.

The solar absorptance values presented for requiring infinite radiator platform area represent an upper limit to the acceptable degraded absorptance values when sizing the radiators. These values correspond to external heat fluxes sufficiently large such that infinite radiator area would be required for "in spec" operation. If these values are so low that realistic rates of degradation would cause absorptance values to exceed or closely approach them during the vehicle life, then the mission β and orientation must be reexamined. Such is the case for the XPOP orientations, however, not so for the ZPOP orientations.

Using the 0.005 $\Delta\alpha_s$/month rate as a reasonable estimate for radiator degradation on the power module, the table lists next the operational life or EOL value based upon this rate. The 60+ values for the ZPOP orientations indicate five year plus life can be expected. Values closely surrounding two years are indicative of the XPOP orientations.

The last column represents the required platform area to remain "in spec" for five years with a degradation rate of 0.005 $\Delta\alpha_s$/month. It is clear from these data the current power module configuration is sufficient for the ZPOP orientations. It is clear for the XPOP orientations the values required are excessively high indicating 284 to 365 percent increases in platform area required over the current configuration.

This data is presented in greater detail in the figures which follow this text. Figures 2-26 through 2-29 present degradation rates versus life (in spec) after launch (EOL) as a function of β for the two orientations and two materials considered. Figures 2-30 through 2-33 present degradation rates versus required platform area for five-year life as a function of β angle for the two orientations and two materials considered.

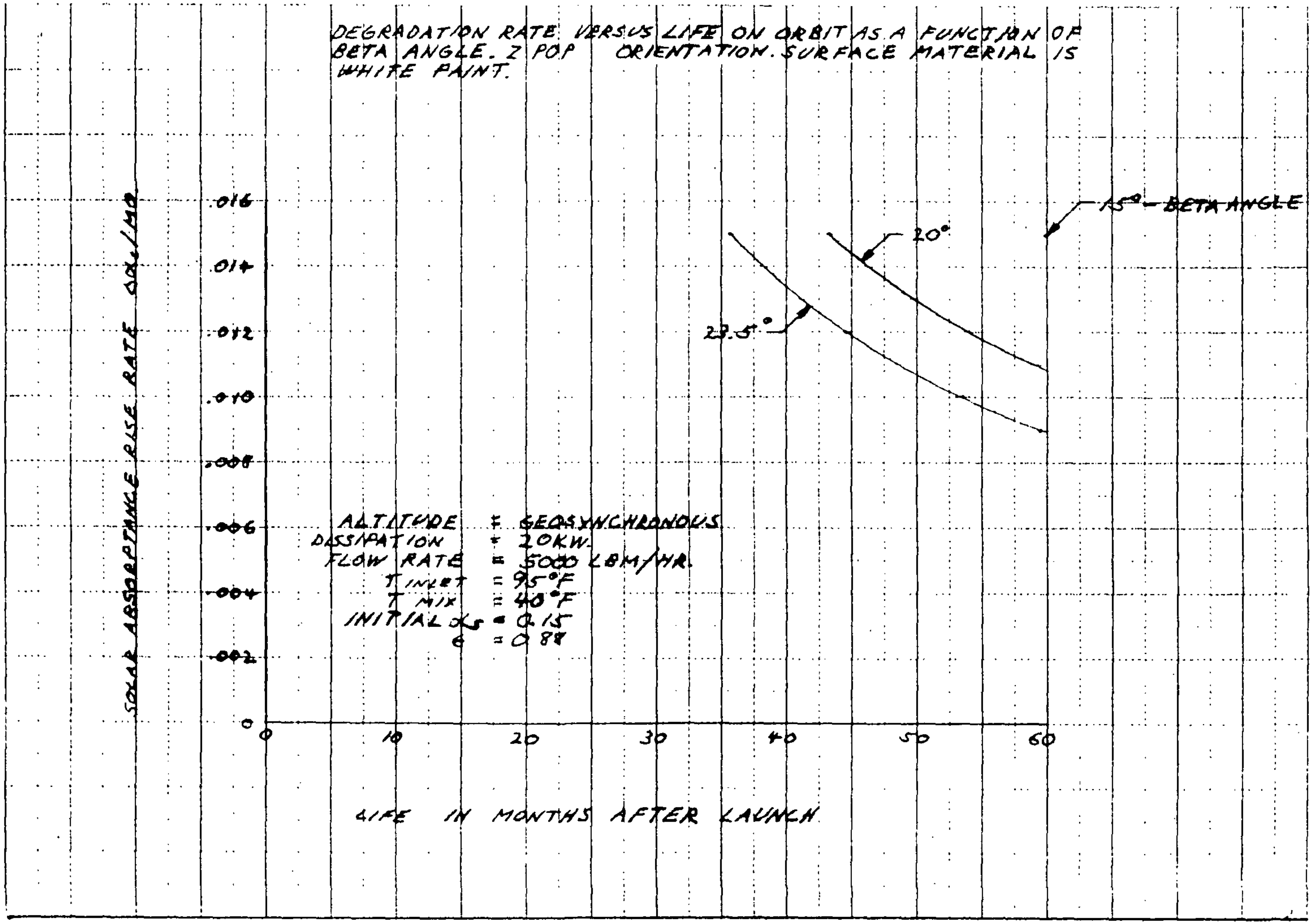

FIGURE 2-26 DEGRADATION RATE VERSUS LIFE ON ORBIT AS A FUNCTION OF BETA ANGLE, ZPOP ORIENTATION: SURFACE MATERIAL IS WHITE PAINT

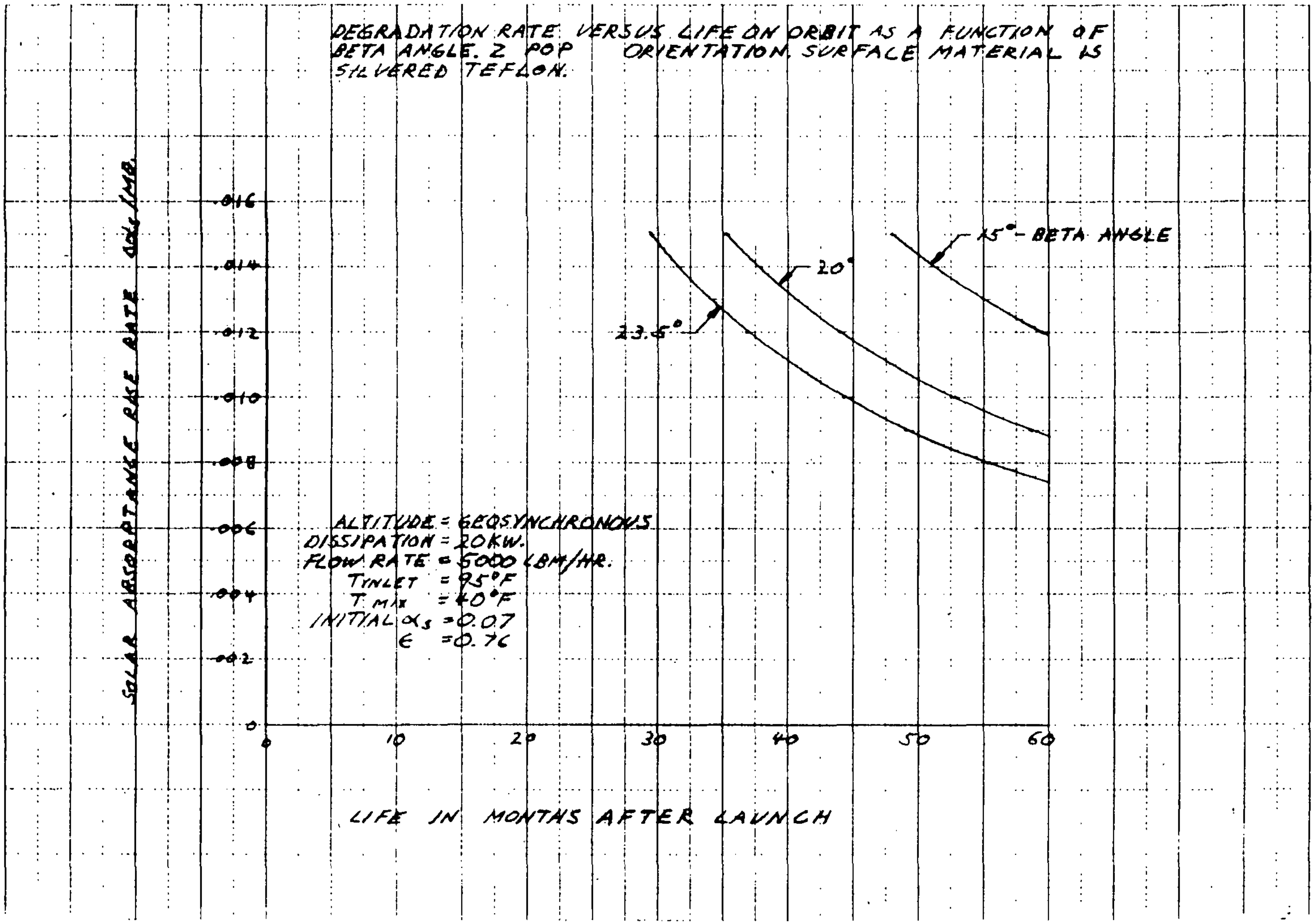

FIGURE 2-27 DEGRADATION RATE VERSUS LIFE ON ORBIT AS A FUNCTION OF BETA ANGLE ZPOP ORIENTATION; SURFACE MATERIAL IS SILVERED TEFLON

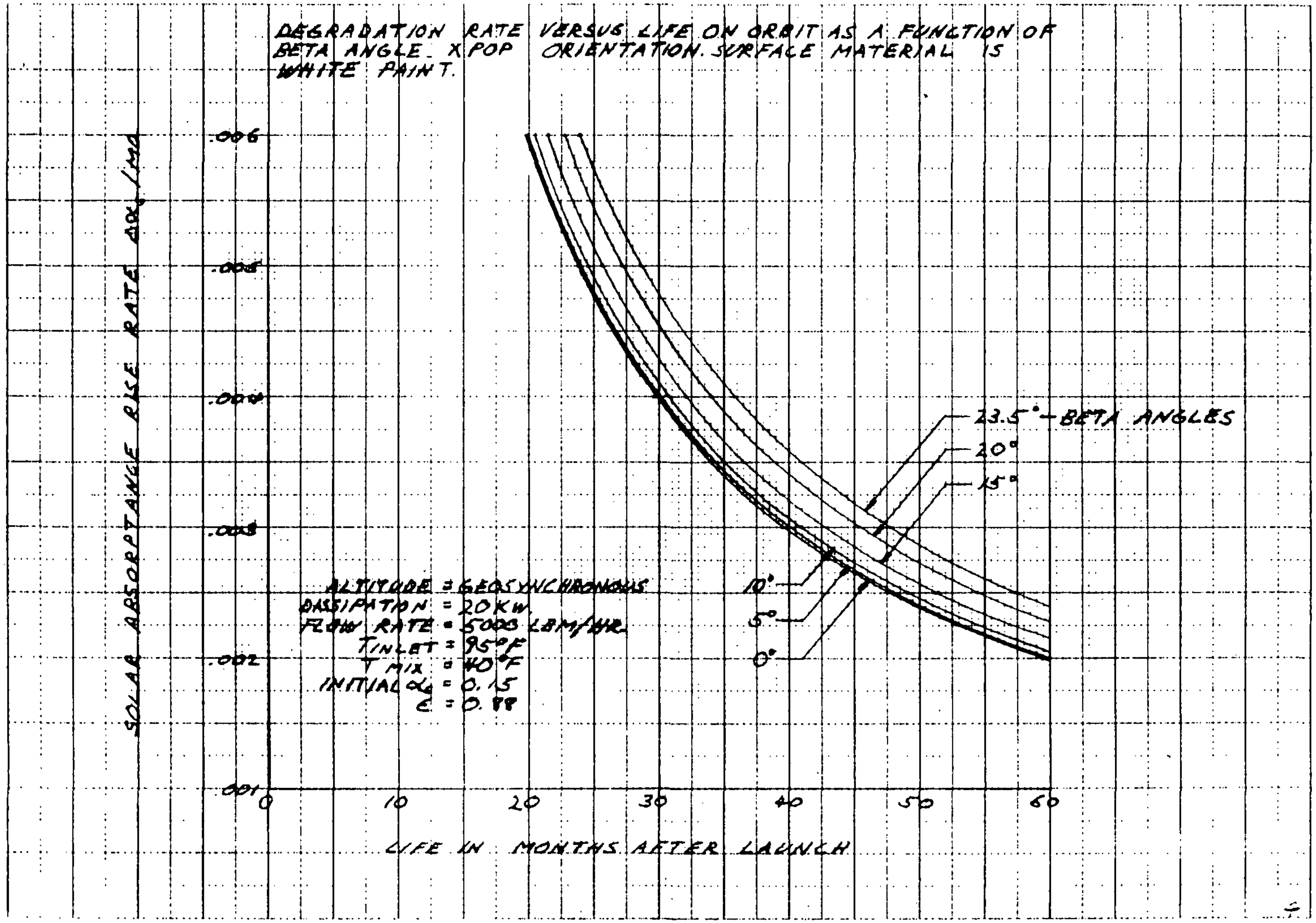

FIGURE 2-28 DEGRADATION RATE VERSUS LIFE ON ORBIT AS A FUNCTION OF BETA ANGLE, XPOP ORIENTATION; SURFACE MATERIAL IS WHITE PAINT

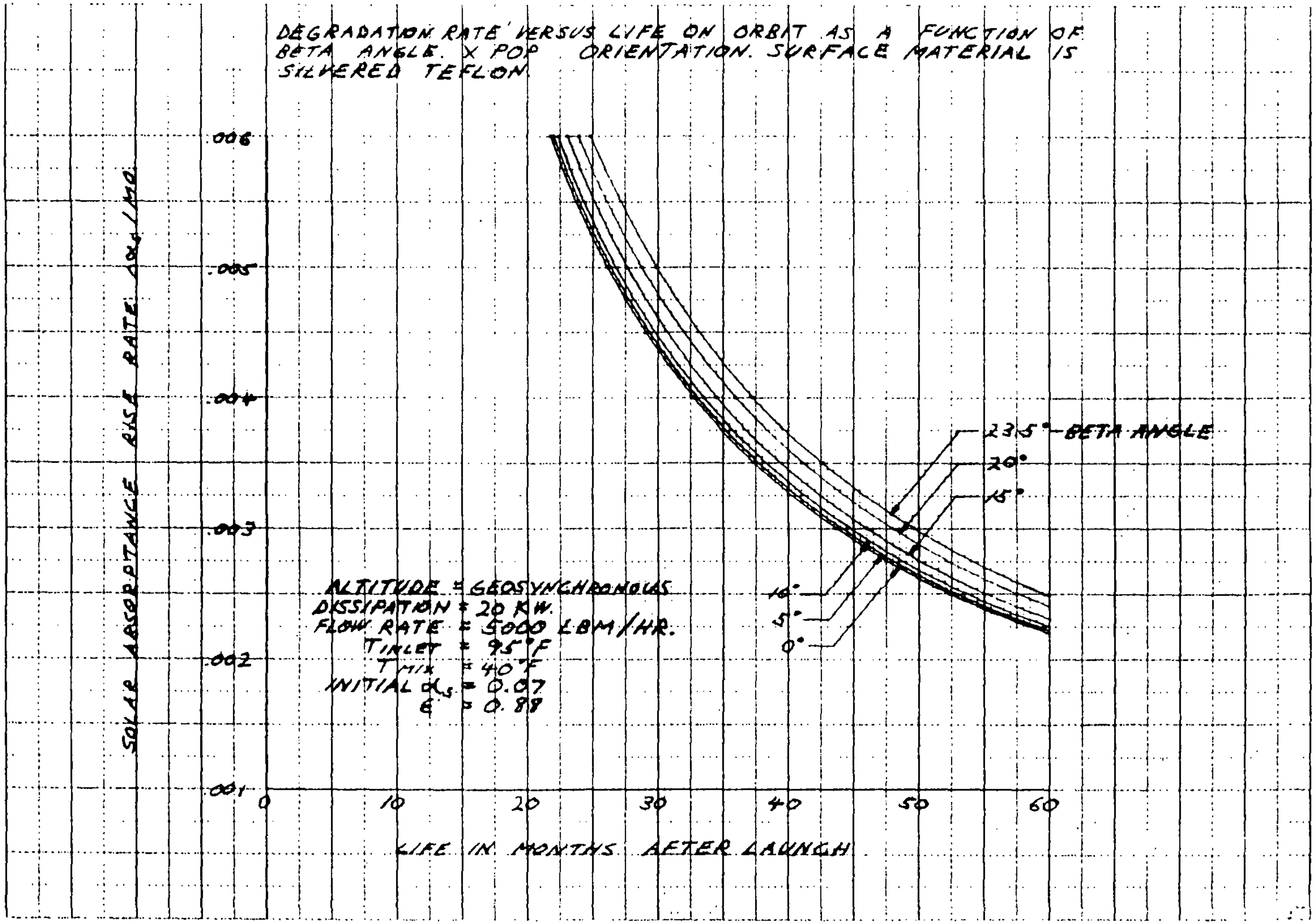

FIGURE 2-29 DEGRADATION RATE VERSUS LIFE ON ORBIT AS A FUNCTION OF BETA ANGLE, XPOP ORIENTATION; SURFACE MATERIAL IS SILVERED TEFLON

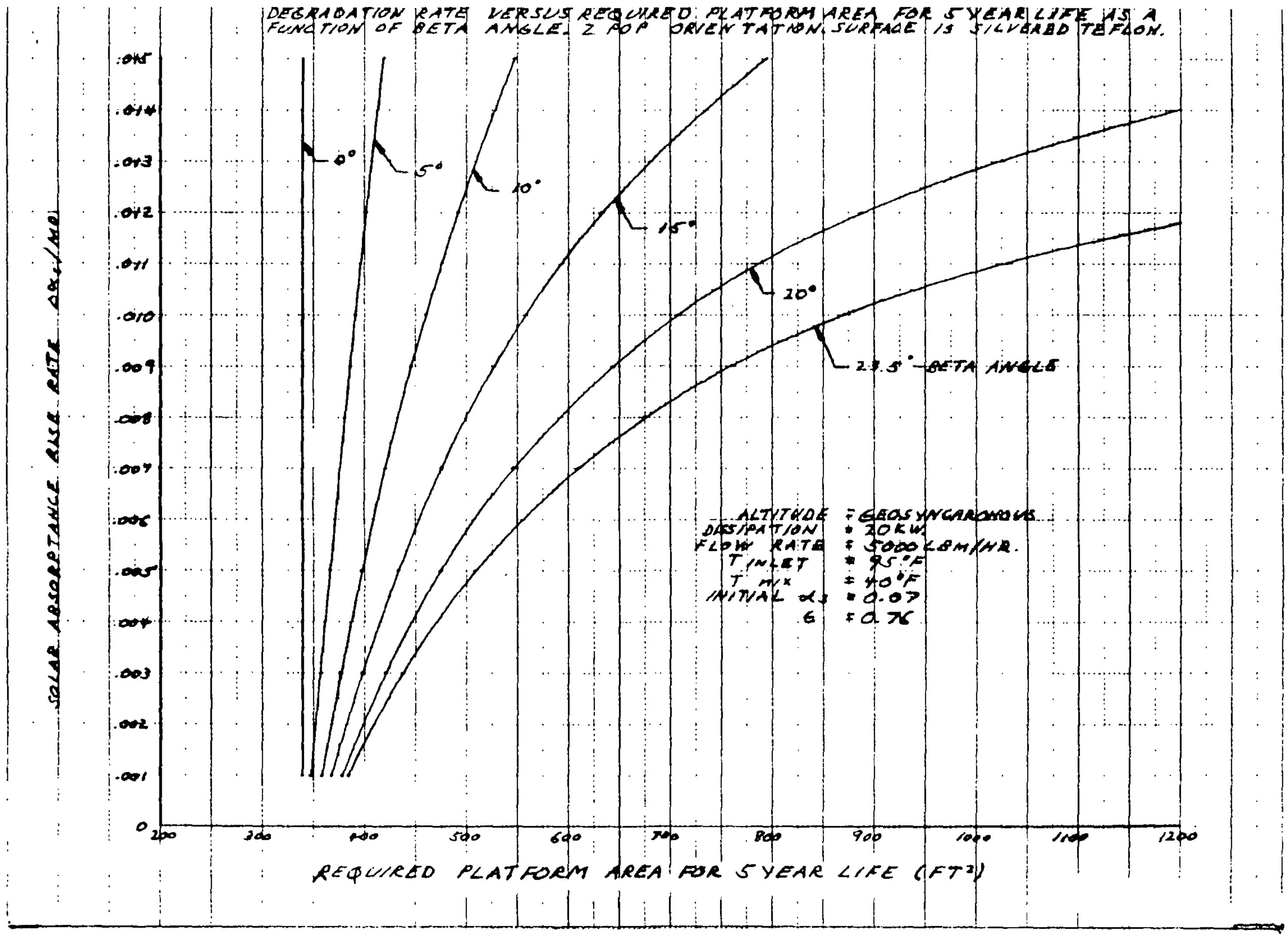

FIGURE 2-30 DEGRADATION RATE VERSUS REQUIRED PLATFORM AREA FOR FIVE-YEAR LIFE AS A FUNCTION OF BETA ANGLE, ZPOP ORIENTATION; SURFACE IS SILVERED TEFLON

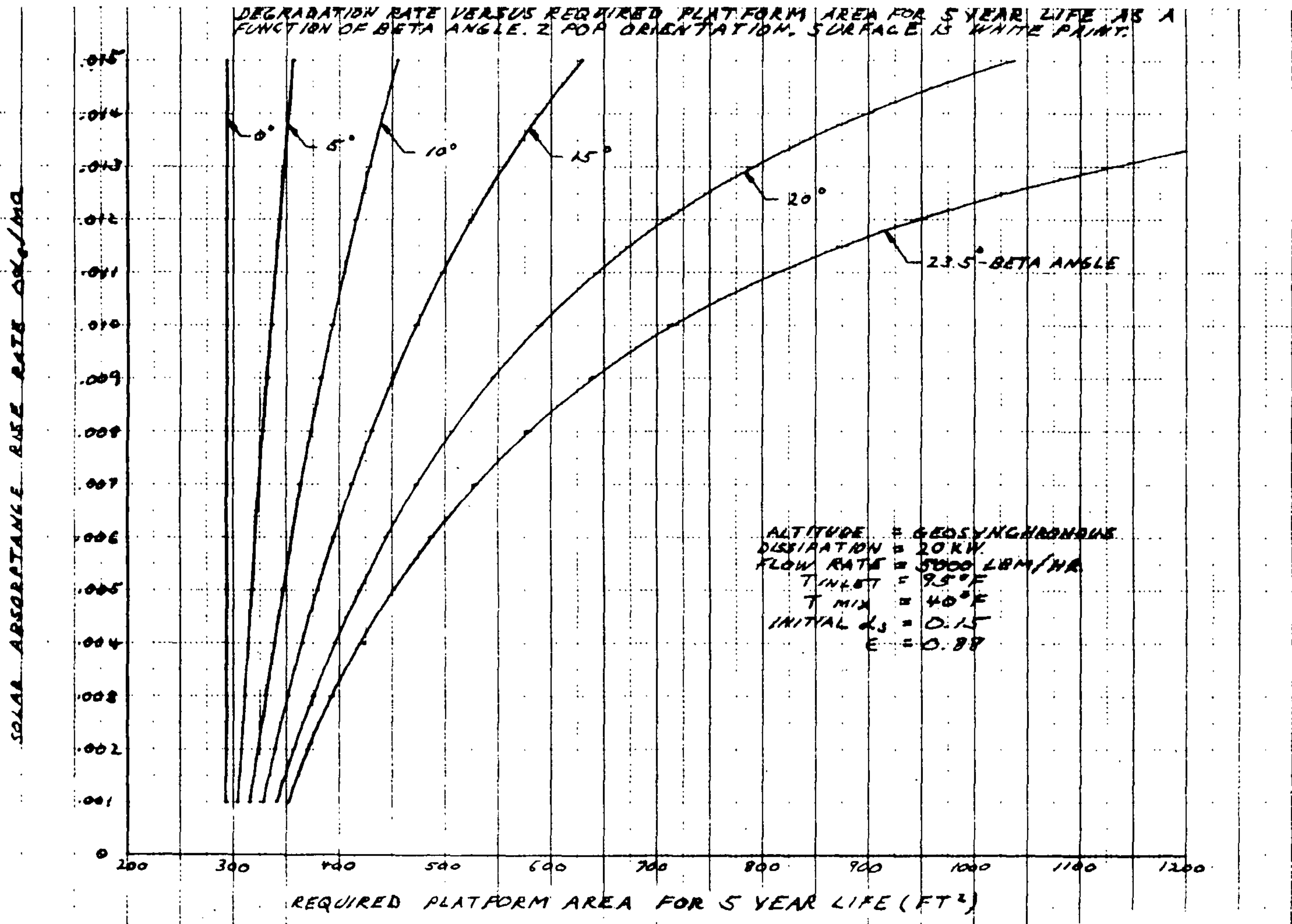

FIGURE 2-31 DEGRADATION RATE VERSUS REQUIRED PLATFORM AREA FOR FIVE-YEAR LIFE AS A FUNCTION OF BETA ANGLE, ZPOP ORIENTATION; SURFACE IS WHITE PAINT

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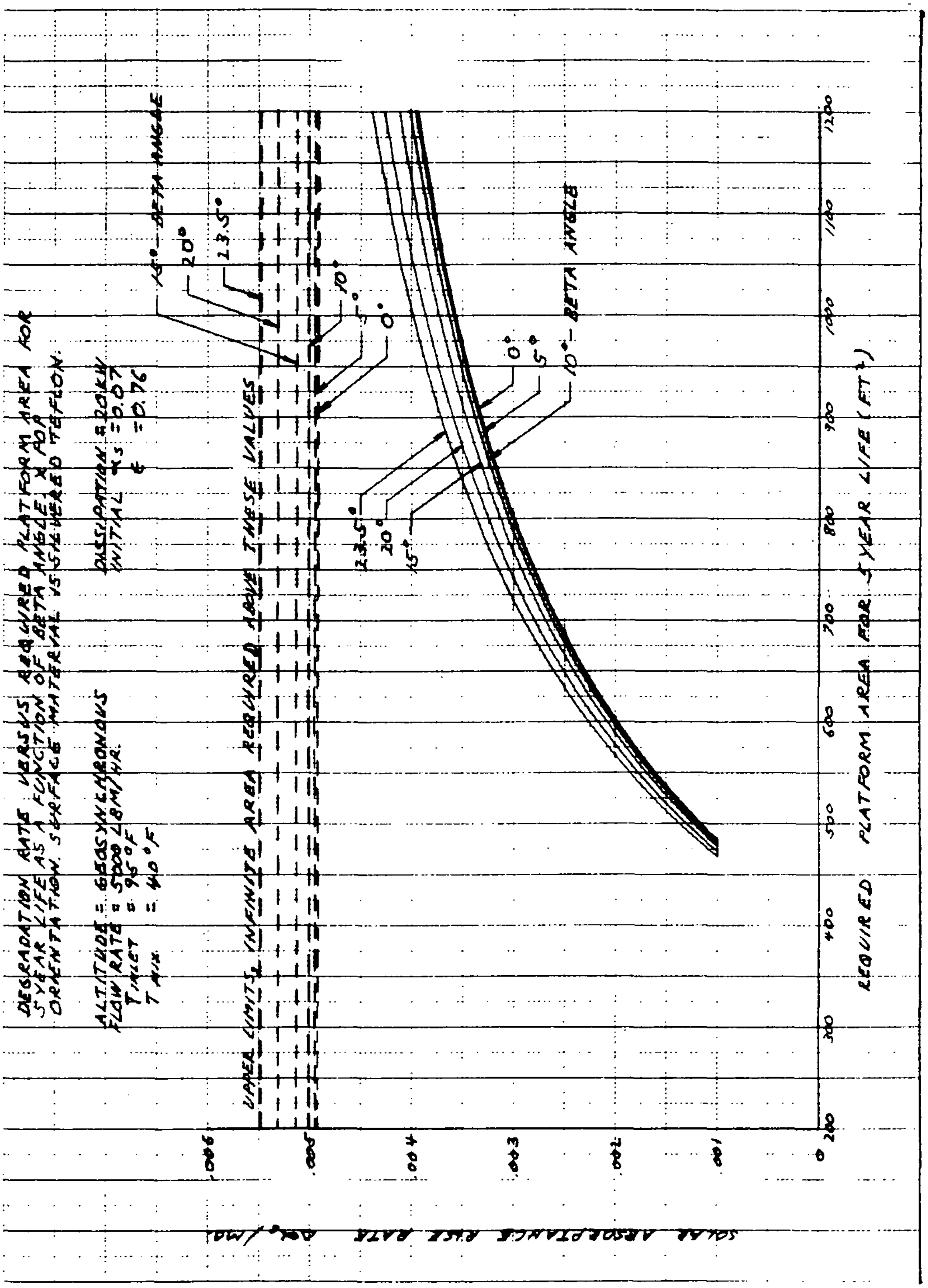

FIGURE 2-32 DEGRADATION RATE VERSUS REQUIRED PLATFORM AREA FOR FIVE-YEAR LIFE AS A FUNCTION OF BETA ANGLE, XPOP ORIENTATION; SURFACE IS SILVERED TEFLON

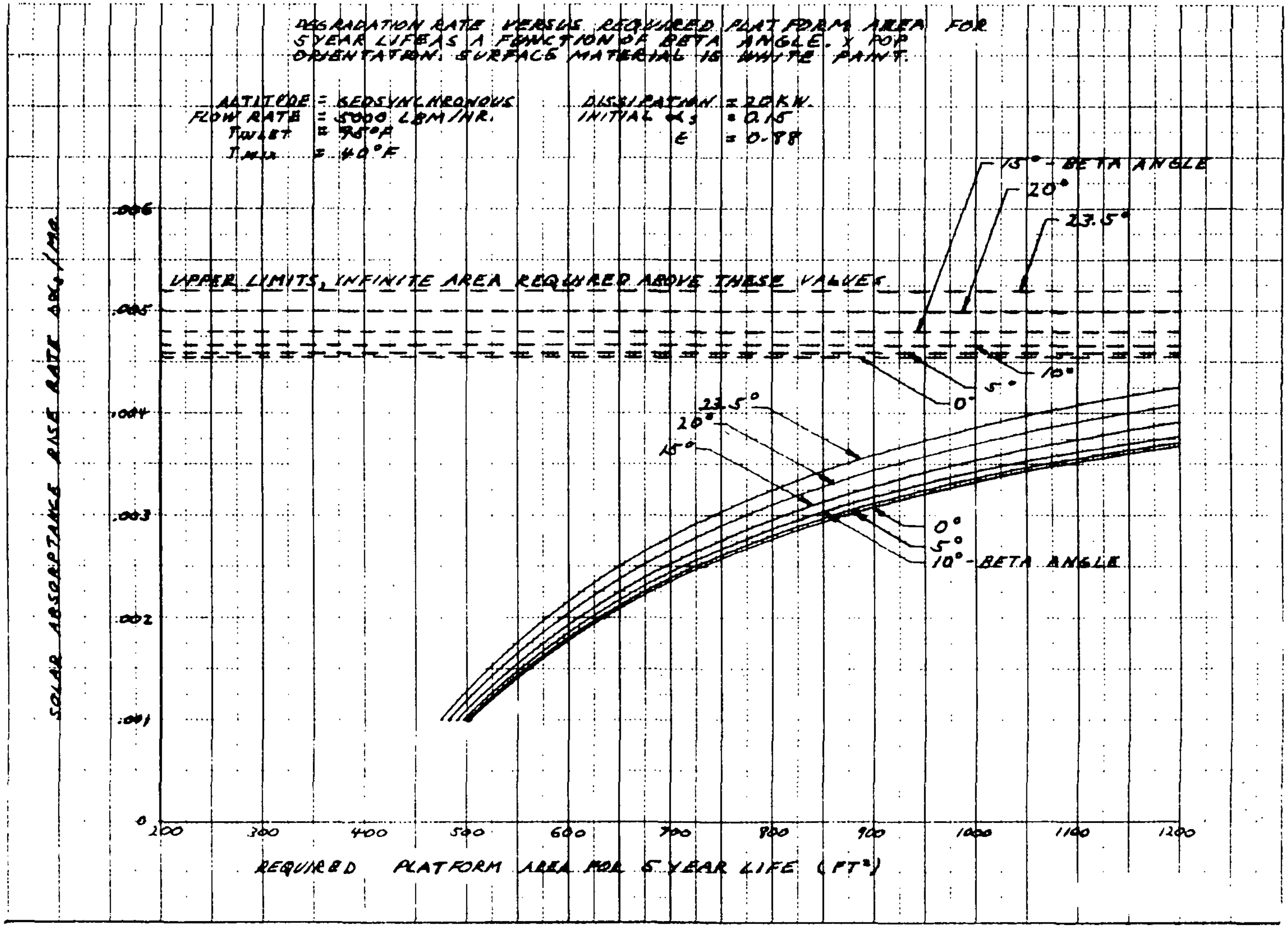

FIGURE 2-33 DEGRADATION RATE VERSUS REQUIRED PLATFORM AREA FOR FIVE-YEAR LIFE AS A FUNCTION OF BETA ANGLE, XPOP ORIENTATION; SURFACE IS WHITE PAINT

These results indicate that with anticipated degradation rates on the order of 0.005 $\Delta\alpha_s$/month, radiators covered with either white paint (zinc orthotitanate) or silvered Teflon (with the exception of radiation bombardment problems) oriented with the ZPOP orientation could provide five years of life for the evaluated power module configuration in GEO with "in spec" operation. Oriented in the XPOP orientations it is clear that, without reorienting the radiators with a gimbal system to keep them parallel,or nearly parallel, to the plane of the eclyptic, with the configuration studied the EOL value is approximately 2 to 2.5 years. Thus, refurbishment would be required at least once during a five year period.

These results indicate a small deviation from the ZPOP orientations could be made and still provide five-year life, however, it is clear five-year survival in the GEO environment is clearly dependent upon a thermally favorable orientation. Considering that this is a preliminary and rather idealized study, it is clear there is little margin for deviation from a thermally most favorable vehicle orientation, unless the radiators are gimbaled, if five-year life is to be achieved.

2.2 COMPUTER PROGRAM DEVELOPMENT

Four computer programs have been developed which provide a preliminary design and evaluation tool for active radiator systems in LEO and GEO. Two programs have been developed as general programs for space station analysis. The other two programs have been developed to provide an analysis tool for the 25-kW power module.

Both types of programs find the radiator-flow solution and evaluate external heat loads in the same way; however, the two programs are conceptually different. The general space station programs are more in the nature of a preliminary design tool, while the power module programs are more of an evaluation tool. For many purposes both program types could be used for the same task. However, the space station programs have greater capability for sizing radiator platform areas and coolant flow rates along with the ability to size both flat extended and cylindrical wraparound radiators.

Both program types (general and power module) have been formatted according to the general orbital considerations:

a. The bypass thermal control system is the type of system both programs evaluate.

b. Both LEO programs are limited to altitudes between 100 and 1000 nautical miles, with β angles ranging from 0 to $\pm$ 90 degrees. Both GEO programs assume an altitude of 19,370 nautical miles and any β angle may be input, however, it should vary between 0 and 23.5 degrees to be geosynchronous.

c. Both LEO programs are restricted to LEO conditions because of the assumption that orbital periods are sufficiently small to allow orbital mean temperatures to be indicative of temperatures over the entire orbit. This allows orbital mean external heat loads to be used and steady-state solutions to be determined. Both GEO programs assume the orbit period is sufficiently long to assume zero thermal capacitance radiators, allowing complete orbital solutions to be found by a steady-state numerical solution technique used for each position in orbit that is specified. In addition to long orbit periods, efficient radiators are designed to be low capacitance; rejecting heat and not storing it, thus supporting the assumption.

d. Both LEO programs evaluate flat extended radiators oriented in the orbit plane, as this is an optimal configuration for a fixed system. In addition, the LEO space station program evaluates cylindrical wrap-around module radiators oriented with the axis pointing toward the earth as that is the optimal configuration for such a fixed system. The flat radiators are double sided; thus, the area considered is platform area. While these orientations are thermally favorable, the GEO programs are not restricted to them because the external heat fluxes are not determined strictly in the coding but rather result from tabular inputs. This is necessary as shading must be input on a function of orbit position which is not the case in LEO where only mean values are required for the programs.

e. Both program types evaluate degraded performance with time on orbit. Rates of degradation may be input along with time on orbit and intervals over which solutions are obtained. In the case of the GEO programs complete orbital solutions are provided at user specified times over which the degradation occurs.

Both LEO programs allow the parameters of altitude, orbit β angle, required fluid heat-load dissipation, and degradation rates to be selectively inputted as singular values or as ranges with specified intervals. This allows the user to evaluate a specific case of interest or generate an entire parametric study in a single run. Other inputs vary depending on which program is used. This is also true of the GEO programs except for the altitude which is fixed and the β angle which is input and cannot be varied parametrically in a single run because of the restriction of reading in corresponding external heat load tables.

2.2.1 LEO General Space Station Program

The LEO space station program was developed to be a preliminary design tool, with the major objectives being the determination of required coolant flow rate and radiator area for a prescribed EOL condition based upon degradation. In addition, the entire radiator-flow solution is determined for time increments from initial on-orbit conditions through EOL, providing a quantitative solution to the effects of degradation over the life of the system.

These solutions may be found for both flat extended radiators and cylindrical wrap-around module radiators. The input allows for the solution for each radiator type independently. The required fluid dissipation may be input in such a way that only one type of radiator need be considered or dissipation may be incremented such that flat radiators are sized up to a certain load (break point) after which all additional dissipation will be used to size cylindrical radiators. Thus, a particular radiator (of either type) may be sized, or a combination of independent radiators of both types may be sized for total heat loads for a large station with inhabited modules.

The known input parameters for the program relate a design philosophy. Internal environmental control defines an inlet temperature (T_I), outlet mix temperature (T_M) and a dissipation load (D) specifically or within very small ranges. Orbital β angles and altitude will be defined or ranges set. This information furnishes the required data input for sizing the coolant flow rate, providing the coolant specific heat is known. However, for area sizing, additional information must be determined on the maximum external heat fluxes the system can withstand. For this reason degradation knowledge is essential. A value for EOL α_s must be determined. The area sizing of the radiator, because of external loading, depends on this parameter.

For a given orientation, altitude, and β value, there is a maximum α_s value for which a given system (materials considered) can remain "in spec" even with infinite area. The program computes this value and compares it with an EOL α_s value computed from degradation rate, initial α_s value, and lifetime inputted. Should the EOL α_s be less, a lifetime solution to the flow problem will be computed and area sized. If the EOL α_s is larger, the solution will terminate with the appropriate message. The area will be sized using the computed EOL α_s, assuming the total mass flow rate of coolant is flowing through the radiator as the EOL limiting condition. This provides a minimum area required to meet the EOL condition. The program computes the complete radiator flow solution at specified time intervals (inputted) between initial on-orbit time and EOL (EOL time is specified as a design input and is used to calculate EOL α_s), showing quantitatively how degradation changes the system performance.

The program can thus be used to determine what EOL α_s values are acceptable under design conditions and what rates of degradation are implied to meet EOL lifetimes for given orientations. The program output provides information as to when programmed inputs do not provide a realistic solution. Thus, the necessary information to correlate orbital parameters with area and flow requirements (aiding in pump sizing) for realistic life on orbit for the system is provided.

When a solution is possible, the program provides inlet-fluid temperature, mean radiator temperature, radiator-outlet-fluid temperature, mass flow rate through the radiator, α_s, total solar heat input, total albedo heat input, eta (η) and iterations required for a solution. Eta is defined as

$$\eta = \frac{T^4 - T_R^{\ 4}}{T_I^{\ 4} - T_R^{\ 4}} \tag{6}$$

where

T = mean radiator temperature

In addition to these parameters, design parameters such as radiator type, total mass flow rate, required area, EOL α_s, maximum α_s due to external loads, dissipation, earthshine heat input (not a function of α_s but rather ε, thus remaining constant), orbit parameters, and inlet and mix temperature conditions are printed out.

2.2.2 GEO General Space Station Program

The GEO space station program performs similar functions and maintains the same basic approach or philosophy as the LEO space station program. Special modifications have been added to tailor the program to the GEO environment. Here again, input system parameters and degradation rate, along with vehicle life values, allow one or both types of radiatiors to be sized independantly and the complete performance life of the system is computed and presented to the user.

In this program β may not be parametrically varied but instead a single value may be input which corresponds to the tabular external heat load shape factor data. The reason for this is that for any given β a set of tabular data must be input in the form of heat flux tables for direct solar, earthshine and albedo, in that order. Three tables must be input for each of the two radiator geometries; double-sided flat extended and single-sided cylindrical wrap-around. The reasons for tabular input are twofold, the radiators are not orientation bound with respect to the earth due to the dominance of albedo and earthshine as in LEO and shading must be input as a function of orbit position instead of mean values as in LEO.

The purpose for requiring orbital variations is that complete orbital solutions must be provided in GEO conditions due to the length of the orbit period. The variation of external loads over such an orbit period causes large variations in the system performance and, therefore, orbital mean values are not representative of the orbit as a whole as in the LEO environment. As a result, at user specified points along the input system life, complete orbital solutions are presented so those variations may be evaluated.

These orbital solutions are computed at user-specified orbit positions by a steady-state numerical technique which may be used by assuming zero thermal capacitance for the radiators. This is a good assumption in that the orbit period is sufficiently long for the effect of the capacitance to be negligible and furthermore, efficient radiators are by themselves low capacitance devices designed to reject heat, not store it. The alternative to such an assumption would result in a lumped-parameter nodal model program which would require several times the cost to run and would lose the generality and versatility that makes such an approach an effective preliminary design tool.

Area fractions may also be input so that complete area varying parametric studies can be made within a single run. An area fraction is a number which,when input, will be multiplied with the computed design area required. Thus, not only can the platform area and life performance of an exact sized radiator be determined but also for an oversized or undersized or complete parametric variation study of all three. For example, an area fraction of 1.0 would allow determination to be made of the exact platform area required for a specified life while an area fraction of 1.5 would allow determination of a platform area one and a half times the size required, etc. While there is virtually no limit to the upper bound area fraction which can be used, there is a minimum or lower bound area fraction value. The minimum value is that which causes an area to be determined which is so small that the initial external heat loads cause the cooling system to operate at the limit of "in spec" performance at the position in orbit where external heat loads are a maximum. In other words, at the position in orbit where the external heat loads are a maximum, before any degradation can occur, the radiator will require the total mass flow through it (bypass closed) with the fluid leaving it at the mix temperature in order to reject the full dissipation load. This is the limit of "in spec" operation. As is the case when an EOL α_s exceeds the value for infinite area required, likewise, if an area fraction entered is below the minimum value, the program will print an informative diagnostic and terminate that portion of the solution routine.

For a radiator to be sized with an area fraction of one, the previously defined definition of EOL is used. The radiator is sized such that the limit of "in spec" operation occurs at the intended EOL time and only at the orbit position of the final orbit where the external heat loads are a maximum. It is clear that for some time beyond EOL, i.e.,for periods of operation for deliberately undersized radiators (area fraction less than 1.0), over portions of the orbit "in spec" operation may occur while over portions of the orbit the dissipation and total flow rate must be reduced to maintain the mix temperature (bypass closed). It is possible to reach a point at which there is no flow or dissipation and the system is totally shut down over portions of the orbit or even all of it.

Therefore, three operation regimes may be encountered for which the program tests and computes if needed. The first is the "in spec" operation regime where fluid is flowing through the bypass and the mix temperatures is being met with the radiator rejecting the full dissipation load. The limiting case of this regime is virtually at the EOL condition where full flow is required through the radiator to reject the full dissipation load and the fluid exits the radiator at the mix temperature. The second regime passes beyond the EOL condition and in order to cope with excessive external heat loads the dissipation and total flow rate has been reduced, the bypass is closed and the flow exits the radiator at the mix temperature. The third regime is that in which total shutdown is required. The external heat loads are such that the mix temperatures cannot be met with even partial system operation, and all dissipation and flow are discontinued. It is conceivable that all three regimes could occur within an orbit if an under sized radiator were being evaluated. The program is capable of handling all such regimes and complex solutions.

Earth eclipsing is handled by the program also. It is not necessary to put eclipse values in the direct solar tabular inputs. The program determines if eclipsing is required and if so computes the orbit positions of entrance and exit and zeros out all direct solar tabular input between these values. In addition,it prints these values out and includes them in the orbital solution. In the solution technique it computes values at these points assuming the direct solar input is present but ends at these points;thus all values in between have no direct solar input associated with their solution.

As does the LEO program, the GEO program can be used to determine what EOL α_s values are acceptable under design conditions and what rates of degradation are implied to meet EOL lifetimes for given orientations. The primary purpose is to size radiator platform areas and flow rates given surface coating properties and provide a complete solution of lifetime performance. Although the studies performed have used the program for other tasks it could also be used to evaluate freezing problems with coolants. The program output provides information as to when programmed inputs do not provide a realistic solution. Thus, the necessary information to correlate orbital parameters with area and flow requirements (aiding in pump sizing) for realistic life on orbit for the system is provided.

When a solution is possible, the program provides complete orbital solutions (user-specified orbit positions) for user-specified points in time for the entire life of the system. The orbital solution outputs consist of orbit position, inlet fluid temperatures, mean radiator temperature, radiator-outlet-fluid temperatures, mass flow rate through the radiator, direct solar heat load, earthshine heat load, albedo heat load, dissipation, eta , and the number of iterations required for the solution.

In addition to these parameters, design parameters such as radiator type,total dissipation, β angle and altitude, inlet and mix temperatures, computed area and minimum area fraction,computed total mass flow rate, α_s for requiring infinite radiator area, maximum α_s value for EOL, EOL, degradation rate, eclipse angles (if required), time after launch, and α_s value corresponding to time after launch are printed out.

In conclusion this program performs conceptually the same as the LEO general space station program with the exception of the aforementioned changes to adapt it to the GEO environment.

2.2.3 LEO 25-kW Power Module Program

The LEO power module program has been designed to be an evaluation tool for the module active radiator system. This program solves the radiator-flow problem, but only for flat extended radiators. While this program can be used for radiator sizing, a nominal area is input for which a coolant flow rate is sized in the same way as the space station program. Also, while this program does provide minimum area size for candidate EOL α_s (which it also computes), its purpose is to evaluate the change in radiator performance with time and show when actual EOL will occur and at what α_s.

In the space station program, the time period inputted was treated as the EOL value for design; in this program it is not. A portion of the program uses the input time to compute an area sizing and α_s for such a period of time (assumed candidate EOL); however, the area inputted does not necessarily correlate with the inputted time, nor does that time necessarily represent actual EOL in this program. This program computes the degraded system solution at intervals (user specified) until either the inputted time period runs out or the radiator reaches a temperature equal to the inlet fluid. After the actual EOL condition is reached (degradation has occurred until all the flow is required through the radiator), the solution continues providing an evaluation of system degradation "out of spec" and a measure of increased required flow rates and temperatures encountered past actual EOL as a function of time.

While the space station program reveals if a specified EOL solution is possible and, if so, what it is, this program reveals when actual EOL will occur and subsequent "out of spec" performance. The area sizing calculation is performed to show what area is required at the EOL radiator mass flow rate to sustain "in spec" operation for the time period inputted. This area enables a determination to be made if the nominal area inputted is oversized or undersized.

In addition, a maximum value for α_s is computed for which infinite rediator-area is required to remain "in spec." If the α_s computed over the time period inputted is greater than the infinite area α_s limit, then area cannot be computed and the situation is printed out.

For the degraded solution, the outputs printed (inlet fluid temperature, mean radiator temperature, radiator outlet fluid temperature, mass flow rate through radiator, α_s, total solar heat input, total albedo heat input, eta and iterations required for a solution) are the same as those for the space station program.

In addition to these parameters, design parameters such as total mass flow rate, area sizing for time period α_s, α_s maximum for infinite area caused by external loads, dissipation, total earthshine heat input (constant), orbital parameters, and inlet and mix temperature conditions are output.

2.2.4 GEO 25-kW Power Module Program

The GEO power module program is conceptually almost identical to the LEO program. The differences are modifications to adapt it specifically to the GEO environment. Like the LEO program, it considers only flat extended radiators and evaluates an already sized (platform area input) radiator for determination of EOL and provides an evaluation of the radiator performance with time. It also computes α_s values for infinite area requirement and sizes areas required for the specified time period input.

The main difference in input is that the external heat loads must be input in tabular form in the same fashion as the GEO space station program. This criteria restricts β to a single value input per run also.

This program computes the degraded system solution at intervals (user-specified) throughout a user-specified time after launch. These solutions, as in the case of the GEO space station program, are complete orbit solutions with eclipsing if required. All three types of solution regimes are also considered and evaluated if necessary. While the LEO program allowed the radiator to warm up and possibly approach the inlet fluid temperatures, the GEO program provides for a undersized radiator to proceed through the three aforementioned solution regimes.

The main purpose of this program is to provide an evaluation of radiator-flow performance for an already sized radiator (power module) in the GEO environment and provide required area and α_s limit information for design evaluation.

For the orbital solutions, the outputs printed are orbit position, inlet-fluid temperature, mean radiator temperature, radiator-outlet-fluid temperature, mass flow rate through the radiator, direct solar heat load, earthshine heat load, albedo heat load, dissipation, eta and the number of iterations required for the solution.

In addition to these parameters, design parameters such as total dissipation, inlet and mix temperatures, total mass flow rate, area input, β angle and altitude, eclipse angles if required, time after launch and corresponding α_s value are also printed out.

All of the GEO analysis of the power module included in this report was performed with the use of this program.

2.2.5 External Heat Inputs

External heat inputs include direct solar, earthshine, and albedo inputs. All three of these inputs are significant in the LEO environment. Earthshine and albedo can be negligilble in the GEO environment but have been included in the GEO computer programs for thoroughness. The basic mathamatical definitions for the three types of external heat loads presented below are used for both the LEO and GEO environments. For LEO, however, orbital mean values for heat fluxes may be developed for orbital calculations while for GEO complete orbital variations must be considered. External heat loads may be defined as follows:

Solar heat input may be defined as follows:

$$Q_s = SAF_s \alpha_s \tag{7}$$

where

S = solar flux (mean) incident on surface (442 BTU/hr-ft^2)

A = surface area (ft^2)

F_s = shape factor defined as $F_s = Q_s/SA\,\alpha_s$

F_s is a measure of projected area normal to solar flux and can be represented by cos ϕ where ϕ is the angle between the solar vector and surface normal. The value of S presented is a mean value; it varies between 426 and 454 BTU/hr-ft^2.

The earthshine heat input, which is thermal radiation from the earch, may be defined as:

$$Q_E = EAF_E\,\varepsilon \tag{8}$$

E = earth thermal radiation flux incident on a surface (66.36 BTU/hr-ft^2)

ε = emittance of surface

F_E = shape factor defined as $F_E = Q_E/EA\,\varepsilon$; F_E is more complicated than F_s in that it not only accounts for projected surface area but also the distribution of incident radiation as earth emission cannot be considered collimated as solar flux can. It is a geometric configuration factor.

The albedo heat input is solar-flux incident on a surface which is reflected from the earth and may be defined as follows:

$$Q_A = Sa\ F_A\ A\ \alpha_s \tag{9}$$

where

a = reflectance of earth, has average value of 0.4

F_A = shape factor defined as: $F_A = Q_A/Sa\ A\ \alpha_s$ F_A is also more complicated than F_s in that it not only accounts for projected surface area but also the distribution of solar radiation reflected from the earth.

The earthshine and albedo formulae for a cylinder replace the area with the product of diameter times length, and the shape factors are based upon this convention. In order to factor out or use area in these formulae for a cylinder, a factor of π must be used to compensate for the shape factor convention.

To provide straightforward use of the external input formulations for LEO, the shape factors must be formulated as functions of orbit position (Θ = orbit angular position defined as zero at the subsolar point), β angle, and altitude. Restricting the flat radiator orientation to the plane of the orbit and the cylindrical radiator orientation to the axis pointing toward the earth, a simple set of formulations and assumptions may be applied.

With the orientations defined, data from Reference 9 was used to derive the F_E values as a function of altitude (being independent of β) for both types or radiators. These data were then curve-fitted into the following polynomial expressions:

Flat plate:

$$F_E = 0.4127579927 - AL\,(0.6963855121 \times 10^{-3}) + AL^2\,(0.6778353736 \times 10^{-6}) - AL^3\,(0.2684461542 \times 10^{-9}) \tag{10}$$

Cylinder:

$$F_E = 1.296533585 - AL\ (0.218701805 \times 10^{-2}) + AL^2\ (0.2127767402 \times 10^{-5}) - AL^3\ (0.8424327902 \times 10^{-9}) \quad (11)$$

where

AL = altitude (nmi)

These expressions are valid from 100 to 1000 nautical miles in altitude.

The only way to handle albedo F_A values in a fashion which is not unwieldy, is to devise a formulation which approximates the rigorous solution. The following common approximation was used:

$$F_A = F_E \cos (\psi) \quad (12)$$

where

ψ = The angle between a vector along the solar line and a vector pointing toward the center of the earth.

This approximation is very accurate (within a few percent) for orbital mean values and only becomes inaccurate when β is close to 90 degrees. However, at such β values the value for albedo is usually so small when compared with other inputs the discrepancy is negligible. In terms of θ and β the expression becomes

$$F_A = F_E \cos (\theta) \cos (\beta) \quad (13)$$

The direct solar F_S values obtain the following functional forms, being independent of altitude:

Flat Plate:

$$F_S = \sin(\beta) \tag{14}$$

Cylinder:

$$F_S = \frac{1}{\pi} (\sin (\cos^{-1} (\cos (\theta) \cos (\beta)))) \tag{15}$$

The orbital mean shape factor values are required; thus, the above equations must be numerically integrated over an entire orbit (θ) to determine mean values. For direct solar F_S values, shading caused by earth eclipsing must be considered. The following equation reveals the orbit position at which eclipsing starts as a function of β, altitude and radius of the earth [(R) = 3441 nautical miles]:

$$\theta = \left(\tan^{-1} \left[\frac{\tan \left[\cos^{-1} \left[\frac{R \sin \left[\cos^{-1} \left(\frac{(AL + R) \sin \beta}{R} \right) \right]}{(AL + R) \cos \beta} \right] \right]}{\cos \beta} \right] + \frac{\Pi}{2} \right) \text{(radians)} \tag{16}$$

The above θ and its complement define the orbital range over which shading occurs, and F_S values must be zero for the integration over this interval.

Equations (10) through (16) are programmed and mathematically manipulated to generate orbital mean F_S, F_E, and F_A values which then may be used in conjunction with Equations (7) through (9) to generate the orbital mean external heat inputs for LEO. Figures 2-34 through 2-39 provide plots of the orbital mean shape factors in LEO for direct solar, earthshine, and albedo external heat inputs as a function of altitude and β angle. Figure 2-40, generated by Equation (16), shows the beginning of earth eclipsing as a function of β and altitude.

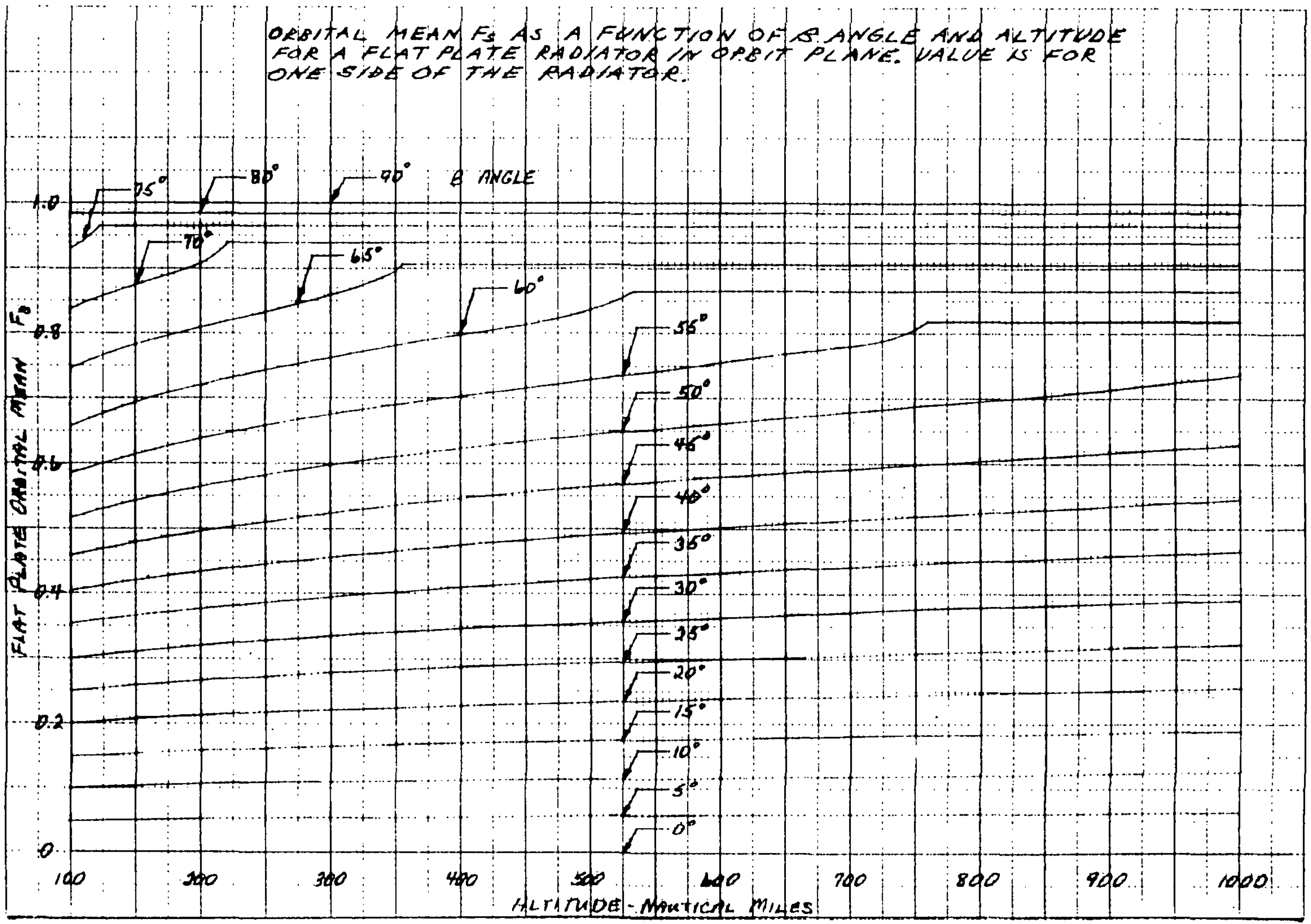

FIGURE 2-34 ORBITAL MEAN F_S AS A FUNCTION OF BETA ANGLE AND ALTITUDE FOR A FLAT PLATE RADIATOR IN ORBIT PLANE; VALUE IS FOR ONE SIDE OF THE RADIATOR

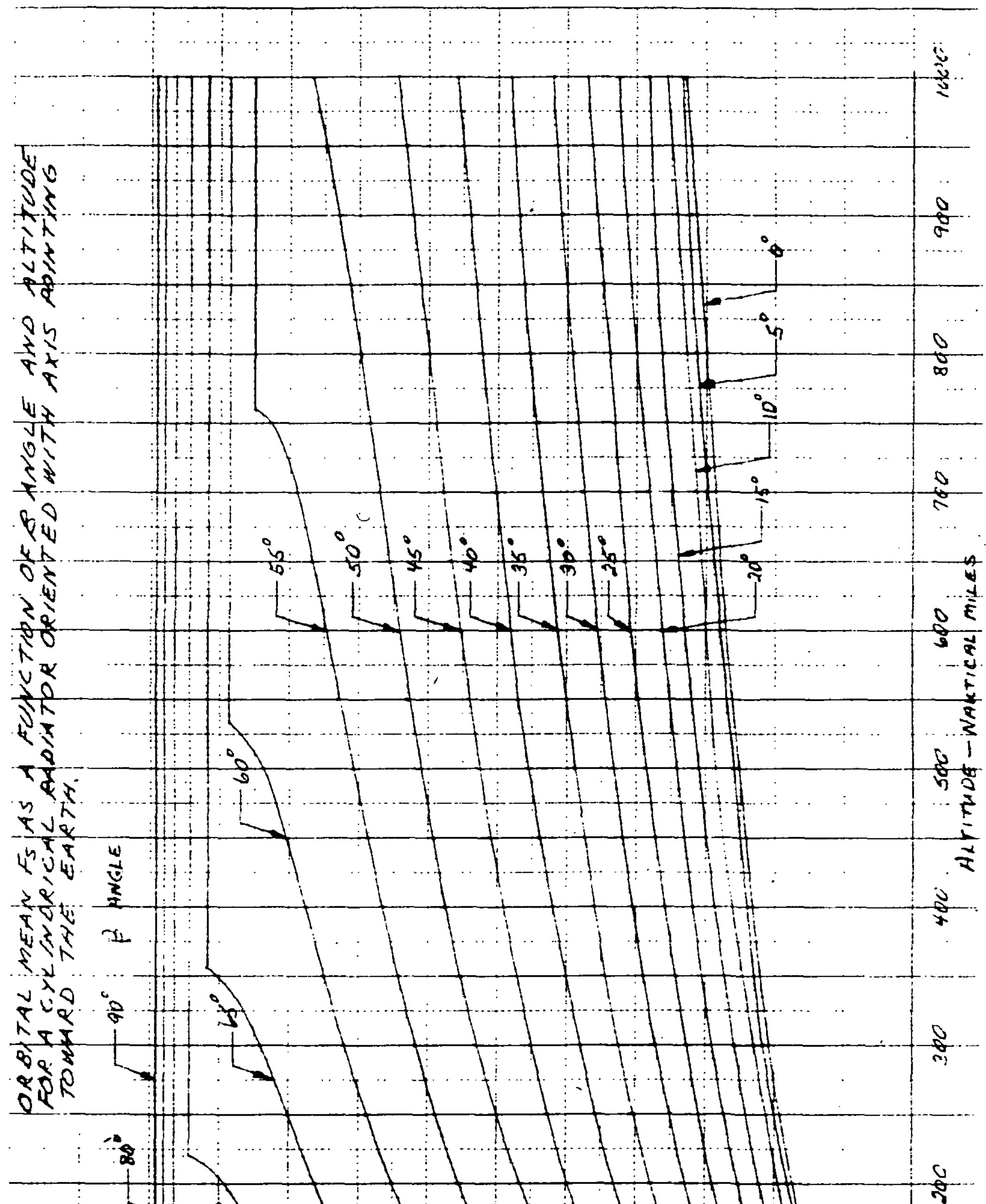

FIGURE 2-35 ORBITAL MEAN F_S AS A FUNCTION OF BETA ANGLE AND ALTITUDE FOR A CYLINDRICAL RADIATOR ORIENTED WITH AXIS POINTING TOWARD THE EARTH

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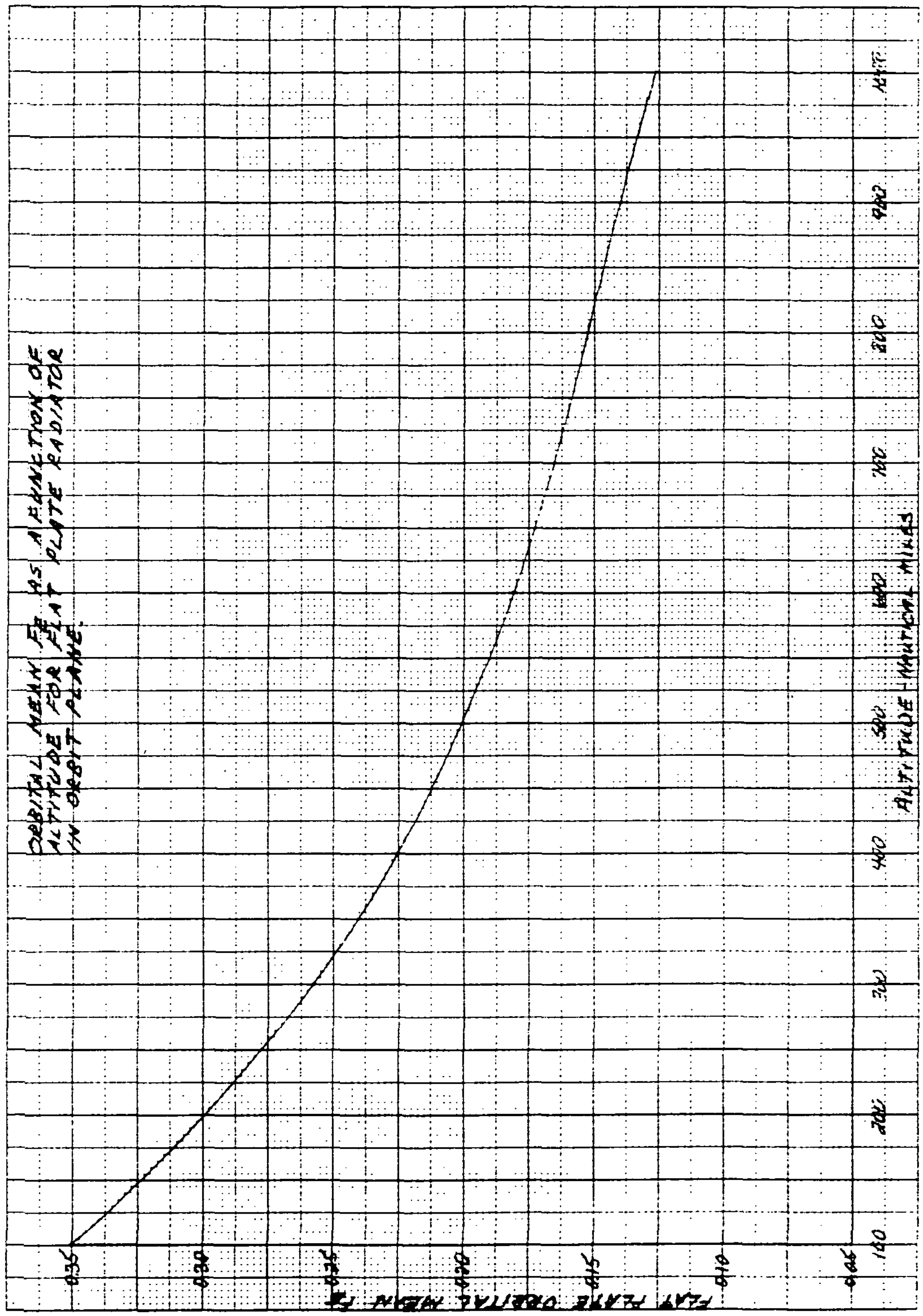

FIGURE 2-36 ORBITAL MEAN F_E AS A FUNCTION OF ALTITUDE FOR FLAT PLATE RADIATOR IN ORBIT PLANE

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FIGURE 2-37 ORBITAL MEAN F_E AS A FUNCTION OF ALTITUDE AND CYLINDRICAL RADIATOR ORIENTED WITH AXIS POINTING TOWARD EARTH

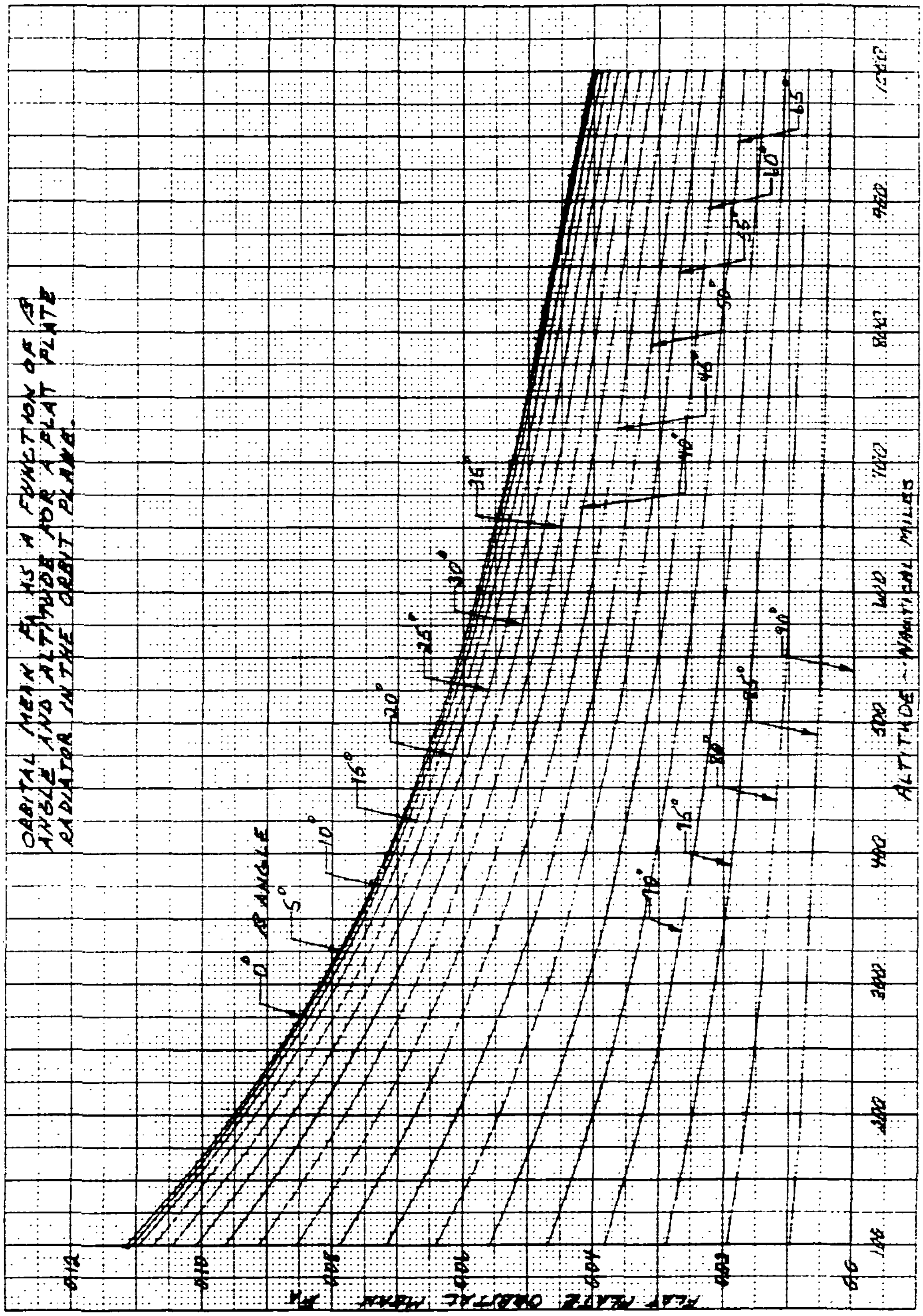


FIGURE 2-38 ORBITAL MEAN F_A AS A FUNCTION OF BETA ANGLE AND ALTITUDE FOR A FLAT PLATE RADIATOR IN THE ORBIT PLANE

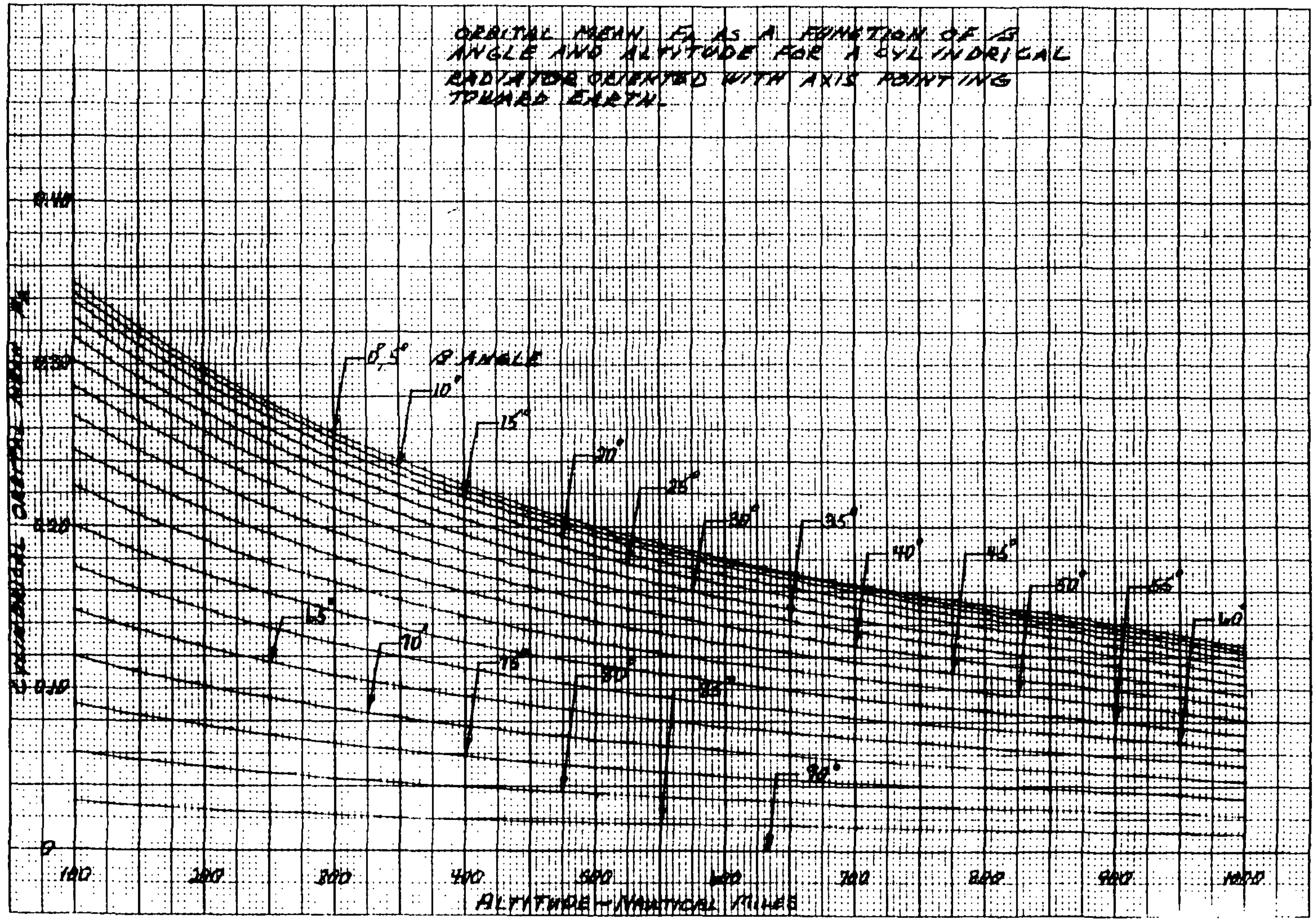


FIGURE 2-39 ORBITAL MEAN F_A AS A FUNCTION OF BETA ANGLE AND ALTITUDE FOR A CYLINDRICAL RADIATOR ORIENTED WITH AXIS POINTING TOWARD EARTH

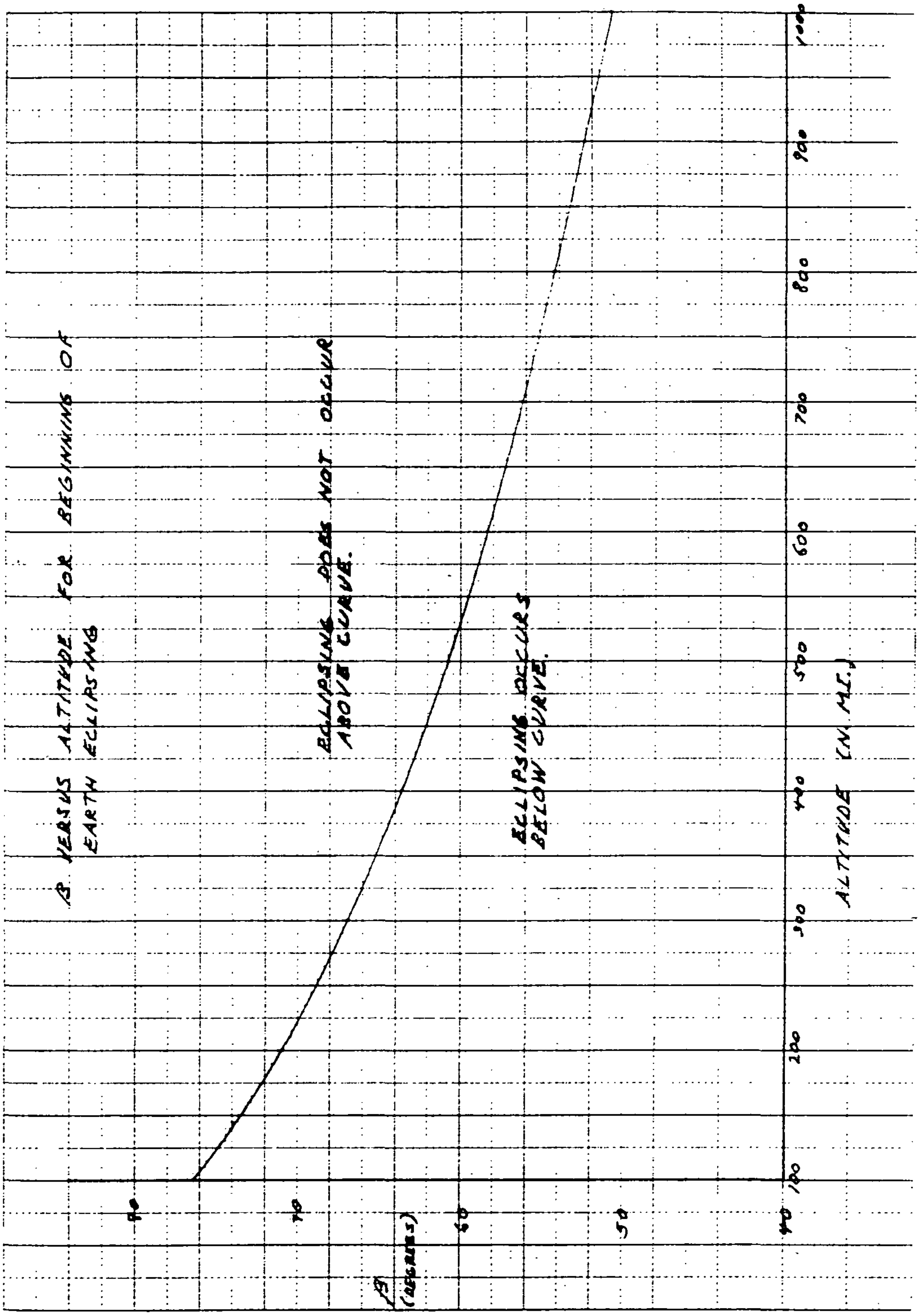


FIGURE 2-40 BETA VERSUS ALTITUDE FOR BEGINNING OF EARTH ECLIPSING

In the GEO environment orbital external mean flux values are insufficient as orbital variations in external heat loads are required. In addition, orientations for thermally favorable conditions require minimizing direct solar heat loads instead of the combination of earthshine and albedo as in the LEO case. This increases the selection of thermally favorable orientations in GEO such as the X SI orientation. As a result of these conditions, external heat loads are not exclusively a part of the internal operation of the coding in the GEO programs. Instead they are input in tabular form as shape factor tables. This allows for variation with orbit position to include shading as well as external fluxes and allows the programs to handle any orientations and provide detailed orbit solutions.

While the equations presented could be used to generate or approximate GEO fluxes for some orientations (earthshine excluded), the equation complexity needed would be unwieldy for more general applicability for GEO considerations. In order to generate the tabular input for the GEO analyses in this report the ALL PLANET FLUX PROGRAM from NASA Goddard Space Flight Center was used. It is recommended that the user of the GEO programs in this report gain access to an external heat loads computer program to generate the required input.

With an understanding of the generation of external heat loads in the LEO programs and the requirements for tabular external heat load data for the GEO programs, it is now necessary to present the solution technique for the radiator-flow problem.

2.2.6 Solution to the Radiator-Flow Problem

Analysis of a differential strip being perpendicular to the parallel flow through the radiator can yield a set of dimensionless equations. These equations reduce the solution of an on-orbit active-radiator problem to a simple computerized set of numerical calculations or even a simple graphical solution by hand. The following derivation develops the equations and the solution technique used in both computer programs to solve these equations.

Figure 2-41 shows a differential strip of a radiator with mathematical terms defining heat inputs and outputs. The derivation will be performed for a flat-plate radiator and the differences in terms will be presented for a cylindrical radiator. The assumptions made are that the radiator is in equilibrium and there is no conduction of heat along the radiator itself.

Considering heat loads into the differential strip, the heat caused by fluid entering becomes

$$\dot{m}_R \ CpT_x$$

where

T = Temperature.

Heat input caused by external loads becomes

$$(S \ \alpha_s F_S + 2SaF_A \ \alpha_s + 2E \ \varepsilon \ F_E + q_p) \ Wdx \qquad \text{(flat plate)}$$

$$\left(S \ \alpha_s F_S + \frac{SaF_A \ \alpha_s}{\pi} + \frac{E \ \varepsilon \ F_E}{\pi} + q_p\right) W\pi dx \qquad \text{(cylinder)}$$

where

W = radiator width for flat plate radiator and diameter for a cylindrical radiator

q_p = parasitic heat flux caused by radiation exchange with other surfaces.

478-1550

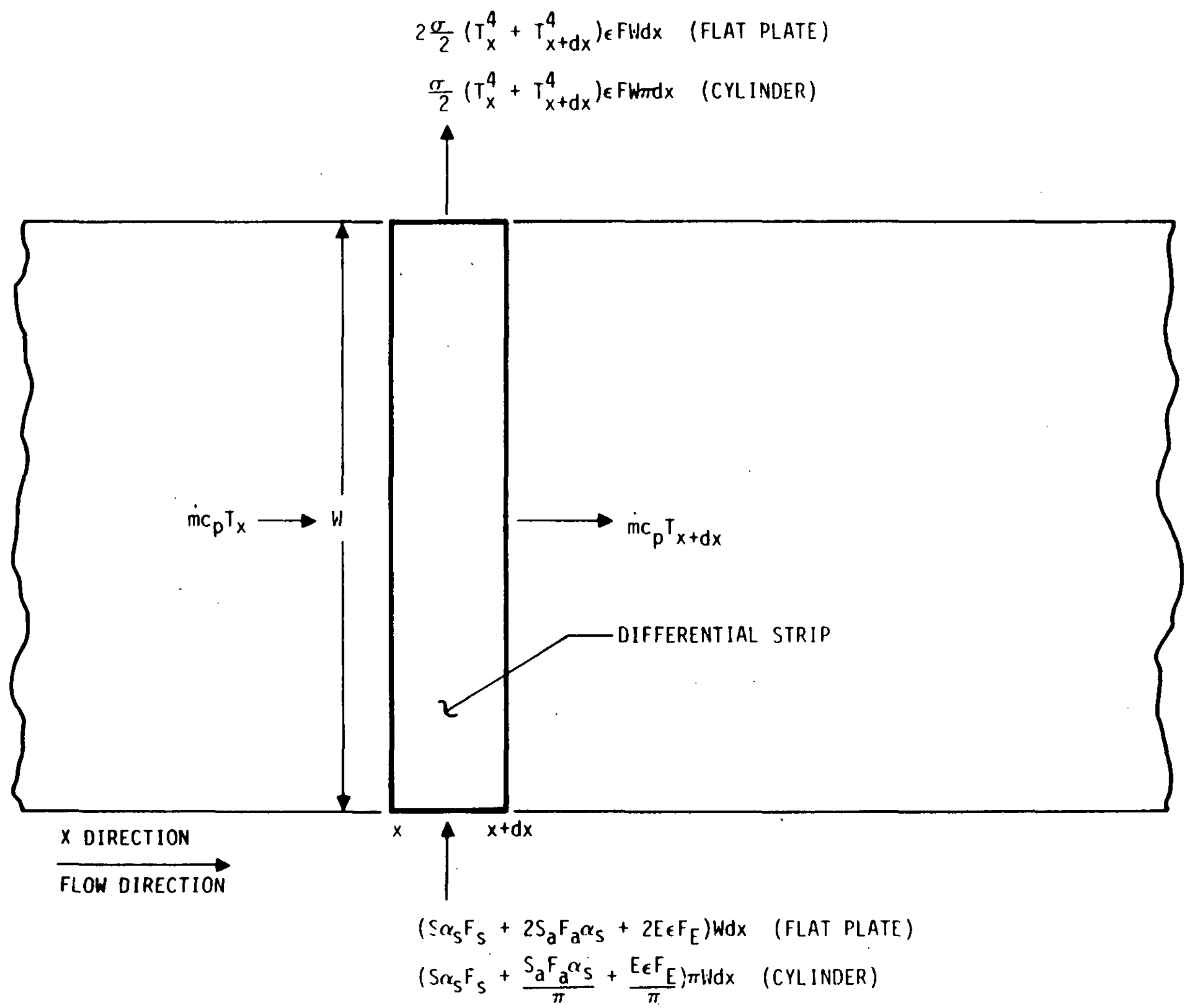


FIGURE 2-41 DEFINITION OF DIFFERENTIAL STRIP OF RADIATOR WITH HEAT FLOWS

Considering heat loads leaving the differential strip, the heat load due to the fluid becomes

$$\dot{m}_R \, CpT_{x+dx}$$

The heat load leaving the strip because of radiation to space becomes

$$2\sigma \left(\frac{T_x^{\,4} + T_{x+dx}^4}{2} \right) \varepsilon \; FWdx \qquad \text{(flat plate)}$$

$$\sigma \left(\frac{T_x^{\,4} + T_{x+dx}^4}{2} \right) \varepsilon \; FW\pi dx \qquad \text{(cylinder)}$$

where

σ = Stefan-Boltzmann constant (0.173×10^{-8} BTU/hr-ft^2-$^oR^4$)

F = view factor surface has to space.

For this analysis the q_p term will not be considered. It is not used in the computer programs because of the difficulty of computing such a term. In a more rigorous model, however, it could be used. The reader should note that it exists, although often negligible in value.

Summing the terms with the convention of heat out minus heat in gives for a flat plate:

$$\dot{m}_R Cp(T_{x+dx} - T_x) + 2\sigma \left(\frac{T_x^{\,4} + T_{x+dx}^4}{2} \right) \varepsilon \; FWdx - (S \, \alpha_s F_S + 2SaF_A \, \alpha_s + 2E\varepsilon F_E) = 0 \qquad (17)$$

let

$$(S\ \alpha_s\ F_S + 2SaF_A\ \alpha_s + 2E\ \varepsilon\ F_E) = q_{EXT} \tag{18}$$

Rearranging Equation (17):

$$\frac{dT}{q_{EXT} - 2\sigma\ \varepsilon\ FT^4} = \frac{Wdx}{\dot{m}_R\ Cp} \tag{19}$$

Integrating:

$$\frac{Wdx}{\dot{m}_R\ Cp} = \frac{1}{(2\sigma\ \varepsilon\ F)^{1/4}} \left\{ \frac{1}{4(q_{EXT})^{3/4}} \ln \left| \frac{(q_{EXT})^{1/4} + (2\sigma\ \varepsilon\ F)^{1/4}T}{(q_{EXT})^{1/4} - (2\sigma\ \varepsilon\ F)^{1/4}T} \right| + \frac{1}{2\ (q_{EXT})^{3/4}} \tan^{-1} \left[\frac{(2\sigma\ \varepsilon\ F)^{1/4}T}{(q_{EXT})^{1/4}} \right] \right\} \Bigg|_{T_I}^{T_R} \tag{20}$$

let

$A = WX$ (by definition)

$$k = \left(\frac{2\sigma\ \varepsilon\ F}{q_{EXT}} \right)^{1/4} \tag{21}$$

(for a cylinder the factor of 2 would be missing)

Substituting T_R, T_I and k and rearranging, the following equation is obtained:

$$\left(\frac{q_{EXT}A}{\dot{m}_R C p T_I}\right)(KT_I) = 1/4\left(\ln\left|\frac{1 + (KT_I)\left(\frac{T_R}{T_I}\right)}{1 - (KT_I)\left(\frac{T_R}{T_I}\right)}\right| - \ln\left|\frac{1 + (KT_I)}{1 - (KT_I)}\right|\right)$$

$$+ 1/2\left(\tan^{-1}\left[(KT_I)\left(\frac{T_R}{T_I}\right)\right] - \tan^{-1}\left[KT_I\right]\right) \quad (22)$$

The above equation relates external heat inputs to the radiator area and mass flow rate of coolant, and correlates these parameters with fluid temperatures. All of this is accomplished in terms of dimensionless parameters. Now the dissipation D must be related to these parameters through a second dimensionless expression. Relating D to the radiator flow, an equation similar to Equation (5) is obtained:

$$D = \dot{m}_R Cp\ (T_I - T_R) \quad (23)$$

Dividing this expression by $q_{EXT}A$ and rearranging, the following expression is obtained:

$$\frac{D}{q_{EXT}A} = \left(\frac{\dot{m}_R C p T_I}{q_{EXT}A}\right)\left[1 - \frac{T_R}{T_I}\right] \quad (24)$$

This expression is the second required equation in terms of dimensionless parameters, and it now provides a relationship between D and the other flow parameters. Equation (22) is valid only for values of KT_R, which is represented by $\left[KT_I\left(\frac{T_R}{T_I}\right)\right]$, greater than 1.0; below this value it has regions of both no physical significance and a partial absorber instead of an efficient radiator.

Rearranging Equation (24), the following form is obtained:

$$\left(\frac{\dot{m}_R\ C_p\ T_I}{q_{EXT}\ A}\right) = \frac{D}{q_{EXT}\ A\left[1-\frac{T_R}{T_I}\right]} \tag{25}$$

Multiplying the top and bottom of the right side by $2\sigma\varepsilon\ FT_I^{\ 4}$ and substituting Equation (21) the following expression is obtained:

$$\left(\frac{\dot{m}_R\ C_p\ T_I}{q_{EXT}A}\right) = \frac{D(KT_I)^4}{2\sigma\varepsilon\ AF\ T_I^{\ 4}\left[1-\frac{T_R}{T_I}\right]} \tag{26}$$

(for a cylinder the factor of 2 is missing)

This equation is in a form which relates the flow rate and dissipation with the parameter KT_I. This equation, combined with Equation (22) forms an essential part of the solution routine in the GEO computer programs. By solving these equations iteratively for q_{EXT} and KT_I, for the limiting case of total mass flow through the radiator and $T_R = T_M$, the end-of-life (EOL) total external heat load can be determined which can then be used to determine which of the three solution regimes the actual solution exists in.

C-2

Figure 2-42 displays a plot of Equations (22) and (24) as functions of KT_I and $D/q_{EXT}A$ for pertinent ranges of the parameters. These two dimensionless numbers can be computed from known parameters, yielding values for T_R/T_I and $\frac{\dot{m}_R CpT_I}{q_{EXT}A}$ from the graph. This gives an immediate solution to the flow problem. Thus, T_R may be determined and either $\dot{m}_R$ or A will be known, depending on the calculation, allowing the other to be immediately found. If the calculation is to size area, $\dot{m}_R$ will equal $\dot{m}_T$ and thus will be known as a worst-case EOL condition, allowing A to be found from the dimensionless parameter. If A is known, $\dot{m}_R$ may be found for a degraded condition from the dimensionless parameter.

For the special case of KT_R equal to 1.0, the area is infinite, this case allows calculation of the α_s maximum limit for which the system can remain "in spec" even with infinite area. Equating KT_R equal to 1.0, the following formulations are found by substituting equations (18) and (21) and rearranging:

$$\alpha_s = \frac{2\varepsilon\left(\sigma F T_R^{\,4} - EF_E\right)}{S(F_S + 2aF_A)} \qquad \text{(flat plate)} \qquad (27)$$

$$\alpha_s = \frac{\varepsilon\left(\sigma F T_R^{\,4} - \frac{EF_E}{\pi}\right)}{S\left(F_S + \frac{aFA}{\pi}\right)} \qquad \text{(cylinder)} \qquad (28)$$

Using system-defined values such as temperatures and dissipation, and orbit definition relating β and altitude along with known constants, Figures 2-34 through 2-39 (for LEO only) and Figure 2-42 may be used to graphically solve the radiator-flow problem in a concise fashion. The only parameter yet to be solved for is the mean temperature of the radiator. This can be solved by a simple heat balance. The equations for solution are as follows:

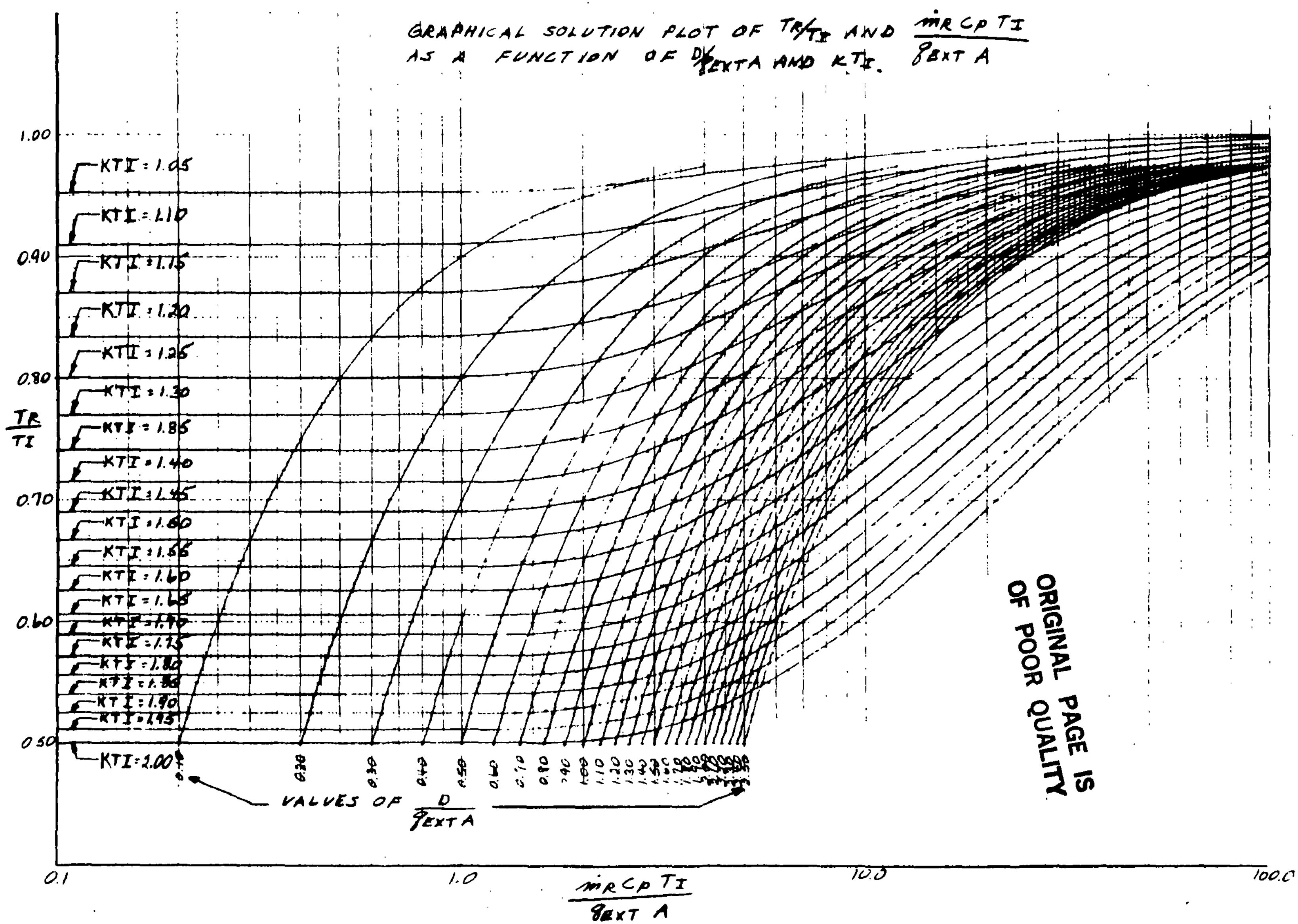


FIGURE 2-42. GRAPHICAL SOLUTION PLOT OF T_R/T_I AND $\frac{\dot{m}_R C_p T_I}{q_{EXT}A}$ AS A FUNCTION OF $D/q_{EXT}A$ AND KT_I

$$T = \left[\left(D + S\,\alpha_s\,F_S + 2\,Sa\,\alpha_s\,F_A + 2\,E\,\varepsilon\,F_E\right)/(2\sigma\varepsilon F)\right]^{1/4} \quad \text{(flat plate)} \tag{29}$$

$$T = \left[\left(D + S\,\alpha_s F_S + \frac{Sa\,\alpha_s\,F_A}{\pi} + \frac{E\,\varepsilon\,F_E}{\pi}\right)/(\sigma\,\varepsilon\,F)\right]^{1/4} \quad \text{(cylinder)} \tag{30}$$

where

T = mean radiator temperature.

The total solution to the radiator-flow problem has been programmed in both LEO and GEO programs using the above equations. The numerical bisection procedure is used to find the intersection of the family parameters KT_I and $D/q_{EXT}A$ to provide solutions to Equations (22) and (24) in a concise and accurate fashion. The number of iterations required are printed out with the solution under the heading "ITN."

The techniques embodied in the computer programs provide the basis for useful preliminary design tools with powerful and rigorous solution capacity, while still maintaining the ability for sufficient generality in terms of orbital and system requirements. All analyses performed in this study were performed with these programs.

2.2.7 External Heat Input Blockage Factors

Because there is no concise way of accounting for the parasitic load (q_p) absent in many of the equations (its value is often negligible) it has been neglected. However, the presence of other surfaces often causes blockage of external heat inputs, which cannot be neglected. Therefore, blockage factors which provide the degree of blockage (or passage) of direct solar, albedo, and earthshine inputs individually are inputs to both LEO programs. There are values for each type of external input for the radiator and in the case of the space station program, values are input for both types of radiators independently. As an example, if a value of 0.6 is input for direct solar, this implies only 60 percent of the vailable direct solar input is incident on the radiator and 40 percent has been blocked by other surfaces. Values of 0.0 mean total blockage and values of 1.0 mean no blockage.

External heat load blockage for the GEO programs must be included in the appropriate shape factor tabular input.

2.2.8 Limits Set on Iterative Solution Routines

Two types of iterative solutions are required in the computer programs. The first type solves Equations (22) and (24) for the dimensionless flow rate parameter and T_R/T_I. This is done by iterating on the value of T_R/T_I using the bi-section numerical method. This type of solution technique can be found in all four computer programs being located in subroutines SOLVE (power module program), SOLVEP and SOLVEC (general space station program). The second type of iterative solution required solves Equations (22) and (26) for the dimensionless mass flow rate parameter and KT_I. This is done by iterating on the value of KT_I using the bi-section numerical method. This type of solution technique can be found in only the GEO programs in subroutines SOLVEP and SOLVEC.

The bisection solution method was selected due to its stability when dialing with equations of such mathematical nature. This method requires a bracketing of the solution initially, thus establishing the limits of the solution range.

The first solution type is very well behaved with the limits set, and should never present a problem. The lower limit of T_R/T_I = $1.00001/KT_I$ first prevents the problem of KT_R = 1.0 which would blow up Equation (22) and the upper limit of T_R/T_I = 0.999 is just below the value of 1.0 which prevents extraneous solutions in a portion of the equations way outside of realistic solutions where the equations oscillate and cross each other erratically. These limits have provided solutions varying from heavily dissipation dominated to heavily external heat load dominated radiators, even when under-or oversized.

It is more difficult to set the upper limit for the second solution type. Solution values for KT_I tend to be small values approaching the limit established by $KT_R = 1.0$ when radiators are external heat load dominated or oversized or both. The lower limit has been set at $KT_I = 1.00001/(T_R/T_I)$ which is very well behaved and should provide no problems. The erratic oscillation and cross-over behavior of the equations occur at values way above this value. For radiators which are dissipation-dominated, or undersized, or both, the solution values of KT_I tend toward a higher value. Unfortunately the solution, while below, is very close to values at which the erratic equation behavior begins. The value of $KT_I = 8.0$ has been set as the results of a large amount of testing in this solution region. It is believed this upper bound value should provide a bracketing of the solution for all realistic cases of this nature without the risk of finding an obviously erroneous solution. While no problem should arise the user should be aware of this limit value as potential problems could develop for cases of extreme under sizing and/or dissipation domination.

2.2.9 LEO Program Inputs

The following card inputs are required. Use of the inputs in one or both of the programs is indicated alongside the card designation:

Card 1: (Both programs)

Parameter Name	Description	Field Columns	Format
NAL1	Lowest altitude considered (nmi)	1-10	I 10
NAL2	Highest altitude considered (nmi)	11-20	I 10
NAL3	Incremental altitude value for looping (nmi)	21-30	I 10

Card 2: (Both programs)

Parameter Name	Description	Field Columns	Format
NB1	Lowest β angle considered (degrees)	1-10	I 10
NB2	Highest β angle considered (degrees)	11-20	I 10
NB3	Incremental β value for looping (degrees)	21-30	I 10

Card 3: (Both programs)

Parameter Name	Description	Field Columns	Format
ND1	Lowest value of dissipation (kW)	1-10	I 10
ND2	Highest value of dissipation (kW)	11-20	I 10
ND3	Incremental dissipation value for looping (kW)	21-30	I 10
BREAK (Space Station Program Only)	Dissipation value to change from flat to cylindrical radiators (kW)	31-40	F10.4

Card 4: (Power Module Program only)

Parameter Name	Description	Field Columns	Format
MDP	Time period over which solution is considered (months)	1-10	I 10
MODI	Time increment between solutions within MDP period (months)	11-20	I 10

Card 4: (Space Station Program Only)

Parameter Name	Description	Field Columns	Format
MDP	EOL time period for flat-plate radiator over which solution is considered (months)	1-10	I 10
MDC	EOL time period for cylindrical radiator over which solution is considered (months)	11-20	I 10
MODIP	Flat-plate radiator time increment between solutions within MDP period (months)	21-30	I 10
MODIC	Cylindrical radiator time increment between solutions within MDC period (months)	31-40	I 10

All following cards are inputs for either flat-plate radiators or cylindrical radiators and have an appropriate "P" or "C" in column one:

Card 5: (Both programs)

Parameter Name	Description	Field Columns	Format
TEST	Alphanumeric P	1	A1
PTI	Flat-plate radiator inlet temperature (^oF)	11-20	F10.4
PTM	Flat-plate radiator mix temperature (^oF)	31-40	F10.4
PAREA (Module Program only)	Radiator platform area (ft^2)	51-60	F10.4

Card 6: (Space Station Program only)

Parameter Name	Description	Field Columns	Format
TEST	Alphanumeric C	1	A1
CTI	Cylindrical radiator inlet temperature (°F)	11-20	F10.4
CTM	Cylindrical radiator mix temperature (°F)	31-40	F10.4

Card 6: (Module Program), Card 7: (Space Station Program)

Parameter Name	Description	Field Columns	Format
TEST	Alphanumeric P	1	A1
PSHDS	Flat-plate radiator, direct solar blockage factor, range: 0-1.0	11-20	F10.4
PSHDE	Flat-plate radiator earthshine blockage factor, range: 0-1.0	31-40	F10.4
PSHDA	Flat-plate radiator albedo blockage factor, range: 0-1.0	51-60	F10.4

Card 7: (Module Program), Card 9: (Space Station Program)

Parameter Name	Description	Field Columns	Format
TEST	Alphanumeric P	1	A1
PSPACE	Flat-plate radiator view factor to space	11-20	F10.4
PCP	Flat-plate radiator coolant specific heat (BTU/lbm-°R)	31-40	F10.4

Card 8: (Module Program), Card 11: (Space Station Program)

Parameter Name	Description	Field Columns	Format
TEST	Alphanumeric P	1	A1
PALPHA	Flat-plate radiator initial α_s value	11-20	F10.4
EMTP	Emittance of flat-plate radiator	31-40	F10.4
PDEG	Flat-plate radiator linear degradation rate ($\Delta\alpha_s$/Mo.)	51-60	F10.4

Card 8: (Space Station Program only)

Parameter Name	Description	Field Columns	Format
TEST	Alphanumeric C	1	A1
CSHDS	Cylindrical radiator direct solar blockage factor, range: 0-1.0	11-20	F10.4
CSHDE	Cylindrical radiator earthshine blockage factor, range: 0-1.0	31-40	F10.4
CSHDA	Cylindrical radiator albedo blockage factor, range: 0-1.0	51-60	F10.4

Card 10: (Space Station Program Only)

Parameter Name	Description	Field Columns	Format
TEST	Alphanumeric C	1	A1
CSPACE	Cylindrical radiator view factor to space	11-20	F10.4
CCP	Cylindrical radiator coolant specific heat (BTU/lbm-^{o}R)	31-40	F10.4

Card 12: (Space Station Program only)

Parameter Name	Description	Field Columns	Format
TEST	**Alphanumeric C**	1	A1
CALPHA	**Cylindrical radiator initial α_s value**	11-20	F10.4
EMTC	**Emittance of the cylindrical radiator**	31-40	F10.4
CDEG	**Cylindrical radiator linear degradation rate ($\Delta\alpha_s$/Mo.)**		

2.2.10 GEO Program Inputs

The following card inputs are required. Use of the inputs in one or both of the programs is indicated alongside the card designation:

Card 1: (Both Programs)

Parameter Name	Description	Field Columns	Format
BETA	Orbit β angle (degrees)	6-10	F5.2

Card 2: (Both Programs)

Parameter Name	Description	Field Columns	Format
ND1	Lowest value of dissipation (kW)	1-10	I 10
ND2	Highest value of dissipation (kW)	11-20	I 10
ND3	Incremental dissipation value for looping (kW)	21-30	I 10
BREAK (Space Station program only)	Dissipation value to change from flat to cylindrical radiators (kW)	31-40	F10.4

Card 3: (Power Module Program only)

Parameter Name	Description	Field Columns	Format
MDP	Time period over which solution is considered (months)	1-10	I 10
MODI	Time increment between solutions within MDP period (months)	11-20	I 10
INTR	Orbital increment for printout of orbital solution (degrees)	21-30	I 10

Card 3: (Space Station Program only)

Parameter Name	Description	Field Columns	Format
MDP	EOL time period for flat-plate radiator over which solution is considered (months)	1-10	I 10
MODIP	Flat-plate radiator time increment between solutions within MDP period (months)	11-20	I 10
INTP	Orbital increment for printout of orbital solution for flat-plate radiator (degrees)	21-30	I 10
MDC	EOL time period for cylindrical radiator over which solution is considered (months)	31-40	I 10
MODIC	Cylindrical radiator time increment between solutions within MDC period (months)	41-50	I 10
INTC	Orbital increment for printout of orbital solution for cylindrical radiator (degrees)	51-60	I 10

The next card for both programs begins the external heat input tables. The tables for the power module program are numbered 1 through 3. the tables are tabulated values of external heat load shape factors as a function of orbit position for direct solar, earthshine and albedo inputs, in that order. For the space station program; tables 1 through 6 are required, the first three being heat load shape factors (in same order as power module program) for the flat-plate radiator and the second three (4-6) for the cylindrical radiator (same order also). The tables for both programs are formated the same and may have up to 50 values each. The tables must begin with an orbit position of 0.0 and end with a position of 360.0.

The first card of each table is a table number and title and with the following format:

Parameter Name	Description	Field Columns	Format
NUM	Table number	1-5	I 5
TINFO	Table title	9-80	18A4

The table cards have the following format:

Parameter Name	Description	Field Columns	Format
OP	Orbit position (degrees)	11-20	E10-4
F	External heat load shape factor	26-37	E12.6

After the 360.0 orbit position card for the last table is input the following cards follow. All of the following cards are inputs for either flat-plate or cylindrical radiators and have an appropriate "P" or "C" in column one:

Next card: (Both Programs)

Parameter Name	Description	Field Columns	Format
TEST	Alphanumeric P	1	A1
PTI	Flat-plate radiator inlet temperature (^{o}F)	11-20	F10.4
PTM	Flat-plate radiator min temperatures (^{o}F)	21-30	F10.4
PAREA (Module program only)	Radiator platform area (ft^2)	31-40	F10.4

Next card: (Space Station Program only)

Parameter Name	Description	Field Columns	Format
TEST	Alphanumeric C	1	A1
CTI	Cylindrical radiator inlet temperature (^{o}F)	11-20	F10.4
CTM	Cylindrical radiator mix temperature (^{o}F)	21-30	F10.4

Next card: (Both Programs)

Parameter Name	Description	Field Columns	Format
TEST	Alphanumeric P	1	A1
PSPACE	Flat-plate radiator view factor to space	11-20	F10.4
PCP	Flat-plate radiator coolant specific heat (BTU/lbm-^{o}R)	21-30	F10.4

Next card: (Space Station Program only)

Parameter Name	Description	Field Columns	Format
TEST	Alphanumeric C	1	A1
CSPACE	Cylindrical radiator view factor to space	11-20	F10.4
CCP	Cylindrical radiator coolant specific heat (BTU/lbm-^{o}R)	21-30	F10.4

Next card: (Both programs)

Parameter Name	Description	Field Columns	Formost
TEST	Alphanumeric P	1	A1
PALPHA	Flat-plate radiator initial αs value	11-20	F10-4
EMTP	Emittance of flat-plate radiator	21-30	F10.4
PDEG	Flat-plate radiator linear degradation rate ($\Delta\alpha_s$/Mo.)	31-40	F10.4
PFRAC (Space Station Program only)	Flat-plate radiator area fraction	41-50	F10.4

Next card: (Space Station Program only)

Parameter Name	Description	Field Columns	Formost
TEST	Alphanumeric C	1	A1
CALPHA	Cylindrical radiator initial α_s value	11-20	F10.4
EMTC	Emittance of cylindrical radiator	21-30	F10.4
CDEG	Cylindrical radiator linear degradation rate ($\Delta\alpha_s$/Mo.)	31-40	F10.4
CFRAC	Cylindrical radiator area fraction	41-50	F10.4

The reason for the alphanumeric P and C designations is two-fold. First of all, it is to make the user aware of the input, as a mistaken input dealing with the radiator parameters could result in an excessive output of useless data and unnecessary waste of machine time. With their ability to vary parameters, these programs are capable of generating large quantities of printout requiring caution with input data. The other reason is concerned with the space station programs only. Cards for the flat-plate and cylindrical radiators are inputted in alternating fashion: first a card for the flat-plate radiator, then a card for the cylindrical radiator. Such an identification procedure makes the user more aware and the data more easily identifiable.

The last card input in both programs deals with surface properties, α_s, ε, and degradation rate (and area fraction for GEO space station program). As many of these cards as desired may be added on to generate a study over a range of property values, degradation rates or area fractions. The program will perform calculations for all other inputs for each one of these cards until no more cards are found, at which time it will terminate the run. For the space station programs, additional surface property cards must be inputted in pairs, one for the flat-plate radiator then one for the cylindrical radiator.

A special routine called "Readre" is called in the beginning of the programs. This routine allows a card to be reread off a unit 99 instead of the unit 5 card reader. The candidate P or C value is read by the card reader and then, if the proper designation is in column 1, the remaining values are read from unit 99. It is assumed another computer will have a similar routine; if not, little code change would be needed to eliminate the "Readre" routine. It is merely a programming convenience.

The LEO power module program inputs consist of eight cards plus possible additional surface-property cards. The LEO space station program inputs consist of 12 cards plus possible additional pairs of surface-property cards.

The GEO power module program inputs consist of six specific cards plus the external heat load tables and possible additional surface-property cards. The GEO general space station program inputs consist of nine specific cards plus the external heat load tables and possible additional pairs of surface-property cards.

With these inputs, as listed above, individual problems may be evaluated or entire parametric studies can be generated with a single run. Core allocation for LEO programs need only be 45 k for the power module program and 55 k for the space station program. Core allocation for the GEO programs need only be 50 k for the power module program and 62 k for the space station program.

No tape drives or disk storage are required. The program listings, along with sample cases including inputs and outputs, will be presented in Appendixes A, B, C, D, and E.

The coding has been written so that operations are clearly distinguishable and announced by commend cards. Equations have been programmed in their basic form to be easily recognizable. In conclusion, the coding has been written not to be as concise or complex as possible but to be effective and explicitly understandable.

2.3 TECHNOLOGY ASSESSMENT

While prediction of the effects of the space environment on thermal-control surfaces is a problem faced on all space programs, the associated data base is diffuse and must be applied with caution. The problem of predicting the effect of radiation interaction with materials in vacuum is complex and difficult to solve. Experimentally obtained data are limited because of inadequate simulation techniques. Flight experiments are the basis for the best engineering information available today on the effects of the space environment on thermal-control surfaces. However, such data are limited to the accuracy of temperature measurements, and may be significantly biased by unknown events that occurred prior to or during the mission (e.g., pre-orbit contamination, on-orbit contamination, electrostatic discharge damage, etc.).

2.3.1 Literature Search

AESC conducted a literature search and industry survey of thermal-control-surface technology and application. Particular attention was given to caveats and limitations affecting the application of the data to the use in the study.

The literature search (Reference 12) identified the current state of the art is space-stable thermal-control surfaces where low-temperature thermal control is required. This search made use of the on-line computer capabilities of DIALOG, the system monitored by Lockheed Information Sciences Laboratory in Palo Alto, California. With DIALOG, all Government-sponsored work released to the public from the year 1964 to date can be searched with a high degree of specificity (NTIS data base). Other computer-search systems were used to screen the material published in over 7000 worldwide major scientific and technical journals from 1970 to date. The indexing done by the following data bases were searched: INSPEC (formerly Science Abstracts), COMPENDEX (Engineering Index), ISMEX, SCISEARCH, and CDA (Comprehensive Dissertation Abstracts).

The information data base of NASA was consulted as well. A search strategy was devised to provide the most logical and complete search for all parameters involved in the identification of space-stable thermal-control surfaces. In addition to on-line efforts, the latest NASA budget hearings were reviewed, the requirements posed by the current NASA 5-year plan were perused, and proceedings of symposia and conferences considering the problem, but not indexed conventionally, were reviewed.

The information available from appropriate information analysis centers (such as the Defense Documentation Center) was sought for classified literature. Only that portion of the search that was unclassified is presented in this report. Assistance was also sought from the Government-Industrial Data Exchange Program (GIDEP) at Corona, California.

Finally, pertinent information from other NASA facilities (such as Goddard, MSFC, etc.) that do not report all of their efforts through NASA's announcement publications, STAR (Scientific and Technical Aerospace Reports) was sought to assure completeness of the effort.

2.3.2 Industry Survey

To supplement the literature search, AESC also conducted an industry survey. The results of that survey, along with the organization and responsible individuals, are presented in Appendix F. A sampling of the type of information requested from those agencies and industrial organization who participated was as follows:

- Do you agree with the findings of the literature search? That is, is it your opinion that (1) space-stable materials are available for low earth orbits, and (2) space-stable materials for geosynchronous orbits do not exist (i.e., for lifetimes greater than five (5) years).
- What type of programs do you envision will be needed to meet the requirements of long-term (25 years) missions.
- If a NASA center - do you plan to submit RTOP's in any of these areas?

The information in the Appendix is presented not in any preferential order, but as presented to the study manager in the survey.

2.4 DEGRADATION ANALYSIS

The successful completion of any space mission requires that the vehicle, including its many sophisticated components and data acquisition packages, be maintained within certain prescribed operational limits.

Past experience has demonstrated that contamination can be a significant factor in whether a spacecraft or satellite can successfully meet its mission objectives. It will also be a continuing problem with future vehicles, especially those employing extensive electro-optics, and/or scheduled for long lifetimes in space. The contaminating and abrasive effects that attitude control and primary thruster plumes can have on sensitive surfaces and instruments has been recognized for years; deposition and abrasive effects can alter the power output of solar cells, distort images due to altered transmission of optical equipment, and degrade the reflectance and emittance of thermal control surfaces and coatings.

To prevent failures or malfunctions in space requires a careful assessment of materials usage in spacecraft. Such preventative measures have become a necessity. The presence of contamination on a spacecraft is not necessarily synonymous with total failure of a mission, but is more frequently identified as a source of system degradation or malfunction.

2.4.1 Sources of Contamination

High-performance optical systems and critical functional surfaces aboard an advanced long-life space vehicle require effective contamination control measures to maintain performance stability and to ensure data accuracy. Major contamination events include: (a) ground-based initial contaminant loading during the factory-to-launch operational sequence; (b) launch vehicle interface effects during the launch/ascent/payload-deployment event where booster plume impingement-recirculation and internal contaminant transports constitute the main contamination modes; (c) the post-deployment mission phase characterized by vacuum-exposed outgassing-deposition, thruster jet expulsion, venting, interaction with the ambient atmosphere, release of particulates, and, in certain applications, space radiation and proton sputtering. A summary of major contamination modes and sources encountered during spacecraft operations is presented in Table 2-4.

TABLE 2-4 CONTAMINATION MODES

Mode	Sources
• Outgassing deposition (molecular)	• Surface desorption - adsorption. Lubricants, adhesives, and all evaporable surface materials • Leaks, vents, shuttle interface
• Cloud formation (molecular and particulate)	• Leaks, vents, dust recirculation, particle dispersion
• Plume impingements	• Thruster plumes
• Miscellaneous (radiation, electrostatic forces, proton sputtering, meteoroids)	• Atmospheric particles, electrostatic discharge, meteoroids

An overview of general spacecraft contamination concerns shown in Table 2-5 indicates that three key issues must be carefully evaluated in order to develop an effective contamination control system and management plan:

- Initial contamination budget - cleanliness level, including maintenance, handling, and other pertinent procedural factors.
- Material selection - outgassing-deposition properties, pre-flight space conditioning being a possible means of contamination preventive measures.
- Configuration and subsystem designs - avoidance of contaminant fluxes; implementation of onboard contamination preventive measures.

TABLE 2-5 GENERAL SPACECRAFT CONTAMINATION CONCERNS

- Deposition or film formation - surface physical/chemical property changes; optical and thermal performance degradation
- Plume/impingement or particle streams - surface erosion, blast damage
- Particulate/molecular environments - light scattering and absorption
- Radiation, proton sputtering, electrostatic forces - surface outgassing, contaminant flux trajectories

For the new generation of space vehicles within mission objectives of performing scientific experiments and observations over a long-life period, these issues may have to be evaluated based on stringent contamination constraints whereupon accurate contamination predictions become mandatory.

2.4.2 Contamination Analysis Program

Numerous spacecraft have experienced increases in component maximum operational temperature with time. These increases are caused principally by a gradual degradation of solar absorptance (α_s) of primary heat rejection radiators. Orbital data on well instrumented systems have indicated that this degradation is caused by some undefined contamination source(s).

These warming trends highlighted the need for a contamination model that could identify the causes of the increase in component temperature with time and determine the effects of design changes. Because of the many facets to such a mathematical model, the computer program to predict mass deposition (contamination) is structured so that it is assembled in modular fashion (Figure 2-43).

The basic model is derived from the methods developed on the Satellite Contamination Program (SATCON). In the SATCON Program, the effects of

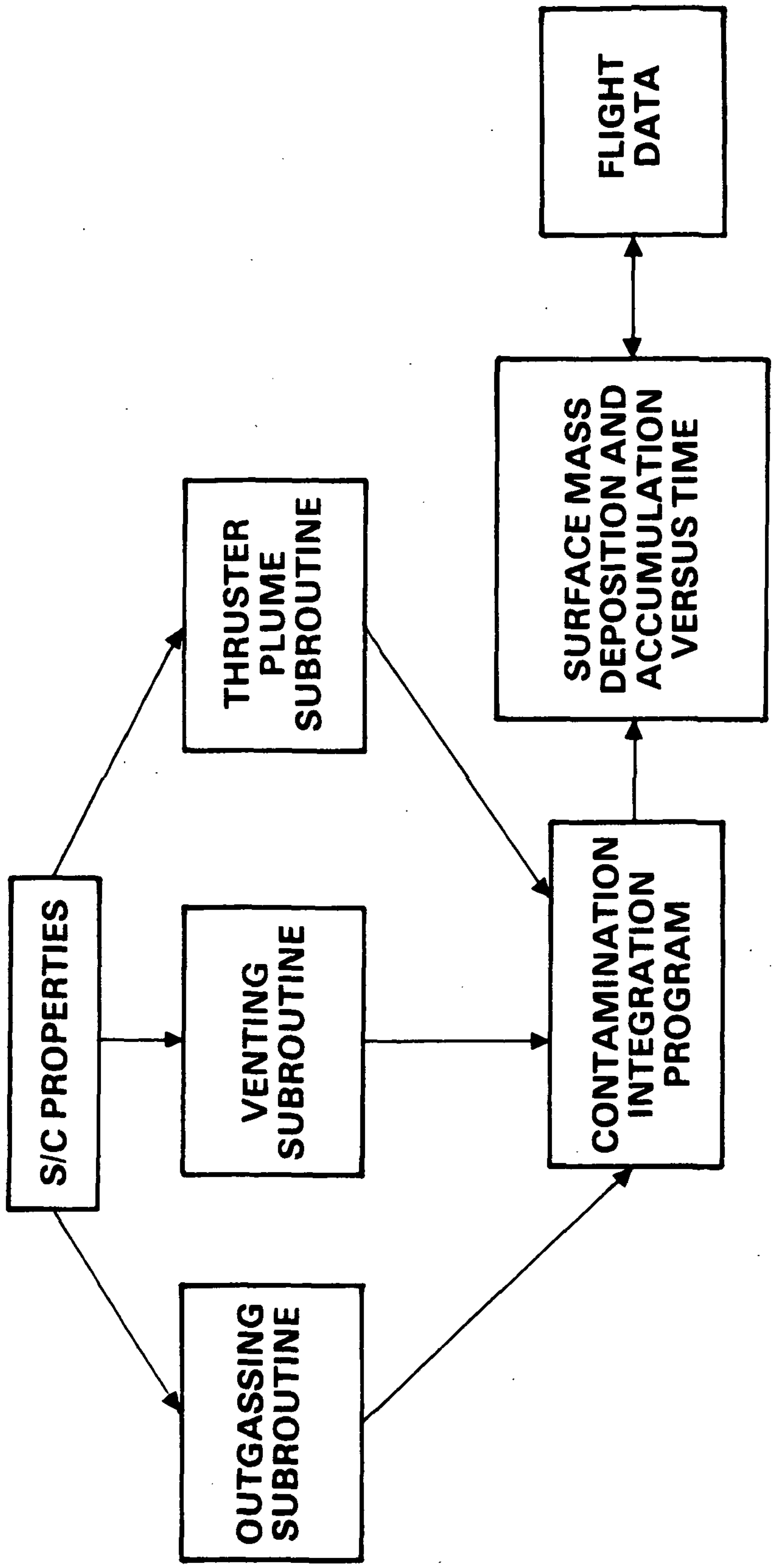


FIGURE 2-43 PROGRAM PREDICTS CONTAINMENT MASS DISTRIBUTION

378-1144

self-induced contamination of critical thermal control and optical surfaces are being determined. These data are being used to predict contamination effects on satellite system performance. The overall program is a multi-system study, with AESC concentrating on developing and verifying a general set of equations which describe contamination effects for optical and thermal-control systems. Satellite self-contamination in normal operation is the primary consideration. Briefly, the SATCON study is a progression of detailed tasks leading to the system overall effects evaluation as follows: (a) possible contamination source materials and target receptors are selected from candidate satellite surface materials; (b) for these materials, a theory of contamination mechanism and a set of equations are developed; (c) measurements of material emission kinetics are made under space conditions -- a vacuum microbalance and a particle analyzer are used to determine particle composition and dynamics; (d) the transport mechanism is measured to validate the theory; (e) the thermal and optical effects of contamination are measured; and (f) testing is performed to verify the equations. The equations under this program provide the basic methodology for mathematical model development.

This program, which is named the Aerojet Mass Analyzer Program (AMAP), relates the mass source release rates, mass transfer coefficient, and desorption rates for all major outgassing sources along any line of sight. The program includes accounting for capture coefficient, reemission rates, and revolatilization rates of individual materials and sources. In addition, it also handles all internodal coupling caused by multiple bounces.

AMP concentrates on the most probable on-orbit contamination sources, i.e., external surface materials outgassing, venting of internal outgassing, and thruster plume impingements. Typical data inputs to the program consist of the following: (a) nodal geometry, (b) nodal temperatures, (c) shape factors, (d) contaminant capture coefficients, (e) contaminant rate constants, and (f) program control data.

2.4.3 Contamination Assessment

A contamination assessment was performed for the 25 kW power module to determine the distribution of any deposition from direct flux of contaminants on critical surfaces. A total system was considered which included the power module (with solar arrays and thermal radiations deployed) and the STS orbiter in various rendezvous closing sequences. Five (5) separate cases were considered in this analysis. Since a 25 kW Power Module/STS Orbiter rendezvous scenario was not developed during the period of performance of this study, it was unanimously decided to develop and use a modified Skylab/SB scenario as a guideline, Table 2-6 and Figure 2-44 show the rendezvous assumptions and cases considered in this study. The specific input parameters for these models consisted of (a) 105 surface nodes, (b) 10 source materials, and (c) various closing rates. The major external surfaces, along with the principal contamination sources considered in these analyses, are shown in Figures 2-45 through 2-47 and Table 2-7, respectively. The resulting mass deposition is shown in Table 2-8. The results indicate that for the configurations considered major on orbit contamination will occur when the orbiter closes to within 500 feet of the power module. This is evinced by the fact that 1.0 micrograms of hydrazinium nitrate deposit on the solar arrays and thermal radiators.

TABLE 2-6 RENDEZVOUS ASSUMPTIONS

- 25 kW/STS Rendezvous Scenario not Developed
- Used Modified Skylab/STS Scenario as Guideline

Closing Interval (ft)	Closing Rate
3000 to 1000	1000 ft/30 sec
1000 to 500	500 ft/30 sec
500 to 200	300 ft/30 sec
200 to 30	170 ft/30 sec
Tethered at 30 ft for 7 hours	

- Z POP, +Z Orbiter Approach

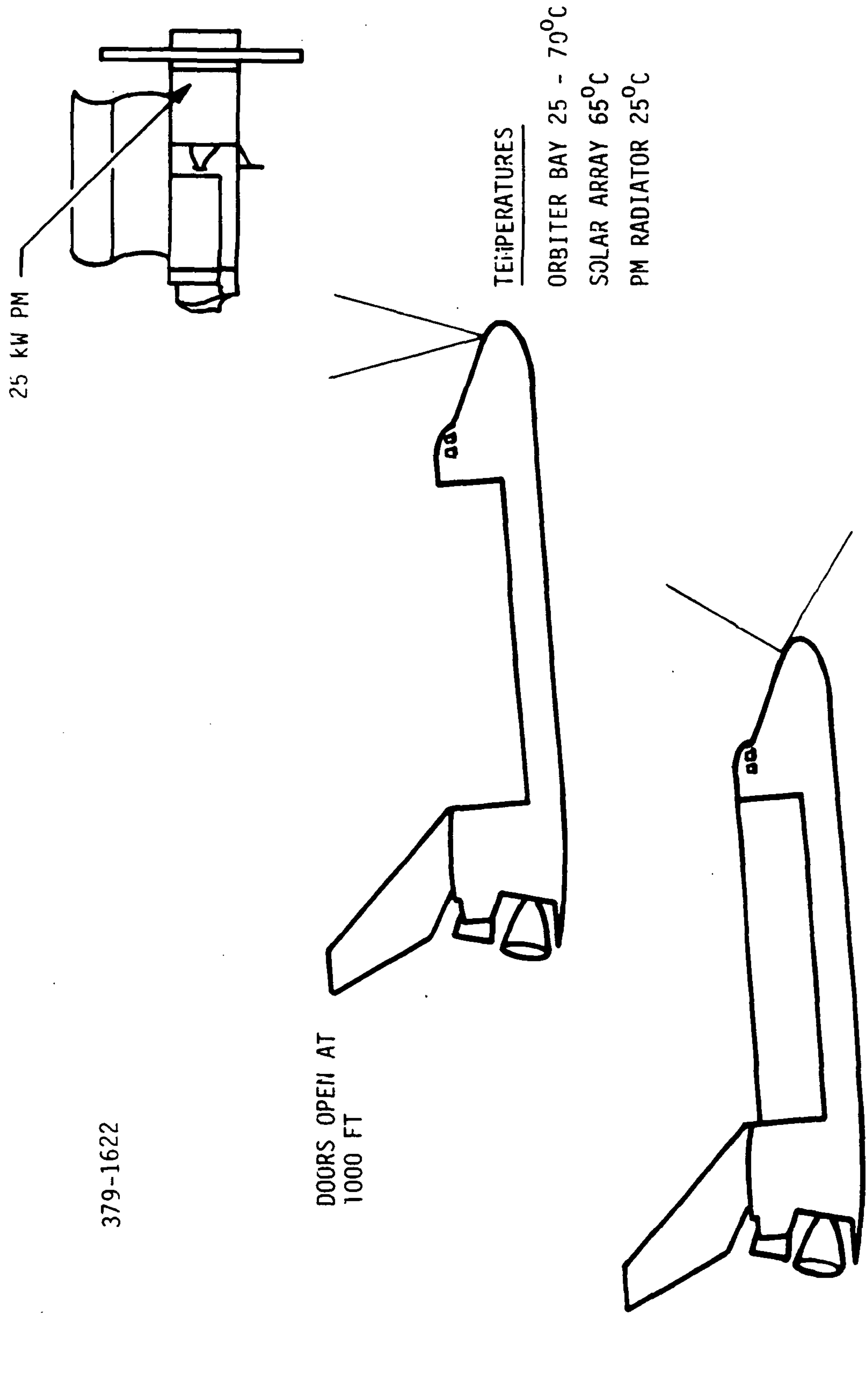


FIGURE 2-44 RENDEZVOUS CLOSING SEQUENCE

379-1623

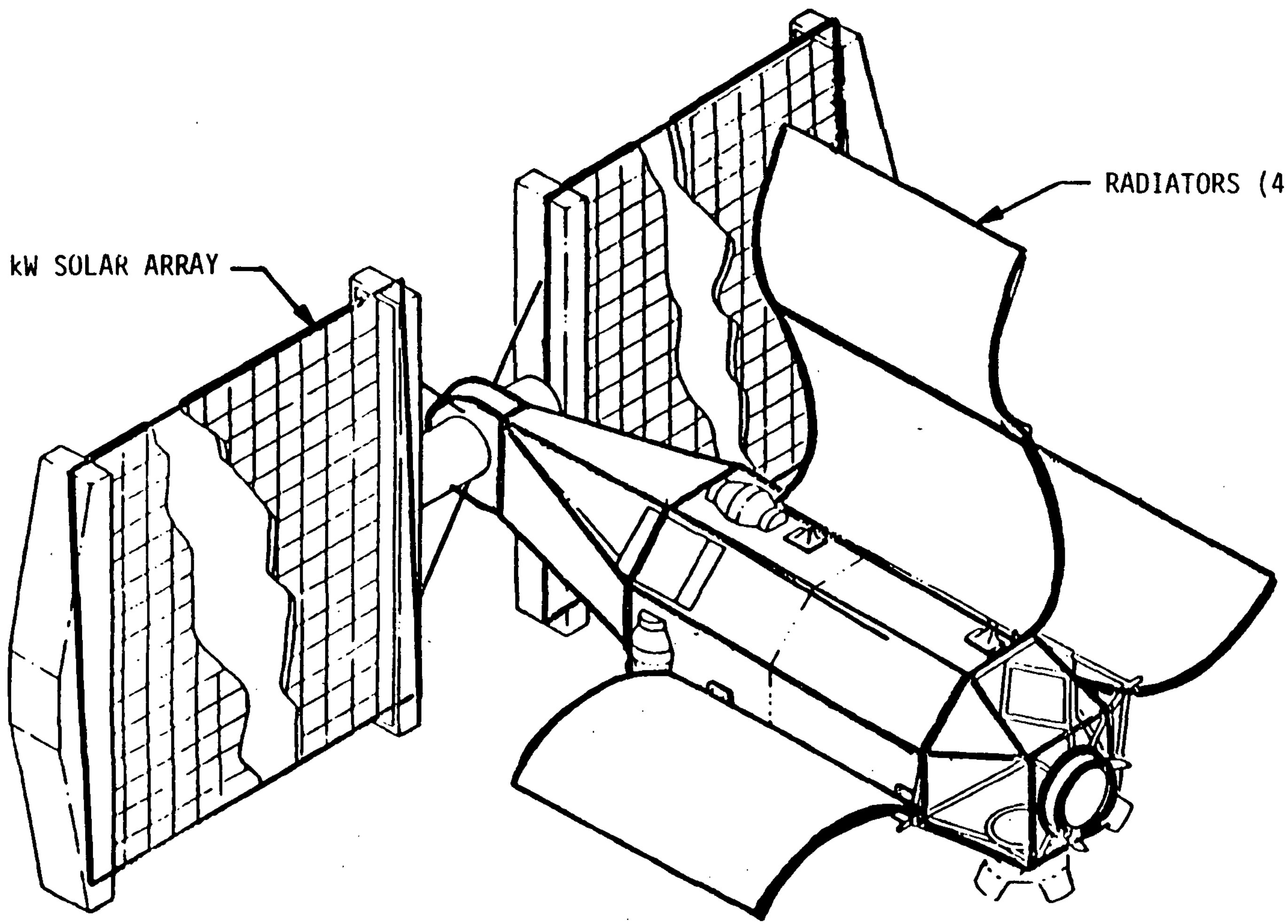
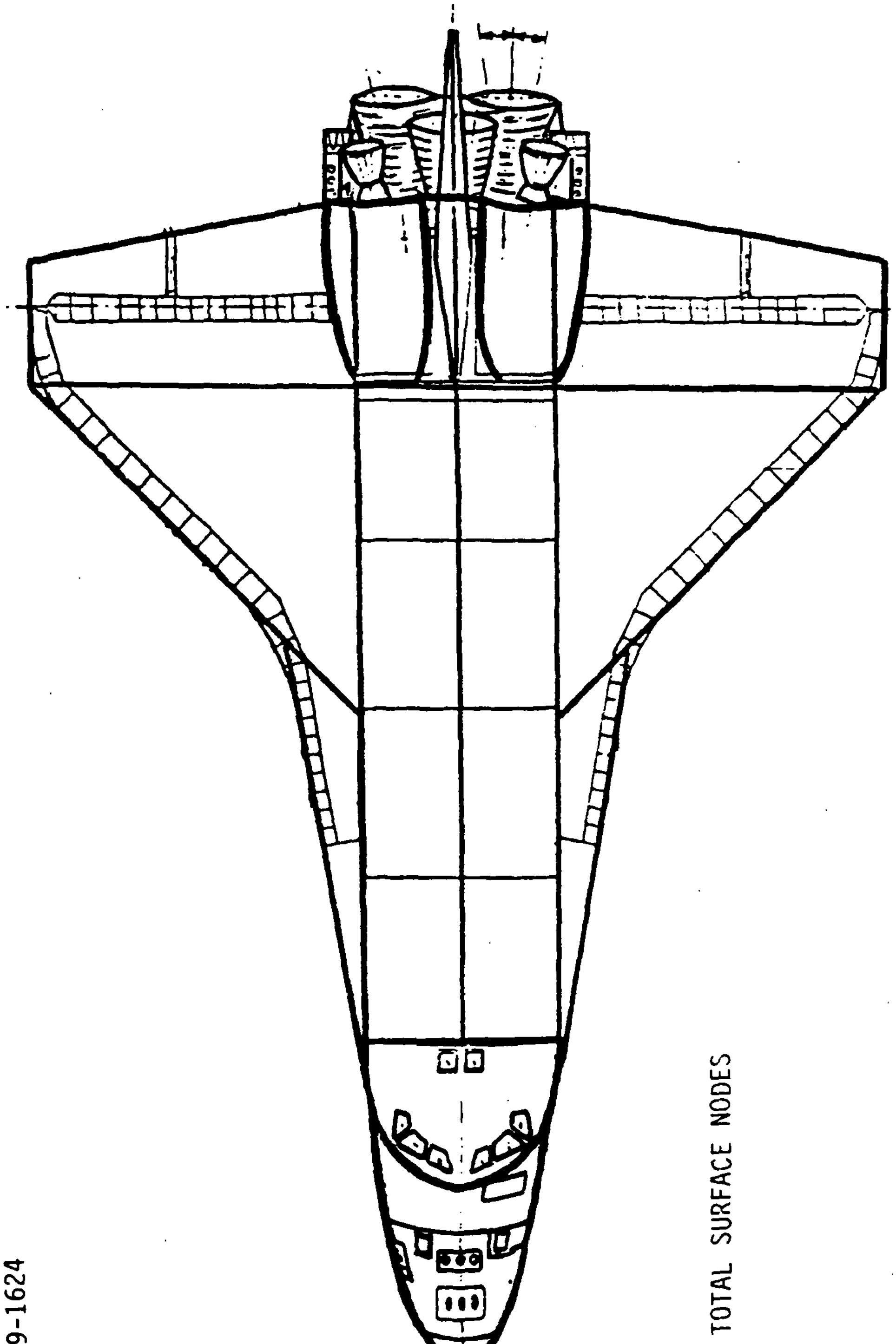


FIGURE 2-45 CONTAMINATION NODAL MODEL--25 kW POWER MODULE



379-1624

55 TOTAL SURFACE NODES

FIGURE 2-46 CONTAMINATION NODAL MODEL--ORBITER

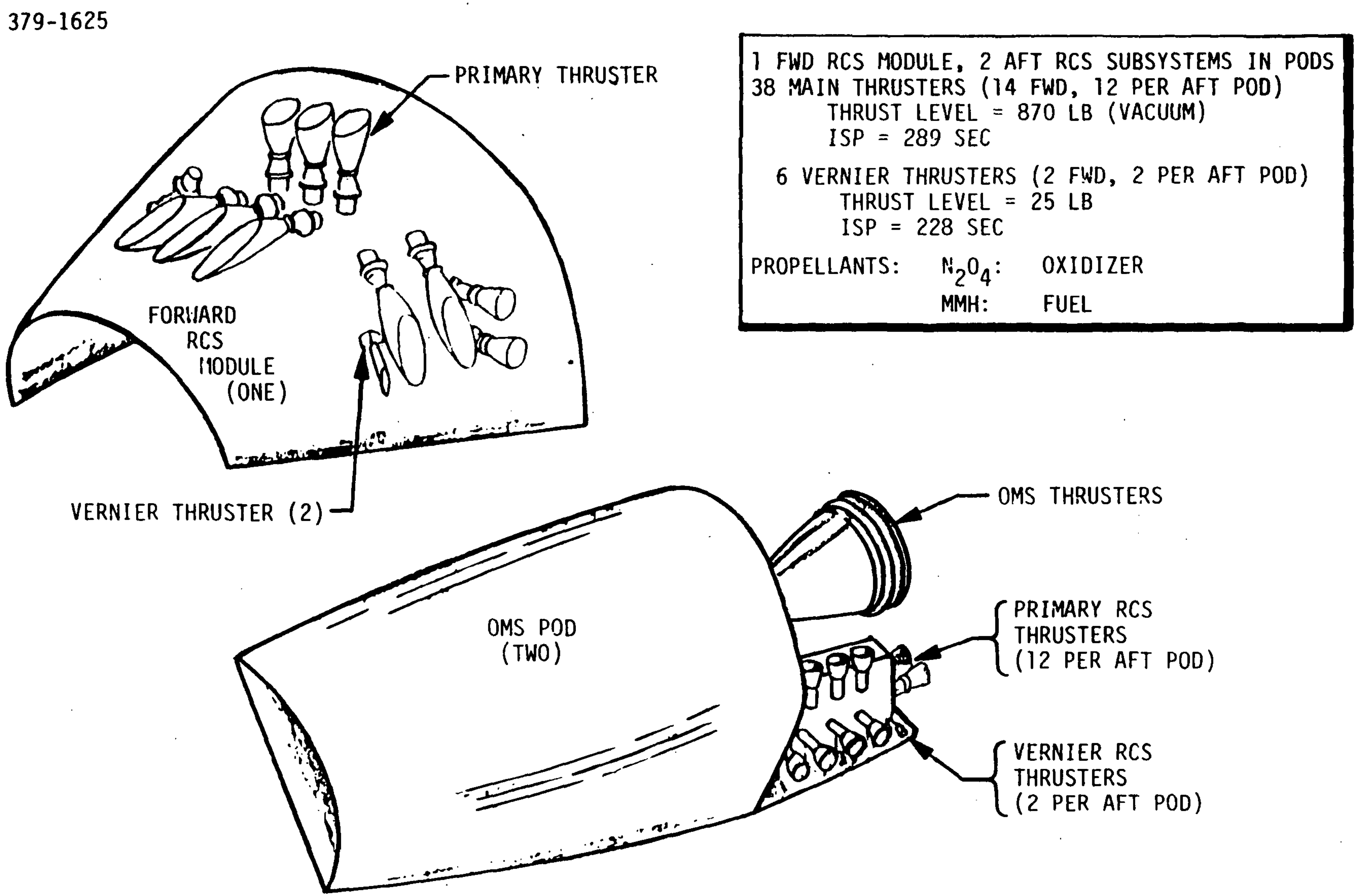


FIGURE 2-47 ORBITER THRUSTER LOCATIONS

TABLE 2-7 PRINCIPAL CONTAMINATION SOURCES

Exposed Orbiter Bay Materials

	Wt (lb)	VCM (%)
• TG 15000 Bulkhead Liner	291	0.02
• Beta Cloth Bay Liner	80	0.03
• Radiator Teflon/Adhesive	40	0.21
• MLI	25	0.02
• Super Koropon Paint	20	0.10

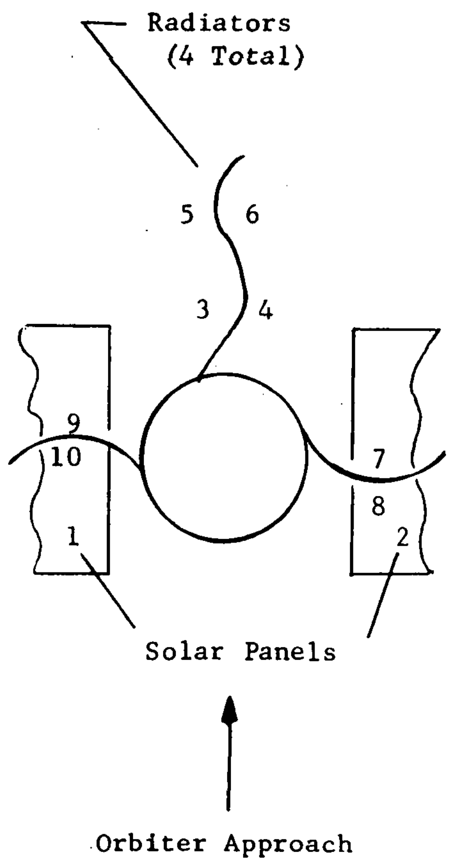
Exposed Power Module Materials

	Wt (lb)	VCM (%)
• Solar Panels		
-- DC 93-500 Adhesive	180	0.003
-- Sylgan J-500 Damping	70	0.03
• Radiator Teflon/Adhesive	40	0.05
• MLI	150	0.02
• Braycote 48	1	0.10

Orbiter B1 - Propellant Effluents

- 38 RCS Thrusters (870 lb thrust, $\dot{M}$ = 1420 GM/sec/engine)
- 6 VCS Thrusters (25 lb thrust, $\dot{M}$ = 41 GM/sec/engine)
- Principal Plume Contaminant is Hydrazinium Nitrate
  - -- 2% of Exhaust Product
  - -- Capture Coefficient Measured at AEDC (0.002)
- Selected Engine Pulse Duration of 40 Milliseconds
- Used Single Pulse Firing for Each Closing Interval
  - -- Thruster Group Fired Simultaneously
  - -- Assumed all Axes of Thruster Pods Activated One Cycle Only

TABLE 2-8 ACCUMULATED CONTAMINATION ON PM SURFACES DURING RENDEZVOUS SURFACES



Surface ID	Orbiter to PM Separation (feet)				
	1000	500	200	30 at Tether	Tethered for 7 hrs
1	20*	117	617	61,178	60,520
2	20	117	617	61,178	60,520
3	3	13	25	10,991	10,987
4	3	13	25	9,817	9,829
5	3	13	32	17,079	17,038
6	3	13	41	21,414	21,392
7	0.3	0.04	0.8	37	22
8	26	123	874	338,262	336,567
9	0.5	0.8	0.8	42	28
10	26	124	880	351,285	349,587

* Equivalent contamination film thickness in angstroms

2.4.4 Contamination and Its Effects

The prediction of molecular and particulate mass depositions is only the first step in determining the thermooptical performance perturbations of contaminated systems such as the power module. In fact, when a surface is being contaminated by direct impingement of a thruster plume, considerable erosion and aerodynamic heating may occur as well as the deposition of combustion reaction products. Usually, however, these surfaces are not contamination-sensitive, and they primarily act as secondary sources by redistributing the initially deposited motor reaction products to the remote sensitive surfaces after the motor is shut down. On these sensitive surfaces, such as cold low α_s/ϵ_{th} radiator surfaces, and the principal optical components of earth and sun sensors, the molecular and particulate deposits can cause two principal deleterious effects. In the first case, as a more or less uniform layer of contamination, they will significantly vary the optical properties of the host surfaces causing deviations from the initial design values of spectral reflectance (ρ_λ), spectral transmittance (τ_λ), solar absorptance (α_s), and thermal emittance (ϵ_{th}). In the second case, these deposits are usually formed in clusters, not layers, and besides varying the spectral properties mentioned above, they can also scatter reflected and refracted energy into off-specular directions. Clearly, the first effect is relevant to thermal control surfaces, while the second scattering effect is of primary concern in the off-axis rejection of optical systems.

2.4.5 Optical Effects Theory

To accurately calculate the spectral reflectance and transmittance of a contaminated surface requires a two-step procedure. The first step is to determine optical constants of the contamination deposit which is considered to be a uniform composite of the various contamination products which are deposited. These spectral optical constants are the index of refraction (N_λ) and the coefficients of extinction (K_λ), which are the amplitudes of the real and imaginary components of the complex index of refraction respectively. They are intensive constitutive material properties directly defined by the empirical conductivity and dielectric constant of classical electromagnetic theory. The second step is to analyze the contaminated surface as a laminated multilayer structure consisting of the clean host surface which in itself may consist of several strata of materials (e.g., silvered Teflon) covered by the composite contamination deposit which then constitutes the outer-most layer. The thickness and the two optical constants of each laminate are required. It should be noted that the output parameters, spectral reflectance and transmittance, are extensive properties dependent upon the angle of incidence of the incident light beam, as well as being strongly coupled to the intensive optical constants of the various laminae.

A cursory analysis of contamination and its effects on the power module shows that an orbiter rendezvous will degrade the power module radiators beyond the end-of-life (EOL) limits. This is depicted dramatically in Figure 2-48.

The in-depth contamination analysis has shown that severe hydrazine thruster plume contamination occurs during orbiter rendezvous closing maneuvers. The main problem region is during the closing maneuvers from 200 feet to the tether position of the 25 kW/SB orbiter. The effects analysis indicates that it is more than likely that a total loss of power module radiator capability and a 15 to 20 percent loss of power module solar array output will occur after an STS maintenance visit; unless, that is, mission specific rendezvous conditions are developed to eliminate both the severe contamination scenario and possible disorientation of the power module from plume impingement.

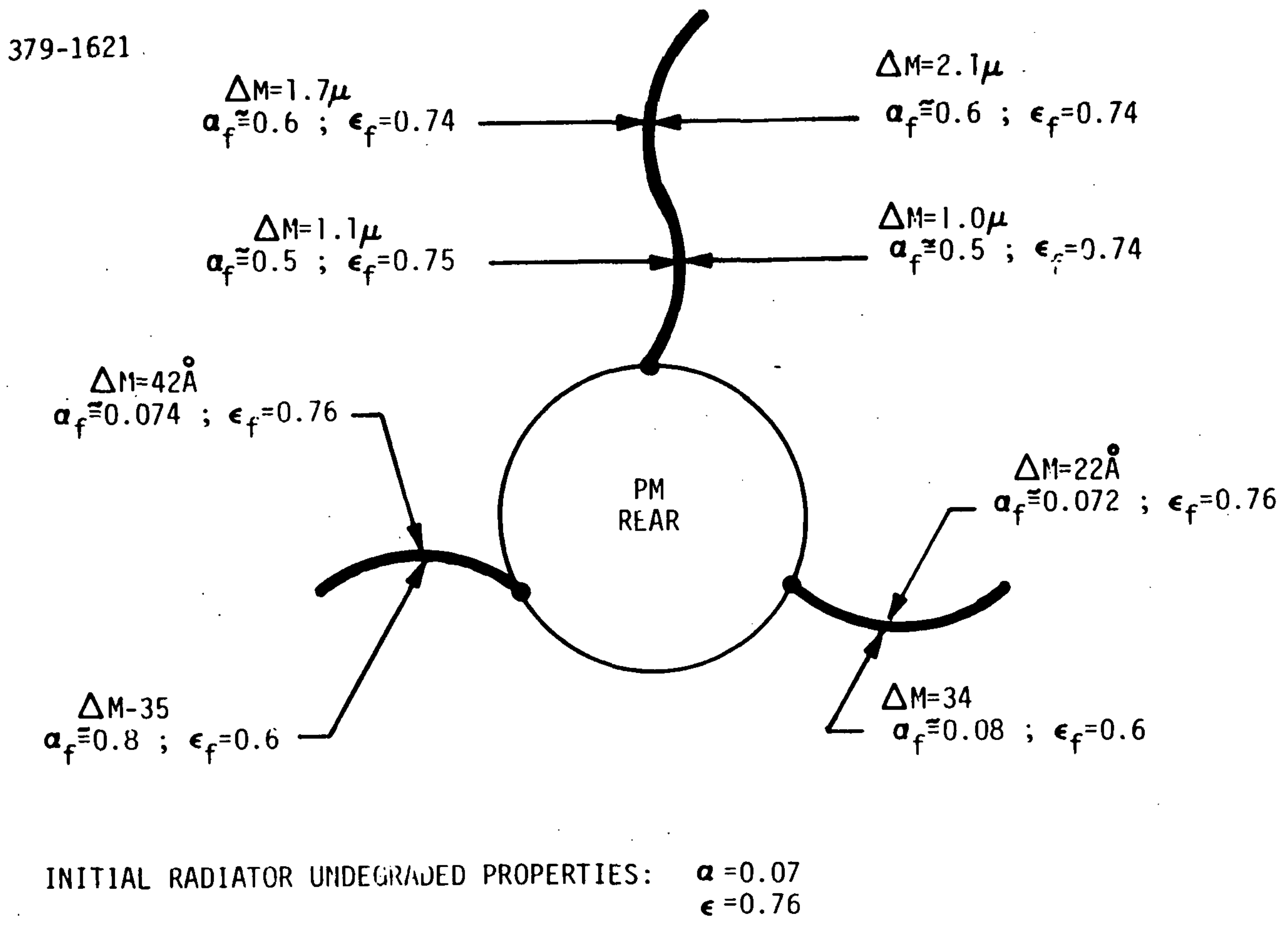


FIGURE 2-48 ORBITER RENDEZVOUS DEGRADES PM RADIATORS BEYOND EOL LIMITS

2.5 PROGRAM PLANNING

This is the capstone task of the study. All previous efforts on this study have been tailored to allow this task to be accomplished effectively and efficiently.

As the overall systems coordinator of future space-station missions, NASA must ensure that thermal-control surfaces applicable to the full range of missions are available to the thermal-design engineer when required. Funding constraints plus good system management dictate that the number of future thermal-control surfaces that require development be kept to a minimum.

To date, little effort has gone into designing thermal-control systems that promote the concepts of commonality and universality. It has been industry practice to design specialized thermal-control systems for nearly every experiment. Since little industry-wide effort has gone into the design and development of flexible thermal-control systems, we believe that new design approaches will have to be examined to accomplish NASA's objectives. Effort should be expended in considering (a) ways to reduce the interface characteristics of present coatings while simulataneously extending their reliability and life, and (b) ways to ensure that these thermal-control surfaces serve the widest range of missions, including, as a must, the 25-kW Power Module.

2.5.1 Technology Assessment

A comparison was made between the current technology and the thermal-control-surface requirements for both the 25-kW power module and the space station, with more emphasis on the 25-kW power module. Table 2-9 lists those areas which were addressed by the study.

2.5.2 Major Study Findings

Based on the analyses of the missions and on the power module design, no new or improved thermal-control surface will be required. In examining both silvered Teflon (Ag/FEP) and one of the more stable white paints for LEO (i.e., zinc orthotitanate/potassium silicate) it is concluded that

TABLE 2-9 TECHNOLOGY AREAS ASSESSED IN THE SSTCS STUDY

• Ground-based testing	• Electrostatic charging of spacecraft
⊙ In-orbit servicing	⊙ Contamination modeling and control techniques
⊙ Monitoring instrumentation	• Nuclear radiation effects
⊙ Contamination control and avoidance	• Simulation and testing improvements
⊙ New and improved materials	⊙ Safety
	⊙ Cost

both materials would inherently survive the radiation environment for five years. Unfortunately, when used on the radiators, these thermal-control surfaces are easily subjected to contamination which will subsequently degrade their performance. The contamination environment to which this platform will be subjected will be the key lifetime limiting factor. If the radiators are to be fully extended for the mission duration, in addition to the approximate 4000 ft^2 of solar array adhesives, they will be exposed to the blast and subsequent impingement of both the STS Reaction Control System (RCS) and Vernier Control System (VCS). If this platform is to operate on a continual basis for a period of five years, it will require new or replacement radiators before EOL. A summary of major study findings is listed in Table 2-10.

An overview of general spacecraft contamination concerns shown in Table 2-11 indicates that three key issues must be carefully evaluated in order to develop an effective contamination control system and management plan:

- Initial contamination budget - cleanliness level, including maintenance, handling, and other pertinent procedural factors.
- Material selection - outgassing, transport-deposition properties, preflight space conditioning being a possible means of contamination reduction.

TABLE 2-10 MAJOR STUDY FINDINGS

• Developed useful analysis tools for tradeoff study of thermal control radiators for space station application
• Five year life in GEO attainable with current technology and expected degradation rates if favorable orientation selected
• Current thermal control materials (silvered teflon and ZOT white paint) found suitable for mission requirements - contamination dominates the degradation problem
• Rendezvous contamination from orbiter thrusters poses series threat to mission - protective techniques must be used

- Configuration and subsystem designs - avoidance of contaminant fluxes, implementation of on-board contamination preventive measures.

Contamination procedures will require advancement in a number of areas to maintain higher level of cleanliness for this and future missions. Those areas of concern are indicated in Table 2-9 by ⊙.

TABLE 2-11 GENERAL SPACECRAFT CONTAMINATION CONCERNS

- **Deposition or Film Formation - Surface physical/chemical property changes, optical and thermal performance degradation**
- **Plume Impingement or Particle Streams - Surface erosion, blast damage**
- **Particulate/Molecular Environments - Light scattering and absorption**
- **Radiation, Micrometeoroid Sputtering - Surface outgassing, contaminant flux trajectories**

Since configuration changes or the implementation of on-board contamination preventive measures are required to meet mission lifetimes, it is recommended that the following be considered in future study efforts:

- Additional Mission Thermal impact analyses required
  - Tri-Radiator system in LEO and GEO
  - Optimize orbit parameters for longest life
- Gimbal-oriented radiators will extend life
  - Required development of reliable rotating/flexible fluid transfer interface
- Improve assessment of long-term contamination degradation
  - Analysis
  - Test
  - Flight monitoring

- Develop solutions for rendezvous contamination prevention
  - Scenario analysis
  - Concept development
  - Protection
- Develop concepts for on-orbit repair/refurbishment of thermal control surfaces

2.5.3 Additional Study Concerns

The electrostatic charging of spacecraft from magnetospheric disturbances and on-board sources is of great concern for missions at or near geosynchronous attitude. Many spacecraft have experienced charge buildup in multilayer insulations and dielectric thermal-control surfaces. In addition, circuitry switching believed attributable to these sources has occurred on numerus occasions. High voltage with SEP, NEP, nuclear power, and large solar panels can provide strong charging sources on future missions. New or improved space-stable conductive, thermal-control surfaces are required.

Thermal-control surfaces are easily subjected to contamination which can subsequently degrade their performance. Extremely cold radiators required for cryogenic cooling can act as molecular sinks for any liquids or gases. Contamination of optics can degrade video coverage and G&C trackers. SEP, using mercury or cesium as a fuel, can deposit its exhaust products on nearby radiators, lowering their emittance, and thus their capability to reject heat from high-temperature power-conversion units. Hot plasma from NEP could contaminate and damage critical thermal-control surfaces.

Contamination procedures will require advancement in a number of areas to maintain higher levels of cleanliness for future missions. Cleaning procedures, such as using heaters to drive off contaminants, can be utilized. Active cleaning techniques (e.g., atomic-oxygen sputtering) to drive off vapor-deposited contaminants (e.g., mercury or cesium ions) should be considered. Monitoring techniques (QCMS), such as those used on present-day spacecraft, are also a must. The system costs of maintaining adequate contamination control will continue to expand if tight reins are not put on the subject from the conception of a mission.

The disposal of hazardous waste payloads by launches from earth to deep space may become feasible. Technology requirements to include nuclear radiation effects of thermal-control surfaces should be considered.

Improvements in simulation accuracy, speeding up the testing process, personnel safety, and overall system cost reductions are technology developments required to advance the state-of-the-art in this field.

Section 3

CONCLUDING REMARKS

This study has resulted in the definition of generalized-space-station active-thermal-control-radiation heat-rejection requirements: geometry, orbital constraints, potential degradation effects, and environmental considerations. In addition, four computer programs have been developed which provide a preliminary design and evaluation tool for active radiator systems in low earth orbit. Two programs were developed as general programs for space station analysis while the other programs were specifically tailored to provide an analysis tool for the 25-kW power module. The power module programs were extensively used for both the degradation at end-of-life and radiator sizing analyses for the module.

Results indicate that the present thermal-control system of the 25-kW power module design cannot survive "in spec" for a five-year period (even with the most favorable conditions) without lowering the primary mission β angle considerably, or without refurbishing or replacing the radiators at least once.

The literature search has indicated that space-stable, thermal-control surfaces exist today for extended low-earth-orbit (LEO) missions (contamination free). Unfortunately, the same cannot be said for geosynchronous altitude missions. Except for the costly silvered-quartz second-surface mirrors, low α/ϵ ratio thermal-control surfaces will not survive long-duration missions. Missions (contamination-free) at this altitude requiring low-cost low α/ϵ surfaces will most likely be forced to replace or refurbish surfaces after five years.

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Appendix A

FORTRAN LISTINGS FOR COMPUTER PROGRAMS

The Fortran listings of both LEO and GEO computer programs are presented in this Appendix. For both cases, listing of the power module program will be presented first, followed directly by the listing for the general space station program.

Report 5836

LEO 25 kW POWER MODULE PROGRAM

```
C
C     ******************************************************************
C
C     L E O   2 5 K W   P O W E R   M O D U L E   P R O G R A M .
C
C     THIS PROGRAM IS DESIGNED TO EVALUATE RADIATOR PERFORMANCE WITHIN
C     THE THERMAL CONTROL SYSTEM FOR THE 25 KW POWER MODULE PROGRAM.
C     IT COMPUTES THE MEAN RADIATOR TEMPERATURE, REQUIRED MASS FLOW RATE
C     AND EXIT FLUID TEMPERATURE FOR DOUBLE SIDED FLAT PLATE RADIATORS,
C     THIS INCLUDES DEGRADED PERFORMANCE WITH TIME. IT IS ASSUMED PLANE
C     OF RADIATORS IS IN ORBIT PLANE, EXTERNAL LOADS ARE COMPUTED IN
C     THE PROGRAM INCLUDING DIRECT SOLAR, ALBEDO AND EARTHSHINE. SHAPE
C     FACTOR TO SPACE AND EXTERNAL INPUT BLOCKAGE FACTORS MAY BE INPUT.
C     PROGRAM MAY BE USED TO PARAMETRICALLY EVALUATE EFFECTS OF
C     DEGRADATION, RADIATOR PERFORMANCE AND AREA SIZING FOR A VARIETY OF
C     INPUT ORIENTATIONS, DISSIPATIONS, DEGRADATION RATES AND ALTITUDES
C     FROM 100 TO 1000 NAUTICAL MILES. THIS PROGRAM IS FOR ' L E O '
C     CONDITIONS ONLY ASSUMING ORBIT PERIODS SUFFICIENTLY SMALL TO USE
C     MEAN ORBITAL EXTERNAL INPUT SHAPE FACTORS.
C
C     ******************************************************************
C
      DIMENSION X(2),DIFF(2)
      DATA PLATE/'P   '/
      CALL READRE
C     ******************************************************************
C     EARTH ORBITAL CONSTANTS.
C     ******************************************************************
      R=3441.0
      S=442.4
      A=0.4
      E=66.36
      SIGMA=0.173E-08
C     ******************************************************************
C     READ IN INPUT DATA FOR GENERAL ORBITAL CONSIDERATIONS.
C     ******************************************************************
      READ(5,200) NAL1,NAL2,NAL3
  200 FORMAT (3I10)
      READ(5,200) NB1,NB2,NB3
      READ(5,200) ND1,ND2,ND3
      READ(5,200) MDP,MODI
C     ******************************************************************
C     READ IN INPUT DATA FOR PLATE RADIATOR CONSIDERATIONS.
```

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```
C     ******************************************************************
      READ(5,202) TEST
  202 FORMAT (1A4)
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PTI,PTM,PAREA
  204 FORMAT (10X,3(F10.4,10X))
      PTI=PTI+459.67
      PTM=PTM+459.67
      READ(5,202) TEST
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PSHDS,PSHDE,PSHDA
      READ(5,202) TEST
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PSPACE,PCP
  250 READ(5,202,END=800) TEST
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PALPHA,EMTP,PDEG
C     ******************************************************************
C     PRINTOUT OF PERTINENT INPUTS.
C     ******************************************************************
      WRITE(6,20)
      WRITE(6,206)
  206 FORMAT(1X,'2 5 K W   P O W E R   M O D U L E   P R O G R A M .',//
     */)
      WRITE(6,207) NAL1,NAL2,NAL3
  207 FORMAT (1X,'ALTITUDE (N.MI.), LOWEST = ',I5,2X,'HIGHEST = ',I5,2X,
     *'INCREMENT = ',I5,/)
      WRITE(6,208) NB1,NB2,NB3
  208 FORMAT (1X,'ORBIT INCLINATION (DEG.), LOWEST = ',I5,2X,'HIGHEST =
     *',I5,2X,'INCREMENT = ',I5,/)
      WRITE(6,209) ND1,ND2,ND3
  209 FORMAT (1X,'DISSIPATION (KW.), LOWEST = ',I5,2X,'HIGHEST = ',I5,2X
     *,'INCREMENT = ',I5,/)
      WRITE(6,210) MDP,MODI
  210 FORMAT (1X,'MONTHS DEGRADATION FOR PLATE RADIATOR = ',I5,2X,'INCRE
     *MENT = ',I5,/)
      WRITE (6,211)
  211 FORMAT (1X,'SHADING COEFFICIENTS')
      WRITE(6,212) PSHDS,PSHDE,PSHDA
  212 FORMAT (1X,'PLATE, SOLAR = ',F10.6,2X,'EARTHSHINE = ',F10.6,2X,'AL
     *BEDO = ',F10.6,/)
      WRITE(6,214) PSPACE,PCP
  214 FORMAT (1X,'PLATE, SHAPE FACTOR TO SPACE = ',F10.6,2X,'FLUID CP =
```

```
     *',F10.4,2X,'BTU/LBM-R.',/)
      WRITE(6,216)
  216 FORMAT (1X,'RADIATOR MATERIAL PROPERTIES')
      WRITE(6,217) PALPHA,EMTP,PDEG
  217 FORMAT (1X,'PLATE, ABSORPTANCE = ',F10.5,2X,'EMITTANCE = ',F10.5,2
     *X,'MONTHLY CHANGE IN ABSORPTANCE = ',F10.6,/)
C     ******************************************************************
C     CONTROL LOOP FOR ALTITUDE VARIATION.
C     ******************************************************************
      DO 270 M=NAL1,NAL2,NAL3
      AL=1.0*M
C     ******************************************************************
C     CALCULATION OF EARTHSHINE SHAPE FACTORS FROM POLYNOMIAL FITS.
C     ******************************************************************
      FP=0.4127579927-AL*0.6963855121E-03+(AL**2)*0.6778353736E-06-(AL**
     *3)*0.2684461542E-09
      FP=FP*PSHDE
C     ******************************************************************
C     CONTROL LOOP FOR ORBIT INCLINATION VARIATION.
C     ******************************************************************
      DO 270 L=NB1,NB2,NB3
      B=1.0*L
      B=B*(3.141593/180.0)
C     ******************************************************************
C     CALCULATION OF ORBITAL MEAN FS AND FA VALUES.
C     ******************************************************************
      THETA=0.0
      PFS=0.0
      PFA=0.0
      DO 3 N=1,360
      THETA=THETA+1.0*(3.14159/180.0)
C     ******************************************************************
C     ALBEDO AND DIRECT SOLAR SHAPE FACTOR CALCULATIONS FOR FLAT
C     PLATE RADIATOR.
C     ******************************************************************
      FS=SIN(B)
      TEST=((AL+R)*SIN(B))/R
      IF(TEST.GT.1.0) GO TO 4
      SANGLE=ATAN((TAN(ARCOS((R*SIN(ARCOS(((AL+R)*SIN(B))/R)))/((AL+R)*C
     *OS(B)))))/COS(B))+3.14159/2.0
      COMP=2.0*(3.14159)-SANGLE
      IF(THETA.GT.SANGLE.AND.THETA.LT.COMP) FS=0.0
    4 CONTINUE
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```
      PFS=PFS+FS
      GAMMA=COS(THETA)*COS(B)
      FA=FP*GAMMA
      IF(FA.LT.0.0) FA=0.0
      PFA=PFA+FA
    3 CONTINUE
      PFSM=(PFS/360.0)*PSHDS
      PFAM=(PFA/360.0)*PSHDA
C     ******************************************************************
C     CONTROL LOOP FOR DISSIPATION VARIATION.
C     ******************************************************************
      DO 270 K=ND1,ND2,ND3
      DD=1.0*K
      D=CD*3.412*1000.0
C     ******************************************************************
C     COMPUTATION OF INITIAL ON ORBIT PARAMETERS FOR FLAT PLATE RADIATOR
C     ******************************************************************
      FLO=D/(PCP*(PTI-PTM))
      PERTH=2.0*E*EMTP*FP*PAREA
      PSOL=S*PALPHA*PFSM*PAREA
      PAL=2.0*A*S*PALPHA*PFAM*PAREA
C     ******************************************************************
C     PRINTOUT OF INITIAL ON ORBIT PARAMETERS FOR FLAT PLATE RADIATOR.
C     ******************************************************************
      WRITE(6,20)
   20 FORMAT (1H1)
      D1=D/(3.412*1000.0)
      WRITE(6,21)D,D1
   21 FORMAT (1X,'FLAT PLANE RADIATOR FOR CASE OF ',F8.1,1X,'BTU/HR. DIS
     *SIPATION = ',F5.1,1X,'KW.',/)
      PTI=PTI-459.67
      PTM=PTM-459.67
      WRITE(6,27) PTI,PTM,FLO
   27 FORMAT (1X,'TEMPERATURES (F), INLET = ',F7.2,' , MIX = ',F7.2,' ,
     *COOLANT FLOW RATE (LBM/HR) = ',F9.2,/)
      PTI=PTI+459.67
      PTM=PTM+459.67
      WRITE(6,22) PAREA
   22 FORMAT (1X,'PLATFORM AREA IN FT2 = ',F10.4,/)
      B=B*(180.0/3.14159)
      WRITE(6,35) B,AL
   35 FORMAT(1X,'ORBIT INCLINATION =',F5.1,1X,'DEGREES, ALTITUDE =',F7.1
     *,1X,'NAUTICAL MILES.',/)
```

```
      B=B*(3.14159/180.0)
      WRITE(6,51) PERTH,PSOL,PAL
   51 FORMAT (1X,'EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = ',F10.3,2
     *X,'SOLAR = ',F10.3,2X,'ALBEDO = ',F10.3,/)
      WRITE(6,28)
   28 FORMAT (1X,'EFFECT OF DEGRADATION',/)
      WRITE(6,29)
   29 FORMAT (1X,'     MONTH      INLET (F)          RAD (F)     OUTLET (F
     *)    MFR(LBM/HR)  ABSORPTANCE    SCL(BTU/HR)      AL(BTU/HR)       E
     *TA       ITN',/)
C     ******************************************************************
C     CALCULATION OF TEMPS. AND FLUID PARAMETERS WITH DEGRADATION
C     FOR FLAT PLATE RADIATOR.
C     SOLUTION OF GOVERNING NON-DIMENSIONAL EQUATIONS FOUND BY
C     BI-SECTION METHOD.
C     ******************************************************************
      DALPHA=PALPHA
      NMDP=MDP+1
      DO 400 J=1,NMDP,MODI
      PT4=(D+S*PAREA*PFSM*DALPHA+2.0*S*A*DALPHA*PFAM*PAREA+2.0*E*PAREA*E
     *MTP*FP)/(PAREA*PSPACE*EMTP*SIGMA*2.0)
      PT=PT4**0.25
      IF(PT.LT.PTI) GO TO 285
      WRITE(6,301)
  301 FORMAT (1X,'SOLUTION TERMINATED DUE TO RADIATOR MEAN TEMPERATURE B
     *EING GREATER THAN FLUID INLET TEMPERATURE.',/)
      GO TO 265
  285 N=0
      QEXT=S*DALPHA*PFSM+2.0*S*A*DALPHA*PFAM+2.0*E*EMTP*FP
      PK=((2.0*SIGMA*EMTP*PSPACE)/QEXT)**0.25
      PTIK=PTI*PK
C     ******************************************************************
C     TEST TO SEE IF SOLUTION WITHIN PROPER RANGE OF PARAMETERS.
C     ******************************************************************
      XL=1.0001/PTIK
      XR=C.999
      P1L=(0.25*ALOG(ABS((1.0+PTIK*XL)/(1.0-PTIK*XL)))-0.25*ALOG(ABS((1.
     *0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*XL)-0.5*ATAN(PTIK))/PTIK
      P1L=1.0/P1L
      P2L=(D/(QEXT*PAREA))/(1.0-XL)
      DIFFL=P1L-P2L
      P1R=(0.25*ALOG(ABS((1.0+PTIK*XR)/(1.0-PTIK*XR)))-0.25*ALOG(ABS((1.
     *0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*XR)-0.5*ATAN(PTIK))/PTIK
```

```
      P1R=1.0/P1R
      P2R=(D/(QEXT*PAREA))/(1.0-XR)
      DIFFR=P1R-P2R
      TEST=DIFFL*DIFFR
      IF(TEST.LT.0.0) GO TO 260
  220 WRITE(6,221)
  221 FORMAT (1X,'SOLUTION OUTSIDE TO/TI RANGE, SOLUTION TERMINATED.',/)
      GO TO 265
C     ******************************************************************
C     ITERATION PROCESS FOR SOLUTION.
C     ******************************************************************
  260 TEMP=XL
      X(1)=(XL+XR)/2.0
      X(2)=XR
  224 DO 222 NX=1,2
      P1=(0.25*ALOG(ABS((1.0+PTIK*X(NX))/(1.0-PTIK*X(NX))))-0.25*ALOG(AB
     *S((1.0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*X(NX))-0.5*ATAN(PTIK))/PTI
     *K
      P1=1.0/P1
      P2=(D/(QEXT*PAREA))/(1.0-X(NX))
      DIFF(NX)=P1-P2
  222 CONTINUE
      TEST=DIFF(1)*DIFF(2)
      CRITRA=0.002
      DIF=(ABS(X(1)-X(2))/((X(1)+X(2))/2.0))*100.0
      N=N+1
      IF(DIF.LE.CRITRA) GO TO 240
      IF(TEST.GT.0.0) GO TO 225
      TEMP=X(1)
      X(1)=(X(1)+X(2))/2.0
      GO TO 224
  225 X(2)=X(1)
      X(1)=TEMP
      X(1)=(X(1)+X(2))/2.0
      GO TO 224
  240 T=(X(1)+X(2))/2.0
      P=(P1+P2)/2.0
C     ******************************************************************
C     COMPUTATION OF SOLUTION DIMENSIONAL VALUFS.
C     ******************************************************************
      PTR=T*PTI
      PMRATE=P*((QEXT*PAREA)/(PCP*PTI))
      PADA=(PT**4-PTR**4)/(PTI**4-PTR**4)
```

```
      PDSOL=S*DALPHA*PFSM*PAREA
      PDAL=2.0*A*S*DALPHA*PFAM*PAREA
C     ******************************************************************
C     PRINTOUT OF DEGRADED CONDITIONS FOR FLAT PLATE RADIATOR.
C     ******************************************************************
      PTI=PTI-459.67
      PT=PT-459.67
      PTR=PTR-459.67
      NN=J-1
      WRITE(6,30) NN,PTI,PT,PTR,PMRATE,DALPHA,PDSOL,PDAL,PADA,N
   30 FORMAT (1X,I10,4(5X,F10.2),5X,F8.6,2(5X,F10.2),5X,F4.2,5X,I4)
      PTI=PTI+459.67
      PT=PT+459.67
      PTR=PTR+459.67
      DALPHA=DALPHA+PDEG*MODI
  400 CONTINUE
C     ******************************************************************
C     COMPUTE END OF LIFE SOLAR ABSORPTANCE VALUE AND REQUIRED RADIATOR
C     PLATFORM AREA TO REMAIN IN 'SPEC' WITH SUCH AN ABSORPTANCE.
C     ******************************************************************
  265 ALIFE=PALPHA+MDP*PDEG
      QLIFE=S*ALIFE*PFSM+2.0*S*A*ALIFE*PRAM+2.0*E*EMTP*FP
      PKLIFE=((2.0*SIGMA*EMTP*PSPACE)/QLIFE)**0.25
      PKPTM=PKLIFE*PTM
      PAAI=(2.0*EMTP*(SIGMA*PSPACE-((1.0/PTM)**4)*E*FP))/(S*(PFSM+2.0*A*
     *PFAM)*((1.0/PTM)**4))
      IF(PAAI.GT.1.0) PAAI=1.0
      IF(PKPTM.LE.1.0) GO TO 190
      PKTIL=PTI*PKLIFE
      XLIFE=PTM/PTI
      PL=(0.25*ALOG(ABS((1.0+PKTIL*XLIFE)/(1.0-PKTIL*XLIFE)))-0.25*ALOG(
     *ABS((1.0+PKTIL)/(1.0-PKTIL)))+0.5*ATAN(PKTIL*XLIFE)-0.5*ATAN(PKTIL
     *))/PKTIL
      AREA=PL*((FLO*PCP*PTI)/QLIFE)
C     ******************************************************************
C     PRINT ABSORPTANCE AND AREA VALUES.
C     ******************************************************************
      WRITE(6,281) AREA,MDP
  281 FORMAT (/,1X,'PLATFORM AREA REQUIRED TO REMAIN IN SPEC = ',F8.2,2X
     *,'FT2 FOR ',I3,2X,'MONTHS ON ORBIT.',/)
      WRITE(6,280) ALIFE,MDP,PDEG
  280 FORMAT (1X,'SOLAR ABSORPTANCE = ',F7.5,2X,'FOR ',I3,2X,'MONTHS OF
     *LIFE WITH A DEGRADATION RATE OF ',F8.6,2X,'CHANGE IN ABSORPTANCE P
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```
     *ER MONTH.',/)
      WRITE(6,192) PAAI
  192 FORMAT (1X,'SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LO
     *ADS FOR SIZING RADIATOR AREA = ',F7.5,/)
      GO TO 270
  190 WRITE(6,191) PAAI
  191 FORMAT(/,1X,'EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO
     * REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = ',F7.5,/)
  270 CONTINUE
      GO TO 700
C     ******************************************************************
C     PROGRAM TERMINATION CONTROL.
C     ******************************************************************
  203 WRITE(6,219)
  219 FORMAT (1X,'MISTAKE MADE IN PLATE RADIATOR INPUT, PROGRAM TERMINAT
     *ED.')
  700 GO TO 250
  800 RETURN
      END
C     ******************************************************************
C     *  INPUT DATA                                                    *
C     ******************************************************************
       235       270        35
        10        90        20
        12        12         1
        60         1
P           94.6                40.0                634.2
P            0.9                 0.9                  0.9
P            0.91                0.25
P            0.07                0.76                  0.003
P            0.07                0.76                  0.006
P            0.07                0.76                  0.009
```

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LEO GENERAL SPACE STATION PROGRAM

```
C
C     ******************************************************************
C
C     L E O   G E N E R A L   S P A C E   S T A T I O N   P R O G R A M
C
C     PROGRAM TO COMPUTE THE PLATFORM AREA REQUIRED FOR SPACE RADIATORS
C     AND THEIR DEGRADED PERFORMANCE WITH TIME. IT IS ASSUMED FLAT
C     EXTENDED RADIATORS WILL HANDLE DISSIPATION LOAD UP TO BREAK POINT
C     AND THEN MODULE WRAP-AROUND ONE SIDED RADIATORS WILL HANDLE ALL
C     ADDITIONAL DISSIPATION LOADS. IT IS ASSUMED FLAT RADIATORS ARE IN
C     THE ORBIT PLANE AND WRAP-AROUND RADIATORS ARE CYLINDRICAL IN SHAPE
C     WITH END POINTING TOWARD THE EARTH. THIS PROGRAM IS FOR ' L E O '
C     CONDITIONS ONLY AND ASSUMES ORBIT PERIODS SMALL ENOUGH TO USE
C     ORBITAL MEAN EXTERNAL HEAT LOAD SHAPE FACTORS. THIS PROGRAM
C     HANDLES DIRECT SOLAR, ALBEDO, AND EARTHSHINE INPUTS. ALTITUDE
C     RANGE IS FROM 100 TO 1000 NAUTICAL MILES.
C
C     ******************************************************************
C
      DIMENSION X(2),DIFF(2)
      DATA PLATE/'P   '/
      DATA CYL/'C   '/
      CALL READRE
C     ******************************************************************
C     EARTH ORBITAL CONSTANTS.
C     ******************************************************************
      R=3441.0
      S=442.4
      A=0.4
      E=66.36
      SIGMA=0.173E-08
C     ******************************************************************
C     READ IN INPUT DATA FOR GENERAL ORBITAL CONSIDERATIONS.
C     ******************************************************************
      READ(5,200) NAL1,NAL2,NAL3
  200 FORMAT (3I10,F10.4)
      READ(5,200) NB1,NB2,NB3
      READ(5,200) ND1,ND2,ND3,BREAK
C     ******************************************************************
C     READ IN DATA FOR PLATE AND CYLINDRICAL RADIATOR CONSIDERATIONS.
C     ' P ' STANDS FOR PLATE RADIATOR.
C     ' C ' STANDS FOR CYLINDRICAL RADIATOR.
C     ******************************************************************
```

```
      READ(5,201) MDP,MDC,MODIP,MODIC
  201 FORMAT (4I10)
      READ(5,202) TEST
  202 FORMAT (IA4)
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PTI,PTM
  204 FORMAT (10X,3(F10.4,10X))
      PTI=PTI+459.67
      PTM=PTM+459.67
      READ(5,202) TEST
      IF(TEST.NE.CYL) GO TO 205
      READ(99,204) CTI,CTM
      CTI=CTI+459.67
      CTM=CTM+459.67
      READ(5,202) TEST
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PSHDS,PSHDE,PSHDA
      READ(5,202) TEST
      IF(TEST.NE.CYL) GO TO 205
      READ(99,204) CSHDS,CSHDE,CSHDA
      READ(5,202) TEST
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PSPACE,PCP
      READ(5,202) TEST
      IF(TEST.NE.CYL) GO TO 205
      READ(99,204) CSPACE,CCP
  750 READ(5,202,END=300) TEST
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PALPHA,EMTP,PDEG
      READ(5,202,END=300) TEST
      IF(TEST.NE.CYL) GO TO 205
      READ(99,204) CALPHA,EMTC,CDEG
C     *****************************************************************
C     PRINTOUT OF PERTINENT INPUTS.
C     *****************************************************************
      WRITE(6,20)
      WRITE(6,206)
  206 FORMAT(1X,'S P A C E   S T A T I O N   R A D I A T O R   P R O G R
     * A M',///)
      WRITE(6,207) NAL1,NAL2,NAL3
  207 FORMAT (1X,'ALTITUDE (N.MI.), LOWEST = ',I5,2X,'HIGHEST = ',I5,2X,
     *'INCREMENT = ',I5,/)
      WRITE(6,208) NB1,NB2,NB3
```

```
208 FORMAT (1X,'ORBIT INCLINATION (DEG.), LOWEST = ',I5,2X,'HIGHEST =
   *',I5,2X,'INCREMENT = ',I5,/)
    WRITE(6,209) ND1,ND2,ND3,BREAK
209 FORMAT (1X,'DISSIPATION (KW.), LOWEST = ',I5,2X,'HIGHEST = ',I5,2X
   *,'INCREMENT = ',I5,//,1X,'BREAK POINT FROM PLATE TO CYLINDRICAL RA
   *DIATORS (KW.) = ',F7.2,/)
    WRITE(6,210) MDP,MODIP,MDC,MODIC
210 FORMAT (1X,'MONTHS DEGRADATION FOR FLAT PLATE RADIATOR  = ',I5,2X,
   *'INCREMENT = ',I5,/,1X,'MONTHS DEGRADATION FOR CYLINDRICAL RADIATO
   *R = ',I5,2X,'INCREMENT = ',I5,/)
    WRITE (6,211)
211 FORMAT (1X,'SHADING COEFFICIENTS')
    WRITE(6,212) PSHDS,PSHDE,PSHDA
212 FORMAT (1X,'PLATE,  SOLAR = ',F10.6,2X,'EARTHSHINE = ',F10.6,2X,'AL
   *BEDO = ',F10.6)
    WRITE(6,213) CSHDS,CSHDE,CSHDA
213 FORMAT (1X,'CYL. ,  SOLAR = ',F10.6,2X,'EARTHSHINE = ',F10.6,2X,'AL
   *BEDO = ',F10.6,/)
    WRITE(6,214) PSPACE,PCP
214 FORMAT (1X,'PLATE,  SHAPE FACTOR TO SPACE = ',F10.6,2X,'FLUID CP =
   *',F10.4,2X,'BTU/LBM-R.')
    WRITE(6,215) CSPACE,CCP
215 FORMAT (1X,'CYL. ,  SHAPE FACTOR TO SPACE = ',F10.6,2X,'FLUID CP =
   *',F10.4,2X,'BTU/LBM-R.',/)
    WRITE(6,216)
216 FORMAT (1X,'RADIATOR MATERIAL PROPERTIES')
    WRITE(6,217) PALPHA,EMTP,PDEG
217 FORMAT (1X,'PLATE, ABSORPTANCE = ',F10.5,2X,'EMITTANCE = ',F10.5,2
   *X,'MONTHLY CHANGE IN ABSORPTANCE = ',F10.6)
    WRITE(6,218) CALPHA,EMTC,CDEG
218 FORMAT (1X,'CYL. , ABSORPTANCE = ',F10.5,2X,'EMITTANCE = ',F10.5,2
   *X,'MONTHLY CHANGE IN ABSORPTANCE = ',F10.6,/,1H1)
C   *****************************************************************
C   CONTROL LOOP FOR ALTITUDE VARIATION.
C   *****************************************************************
    DO 270 M=NAL1,NAL2,NAL3
    AL=1.0*M
C   *****************************************************************
C   CALCULATION OF EARTHSHINE SHAPE FACTORS FROM POLYNOMIAL FITS.
C   *****************************************************************
    FP=0.4127579927-AL*0.6963855121E-03+(AL**2)*0.6778353736E-06-(AL**
   *3)*0.2684461542E-09
    FP=FP*PSHDE
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```
      FC=1.296533585-AL*0.218701805E-02+(AL**2)*0.2127767402E-05-(AL**3)
     **0.8424327902E-09
      FC=FC*CSHDE
C     ******************************************************************
C     CONTROL LOOP FOR ORBIT INCLINATION VARIATION.
C     ******************************************************************
      DO 270 L=NB1,NB2,NB3
      B=1.0*L
      B=B*(3.141593/180.0)
C     ******************************************************************
C     CALCULATION OF ORBITAL MEAN FS AND FA VALUES.
C     ******************************************************************
      THETA=0.0
      PFS=0.0
      PFA=0.0
      CFS=0.0
      CFA=0.0
      DO 3 N=1,360
      THETA=THETA+1.0*(3.14159/180.0)
C     ******************************************************************
C     ALBEDO AND DIRECT SOLAR SHAPE FACTOR CALCULATIONS FOR FLAT
C     PLATE RADIATOR.
C     ******************************************************************
      FS=SIN(B)
      TEST=((AL+R)*SIN(B))/R
      IF(TEST.GT.1.0) GO TO 4
      SANGLE=ATAN((TAN(ARCOS((R*SIN(ARCOS(((AL+R)*SIN(B))/R)))/((AL+R)*C
     *OS(B)))))/COS(B))+3.14159/2.0
      COMP=2.0*(3.14159)-SANGLE
      IF(THETA.GT.SANGLE.AND.THETA.LT.COMP) FS=0.0
    4 CONTINUE
      PFS=PFS+FS
      GAMMA=COS(THETA)*COS(B)
      FA=FP*GAMMA
      IF(FA.LT.0.0) FA=0.0
      PFA=PFA+FA
C     ******************************************************************
C     ALBEDO AND DIRECT SOLAR SHAPE FACTOR CALCULATIONS FOR
C     CYLINDRICAL RADIATOR.
C     ******************************************************************
      FS=(1.0/3.14159)*SIN(ARCOS(COS(THETA)*COS(B)))
      IF(TEST.GT.1.0) GO TO 50
      IF(THETA.GT.SANGLE.AND.THETA.LT.COMP) FS=0.0
```

```
   50 CFS=CFS+FS
      FA=FC*GAMMA
      IF(FA.LT.0.0) FA=0.0
      CFA=CFA+FA
    3 CONTINUE
      PFSM=(PFS/360.0)*PSHDS
      PFAM=(PFA/360.0)*PSHDA
      CFSM=(CFS/360.0)*CSHDS
      CFAM=(CFA/360.0)*CSHDA
C     ******************************************************************
C     CONTROL LOOP FOR DISSIPATION VARIATION.
C     ******************************************************************
      DO 270 K=ND1,ND2,ND3
      DD=1.0*K
      D=DD*3.412*1000.0
      IF(DD.GT.BREAK) GO TO 150
C     ******************************************************************
C     COMPUTATION OF INITIAL ON ORBIT PARAMETERS FOR FLAT PLATE RADIATOR
C     AREA SIZED FOR MAXIMUM SOLAR ABSORPTANCE OVER TIME INTERVAL.
C     ******************************************************************
      PAMAX=PALPHA+MDP*PDEG
      PAAI=(2.0*EMTP*(SIGMA*PSPACE-((1.0/PTM)**4)*E*FP))/(S*(PFSM+2.0*A*
     *PFAM)*((1.0/PTM)**4))
      IF(PAAI.GT.1.0) PAAI=1.0
      CHECK=0.0
      IF(PAMAX.EQ.PAAI.OR.PAMAX.GT.PAAI) CHECK=1.0
      IF(PAMAX.EQ.PAAI.OR.PAMAX.GT.PAAI) GO TO 400
      QLIFE=S*PAMAX*PFSM+2.0*S*A*PAMAX*PFAM+2.0*E*EMTP*FP
      PKLIFE=((2.0*SIGMA*EMTP*PSPACE)/QLIFE)**0.25
      PKPTM=PKLIFE*PTM
      PFLO=D/(PCP*(PTI-PTM))
      PKPTI=PKLIFE*PTI
      XLIFE=PTM/PTI
      PL=(0.25*ALOG(ABS((1.0+PKPTI*XLIFE)/(1.0-PKPTI*XLIFE)))-0.25*ALOG(
     *ABS((1.0+PKPTI)/(1.0-PKPTI)))+0.5*ATAN(PKPTI*XLIFE)-0.5*ATAN(PKPTI
     *))/PKPTI
      PAREA=PL*((PFLO*PCP*PTI)/QLIFE)
      PERTH=2.0*E*EMTP*FP*PAREA
      PSOL=S*PALPHA*PFSM*PAREA
      PAL=2.0*A*S*PALPHA*PFAM*PAREA
C     ******************************************************************
C     PRINTOUT OF INITIAL ON ORBIT PARAMETERS FOR FLAT PLATE RADIATOR.
C     ******************************************************************
```

```
400 WRITE(6,20)
 20 FORMAT (1H1)
    D1=D/(3.414*1000.0)
    WRITE(6,21)D,D1
 21 FORMAT (1X,'FLAT PLANE RADIATOR FOR CASE OF ',F8.1,1X,'BTU/HR. DIS
   *SIPATION = ',F5.1,1X,'KW.',/)
    B=B*(180.0/3.14159)
    WRITE(6,35) B,AL
 35 FORMAT(1X,'ORBIT INCLINATION =',F5.1,1X,'DEGREES, ALTITUDE =',F7.1
   *,1X,'NAUTICAL MILES.',/)
    B=B*(3.14159/180.0)
    IF(CHECK.EQ.1.0) GO TO 800
    PTI=PTI-459.67
    PTM=PTM-459.67
    WRITE(6,27) PTI,PTM
 27 FORMAT (1X,'TEMPERATURES, INLET = ',F7.2,' ,    MIX = ',F7.2,/)
    PTI=PTI+459.67
    PTM=PTM+459.67
    WRITE(6,22) PAREA
 22 FORMAT (1X,'PLATFORM AREA IN FT2 = ',F10.4,/)
    WRITE (6,23) PFLO
 23 FORMAT (1X,'COOLANT MASS FLOW RATE (LBM/HR.) = ',F12.4,/)
    WRITE(6,51) PERTH,PSOL,PAL
 51 FORMAT (1X,'INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = '
   *,F10.3,2X,'SOLAR = ',F10.3,2X,'ALBEDO = ',F10.3,/)
    WRITE(6,401) PAAI
401 FORMAT (1X,'SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LO
   *ADS FOR SIZING RADIATOR AREA = ',F7.5,/)
    WRITE(6,402) PAMAX,MDP,PDEG
402 FORMAT (1X,'MAXIMUM ABSORPTANCE VALUE = ',F7.5,2X,'FOR A PERIOD OF
   * ',I5,2X,'MONTHS AT A DEGRADATION RATE OF ',F7.5,2X,'DELTA ABSORPT
   *ANCE PER MONTH',///)
    GO TO 404
800 WRITE(6,900)
900 FORMAT(///)
    WRITE(6,403) PAAI
403 FORMAT (1X,'MAXIMUM SOLAR ABSORPTANCE VALUE OVER INTERVAL EXCEEDS
   *',F7.5,2X,'WHICH IS UPPER LIMIT REQUIRING INFINITE RADIATOR AREA')
    GO TO 150
404 WRITE(6,28)
 28 FORMAT (1X,'EFFECT OF DEGRADATION',/)
    WRITE(6,29)
 29 FORMAT (1X,'     MONTH      INLET (F)         RAD (F)      OUTLET (F
```

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```
     *)     MFR(LBM/HR)  ABSORPTANCE     SCL(BTU/HR)      AL(BTU/HR)        E
     *TA        ITN',/)
C     ******************************************************************
C     CALCULATION OF TEMPS. AND FLUID PARAMETERS WITH DEGRADATION
C     FOR FLAT PLATE RADIATOR.
C     SOLUTION OF GOVERNING NON-DIMENSIONAL EQUATIONS FOUND BY
C     BI-SECTION METHOD.
C     ******************************************************************
      DALPHA=PALPHA
      NMDP=MDP+1
      DO 26 J=1,NMDP,MODIP
      PT4=(D+S*PAREA*PFSM*DALPHA+2.0*S*A*DALPHA*PFAM*PAREA+2.0*E*PAREA*E
     *MTP*FP)/(PAREA*PSPACE*EMTP*SIGMA*2.0)
      PT=PT4**0.25
      IF(PT.LT.PTI) GO TO 285
      WRITE(6,301)
  301 FORMAT (1X,'SOLUTION TERMINATED DUE TO RADIATOR MEAN TEMPERATURE B
     *EING GREATER THAN FLUID INLET TEMPERATURE.',/)
      GO TO 150
  285 N=C
      QEXT=S*DALPHA*PFSM+2.0*S*A*DALPHA*PFAM+2.0*E*EMTP*FP
      PK=((2.0*SIGMA*EMTP*PSPACE)/QEXT)**0.25
      PTIK=PTI*PK
C     ******************************************************************
C     TEST TO SEE IF SOLUTION WITHIN PROPER RANGE OF PARAMETERS.
C     ******************************************************************
      XL=1.0001/PTIK
      XR=0.999
      P1L=(0.25*ALOG(ABS((1.0+PTIK*XL)/(1.0-PTIK*XL)))-0.25*ALOG(ABS((1.
     *0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*XL)-0.5*ATAN(PTIK))/PTIK
      P1L=1.0/P1L
      P2L=(D/(QEXT*PAREA))/(1.0-XL)
      DIFFL=P1L-P2L
      P1R=(0.25*ALOG(ABS((1.0+PTIK*XR)/(1.0-PTIK*XR)))-0.25*ALOG(ABS((1.
     *0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*XR)-0.5*ATAN(PTIK))/PTIK
      P1R=1.0/P1R
      P2R=(D/(QEXT*PAREA))/(1.0-XR)
      DIFFR=P1R-P2R
      TEST=DIFFL*DIFFR
      IF(TEST.LT.0.0) GO TO 260
      WRITE(6,221)
  221 FORMAT (1X,'SOLUTION OUTSIDE TO/TI RANGE, SOLUTION TERMINATED.',/)
      GO TO 150
```

```
C     ****************************************************************
C     ITERATION PROCESS FOR SOLUTION.
C     ****************************************************************
  260 TEMP=XL
      X(1)=(XL+XR)/2.0
      X(2)=XR
  224 DO 222 NX=1,2
      P1=(0.25*ALOG(ABS((1.0+PTIK*X(NX))/(1.0-PTIK*X(NX))))-0.25*ALOG(AB
     *S((1.0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*X(NX))-0.5*ATAN(PTIK))/PTI
     *K
      P1=1.0/P1
      P2=(D/(QEXT*PAREA))/(1.0-X(NX))
      DIFF(NX)=P1-P2
  222 CONTINUE
      TEST=DIFF(1)*DIFF(2)
      CRITRA=0.002
      DIF=(ABS(X(1)-X(2))/((X(1)+X(2))/2.0))*100.0
      N=N+1
      IF(DIF.LE.CRITRA) GO TO 240
      IF(TEST.GT.0.0) GO TO 225
      TEMP=X(1)
      X(1)=(X(1)+X(2))/2.0
      GO TO 224
  225 X(2)=X(1)
      X(1)=TEMP
      X(1)=(X(1)+X(2))/2.0
      GO TO 224
  240 T=(X(1)+X(2))/2.0
      P=(P1+P2)/2.0
C     ****************************************************************
C     COMPUTATION OF SOLUTION DIMENSIONAL VALUES.
C     ****************************************************************
      PTR=T*PTI
      PMRATE=P*((QEXT*PAREA)/(PCP*PTI))
      PADA=(PT**4-PTR**4)/(PTI**4-PTR**4)
      PDSOL=S*DALPHA*PFSM*PAREA
      PDAL=2.0*A*S*DALPHA*PFAM*PAREA
C     ****************************************************************
C     PRINTOUT OF DEGRADED CONDITIONS FOR FLAT PLATE RADIATOR.
C     ****************************************************************
      PTI=PTI-459.67
      PT=PT-459.67
      PTR=PTR-459.67
```

```
      NN=J-1
      WRITE(6,30) NN,PTI,PT,PTR,PMRATE,DALPHA,PDSOL,PDAL,PADA,N
   30 FORMAT (1X,I10,4(5X,F10.2),5X,F8.6,2(5X,F10.2),5X,F4.2,5X,I4)
      PTI=PTI+459.67
      PT=PT+459.67
      PTR=PTR+459.67
      DALPHA=DALPHA+PDEG*MODIP
   26 CONTINUE
C     ******************************************************************
C     CYLINDRICAL RADIATOR SIZING.
C     ******************************************************************
  150 CONTINUE
      DC=0.0
      IF(DD.LE.BREAK) GO TO 270
      IF(DD.GT.BREAK) DC=D-BREAK*3.412*1000.0
C     ******************************************************************
C     COMPUTATION OF INITIAL ON-ORBIT PARAMETERS FOR CYLINDRICAL
C     RADIATOR.
C     AREA SIZED FOR MAXIMUM SOLAR ABSORPTANCE OVER TIME INTERVAL.
C     ******************************************************************
      CAMAX =CALPHA+MDC*CDEG
      CAAI=(EMTC*(SIGMA*CSPACE*(CTM**4)-(1.0/3.14159)*E*FC))/(S*(CFSM+(1
     *.0/3.14159)*A*CFAM))
      IF(CAAI.GT.1.0) CAAI=1.0
      CHECK=0.0
      IF(CAMAX.EQ.CAAI.OR.CAMAX.GT.CAAI) CHECK=1.0
      IF(CAMAX.EQ.CAAI.OR.CAMAX.GT.CAAI) GO TO 450
      QLIFE=S*CAMAX*CFSM+(S*A*CAMAX*CFAM)/3.14159+(E*EMTC*FC)/3.14159
      CKLIFE=((SIGMA*EMTC*CSPACE)/QLIFE)**0.25
      CKCTM=CKLIFE*CTM
      CFLO=DC/(CCP*(CTI-CTM))
      CKCTI=CKLIFE*CTI
      XLIFE=CTM/CTI
      CL=(0.25*ALOG(ABS((1.0+CKCTI*XLIFE)/(1.0-CKCTI*XLIFE)))-0.25*ALOG(
     *ABS((1.0+CKCTI)/(1.0-CKCTI)))+0.5*ATAN(CKCTI*XLIFE)-0.5*ATAN(CKCTI
     *))/CKCTI
      CAREA=CL*((CFLO*CCP*CTI)/QLIFE)
      CERTH=(E*CAREA*EMTC*FC)/3.14159
      CSOL=S*CAREA*CFSM*CALPHA
      CAL=(S*A*CALPHA*CFAM*CAREA)/3.14159
C     ******************************************************************
C     PRINTOUT OF INITIAL ON-ORBIT PARAMETERS FOR CYLINDRICAL RADIATOR.
C     ******************************************************************
```

```
450 WRITE(6,20)
    DI=DC/(3.414*1000.0)
    WRITE(6,60) DC,DI
 60 FORMAT (1X,'CYLINDRICAL RADIATOR FOR CASE OF ',F9.1,1X,'BTU/HR. DI
   *SSIPATION = ',F5.1,1X,'KW.',/)
    B=B*(180.0/3.14159)
    WRITE(6,35) B,AL
    B=B*(3.14159/180.0)
    IF(CHECK.EQ.1.0) GO TO 801
    CTI=CTI-459.67
    CTM=CTM-459.67
    WRITE(6,27) CTI,CTM
    CTI=CTI+459.67
    CTM=CTM+459.67
    WRITE(6,22) CAREA
    WRITE(6,23) CFLO
    WRITE(6,51) CERTH,CSOL,CAL
    WRITE(6,401) CAAI
    WRITE(6,402) CAMAX,MDC,CDEG
    GO TO 451
801 WRITE(6,900)
    WRITE(6,403) CAAI
    GO TO 270
451 WRITE(6,28)
    WRITE(6,29)
C   ******************************************************************
C   CALCULATION OF TEMPS. AND FLUID PARAMETERS WITH DEGRADATION
C   FOR CYLINDRICAL RADIATOR.
C   SOLUTION OF GOVERNING NON-DIMENSIONAL EQUATIONS FOUND BY
C   BI-SECTION METHOD.
C   ******************************************************************
    DALPHA=CALPHA
    NMDC=MDC+1
    DO 500 J=1,NMDC,MODIC
    CT4=(DC+S*CAREA*CFSM*DALPHA+(S*A*DALPHA*CFAM*CAREA)/3.14159+(E*CAR
   *EA*EMTC*FC)/3.14159)/(CAREA*CSPACE*EMTC*SIGMA)
    CT=CT4**0.25
    CTI=(DC/(CCP*CFLO))+CTM
    IF(CT.LT.CTI) GO TO 600
    WRITE(6,601)
601 FORMAT (1X,'SOLUTION TERMINATED DUE TO RADIATOR MEAN TEMPERATURE B
   *EING GREATER THAN FLUID INLET TEMPERATURE.',/)
    GO TO 270
```

```
  600 N=0
      QEXT=S*DALPHA*CFSM+(S*A*DALPHA*CFAM)/3.14159+(E*EMTC*FC)/3.14159
      CK=((SIGMA*EMTC*CSPACE)/QEXT)**0.25
      CTIK=CTI*CK
C     ******************************************************************
C     TEST TO SEE IF SOLUTION WITHIN PROPER RANGE OF PARAMETERS.
C     ******************************************************************
      XL=1.0001/CTIK
      XR=0.999
      C1L=(0.25*ALOG(ABS((1.0+CTIK*XL)/(1.0-CTIK*XL)))-0.25*ALOG(ABS((1.
     *0+CTIK)/(1.0-CTIK)))+0.5*ATAN(CTIK*XL)-0.5*ATAN(CTIK))/CTIK
      C1L=1.0/C1L
      C2L=(DC/(QEXT*CAREA))/(1.0-XL)
      DIFFL=C1L-C2L
      C1R=(0.25*ALOG(ABS((1.0+CTIK*XR)/(1.0-CTIK*XR)))-0.25*ALOG(ABS((1.
     *0+CTIK)/(1.0-CTIK)))+0.5*ATAN(CTIK*XR)-0.5*ATAN(CTIK))/CTIK
      C1R=1.0/C1R
      C2R=(DC/(QEXT*CAREA))/(1.0-XR)
      DIFFR=C1R-C2R
      TEST=DIFFL*DIFFR
      IF(TEST.LT.0.0) GO TO 660
      WRITE(6,621)
  621 FORMAT (1X,'SOLUTION OUTSIDE TO/TI RANGE, SOLUTION TERMINATED.',/)
      GO TO 270
C     ******************************************************************
C     ITERATION PROCESS FOR SOLUTION.
C     ******************************************************************
  660 TEMP=XL
      X(1)=(XL+XR)/2.0
      X(2)=XR
  624 DO 622 NX=1,2
      C1=(0.25*ALOG(ABS((1.0+CTIK*X(NX))/(1.0-CTIK*X(NX))))-0.25*ALOG(AB
     *S((1.0+CTIK)/(1.0-CTIK)))+0.5*ATAN(CTIK*X(NX))-0.5*ATAN(CTIK))/CTI
     *K
      C1=1.0/C1
      C2=(DC/(QEXT*CAREA))/(1.0-X(NX))
      DIFF(NX)=C1-C2
  622 CONTINUE
      TEST=DIFF(1)*DIFF(2)
      CRITRA=0.002
      DIF=(ABS(X(1)-X(2))/((X(1)+X(2))/2.0))*100.0
      N=N+1
      IF(DIF.LE.CRITRA) GO TO 640
```

```
      IF(TEST.GT.0.0) GO TO 625
      TEMP=X(1)
      X(1)=(X(1)+X(2))/2.0
      GO TO 624
  625 X(2)=X(1)
      X(1)=TEMP
      X(1)=(X(1)+X(2))/2.0
      GO TO 624
  640 T=(X(1)+X(2))/2.0
      C=(C1+C2)/2.0
C     ******************************************************************
C     COMPUTATION OF SOLUTION DIMENSIONAL VALUES.
C     ******************************************************************
      CTR=T*CTI
      CMRATE=C*((QEXT*CAREA)/(CCP*CTI))
      CADA=(CT**4-CTR**4)/(CTI**4-CTR**4)
      CDSOL=S*DALPHA*CFSM*CAREA
      CDAL=A*S*DALPHA*CFAM*CAREA/3.14159
C     ******************************************************************
C     PRINTOUT OF DEGRADED CONDITIONS FOR CYLINDRICAL RADIATOR.
C     ******************************************************************
      CTI=CTI-459.67
      CT=CT-459.67
      CTR=CTR-459.67
      NN=J-1
      WRITE(6,30) NN,CTI,CT,CTR,CMRATE,DALPHA,CDSOL,CDAL,CADA,N
      CTI=CTI+459.67
      CT=CT+459.67
      CTR=CTR+459.67
      DALPHA=DALPHA+CDEG*MODIC
  500 CONTINUE
  270 CONTINUE
      GO TO 750
C     ******************************************************************
C     PROGRAM TERMINATION CONTROL.
C     ******************************************************************
  203 WRITE(6,219)
  219 FORMAT (1X,'MISTAKE MADE IN PLATE RADIATOR INPUT, PROGRAM TERMINAT
     *ED.')
      GO TO 300
  205 WRITE(6,220)
  220 FORMAT (1X,'MISTAKE MADE IN CYLINDER RADIATOR INPUT, PROGRAM TERMI
     *NATED.')
```

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GEO 25 kW POWER MODULE PROGRAM

```
C
C     ************************************************************************
C
C     G E O   2 5 K W   P O W E R   M O D U L E   P R O G R A M .
C
C     THIS PROGRAM IS DESIGNED FOR GEOSYNCHRONOUS ALTITUDE. IT IS
C     DESIGNED TO EVALUATE THE RADIATOR PERFORMANCE WITHIN THE THERMAL
C     CONTROL SYSTEM FOR THE 25 KW POWER MODULE. IT IS CAPABLE OF
C     HANDLING DEGRADATION WITH TIME ON-ORBIT AND PROVIDES COMPLETE
C     ORBITAL SOLUTIONS AS A FUNCTION OF ORBIT POSITION AT VARIOUS USER
C     SPECIFIED TIMES THROUGHOUT ON-ORBIT LIFE. ORBITAL SOLUTIONS
C     INCLUDE TEMPERATURES (RADIATOR MEAN VALUE AND EXIT FLUID VALUE)
C     AND RADIATOR MASS FLOW RATES AS WELL AS REDUCED DISSIPATION UNDER
C     CERTAIN CIRCUMSTANCES. ORBITAL SOLUTIONS ASSUME ZERO THERMAL
C     CAPACITANCE FOR THE RADIATORS. THREE SOLUTION REGIMES CONSIDERED
C     ARE (1) FULL DISSIPATION WITH PARTIAL FLOW THROUGH RADIATOR, (2)
C     REDUCED DISSIPATION AND FLOW THROUGH RADIATOR WITH NO BYPASS FLOW
C     (OUT OF SPEC) AND (3) TOTAL RADIATOR SHUTDOWN. CASES TWO AND THREE
C     ARE DUE TO EXCESSIVE EXTERNAL HEAT LOADS. EXTERNAL HEATING (DIRECT
C     SOLAR, ALBEDO AND EARTHSHINE) IS INPUT IN TABULAR FORM. EARTH
C     ECLIPSING IS INCLUDED. OTHER USEFUL PARAMETERS ARE ALSO COMPUTED
C     SUCH AS REQUIRED PLATFORM AREA FOR RADIATOR TO SURVIVE USER
C     SPECIFIED LIFETIME, FOR AN EXAMPLE. ALSO, DISSIPATION MAY BE
C     PARAMETRICALLY VARIED FOR STUDY PURPOSES.
C
C     ************************************************************************
C
      DIMENSION OP(3,50),F(3,50),TINFO(3,18),X(2),DIFF(2)
      COMMON/TABLE/OP,F
      COMMON/CONTRL/ENDIT
      COMMON/HLOAD/PTI,PSPACE,SIGMA,PAREA,EMTP,QEXT,D,X,DIFF
      DATA PLATE/'P   '/
      CALL READRE
C     ************************************************************************
C     ORBITAL CONSTANTS.
C     ************************************************************************
      R=3441.0
      AL=19370.0
      S=442.4
      A=0.4
      E=66.36
      SIGMA=0.173E-08
      PI=3.14159
```

```
C     ******************************************************************
C     INITIALIZE TABLE STORAGE.
C     ******************************************************************
      DO 6 I=1,50
      DO 6 J=1,3
      OP(J,I)=-10000.0
    6 F(J,I)=-10000.0
C     ******************************************************************
C     READ IN INPUT DATA FOR GENERAL ORBITAL CONSIDERATIONS.
C     ******************************************************************
      READ(5,5) BETA
    5 FORMAT(5X,F5.2)
      READ(5,200) ND1,ND2,ND3
      READ(5,200) MDP,MODI,INTK
  200 FORMAT (3I10)
C     ******************************************************************
C     READ IN TABULAR INPUT.
C     THREE EXTERNAL HEAT INPUT TABLES MUST BE READ IN.
C     THERE MUST BE A TABLE FOR DIRECT SCLAR, EARTHSHINE AND ALBEDO.
C     BLOCKAGE MUST BE INCLUDED IN TABLES.
C     ******************************************************************
   43 READ(5,40) NUM
   40 FORMAT(A4)
      IF(NUM.EQ.PLATE) GO TO 750
      READ(99,46) NUM
   46 FORMAT(I5)
      IF(NUM.EQ.0) GO TO 41
      READ(99,42) (TINFO(NUM,I),I=1,18)
   42 FORMAT(8X,18A4)
      NCARD=0
      N=NUM
      GO TO 43
   41 NCARD=NCARD+1
      READ(99,44) OP(N,NCARD),F(N,NCARD)
   44 FORMAT(10X,E10.4,5X,E12.6)
      IF(N.EQ.3.AND.OP(N,NCARD).EQ.360.0) GO TO 45
      GO TO 43
   45 CONTINUE
C     ******************************************************************
C     READ IN INPUT DATA FOR PLATE RADIATCR CONSIDERATIONS.
C     ******************************************************************
      READ(5,202) TEST
  202 FORMAT (1A4)
```

```
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PTI,PTM,PAREA
  204 FORMAT(10X,3F10.4)
      PTI=PTI+459.67
      PTM=PTM+459.67
      READ(5,202) TEST
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PSPACE,PCP
  250 READ(5,202,END=800) TEST
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PALPHA,EMTP,PDEG
C     ******************************************************************
C     PRINTOUT OF PERTINENT INPUTS.
C     ******************************************************************
      WRITE(6,20)
      WRITE(6,206)
  206 FORMAT(1X,'G E O S Y N C H R O N O U S   2 5 K W   P O W E R   M O
     * D U L E   P R O G R A M .',///)
      WRITE(6,207) AL
  207 FORMAT(1X,'ALTITUDE (N.MI.) = ',F9.1,/)
      WRITE(6,208) BETA
  208 FORMAT(1X,'ORBIT INCLINATION BETA ANGLE (DEGREES) = ',F6.2,/)
      WRITE(6,209) ND1,ND2,ND3
  209 FORMAT (1X,'DISSIPATION (KW.), LOWEST = ',I5,2X,'HIGHEST = ',I5,2X
     *,'INCREMENT = ',I5,/)
      WRITE(6,210) MDP,MODI
  210 FORMAT (1X,'MONTHS DEGRADATION FOR PLATE RADIATOR = ',I5,2X,'INCRE
     *MENT = ',I5,/)
      WRITE(6,218) INTR
  218 FORMAT(1X,'ORBIT PRINT INTERVAL (DEGREES) = ',I5,/)
      WRITE(6,214) PSPACE,PCP
  214 FORMAT (1X,'PLATE, SHAPE FACTOR TO SPACE = ',F10.6,2X,'FLUID CP =
     *',F10.4,2X,'BTU/LBM-R.',/)
      WRITE(6,216)
  216 FORMAT (1X,'RADIATOR MATERIAL PROPERTIES')
      WRITE(6,217) PALPHA,EMTP,PDEG
  217 FORMAT (1X,'PLATE, ABSORPTANCE = ',F10.5,2X,'EMITTANCE = ',F10.5,2
     *X,'MONTHLY CHANGE IN ABSORPTANCE = ',F10.5,/)
C     ******************************************************************
C     PRINT OUT TABULAR INPUT.
C     ******************************************************************
      WRITE(6,60)
   60 FORMAT(1X,'EXTERNAL HEAT INPUT TABLES.',/)
```

```
      DO 61 NM=1,3
      WRITE(6,62) NM,(TINFO(NM,KK),KK=1,18)
   62 FORMAT(1X,I5,3X,18A4)
      DO 61 KK=1,50
      IF(F(NM,KK).NE.-10000.0) WRITE(6,64) OP(NM,KK),F(NM,KK)
   64 FORMAT(1X,10X,F10.2,5X,F10.6)
   61 CONTINUE
C     ******************************************************************
C     CHECK TO SEE IF ECLIPSING EXISTS IN ORBIT AND IF SO COMPUTE ORBIT
C     POSITIONS FOR ENTRANCE AND EXIT OF ECLIPSE.
C     ******************************************************************
      B=BETA*(PI/180.0)
      CHECK=((AL+R)*SIN(B))/R
      IF(CHECK.GT.1.0) GO TO 86
      EANGLE=ATAN((TAN(ARCOS((R*SIN(ARCOS(((AL+R)*SIN(B))/R)))/((AL+R)*C
     *OS(B)))))/COS(B))+PI/2.0
      EANGLE=EANGLE*(180.0/PI)
      COMPA=360.0-EANGLE
   86 CONTINUE
C     ******************************************************************
C     CONTROL LOOP FOR DISSIPATION VARIATION.
C     ******************************************************************
      DO 270 K=ND1,ND2,ND3
      DD=1.0*K
      D=DD*3.412*1000.0
C     ******************************************************************
C     COMPUTATION OF INITIAL ON ORBIT PARAMETERS FOR FLAT PLATE RADIATOR
C     AND SET CONTROL LOOP FOR PROGRESSION OF TIME AFTER LAUNCH.
C     ******************************************************************
      FLO=D/(PCP*(PTI-PTM))
      DALPHA=PALPHA
      NMDP=MDP+1
      DO 360 N=1,NMDP,MODI
C     ******************************************************************
C     COMPUTE LIMITING CASE OF FULL FLOW THROUGH RADIATOR UNDER FULL
C     DISSIPATION CONDITIONS.
C     SUBROUTINE SOLVE SOLVES NON-DIMENSIONAL FLOW EQUATIONS.
C     ******************************************************************
      FIND=1.0
      RM=PTM/PTI
      CALL SOLVE (M,T,P,PTIK,RM,FIND)
      IF(ENDIT.EQ.1.0) GO TO 250
      QVAL=(1.0/P)*(FLO*PCP*PTI)
```

```
      PT4VAL=(D+QVAL)/(PAREA*PSPACE*EMTP*SIGMA*2.0)
      PTVAL=PT4VAL**0.25
C     *****************************************************************
C     PRINTOUT OF INITIAL ON ORBIT PARAMETERS FOR FLAT PLATE RADIATOR.
C     *****************************************************************
      WRITE(6,20)
   20 FORMAT (1H1)
      D1=D/(3.412*1000.0)
      WRITE(6,21)D,D1
   21 FORMAT (1X,'FLAT PLANE RADIATOR FOR CASE OF ',F8.1,1X,'BTU/HR. DIS
     *SIPATION = ',F5.1,1X,'KW.',/)
      PTI=PTI-459.67
      PTM=PTM-459.67
      WRITE(6,27) PTI,PTM,FLO
   27 FORMAT (1X,'TEMPERATURES (F), INLET = ',F7.2,' , MIX = ',F7.2,' ,
     *COOLANT FLOW RATE (LBM/HR) = ',F9.2,/)
      PTI=PTI+459.67
      PTM=PTM+459.67
      WRITE(6,22) PAREA
   22 FORMAT (1X,'PLATFORM AREA IN FT2 = ',F10.2,/)
      WRITE(6,35) BETA,AL
   35 FORMAT(1X,'ORBIT  BETA ANGLE =',F6.2,1X,'DEGREES, ALTITUDE =',1X,F
     *7.1,1X,'NAUTICAL MILES.',/)
      IF(CHECK.GT.1.0) GO TO 85
      WRITE(6,90) EANGLE,COMPA
   90 FORMAT(1X,'ORBIT POSITION ENTERING ECLIPSE = ',2X,F6.2,' , ORBIT P
     *OSITION EXITING ECLIPSE = ',2X,F6.2,/)
      GO TO 87
   85 WRITE(6,88)
   88 FORMAT(1X,'NO ECLIPSING TAKES PLACE IN ORBIT.',/)
   87 NT=N-1
      WRITE(6,51) NT,DALPHA
   51 FORMAT(1X,'TIME AFTER LAUNCH IN MONTHS = ',I4,' , SOLAR ABSORPTANC
     *E VALUE = ',F8.5,/)
      WRITE(6,28)
   28 FORMAT(1X,'ORBITAL SOLUTION',/)
      WRITE(6,29)
   29 FORMAT(1X,'DEGREES  INLET (F)  RAD (F)  OUTLET (F)  MFR(LBM/HR)  S
     *OL(BTU/HR)  ES(BTU/HR)  AL(BTU/HR)  DISSIP(BTU/HR)    ETA  ITN',/)
C     *****************************************************************
C     SET UP CONTROL LOOP FOR ORBIT CALCULATIONS.
C     *****************************************************************
      FLG1=0.0
```

```
      FLG2=0.0
      DO 400 J=1,361,INTR
      THETA=J-1.0
C     ******************************************************************
C     TEST TO SEE IF IN PROPER ORBIT POSITION TO CALCULATE AND PRINT
C     VALUES ENTERING OR LEAVING ECLIPSE. VALUES ARE COMPUTED ASSUMING
C     IT IS JUST PRIOR TO ENTERING AND JUST AFTER LEAVING ECLIPSE.
C     ******************************************************************
      IF(CHECK.GT.1.0) GO TO 80
      CTEST=COMPA+INTR
      IF(THETA.LE.EANGLE.OR.THETA.GE.CTEST) GO TO 80
      DELTA=COMPA-EANGLE
      TCHECK=THETA-INTR
      IF(THETA.EQ.COMPA.AND.TCHECK.GE.EANGLE) GO TO 80
      IF(FLG2.EQ.1.0) GO TO 80
      IF(DELTA.LT.INTR.AND.FLG1.EQ.1.0.AND.THETA.GT.COMPA.AND.TCHECK.LT.
     *EANGLE) FLG2=1.0
      IF(FLG2.EQ.1.0) GO TO 82
      IF(FLG1.EQ.1.0) GO TO 80
      IF(THETA.GT.EANGLE.AND.TCHECK.LT.EANGLE) GO TO 81
      IF(THETA.GT.COMPA.AND.TCHECK.LT.COMPA) GO TO 82
      GO TO 80
   81 J=J-INTR
      FLG1=1.0
      THETA=EANGLE
      GO TO 83
   82 J=J-INTR
      FLG1=1.0
      THETA=COMPA
      GO TO 83
   80 FLG1=0.0
      FLG2=0.0
C     ******************************************************************
C     CALCULATION OF ORBITAL SOLAR, EARTHSHINE AND ALBEDO SHAPE FACTORS
C     AND HEAT LOADS.
C     ******************************************************************
   83 MM=1
      STORE=THETA
      CALL INTP(MM,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
      PFS=THETA
      IF(CHECK.LE.1.0.AND.STORE.GT.EANGLE.AND.STORE.LT.COMPA) PFS=0.0
      THETA=STORE
```

```
      MM=2
      CALL INTP(MM,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
      FP=THETA
      THETA=STORE
      MM=3
      CALL INTP(MM,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
      PFA=THETA
      THETA=STORE
      PDSOL=S*DALPHA*PFS*PAREA
      PERTH=2.0*E*FP*EMTP*PAREA
      PAL=A*S*DALPHA*PAREA*PFA*2.0
C     ******************************************************************
C     TEST TO SEE IF SOLUTION ALLOWS FULL DISSIPATION, REDUCED
C     DISSIPATION OR COMPLETE SHUT DOWN.
C     ******************************************************************
      PT4=(D+S*PAREA*PFS*DALPHA+2.0*E*PAREA*EMTP*FP+2.0*A*S*PAREA*PFA*DA
     *LPHA)/(PAREA*PSPACE*EMTP*SIGMA*2.0)
      QEXT=S*DALPHA*PFS+2.0*E*EMTP*FP+2.0*A*S*DALPHA*PFA
      IF(PT4.GT.PT4VAL) GO TO 450
      GO TO 451
  450 QTEST=QEXT*PAREA
      QDIF=QTEST-QVAL
      IF(QDIF.GE.D) GO TO 452
C     ******************************************************************
C     CASE WHERE DISSIPATION MUST BE CUT DOWN.
C     ******************************************************************
      DVALUE=D-QDIF
      PTR=PTM
      PT=PTVAL
      PMRATE=DVALUE/(PCP*(PTI-PTR))
      PADA=(PT**4-PTR**4)/(PTI**4-PTR**4)
      M=1
      GO TO 501
C     ******************************************************************
C     CASE OF SOLUTION WITHIN FULL DISSIPATION RANGE. ITERATIVE SOLUTION
C     RECUIRED.
C     ******************************************************************
  451 FIND=0.0
      DVALUE=1.0E+74
      PK=((2.0*SIGMA*EMTP*PSPACE)/QEXT)**0.25
      PTIK=PTI*PK
```

```
      CALL SOLVE (M,T,P,PTIK,RM,FIND)
      IF(ENDIT.EQ.1.0) GO TO 800
      PMRATE=P*((QEXT*PAREA)/(PCP*PTI))
      PTR=T*PTI
      PT4=(D+S*PAREA*PFS*DALPHA+2.0*E*PAREA*EMTP*FP+2.0*A*S*PAREA*PFA*DA
     *LPHA)/(PAREA*PSPACE*EMTP*SIGMA*2.0)
      PT=PT4**0.25
      PADA=(PT**4-PTR**4)/(PTI**4-PTR**4)
      GO TO 501
C     ******************************************************************
C     CASE WHERE DISSIPATION IS ZERO AND COMPLETE SHUT DOWN EXISTS.
C     ******************************************************************
  452 M=1
      DVALUE=0.0
      PT4=(S*PAREA*PFS*DALPHA+2.0*E*PAREA*EMTP*FP+2.0*A*S*PAREA*PFA*DALP
     *HA)/(PAREA*PSPACE*EMTP*SIGMA*2.0)
      PT=PT4**0.25
      PMRATE=0.0
C     ******************************************************************
C     PRINTOUT OF DEGRADED CONDITIONS FOR FLAT PLATE RADIATOR.
C     ******************************************************************
  501 PTI=PTI-459.67
      PT=PT-459.67
      PTR=PTR-459.67
      IF(DVALUE.GT.0.0) GO TO 650
      STORE=D
      D=DVALUE
      WRITE(6,502) THETA,PT,PMRATE,PDSOL,PERTH,PAL,D,M
  502 FORMAT(1X,F7.2,7X,'NONE',2X,F7.2,8X,'NONE',2(3X,F10.2),2(2X,F10.2)
     *,6X,F10.2,3X,'NONE',1X,I4)
      D=STORE
      GO TO 503
  650 STORE=D
      IF(DVALUE.LT.D) D=DVALUE
      WRITE(6,30) THETA,PTI,PT,PTR,PMRATE,PDSOL,PERTH,PAL,D,PADA,M
   30 FORMAT(1X,F7.2,2X,F9.2,2X,F7.2,2X,F10.2,2(3X,F10.2),2(2X,F10.2),6X
     *,F10.2,3X,F4.2,1X,I4)
      D=STORE
  503 PTI=PTI+459.67
      PT=PT+459.67
      PTR=PTR+459.67
  400 CONTINUE
C     ******************************************************************
```

```
C     CALCULATION OF ORBITAL MAXIMUM HEAT LOAD VALUES TO BE USED TO
C     DETERMINE END OF LIFE REQUIRED RADIATOR AREA.
C     ******************************************************************
      IFINDM=0
      HLOAD=0.0
      ALIFE=PALPHA+MDP*PDEG
      IF(ALIFE.GT.1.0) ALIFE=1.0
      DO 350 I=1,360
      ITHETA=I
      DO 70 KK=1,3
      THETA=ITHETA
      CALL INTP(KK,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
      IF(KK.EQ.1) PFS=THETA
      IF(KK.EQ.2) FP=THETA
      IF(KK.EQ.3) PFA=THETA
   70 CONTINUE
      IF(CHECK.LE.1.0.AND.I.GT.EANGLE.AND.I.LT.COMPA) PFS=0.0
      TEST=PFS+(((EMTP/ALIFE)*(E/S)*FP)+A*PFA)*2.0
      IF(TEST.GT.HLOAD) PEAK=ITHETA
      IF(TEST.GT.HLOAD) HLOAD=TEST
  350 CONTINUE
      DO 71 KK=1,3
      THETA=PEAK
      CALL INTP(KK,THETA)
      IF(KK.EQ.1) PFS=THETA
      IF(KK.EQ.2) FP=THETA
      IF(KK.EQ.3) PFA=THETA
   71 CONTINUE
C     ******************************************************************
C     COMPUTE END OF LIFE SOLAR ABSORPTANCE VALUE AND REQUIRED RADIATOR
C     PLATFORM AREA TO REMAIN IN 'SPEC' WITH SUCH AN ABSORPTANCE.
C     ******************************************************************
      QLIFE=S*ALIFE*PFS+2.0*E*EMTP*FP+2.0*A*S*ALIFE*PFA
      PKLIFE=((2.0*SIGMA*EMTP*PSPACE)/QLIFE)**0.25
      PKPTM=PKLIFE*PTM
      PAAI=(2.0*EMTP*(SIGMA*PSPACE-((1.0/PTM)**4)*E*FP))/(S*(PFS+2.0*A*P
     *FA)*((1.0/PTM)**4))
      IF(PAAI.GT.1.0) PAAI=1.0
      IF(PKPTM.LE.1.0) GO TO 190
      PKTIL=PTI*PKLIFE
      XLIFE=PTM/PTI
      PL=(0.25*ALOG(ABS((1.0+PKTIL*XLIFE)/(1.0-PKTIL*XLIFE)))-0.25*ALOG(
```

```
      *ABS((1.0+PKTIL)/(1.0-PKTIL)))+0.5*ATAN(PKTIL*XLIFE)-0.5*ATAN(PKTIL
      *))/PKTIL
       AREA=PL*((FLO*PCP*PTI)/QLIFE)
C      ******************************************************************
C      PRINT ABSORPTANCE AND AREA VALUES.
C      ******************************************************************
       WRITE(6,281) AREA,MDP
   281 FORMAT (/,1X,'PLATFORM AREA REQUIRED TO REMAIN IN SPEC = ',F8.2,2X
      *,'FT2 FOR ',I3,2X,'MONTHS ON ORBIT.',/)
       WRITE(6,280) ALIFE,MDP,PDEG
   280 FORMAT (1X,'SOLAR ABSORPTANCE = ',F7.5,2X,'FOR ',I3,2X,'MONTHS OF
      *LIFE WITH A DEGRADATION RATE OF ',F8.5,2X,'CHANGE IN ABSORPTANCE P
      *ER MONTH.',/)
       WRITE(6,192) PAAI
   192 FORMAT (1X,'SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LO
      *ADS FOR SIZING RADIATOR AREA = ',F7.5,/)
       GO TO 361
   190 WRITE(6,191) PAAI
   191 FORMAT(/,1X,'EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO
      * REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = ',F7.5,/)
   361 DALPHA=DALPHA+PDEG*MODI
       IF(DALPHA.GT.1.0) DALPHA=1.0
   360 CONTINUE
   270 CONTINUE
   700 GO TO 250
C      ******************************************************************
C      PROGRAM TERMINATION CONTROL.
C      ******************************************************************
   750 WRITE(6,751)
   751 FORMAT(1X,'MISTAKE MADE IN PLATE RADIATOR EXTERNAL HEAT INPUT TABL
      *ES, PROGRAM TERMINATED.')
       GO TO 800
   203 WRITE(6,219)
   219 FORMAT (1X,'MISTAKE MADE IN PLATE RADIATOR INPUT, PROGRAM TERMINAT
      *ED.')
   800 RETURN
       END
C
C      ******************************************************************
C
C      CALCULATION OF TEMPS. AND FLUID PARAMETERS WITH DEGRADATION
C      FOR FLAT PLATE RADIATOR.
C      SOLUTION OF GOVERNING NON-DIMENSIONAL EQUATIONS FOUND BY
```

```
C     BI-SECTION METHOD.
C
C     ********************************************************************
C
      SUBROUTINE SOLVE (M,T,P,PTIK,RM,FIND)
      DIMENSION X(2),DIFF(2)
      COMMON/CONTRL/ENDIT
      COMMON/HLOAD/PTI,PSPACE,SIGMA,PAREA,EMTP,QEXT,D,X,DIFF
C     ********************************************************************
C     TEST TO SEE IF SOLUTION WITHIN PROPER RANGE OF PARAMETERS.
C     ********************************************************************
      ENDIT=0.0
      M=C
      IF(FIND.EQ.0.0) GO TO 1
      XL=8.0
      XR=1.0001/RM
      P1L=(0.25*ALOG(ABS((1.0+XL*RM)/(1.0-XL*RM)))-0.25*ALOG(ABS((1.0+XL
     *)/(1.0-XL)))+0.5*ATAN(XL*RM)-0.5*ATAN(XL))/XL
      P1L=1.0/P1L
      P2L=(D*(XL**4.0))/(2.0*SIGMA*EMTP*PAREA*PSPACE*(PTI**4.0)*(1.0-RM)
     *)
      DIFFL=P1L-P2L
      P1R=(0.25*ALOG(ABS((1.0+XR*RM)/(1.0-XR*RM)))-0.25*ALOG(ABS((1.0+XR
     *)/(1.0-XR)))+0.5*ATAN(XR*RM)-0.5*ATAN(XR))/XR
      P1R=1.0/P1R
      P2R=(D*(XR**4.0))/(2.0*SIGMA*EMTP*PAREA*PSPACE*(PTI**4.0)*(1.0-RM)
     *)
      DIFFR=P1R-P2R
      TEST=DIFFL*DIFFR
      GO TO 2
    1 XL=1.00001/PTIK
      XR=C.999
      P1L=(0.25*ALOG(ABS((1.0+PTIK*XL)/(1.0-PTIK*XL)))-0.25*ALOG(ABS((1.
     *0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*XL)-0.5*ATAN(PTIK))/PTIK
      P1L=1.0/P1L
      P2L=(D/(QEXT*PAREA))/(1.0-XL)
      DIFFL=P1L-P2L
      P1R=(0.25*ALOG(ABS((1.0+PTIK*XR)/(1.0-PTIK*XR)))-0.25*ALOG(ABS((1.
     *0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*XR)-0.5*ATAN(PTIK))/PTIK
      P1R=1.0/P1R
      P2R=(D/(QEXT*PAREA))/(1.0-XR)
      DIFFR=P1R-P2R
      TEST=DIFFL*DIFFR
```

```
    2 IF(TEST.LT.0.0) GO TO 260
      IF(FIND.EQ.1.0) WRITE(6,221)
  221 FORMAT(1X,'SOLUTION OUTSIDE VALID SOLUTION RANGE FOR LIMITING CASE
     *, SOLUTION TERMINATED.')
      IF(FIND.EQ.0.0) WRITE(6,500)
  500 FORMAT(1X,'SOLUTION OUTSIDE VALID SOLUTION RANGE DURING ORBITAL CO
     *MPUTATIONS, SOLUTION TERMINATED.')
      ENDIT=1.0
      GO TO 3
C     ******************************************************************
C     ITERATION PROCESS FOR SOLUTION.
C     ******************************************************************
  260 TEMP=XL
      X(1)=(XL+XR)/2.0
      X(2)=XR
  224 DO 222 NX=1,2
      IF(FIND.EQ.0.0) GO TO 4
      P1=(0.25*ALOG(ABS((1.0+X(NX)*RM)/(1.0-X(NX)*RM)))-0.25*ALOG(ABS((1
     *.0+X(NX))/(1.0-X(NX))))+0.5*ATAN(X(NX)*RM)-0.5*ATAN(X(NX)))/X(NX)
      P1=1.0/P1
      P2=(D*(X(NX)**4.0))/(2.0*SIGMA*EMTP*PAREA*PSPACE*(PTI**4.0)*(1.0-R
     *M))
      DIFF(NX)=P1-P2
      GO TO 222
    4 P1=(0.25*ALOG(ABS((1.0+PTIK*X(NX))/(1.0-PTIK*X(NX))))-0.25*ALOG(AB
     *S((1.0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*X(NX))-0.5*ATAN(PTIK))/PTI
     *K
      P1=1.0/P1
      P2=(D/(QEXT*PAREA))/(1.0-X(NX))
      DIFF(NX)=P1-P2
  222 CONTINUE
      TEST=DIFF(1)*DIFF(2)
      CRITRA=0.002
      DIF=(ABS(X(1)-X(2))/((X(1)+X(2))/2.0))*100.0
      M=M+1
      IF(DIF.LE.CRITRA) GO TO 240
      IF(TEST.GT.0.0) GO TO 225
      TEMP=X(1)
      X(1)=(X(1)+X(2))/2.0
      GO TO 224
  225 X(2)=X(1)
      X(1)=TEMP
      X(1)=(X(1)+X(2))/2.0
```

```
      GO TO 224
  240 T=(X(1)+X(2))/2.0
      P=(P1+P2)/2.0
    3 RETURN
      END
C
C     ******************************************************************
C
C     SUBROUTINE TO LINEARLY INTERPOLATE IN EXTERNAL HEAT LOAD TABLES.
C
C     ******************************************************************
C
      SUBROUTINE INTP(MM,THETA)
      DIMENSION OP(3,50),F(3,50)
      COMMON/TABLE/OP,F
      COMMON/CONTRL/ENDIT
      ENDIT=0.0
      DO 1 I=1,49
      IF(THETA.EQ.OP(MM,I)) GO TO 2
      IF(OP(MM,I+1).EQ.-10000.0) GO TO 5
      IF(THETA.GT.OP(MM,I).AND.THETA.LT.CP(MM,I+1)) GO TO 3
      IF(THETA.LT.OP(MM,I).AND.THETA.GT.OP(MM,I+1)) GO TO 4
    1 CONTINUE
      IF(THETA.EQ.OP(MM,50)) GO TO 2
      GO TO 5
    2 THETA=F(MM,I)
      GO TO 1000
    3 THETA=F(MM,I)+((THETA-OP(MM,I))/(CP(MM,I+1)-OP(MM,I)))*(F(MM,I+1)-
     *F(MM,I))
      GO TO 1000
    4 THETA=F(MM,I)-((OP(MM,I)-THETA)/(OP(MM,I)-OP(MM,I+1)))*(F(MM,I)-F(
     *MM,I+1))
      GO TO 1000
C     ******************************************************************
C     IF REQUIRED VALUE IS OUT OF TABLE RANGE PROGRAM WILL TERMINATE.
C     ******************************************************************
    5 WRITE(6,7) MM,THETA
    7 FORMAT(//,1X,'OUT OF RANGE IN EXTERNAL HEAT LOAD TABLE',1X,I2,/,1X
     *,'ORBIT POSITION IN DEGREES = ',F8.2,3X,'PROGRAM HAS BEEN TERMINAT
     *ED.')
      ENDIT=1.0
 1000 RETURN
      END
```

GEO GENERAL SPACE STATION PROGRAM

```
C
C     ******************************************************************
C
C     G E O   G E N E R A L   S P A C E   S T A T I O N   P R O G R A M
C
C     THIS PROGRAM IS DESIGNED FOR GEOSYNCHRONOUS ALTITUDE. IT COMPUTES
C     THE PLATFORM AREA REQUIRED FOR SPACE RADIATORS FOR A USER
C     SPECIFIED LIFETIME AND THEIR DEGRADED PERFORMANCE WITH TIME IN THE
C     GEO ENVIRONMENT. IT IS ASSUMED FLAT EXTENDED RADIATORS WILL HANDLE
C     DISSIPATION LOAD UP TO BREAK POINT AND THEN CYLINDRICAL WRAP-
C     AROUND(AROUND MODULES) ONE SIDED RADIATORS WILL HANDLE ALL
C     ADDITIONAL DISSIPATION LOADS. THIS COMPUTED AREA MAY BE MODIFIED
C     TO PARAMETRICALLY PERFORM AREA-LIFE STUDIES IF DESIRED. THIS
C     PROGRAM IS CAPABLE OF HANDLING DEGRADATION WITH TIME ON-ORBIT AND
C     PROVIDES COMPLETE ORBITAL SOLUTIONS AS A FUNCTION OF ORBIT
C     POSITION AT VARIOUS USER SPECIFIED TIMES THROUGHOUT ON-ORBIT LIFE.
C     ORBITAL SOLUTIONS INCLUDE TEMPERATURES(RADIATOR MEAN VALUE AND
C     EXIT FLUID VALUE) AND RADIATOR MASS FLOW RATES AS WELL AS REDUCED
C     DISSIPATION UNDER CERTAIN CIRCUMSTANCES. ORBITAL SOLUTIONS ASSUME
C     ZERO THERMAL CAPACITANCE FOR THE RADIATORS. THREE SOLUTION REGIMES
C     CONSIDERED ARE (1) FULL DISSIPATION WITH PARTIAL FLOW THROUGH
C     RADIATOR, (2) REDUCED DISSIPATION AND FLOW THROUGH RADIATOR WITH
C     NO BYPASS FLOW(OUT OF SPEC) AND (3) TOTAL RADIATOR SHUTDOWN. CASES
C     TWO AND THREE ARE DUE TO EXCESSIVE EXTERNAL HEAT LOADS. EXTERNAL
C     HEATING IN THE FORM OF SHAPE FACTOR TABLES FOR DIRECT SOLAR,
C     EARTHSHINE AND ALBEDO IS INPUT IN TABULAR FORM. TABLES MUST BE
C     INPUT FOR BOTH RADIATOR TYPES. EARTH ECLIPSING IS INCLUDED. INPUT
C     PARAMETERS INSURE SOLUTIONS FOR EACH RADIATOR TYPE MAY BE HANDLED
C     INDEPENDENTLY.
C
C     ******************************************************************
C
      DIMENSION OP(6,50),F(6,50),TINFO(6,18),X(2),DIFF(2),PA(2),CA(2)
      COMMON/TABLE/OP,F
      COMMON/CONTRL/ENDIT
      COMMON/NEED/SIGMA,QEXT,X,DIFF
      COMMON/PLOAD/PTI,PSPACE,PAREA,EMTP,D,PFRAC
      COMMON/CLOAD/CTI,CSPACE,CAREA,EMTC,DC,CFRAC
      DATA PLATE/'P   '/
      DATA CYL/'C   '/
      CALL READRE
C     ******************************************************************
C     ORBITAL CONSTANTS.
```

```
C     ******************************************************************
      R=3441.0
      AL=19370.0
      S=442.4
      A=0.4
      E=66.36
      SIGMA=0.173E-08
      PI=3.14159
C     ******************************************************************
C     INITIALIZE TABLE STORAGE.
C     ******************************************************************
      DO 6 I=1,50
      DO 6 J=1,6
      OP(J,I)=-10000.0
    6 F(J,I)=-10000.0
C     ******************************************************************
C     READ IN INPUT DATA FOR GENERAL ORBITAL CONSIDERATIONS.
C     ******************************************************************
      READ(5,5) BETA
    5 FORMAT(5X,F5.2)
      READ(5,200) ND1,ND2,ND3,BREAK
      READ(5,201) MDP,MODIP,INTP,MDC,MODIC,INTC
  200 FORMAT (3I10,F10.4)
  201 FORMAT(6I10)
C     ******************************************************************
C     READ IN TABULAR INPUT.
C     SIX EXTERNAL HEAT INPUT TABLES MUST BE READ IN.
C     THERE MUST BE TABLES FOR DIRECT SOLAR, EARTHSHINE AND ALBEDO.
C     BLOCKAGE MUST BE INCLUDED IN TABLES.
C     TABLES 1 AND 4 ARE FOR DIRECT SOLAR FS VALUES FOR FLAT PLATE AND
C     CYLINDRICAL RADIATORS, RESPECTIVELY.
C     TABLES 2 AND 5 ARE FOR EARTHSHINE FE VALUES FOR FLAT PLATE AND
C     CYLINDRICAL RADIATORS, RESPECTIVELY.
C     TABLES 3 AND 6 ARE FOR ALBEDO FA VALUES FOR FLAT PLATE AND
C     CYLINDRICAL RADIATORS, RESPECTIVELY.
C     ******************************************************************
   43 READ(5,40) NUM
   40 FORMAT(A4)
      IF(NUM.EQ.PLATE) GO TO 750
      IF(NUM.EQ.CYL) GO TO 750
      READ(99,46) NUM
   46 FORMAT(I5)
      IF(NUM.EQ.0) GO TO 41
```

```
      READ(99,42) (TINFO(NUM,I),I=1,18)
   42 FORMAT(8X,18A4)
      NCARD=0
      N=NUM
      GO TO 43
   41 NCARD=NCARD+1
      READ(99,44) OP(N,NCARD),F(N,NCARD)
   44 FORMAT(10X,E10.4,5X,E12.6)
      IF(N.EQ.6.AND.OP(N,NCARD).EQ.360.0) GO TO 45
      GO TO 43
   45 CONTINUE
C     ****************************************************************
C     READ IN DATA FOR PLATE AND CYLINDRICAL RADIATOR CONSIDERATIONS.
C     ' P ' STANDS FOR PLATE RADIATOR.
C     ' C ' STANDS FOR CYLINDRICAL RADIATOR.
C     ****************************************************************
      READ(5,202) TEST
  202 FORMAT (1A4)
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PTI,PTM
  204 FORMAT(10X,4F10.4)
      PTI=PTI+459.67
      PTM=PTM+459.67
      READ(5,202) TEST
      IF(TEST.NE.CYL) GO TO 205
      READ(99,204) CTI,CTM
      CTI=CTI+459.67
      CTM=CTM+459.67
      READ(5,202) TEST
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PSPACE,PCP
      READ(5,202) TEST
      IF(TEST.NE.CYL) GO TO 205
      READ(99,204) CSPACE,CCP
  250 READ(5,202,END=800) TEST
      IF(TEST.NE.PLATE) GO TO 203
      READ(99,204) PALPHA,EMTP,PDEG,PFRAC
      READ(5,202,END=205) TEST
      IF(TEST.NE.CYL) GO TO 205
      READ(99,204) CALPHA,EMTC,CDEG,CFRAC
C     ****************************************************************
C     PRINTOUT OF PERTINENT INPUTS.
C     ****************************************************************
```

```
      WRITE(6,20)
      WRITE(6,206)
  206 FORMAT(1X,'G E O S Y N C H R O N O U S   S P A C E   S T A T I O N
     *   R A D I A T O R   P R O G R A M .',///)
      WRITE(6,207) AL
  207 FORMAT(1X,'ALTITUDE (N.MI.) = ',F9.1,/)
      WRITE(6,208) BETA
  208 FORMAT(1X,'ORBIT INCLINATION BETA ANGLE (DEGREES) = ',F6.2,/)
      WRITE(6,209) ND1,ND2,ND3,BREAK
  209 FORMAT (1X,'DISSIPATION (KW.), LOWEST = ',I5,2X,'HIGHEST = ',I5,2X
     *,'INCREMENT = ',I5,//,1X,'BREAK POINT FROM PLATE TO CYLINDRICAL RA
     *DIATORS (KW.) = ',F7.2,/)
      WRITE(6,210) MDP,MODIP,MDC,MODIC
  210 FORMAT (1X,'MONTHS DEGRADATION FOR FLAT PLATE RADIATOR  = ',I5,2X,
     *'INCREMENT = ',I5,/,1X,'MONTHS DEGRADATION FOR CYLINDRICAL RADIATO
     *R = ',I5,2X,'INCREMENT = ',I5,/)
      WRITE(6,218) INTP,INTC
  218 FORMAT(1X,'ORBIT PRINT INTERVAL FOR FLAT PLATE RADIATOR (DEGREES)
     *= ',I5,' ,INTERVAL FOR CYLINDRICAL RADIATOR = ',I5,/)
      WRITE(6,640) PFRAC,CFRAC
  640 FORMAT(1X,'AREA FRACTION FOR FLAT PLATE RADIATOR = ',F10.3,' , FOR
     * CYLINDRICAL RADIATOR = ',F10.3,/)
      WRITE(6,214) PSPACE,PCP
  214 FORMAT (1X,'PLATE, SHAPE FACTOR TO SPACE = ',F10.6,2X,'FLUID CP =
     *',F10.4,2X,'BTU/LBM-R.')
      WRITE(6,215) CSPACE,CCP
  215 FORMAT (1X,'CYL. , SHAPE FACTOR TO SPACE = ',F10.6,2X,'FLUID CP =
     *',F10.4,2X,'BTU/LBM-R.',/)
      WRITE(6,216)
  216 FORMAT (1X,'RADIATOR MATERIAL PROPERTIES')
      WRITE(6,217) PALPHA,EMTP,PDEG
  217 FORMAT (1X,'PLATE, ABSORPTANCE = ',F10.5,2X,'EMITTANCE = ',F10.5,2
     *X,'MONTHLY CHANGE IN ABSORPTANCE = ',F10.5)
      WRITE(6,221) CALPHA,EMTC,CDEG
  221 FORMAT (1X,'CYL. , ABSORPTANCE = ',F10.5,2X,'EMITTANCE = ',F10.5,2
     *X,'MONTHLY CHANGE IN ABSORPTANCE = ',F10.5,/)
C     ******************************************************************
C     PRINT OUT TABULAR INPUT.
C     ******************************************************************
      WRITE(6,60)
   60 FORMAT(1X,'EXTERNAL HEAT INPUT TABLES.',/)
      DO 61 NM=1,6
      WRITE(6,62) NM,(TINFO(NM,KK),KK=1,18)
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```
   62 FORMAT(1X,I5,3X,18A4)
      DO 61 KK=1,50
      IF(F(NM,KK).NE.-10000.0) WRITE(6,64) OP(NM,KK),F(NM,KK)
   64 FORMAT(1X,10X,F10.2,5X,F10.6)
   61 CONTINUE
C     ******************************************************************
C     CHECK TO SEE IF ECLIPSING EXISTS IN ORBIT AND IF SO COMPUTE ORBIT
C     POSITIONS FOR ENTRANCE AND EXIT OF ECLIPSE.
C     ******************************************************************
      B=BETA*(PI/180.0)
      CHECK=((AL+R)*SIN(B))/R
      IF(CHECK.GT.1.0) GO TO 86
      EANGLE=ATAN((TAN(ARCOS((R*SIN(ARCOS(((AL+R)*SIN(B))/R)))/((AL+R)*C
     *OS(B)))))/COS(B))+PI/2.0
      EANGLE=EANGLE*(180.0/PI)
      COMPA=360.0-EANGLE
   86 CONTINUE
C     ******************************************************************
C     CONTROL LOOP FOR DISSIPATION VARIATION.
C     ******************************************************************
      DO 270 K=ND1,ND2,ND3
      DD=1.0*K
      D=DD*3.412*1000.0
      IF(DD.GT.BREAK) GO TO 150
C     ******************************************************************
C     CALCULATION OF ORBITAL MAXIMUM HEAT LOAD VALUES TO BE USED TO
C     DETERMINE END OF LIFE REQUIRED AREA FOR FLAT PLATE RADIATOR.
C     SET UP LOOP FOR CALCULATING MINIMAL AREA FRACTION.
C     ******************************************************************
      PAMAX=PALPHA+MDP*PDEG
      IF(PAMAX.GT.1.0) PAMAX=1.0
      DO 91 L=1,2
      IF(L.EQ.2) PAMAX=PALPHA
      IFINDM=0
      HLOAD=0.0
      DO 350 I=1,360
      ITHETA=I
      DO 70 KK=1,3
      THETA=ITHETA
      CALL INTRP(KK,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
      IF(KK.EQ.1) PFS=THETA
      IF(KK.EQ.2) FP=THETA
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      IF(KK.EQ.3) PFA=THETA
   70 CONTINUE
      IF(CHECK.LE.1.0.AND.I.GT.EANGLE.AND.I.LT.COMPA) PFS=0.0
      TEST=PFS+(((EMTP/PAMAX)*(E/S)*FP)+A*PFA)*2.0
      IF(TEST.GT.HLOAD) PEAK=ITHETA
      IF(TEST.GT.HLOAD) HLOAD=TEST
  350 CONTINUE
      DO 71 KK=1,3
      THETA=PEAK
      CALL INTRP(KK,THETA)
      IF(KK.EQ.1) PFS=THETA
      IF(KK.EQ.2) FP=THETA
      IF(KK.EQ.3) PFA=THETA
   71 CONTINUE
C     ******************************************************************
C     COMPUTATION OF INITIAL ON ORBIT PARAMETERS FOR FLAT PLATE RADIATOR
C     AREA SIZED FOR MAXIMUM SOLAR ABSORPTANCE OVER TIME INTERVAL.
C     ******************************************************************
      PAAI=(2.0*EMTP*(SIGMA*PSPACE-((1.0/PTM)**4)*E*FP))/(S*(PFS+2.0*A*P
     *FA)*((1.0/PTM)**4))
      PCHECK=0.0
      IF(PAMAX.EQ.PAAI.OR.PAMAX.GT.PAAI) PCHECK=1.0
      IF(PAMAX.EQ.PAAI.OR.PAMAX.GT.PAAI) GO TO 405
      QLIFE=S*PAMAX*PFS+2.0*S*A*PAMAX*PFA+2.0*E*EMTP*FP
      PKLIFE=((2.0*SIGMA*EMTP*PSPACE)/QLIFE)**0.25
      PFLO=D/(PCP*(PTI-PTM))
      PKPTI=PKLIFE*PTI
      XLIFE=PTM/PTI
      PL=(0.25*ALOG(ABS((1.0+PKPTI*XLIFE)/(1.0-PKPTI*XLIFE)))-0.25*ALOG(
     *ABS((1.0+PKPTI)/(1.0-PKPTI)))+0.5*ATAN(PKPTI*XLIFE)-0.5*ATAN(PKPTI
     *))/PKPTI
   91 PA(L)=PL*((PFLO*PCP*PTI)/QLIFE)
      RATIO=PA(2)/PA(1)
      PAREA=PA(1)*PFRAC
C     ******************************************************************
C     CHECK TO SEE IF AREA FRACTION IS BELOW MINIMUM VALUF ALLOWED.
C     ******************************************************************
      IF(PFRAC.LT.RATIO) WRITE(6,92) RATIO
   92 FORMAT(/,1X,'AREA FRACTION FOR FLAT PLATE RADIATOR IS BELOW MINIMU
     *M ACCEPTABLE VALUE OF ',F5.3,' , SCLUTION TERMINATED.')
      IF(PFRAC.LT.RATIO) GO TO 270
C     ******************************************************************
C     SET CONTROL LOOP FOR PROGRESSION OF TIME AFTER LAUNCH FOR
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C     FLAT PLATE RADIATOR.
C     ******************************************************************
      DALPHA=PALPHA
      NMDP=MDP+1
      DO 400 N=1,NMDP,MODIP
C     ******************************************************************
C     PRINTOUT OF INITIAL ON ORBIT PARAMETERS FOR FLAT PLATE RADIATOR.
C     ******************************************************************
  405 WRITE(6,20)
   20 FORMAT (1H1)
      IF(PAAI.GT.1.0) PAAI=1.0
      D1=D/(3.412*1000.0)
      WRITE(6,21)D,D1
   21 FORMAT (1X,'FLAT PLATE RADIATOR FOR CASE OF ',F8.1,1X,'BTU/HR. DIS
     *SIPATION = ',F5.1,1X,'KW.',/)
      IF(PCHECK.EQ.1.0) GO TO 802
      WRITE(6,35) BETA,AL
   35 FORMAT(1X,'ORBIT  BETA ANGLE =',F6.2,1X,'DEGREES, ALTITUDE =',1X,F
     *7.1,1X,'NAUTICAL MILES.',/)
      PTI=PTI-459.67
      PTM=PTM-459.67
      WRITE(6,27) PTI,PTM
   27 FORMAT (1X,'TEMPERATURES, INLET = ',F7.2,' ,    MIX = ',F7.2,/)
      PTI=PTI+459.67
      PTM=PTM+459.67
      WRITE(6,22) PAREA,RATIO
   22 FORMAT(1X,'PLATFORM AREA IN FT2 = ',F10.2,' , MINIMUM AREA FRACTIO
     *N ACCEPTABLE = ',F6.3,/)
      WRITE (6,23) PFLO
   23 FORMAT (1X,'COOLANT MASS FLOW RATE (LBM/HR.) = ',F12.2,/)
      WRITE(6,401) PAAI
  401 FORMAT (1X,'SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LO
     *ADS FOR SIZING RADIATOR AREA = ',F7.5,/)
      PAMAX=PALPHA+MDP*PDEG
      IF(PAMAX.GT.1.0) PAMAX=1.0
      WRITE(6,402) PAMAX,MDP,PDEG
  402 FORMAT (1X,'MAXIMUM ABSORPTANCE VALUE = ',F7.5,2X,'FOR A PERIOD OF
     * ',I5,2X,'MONTHS AT A DEGRADATION RATE OF ',F7.5,2X,'DELTA ABSORPT
     *ANCE PER MONTH',/)
      GO TO 404
  802 WRITE(6,900)
  900 FORMAT(///)
      WRITE(6,403) PAAI
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  403 FORMAT (1X,'MAXIMUM SOLAR ABSORPTANCE VALUE OVER INTERVAL EXCEEDS
     *',F7.5,2X,'WHICH IS UPPER LIMIT REQUIRING INFINITE RADIATUR AREA')
      GO TO 150
  404 IF(CHECK.GT.1.0) GO TO 85
      WRITE(6,90) EANGLE,COMPA
   90 FORMAT(1X,'ORBIT POSITION ENTERING ECLIPSE = ',2X,F6.2,' , ORBIT P
     *OSITION EXITING ECLIPSE = ',2X,F6.2,/)
      GO TO 87
   85 WRITE(6,88)
   88 FORMAT(1X,'NO ECLIPSING TAKES PLACE IN ORBIT.',/)
   87 NT=N-1
      WRITE(6,51) NT,DALPHA
   51 FORMAT(1X,'TIME AFTER LAUNCH IN MONTHS = ',I4,' , SOLAR ABSORPTANC
     *E VALUE = ',F8.5,/)
      WRITE(6,28)
   28 FORMAT(1X,'ORBITAL SOLUTION',/)
      WRITE(6,29)
   29 FORMAT(1X,'DEGREES  INLET (F)  RAD (F)  OUTLET (F)  MFR(LBM/HR)  S
     *OL(BTU/HR)  ES(BTU/HR)  AL(BTU/HR)  DISSIP(BTU/HR)    ETA  ITN')
C     ******************************************************************
C     COMPUTE LIMITING CASE OF FULL FLOW THROUGH FLAT PLATE RADIATOR
C     UNDER FULL DISSIPATION CONDITIONS.
C     SUBROUTINE SOLVEP SOLVES NON-DIMENSIONAL FLOW EQUATIONS FOR
C     FLAT PLATE RADIATOR.
C     ******************************************************************
      FIND=1.0
      RM=PTM/PTI
      CALL SOLVEP(M,T,P,PTIK,RM,FIND)
      IF(ENDIT.EQ.1.0) GO TO 270
      QVAL=(1.0/P)*(PFLO*PCP*PTI)
      PT4VAL=(D+QVAL)/(PAREA*PSPACE*EMTP*SIGMA*2.0)
      PTVAL=PT4VAL**0.25
C     ******************************************************************
C     SET UP CONTROL LOCP FOR ORBIT CALCULATIONS FOR FLAT PLATE
C     RADIATOR.
C     ******************************************************************
      FLG1=0.0
      FLG2=0.0
      DO 417 J=1,361,INTP
      THETA=J-1.0
C     ******************************************************************
C     TEST TO SEE IF IN PROPER ORBIT POSITION TO CALCULATE AND PRINT
C     VALUES ENTERING OR LEAVING ECLIPSE. VALUES ARE COMPUTED ASSUMING
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C     IT IS JUST PRIOR TO ENTERING AND JUST AFTER LEAVING ECLIPSE.
C     ******************************************************************
      IF(CHECK.GT.1.0) GO TO 80
      CTEST=COMPA+INTP
      IF(THETA.LE.EANGLE.OR.THETA.GE.CTEST) GO TO 80
      DELTA=COMPA-EANGLE
      TCHECK=THETA-INTP
      IF(THETA.EQ.COMPA.AND.TCHECK.GE.EANGLE) GO TO 80
      IF(FLG2.EQ.1.0) GO TO 80
      IF(DELTA.LT.INTP.AND.FLG1.EQ.1.0.AND.THETA.GT.COMPA.AND.TCHECK.LT.
     *EANGLE) FLG2=1.0
      IF(FLG2.EQ.1.0) GO TO 82
      IF(FLG1.EQ.1.0) GO TO 80
      IF(THETA.GT.EANGLE.AND.TCHECK.LT.EANGLE) GO TO 81
      IF(THETA.GT.COMPA.AND.TCHECK.LT.COMPA) GO TO 82
      GO TO 80
   81 J=J-INTP
      FLG1=1.0
      THETA=EANGLE
      GO TO 83
   82 J=J-INTP
      FLG1=1.0
      THETA=COMPA
      GO TO 83
   80 FLG1=0.0
      FLG2=0.0
C     ******************************************************************
C     CALCULATION OF ORBITAL SOLAR, EARTHSHINE AND ALBEDO SHAPE FACTORS
C     AND HEAT LOADS FOR FLAT PLATE RADIATOR.
C     ******************************************************************
   83 MM=1
      STORE=THETA
      CALL INTRP(MM,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
      PFS=THETA
      IF(CHECK.LE.1.0.AND.STORE.GT.EANGLE.AND.STORE.LT.COMPA) PFS=0.0
      THETA=STORE
      MM=2
      CALL INTRP(MM,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
      FP=THETA
      THETA=STORE
      MM=3
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```
      CALL INTRP(MM,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
      PFA=THETA
      THETA=STORE
      PDSOL=S*DALPHA*PFS*PAREA
      PERTH=2.0*E*FP*EMTP*PAREA
      PAL=A*S*DALPHA*PAREA*PFA*2.0
C     ****************************************************************
C     TEST TO SEE IF SOLUTION ALLOWS FULL DISSIPATION, REDUCED
C     DISSIPATION OR COMPLETE SHUT DOWN.
C     ****************************************************************
      PT4=(D+S*PAREA*PFS*DALPHA+2.0*E*PAREA*EMTP*FP+2.0*A*S*PAREA*PFA*DA
     *LPHA)/(PAREA*PSPACE*EMTP*SIGMA*2.0)
      QEXT=S*DALPHA*PFS+2.0*E*EMTP*FP+2.0*A*S*DALPHA*PFA
      IF(PT4.GT.PT4VAL) GO TO 450
      GO TO 451
  450 QTEST=QEXT*PAREA
      QDIF=QTEST-QVAL
      IF(QDIF.GE.D) GO TO 452
C     ****************************************************************
C     CASE WHERE DISSIPATION MUST BE CUT DOWN.
C     ****************************************************************
      DVALUE=D-QDIF
      PTR=PTM
      PT=PTVAL
      PMRATE=DVALUE/(PCP*(PTI-PTR))
      PADA=(PT**4-PTR**4)/(PTI**4-PTR**4)
      M=1
      GO TO 501
C     ****************************************************************
C     CASE OF SOLUTION WITHIN FULL DISSIPATION RANGE. ITERATIVE SOLUTION
C     REQUIRED.
C     ****************************************************************
  451 FIND=0.0
      DVALUE=1.0E+74
      PK=((2.0*SIGMA*EMTP*PSPACE)/QEXT)**0.25
      PTIK=PTI*PK
      CALL SOLVEP(M,T,P,PTIK,RM,FIND)
      IF(ENDIT.EQ.1.0) GO TO 800
      PMRATE=P*((QEXT*PAREA)/(PCP*PTI))
      PTR=T*PTI
      PT4=(D+S*PAREA*PFS*DALPHA+2.0*E*PAREA*EMTP*FP+2.0*A*S*PAREA*PFA*DA
     *LPHA)/(PAREA*PSPACE*EMTP*SIGMA*2.0)
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```
      PT=PT4**0.25
      PADA=(PT**4-PTR**4)/(PTI**4-PTR**4)
      GO TO 501
C     ******************************************************************
C     CASE WHERE DISSIPATION IS ZERO AND COMPLETE SHUT DOWN EXISTS.
C     ******************************************************************
  452 M=1
      DVALUE=0.0
      PT4=(S*PAREA*PFS*DALPHA+2.0*E*PAREA*EMTP*FP+2.0*A*S*PAREA*PFA*DALP
     *HA)/(PAREA*PSPACE*EMTP*SIGMA*2.0)
      PT=PT4**0.25
      PMRATE=0.0
C     ******************************************************************
C     PRINTOUT OF DEGRADED CONDITIONS FOR FLAT PLATE RADIATOR.
C     ******************************************************************
  501 PTI=PTI-459.67
      PT=PT-459.67
      PTR=PTR-459.67
      IF(DVALUE.GT.0.0) GO TO 650
      STORE=D
      D=DVALUE
      WRITE(6,502) THETA,PT,PMRATE,PDSOL,PERTH,PAL,D,M
  502 FORMAT(1X,F7.2,7X,'NONE',2X,F7.2,8X,'NONE',2(3X,F10.2),2(2X,F10.2)
     *,6X,F10.2,3X,'NONE',1X,I4)
      D=STORE
      GO TO 503
  650 STORE=D
      IF(DVALUE.LT.D) D=DVALUE
      WRITE(6,30) THETA,PTI,PT,PTR,PMRATE,PDSOL,PERTH,PAL,D,PADA,M
   30 FORMAT(1X,F7.2,2X,F9.2,2X,F7.2,2X,F10.2,2(3X,F10.2),2(2X,F10.2),6X
     *,F10.2,3X,F4.2,1X,I4)
      D=STORE
  503 PTI=PTI+459.67
      PT=PT+459.67
      PTR=PTR+459.67
  417 CONTINUE
      DALPHA=DALPHA+PDEG*MODIP
      IF(DALPHA.GT.1.0) DALPHA=1.0
  400 CONTINUE
C
C     ******************************************************************
C
C     CYLINDRICAL RADIATOR SIZING.
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C
C     ********************************************************************
C
  150 CONTINUE
      DC=0.0
      IF(DD.LE.BREAK) GO TO 270
      IF(DD.GT.BREAK) DC=D-BREAK*3.412*1000.0
C     ********************************************************************
C     CALCULATION OF ORBITAL MAXIMUM HEAT LOAD VALUES TO BE USED TO
C     DETERMINE END OF LIFE REQUIRED AREA FOR CYLINDRICAL RADIATOR.
C     SET UP LOOP FOR CALCULATING MINIMAL AREA FRACTION.
C     ********************************************************************
      CAMAX =CALPHA+MDC*CDEG
      IF(CAMAX.GT.1.0) CAMAX=1.0
      DO 93 L=1,2
      IF(L.EQ.2) CAMAX=CALPHA
      IFINDM=0
      HLOAD=0.0
      DO 406 I=1,360
      ITHETA=I
      DO 407 KK=4,6
      THETA=ITHETA
      CALL INTRP(KK,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
      IF(KK.EQ.4) CFS=THETA
      IF(KK.EQ.5) FC=THETA
      IF(KK.EQ.6) CFA=THETA
  407 CONTINUE
      IF(CHECK.LE.1.0.AND.I.GT.EANGLE.AND.I.LT.COMPA) PFS=0.0
      TEST=CFS+(((EMTC/CAMAX)*(E/S)*FC)+A*CFA)*(1.0/PI)
      IF(TEST.GT.HLOAD) PEAK=ITHETA
      IF(TEST.GT.HLOAD) HLOAD=TEST
  406 CONTINUE
      DO 408 KK=4,6
      THETA=PEAK
      CALL INTRP(KK,THETA)
      IF(KK.EQ.4) CFS=THETA
      IF(KK.EQ.5) FC=THETA
      IF(KK.EQ.6) CFA=THETA
  408 CONTINUE
C     ********************************************************************
C     COMPUTATION OF INITIAL ON-ORBIT PARAMETERS FOR CYLINDRICAL
C     RADIATOR.
```

```
C     AREA SIZED FOR MAXIMUM SOLAR ABSORPTANCE OVER TIME INTERVAL.
C     ******************************************************************
      CAAI=(EMTC*(SIGMA*CSPACE*(CTM**4)-(1.0/PI)*E*FC))/(S*(CFS+(1.0/PI)
     **A*CFA))
      CCHECK=0.0
      IF(CAMAX.EQ.CAAI.OR.CAMAX.GT.CAAI) CCHECK=1.0
      IF(CAMAX.EQ.CAAI.OR.CAMAX.GT.CAAI) GO TO 409
      QLIFE=S*CAMAX*CFS+(S*A*CAMAX*CFA)/PI+(E*EMTC*FC)/PI
      CKLIFE=((SIGMA*EMTC*CSPACE)/QLIFE)**0.25
      CFLO=DC/(CCP*(CTI-CTM))
      CKCTI=CKLIFE*CTI
      XLIFE=CTM/CTI
      CL=(0.25*ALOG(ABS((1.0+CKCTI*XLIFE)/(1.0-CKCTI*XLIFE)))-0.25*ALOG(
     *ABS((1.0+CKCTI)/(1.0-CKCTI)))+0.5*ATAN(CKCTI*XLIFE)-0.5*ATAN(CKCTI
     *))/CKCTI
   93 CA(L)=CL*((CFLO*CCP*CTI)/QLIFE)
      RATIO=CA(2)/CA(1)
      CAREA=CA(1)*CFRAC
C     ******************************************************************
C     CHECK TO SEE IF AREA FRACTION IS BELOW MINIMUM VALUE ALLOWED.
C     ******************************************************************
      IF(CFRAC.LT.RATIO) WRITE(6,94) RATIO
   94 FORMAT(/,1X,'AREA FRACTION FOR CYLINDRICAL RADIATOR IS BELOW MINIM
     *UM ACCEPTABLE VALUE OF ',F5.3,' , SOLUTION TERMINATED.')
      IF(CFRAC.LT.RATIO) GO TO 250
C     ******************************************************************
C     SET CONTROL LOOP FOR PROGRESSION OF TIME AFTER LAUNCH FOR
C     CYLINDRICAL RADIATOR.
C     ******************************************************************
      DALPHA=CALPHA
      NMDC=MDC+1
      DO 500 N=1,NMDC,MODIC
C     ******************************************************************
C     PRINTOUT OF INITIAL ON-ORBIT PARAMETERS FOR CYLINDRICAL RADIATOR.
C     ******************************************************************
  409 WRITE(6,20)
      IF(CAAI.GT.1.0) CAAI=1.0
      D1=DC/(3.414*1000.0)
      WRITE(6,52) DC,D1
   52 FORMAT (1X,'CYLINDRICAL RADIATOR FOR CASE OF ',F9.1,1X,'BTU/HR. DI
     *SSIPATION = ',F5.1,1X,'KW.',/)
      IF(CCHECK.EQ.1.0) GO TO 801
      WRITE(6,35) BETA,AL
```

```
      CTI=CTI-459.67
      CTM=CTM-459.67
      WRITE(6,27) CTI,CTM
      CTI=CTI+459.67
      CTM=CTM+459.67
      WRITE(6,22) CAREA,RATIO
      WRITE(6,23) CFLO
      WRITE(6,401) CAAI
      CAMAX=CALPHA+MDC*CDEG
      IF(CAMAX.GT.1.0) CAMAX=1.0
      WRITE(6,402) CAMAX,MDC,CDEG
      GO TO 410
  801 WRITE(6,900)
      WRITE(6,403) CAAI
      GO TO 270
  410 IF(CHECK.GT.1.0) GO TO 53
      WRITE(6,90) EANGLE,COMPA
      GO TO 54
   53 WRITE(6,88)
   54 NT=N-1
      WRITE(6,51) NT,DALPHA
      WRITE(6,28)
      WRITE(6,29)
C     ******************************************************************
C     COMPUTE LIMITING CASE OF FULL FLOW THROUGH CYLINDRICAL RADIATOR
C     UNDER FULL DISSIPATION CONDITIONS.
C     SUBROUTINE SOLVEC SOLVES NON-DIMENSIONAL FLOW EQUATIONS FOR A
C     CYLINDRICAL RADIATOR.
C     ******************************************************************
      FIND=1.0
      RM=CTM/CTI
      CALL SOLVEC(M,T,P,CTIK,RM,FIND)
      IF(ENDIT.EQ.1.0) GO TO 250
      QVAL=(1.0/P)*(CFLO*CCP*CTI)
      CT4VAL=(DC+QVAL)/(CAREA*CSPACE*EMTC*SIGMA)
      CTVAL=CT4VAL**0.25
C     ******************************************************************
C     SET UP CONTROL LOCP FOR CRBIT CALCULATIONS.
C     ******************************************************************
      FLG1=0.0
      FLG2=0.0
      DO 504 J=1,361,INTC
      THETA=J-1.0
```

```
C     ****************************************************************
C     TEST TO SEE IF IN PROPER ORBIT POSITION TO CALCULATE AND PRINT
C     VALUES ENTERING OR LEAVING ECLIPSE. VALUES ARE COMPUTED ASSUMING
C     IT IS JUST PRIOR TO ENTERING AND JUST AFTER LEAVING ECLIPSE.
C     ****************************************************************
      IF(CHECK.GT.1.0) GO TO 57
      CTEST=COMPA+INTC
      IF(THETA.LE.EANGLE.OR.THETA.GE.CTEST) GO TO 57
      DELTA=COMPA-EANGLE
      TCHECK=THETA-INTC
      IF(THETA.EQ.COMPA.AND.TCHECK.GE.EANGLE) GO TO 57
      IF(FLG2.EQ.1.0) GO TO 57
      IF(DELTA.LT.INTC.AND.FLG1.EQ.1.0.AND.THETA.GT.COMPA.AND.TCHECK.LT.
     *EANGLE) FLG2=1.0
      IF(FLG2.EQ.1.0) GO TO 56
      IF(FLG1.EQ.1.0) GO TO 57
      IF(THETA.GT.EANGLE.AND.TCHECK.LT.EANGLE) GO TO 55
      IF(THETA.GT.COMPA.AND.TCHECK.LT.COMPA) GO TO 56
      GO TO 57
   55 J=J-INTC
      FLG1=1.0
      THETA=EANGLE
      GO TO 58
   56 J=J-INTC
      FLG1=1.0
      THETA=COMPA
      GO TO 58
   57 FLG1=0.0
      FLG2=0.0
C     ****************************************************************
C     CALCULATION OF ORBITAL SOLAR, EARTHSHINE AND ALBEDO SHAPE FACTORS
C     AND HEAT LOADS FOR CYLINDRICAL RADIATOR.
C     ****************************************************************
   58 MM=4
      STORE=THETA
      CALL INTRP(MM,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
      CFS=THETA
      IF(CHECK.LE.1.0.AND.STORE.GT.EANGLE.AND.STORE.LT.COMPA) CFS=0.0
      THETA=STORE
      MM=5
      CALL INTRP(MM,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
```

```
      FC=THETA
      THETA=STORE
      MM=6
      CALL INTRP(MM,THETA)
      IF(ENDIT.EQ.1.0) GO TO 800
      CFA=THETA
      THETA=STORE
      CDSOL=S*DALPHA*CFS*CAREA
      CERTH=(E*FC*EMTC*CAREA)/PI
      CAL=(A*S*DALPHA*CAREA*CFA)/PI
C     ******************************************************************
C     TEST TO SEE IF SOLUTION ALLOWS FULL DISSIPATION, REDUCED
C     DISSIPATION OR COMPLETE SHUT DOWN.
C     ******************************************************************
      CT4=(DC+S*CAREA*CFS*DALPHA+(E*CAREA*EMTC*FC)/PI+(A*S*CAREA*CFA*DAL
     *PHA)/PI)/(CAREA*CSPACE*EMTC*SIGMA)
      CT=CT4**0.25
      QEXT=(S*DALPHA*CFS)+(E*EMTC*FC+A*S*DALPHA*CFA)/PI
      IF(CT4.GT.CT4VAL) GO TO 411
      GO TO 412
  411 QTEST=QEXT*CAREA
      QDIF=QTEST-QVAL
      IF(QDIF.GE.DC) GO TO 413
C     ******************************************************************
C     CASE WHERE DISSIPATION MUST BE CUT DOWN.
C     ******************************************************************
      DVALUE=DC-QDIF
      CTR=CTM
      CT=CTVAL
      CMRATE=DVALUE/(CCP*(CTI-CTR))
      CADA=(CT**4-CTR**4)/(CTI**4-CTR**4)
      M=1
      GO TO 414
C     ******************************************************************
C     CASE OF SOLUTION WITHIN FULL DISSIPATION RANGE. ITERATIVE SOLUTION
C     REQUIRED.
C     ******************************************************************
  412 FIND=0.0
      DVALUE=1.0E+74
      CK=((SIGMA*EMTC*CSPACE)/QEXT)**0.25
      CTIK=CTI*CK
      CALL SOLVEC(M,T,P,CTIK,RM,FIND)
      IF(ENDIT.EQ.1.0) GO TO 800
```

```
      CMRATE=P*((QEXT*CAREA)/(CCP*CTI))
      CTR=T*CTI
      CT4=(DC+S*CAREA*CFS*DALPHA+(E*CAREA*EMTC*FC)/PI+(A*S*CAREA*CFA*DAL
     *PHA)/PI)/(CAREA*CSPACE*EMTC*SIGMA)
      CT=CT4**0.25
      CADA=(CT**4-CTR**4)/(CTI**4-CTR**4)
      GO TO 414
C     ******************************************************************
C     CASE WHERE DISSIPATION IS ZERO AND COMPLETE SHUT DOWN EXISTS.
C     ******************************************************************
  413 M=1
      DVALUE=0.0
      CT4=(S*CAREA*CFS*DALPHA+(E*CAREA*EMTC*FC)/PI+(A*S*CAREA*CFA*DALPHA
     *)/PI)/(CAREA*CSPACE*EMTC*SIGMA)
      CT=CT4**0.25
      CMRATE=0.0
C     ******************************************************************
C     PRINTOUT OF DEGRADED CONDITIONS FOR CYLINDRICAL RADIATOR.
C     ******************************************************************
  414 CTI=CTI-459.67
      CT=CT-459.67
      CTR=CTR-459.67
      IF(DVALUE.GT.0.0) GO TO 415
      STORE=D
      D=DVALUE
      WRITE(6,502) THETA,CT,CMRATE,CDSOL,CERTH,CAL,D,M
      D=STORE
      GO TO 416
  415 STORE=DC
      IF(DVALUE.LT.DC) DC=DVALUE
      WRITE(6,30) THETA,CTI,CT,CTR,CMRATE,CDSOL,CERTH,CAL,DC,CADA,M
      DC=STORE
  416 CTI=CTI+459.67
      CT=CT+459.67
      CTR=CTR+459.67
  504 CONTINUE
      DALPHA=DALPHA+CDEG*MODIC
      IF(DALPHA.GT.1.0) DALPHA=1.0
  500 CONTINUE
  270 CONTINUE
      GO TO 250
C     ******************************************************************
C     PROGRAM TERMINATION CONTROL.
```

```
C     ****************************************************************
  750 WRITE(6,751)
  751 FORMAT(1X,'MISTAKE MADE IN INPUT OF EXTERNAL HEATING TABLES, PROGR
     *AM TERMINATED.')
      GO TO 800
  203 WRITE(6,219)
  219 FORMAT (1X,'MISTAKE MADE IN PLATE RADIATOR INPUT, PROGRAM TERMINAT
     *ED.')
      GO TO 800
  205 WRITE(6,220)
  220 FORMAT (1X,'MISTAKE MADE IN CYLINDER RADIATOR INPUT, PROGRAM TERMI
     *NATED.')
  800 RETURN
      END
C
C     ****************************************************************
C
C     CALCULATION OF TEMPS. AND FLUID PARAMETERS WITH DEGRADATION
C     FOR FLAT PLATE RADIATOR.
C     SOLUTION OF GOVERNING NON-DIMENSIONAL EQUATIONS FOUND BY
C     BI-SECTION METHOD.
C
C     ****************************************************************
C
      SUBROUTINE SOLVEP(M,T,P,PTIK,RM,FIND)
      DIMENSION X(2),DIFF(2)
      COMMON/CONTRL/ENDIT
      COMMON/NEED/SIGMA,QEXT,X,DIFF
      COMMON/PLOAD/PTI,PSPACE,PAREA,EMTP,D,PFRAC
C     ****************************************************************
C     TEST TO SEE IF SOLUTION WITHIN PROPER RANGE OF PARAMETERS.
C     ****************************************************************
      ENDIT=0.0
      M=0
      IF(FIND.EQ.0.0) GO TO 1
      XL=8.0
      XR=1.00001/RM
      P1L=(0.25*ALOG(ABS((1.0+XL*RM)/(1.0-XL*RM)))-0.25*ALOG(ABS((1.0+XL
     *)/(1.0-XL)))+0.5*ATAN(XL*RM)-0.5*ATAN(XL))/XL
      P1L=1.0/P1L
      P2L=(D*(XL**4.0))/(2.0*SIGMA*EMTP*PAREA*PSPACE*(PTI**4.0)*(1.0-RM)
     *)
      DIFFL=P1L-P2L
```

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```
      P1R=(0.25*ALOG(ABS((1.0+XR*RM)/(1.0-XR*RM)))-0.25*ALOG(ABS((1.0+XR
     *)/(1.0-XR)))+0.5*ATAN(XR*RM)-0.5*ATAN(XR))/XR
      P1R=1.0/P1R
      P2R=(D*(XR**4.0))/(2.0*SIGMA*EMTP*PAREA*PSPACE*(PTI**4.0)*(1.0-RM)
     *)
      DIFFR=P1R-P2R
      TEST=DIFFL*DIFFR
      GO TO 2
    1 XL=1.00001/PTIK
      XR=0.999
      P1L=(0.25*ALOG(ABS((1.0+PTIK*XL)/(1.0-PTIK*XL)))-0.25*ALOG(ABS((1.
     *0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*XL)-0.5*ATAN(PTIK))/PTIK
      P1L=1.0/P1L
      P2L=(D/(QEXT*PAREA))/(1.0-XL)
      DIFFL=P1L-P2L
      P1R=(0.25*ALOG(ABS((1.0+PTIK*XR)/(1.0-PTIK*XR)))-0.25*ALOG(ABS((1.
     *0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*XR)-0.5*ATAN(PTIK))/PTIK
      P1R=1.0/P1R
      P2R=(D/(QEXT*PAREA))/(1.0-XR)
      DIFFR=P1R-P2R
      TEST=DIFFL*DIFFR
    2 IF(TEST.LT.0.0) GO TO 260
      IF(FIND.EQ.1.0) WRITE(6,221)
  221 FORMAT(1X,'SOLUTION OUTSIDE VALID SOLUTICN RANGE FOR LIMITING CASE
     *, SOLUTION TERMINATED.')
      IF(FIND.EQ.0.0) WRITE(6,500)
  500 FORMAT(1X,'SOLUTION OUTSIDE VALID SOLUTION RANGE DURING ORBITAL CO
     *MPUTATIONS, SOLUTION TERMINATED.')
      ENDIT=1.0
      GO TO 3
C     ******************************************************************
C     ITERATION PROCESS FCR SOLUTION.
C     ******************************************************************
  260 TEMP=XL
      X(1)=(XL+XR)/2.0
      X(2)=XR
  224 DO 222 NX=1,2
      IF(FIND.EQ.0.0) GU TO 4
      P1=(0.25*ALOG(ABS((1.0+X(NX)*RM)/(1.0-X(NX)*RM)))-0.25*ALOG(ABS((1
     *.0+X(NX))/(1.0-X(NX))))+0.5*ATAN(X(NX)*RM)-0.5*ATAN(X(NX)))/X(NX)
      P1=1.0/P1
      P2=(D*(X(NX)**4.0))/(2.0*SIGMA*EMTP*PAREA*PSPACE*(PTI**4.0)*(1.0-R
     *M))
```

```
      DIFF(NX)=P1-P2
      GO TO 222
    4 P1=(0.25*ALOG(ABS((1.0+PTIK*X(NX))/(1.0-PTIK*X(NX))))-0.25*ALOG(AB
     *S((1.0+PTIK)/(1.0-PTIK)))+0.5*ATAN(PTIK*X(NX))-0.5*ATAN(PTIK))/PTI
     *K
      P1=1.0/P1
      P2=(D/(QEXT*PAREA))/(1.0-X(NX))
      DIFF(NX)=P1-P2
  222 CONTINUE
      TEST=DIFF(1)*DIFF(2)
      CRITRA=0.002
      DIF=(ABS(X(1)-X(2))/((X(1)+X(2))/2.0))*100.0
      M=M+1
      IF(DIF.LE.CRITRA) GO TO 240
      IF(TEST.GT.0.0) GO TO 225
      TEMP=X(1)
      X(1)=(X(1)+X(2))/2.0
      GO TO 224
  225 X(2)=X(1)
      X(1)=TEMP
      X(1)=(X(1)+X(2))/2.0
      GO TO 224
  240 T=(X(1)+X(2))/2.0
      P=(P1+P2)/2.0
    3 RETURN
      END
C
C     *****************************************************************
C
C     CALCULATION OF TEMPS. AND FLUID PARAMETERS WITH DEGRADATION
C     FOR CYLINDRICAL RADIATOR.
C     SOLUTION OF GOVERNING NON-DIMENSIONAL EQUATIONS FOUND BY
C     BI-SECTION METHOD.
C
C     *****************************************************************
C
      SUBROUTINE SOLVEC(M,T,P,CTIK,RM,FIND)
      DIMENSION X(2),DIFF(2)
      COMMON/CONTRL/ENDIT
      COMMON/NEED/SIGMA,QEXT,X,DIFF
      COMMON/CLOAD/CTI,CSPACE,CAREA,EMTC,DC,CFRAC
C     *****************************************************************
C     TEST TO SEE IF SOLUTION WITHIN PROPER RANGE OF PARAMETERS.
```

```
C      ******************************************************************
       ENDIT=0.0
       M=0
       IF(FIND.EQ.0.0) GO TO 1
       XL=8.0
       XR=1.00001/RM
       C1L=(0.25*ALOG(ABS((1.0+XL*RM)/(1.0-XL*RM)))-0.25*ALOG(ABS((1.0+XL
      *)/(1.0-XL)))+0.5*ATAN(XL*RM)-0.5*ATAN(XL))/XL
       C1L=1.0/C1L
       C2L=(DC*(XL**4.0))/(SIGMA*EMTC*CAREA*CSPACE*(CTI**4.0)*(1.0-RM))
       DIFFL=C1L-C2L
       C1R=(0.25*ALOG(ABS((1.0+XR*RM)/(1.0-XR*RM)))-0.25*ALOG(ABS((1.0+XR
      *)/(1.0-XR)))+0.5*ATAN(XR*RM)-0.5*ATAN(XR))/XR
       C1R=1.0/C1R
       C2R=(DC*(XR**4.0))/(SIGMA*EMTC*CAREA*CSPACE*(CTI**4.0)*(1.0-RM))
       DIFFR=C1R-C2R
       TEST=DIFFL*DIFFR
       GO TO 2
     1 XL=1.00001/CTIK
       XR=0.999
       C1L=(0.25*ALOG(ABS((1.0+CTIK*XL)/(1.0-CTIK*XL)))-0.25*ALOG(ABS((1.
      *0+CTIK)/(1.0-CTIK)))+0.5*ATAN(CTIK*XL)-0.5*ATAN(CTIK))/CTIK
       C1L=1.0/C1L
       C2L=(DC/(QEXT*CAREA))/(1.0-XL)
       DIFFL=C1L-C2L
       C1R=(0.25*ALOG(ABS((1.0+CTIK*XR)/(1.0-CTIK*XR)))-0.25*ALOG(ABS((1.
      *0+CTIK)/(1.0-CTIK)))+0.5*ATAN(CTIK*XR)-0.5*ATAN(CTIK))/CTIK
       C1R=1.0/C1R
       C2R=(DC/(QEXT*CAREA))/(1.0-XR)
       DIFFR=C1R-C2R
       TEST=DIFFL*DIFFR
     2 IF(TEST.LT.0.0) GO TO 260
       IF(FIND.EQ.1.0) WRITE(6,221)
   221 FORMAT(1X,'SOLUTION OUTSIDE VALID SOLUTION RANGE FOR LIMITING CASE
      *, SOLUTION TERMINATED.')
       IF(FIND.EQ.0.0) WRITE(6,500)
   500 FORMAT(1X,'SOLUTION OUTSIDE VALID SOLUTION RANGE DURING ORBITAL CO
      *MPUTATIONS, SOLUTION TERMINATED.')
       ENDIT=1.0
       GO TO 3
C      ******************************************************************
C      ITERATION PROCESS FOR SOLUTION.
C      ******************************************************************
```

```
  260 TEMP=XL
      X(1)=(XL+XR)/2.0
      X(2)=XR
  224 DO 222 NX=1,2
      IF(FIND.EQ.0.0) GO TO 4
      C1=(0.25*ALOG(ABS((1.0+X(NX)*RM)/(1.0-X(NX)*RM)))-0.25*ALOG(ABS((1
     *.0+X(NX))/(1.0-X(NX))))+0.5*ATAN(X(NX)*RM)-0.5*ATAN(X(NX)))/X(NX)
      C1=1.0/C1
      C2=(DC*(X(NX)**4.0))/(SIGMA*EMTC*CAREA*CSPACE*(CTI**4.0)*(1.0-RM))
      DIFF(NX)=C1-C2
      GO TO 222
    4 C1=(0.25*ALOG(ABS((1.0+CTIK*X(NX))/(1.0-CTIK*X(NX))))-0.25*ALOG(AB
     *S((1.0+CTIK)/(1.0-CTIK)))+0.5*ATAN(CTIK*X(NX))-0.5*ATAN(CTIK))/CTI
     *K
      C1=1.0/C1
      C2=(DC/(QEXT*CAREA))/(1.0-X(NX))
      DIFF(NX)=C1-C2
  222 CONTINUE
      TEST=DIFF(1)*DIFF(2)
      CRITRA=0.002
      DIF=(ABS(X(1)-X(2))/((X(1)+X(2))/2.0))*100.0
      M=M+1
      IF(DIF.LE.CRITRA) GO TO 240
      IF(TEST.GT.0.0) GO TO 225
      TEMP=X(1)
      X(1)=(X(1)+X(2))/2.0
      GO TO 224
  225 X(2)=X(1)
      X(1)=TEMP
      X(1)=(X(1)+X(2))/2.0
      GO TO 224
  240 T=(X(1)+X(2))/2.0
      P=(C1+C2)/2.0
    3 RETURN
      END
C
C     ******************************************************************
C
C     SUBROUTINE TO LINEARLY INTERPOLATE IN EXTERNAL HEAT LOAD TABLES.
C
C     ******************************************************************
C
      SUBROUTINE INTRP(MM,THETA)
```

```
      DIMENSION OP(6,50),F(6,50)
      COMMON/TABLE/OP,F
      COMMON/CONTRL/ENDIT
      ENDIT=0.0
      DO 1 I=1,49
      IF(THETA.EQ.OP(MM,I)) GO TO 2
      IF(OP(MM,I+1).EQ.-10000.0) GO TO 5
      IF(THETA.GT.OP(MM,I).AND.THETA.LT.CP(MM,I+1)) GO TO 3
      IF(THETA.LT.OP(MM,I).AND.THETA.GT.OP(MM,I+1)) GO TO 4
    1 CONTINUE
      IF(THETA.EQ.OP(MM,50)) GO TO 2
      GO TO 5
    2 THETA=F(MM,I)
      GO TO 1000
    3 THETA=F(MM,I)+((THETA-OP(MM,I))/(OP(MM,I+1)-OP(MM,I)))*(F(MM,I+1)-
     *F(MM,I))
      GO TO 1000
    4 THETA=F(MM,I)-((OP(MM,I)-THETA)/(OP(MM,I)-OP(MM,I+1)))*(F(MM,I)-F(
     *MM,I+1))
      GO TO 1000
C     ******************************************************************
C     IF REQUIRED VALUE IS OUT OF TABLE RANGE PROGRAM WILL TERMINATE.
C     ******************************************************************
    5 WRITE(6,7) MM,THETA
    7 FORMAT(//,1X,'OUT OF RANGE IN EXTERNAL HEAT LOAD TABLE',1X,I2,/,1X
     *,'ORBIT POSITION IN DEGREES = ',F8.2,3X,'PROGRAM HAS BEEN TERMINAT
     *ED.')
      ENDIT=1.0
 1000 RETURN
      END
```

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Appendix B

SAMPLE PROGRAM INPUTS AND OUTPUTS

A sample case will be presented for each program, showing inputs and program outputs. The purpose of this portion of the report is to familiarize the user with the input formats and format of the program outputs. The first case will deal with the LEO power module program. Immediately following the program output, other cases will be presented using the LEO space station program and the GEO programs. These sample cases are designed to have a high degree of realism where possible and also display the versatile capabilities of these programs in a reasonable fashion for example purposes.

The following case inputs will be used for a sample case of the LEO power module program use:

1. Two altitudes will be considered; 235 and 270 nautical miles.

2. The β angle will be varied from a value of 10 degrees to a value of 90 degrees at 20-degree intervals.

3. The dissipation value will be held constant at 12 kW.

4. The total time duration will be 60 months (5 years), with the solution intervals of one month.

5. The fluid inlet and mix temperatures will be set at 94.6^{o} and 40^{o}F, respectively. The radiator area will be set at a value of 634.2 ft^{2}.

6. All external-input blockage factors will be given a value of 0.9.

7. The view factor to space will be 0.91, and the specific heat of the coolant will be 0.25 Btu/lbm-^{o}R (Freon 21).

8. The initial α_s value will be 0.07, the emittance value will be 0.76, and the degradation rates will be varied from 0.003 to 0.009 $\Delta\alpha_s$/month at intervals of 0.003 $\Delta\alpha_s$/month.

The succeeding pages will present these inputs written out on a coding form, followed by the program output.

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE FEB. 78 PROGRAM NO. POWER MODULE PROGRAM PROGRAMMED BY 1

INPUT FORMATS

1 FIRST CARD:

$\underbrace{235}_{NAL1}$ $\underbrace{270}_{NAL2}$ $\underbrace{35}_{NAL3}$ } FORMAT(3I10)

2 SECOND CARD:

$\underbrace{10}_{MB1}$ $\underbrace{90}_{MB2}$ $\underbrace{20}_{MB3}$ } FORMAT(3I10)

3 THIRD CARD:

$\underbrace{121}_{MD1}$ $\underbrace{12}_{MD2}$ $\underbrace{4}_{MD3}$ } FORMAT(3I10)

4 FOURTH CARD:

$\underbrace{60}_{MDA}$ $\underbrace{4}_{MODI}$ } FORMAT(2I10)

5 FIFTH CARD:

A | $\underbrace{94.6}_{PTI}$ | $\underbrace{40.0}_{PTM}$ | $\underbrace{634.2}_{PAREA}$ } FORMAT(A1, 9X, 3(F10.4, 10X))

TEST

6 SIXTH CARD:

A | $\underbrace{0.9}_{PSHDS}$ | $\underbrace{0.9}_{PSHDE}$ | $\underbrace{0.9}_{PSHDA}$ } FORMAT(A1, 9X, 3(F10.4, 10X))

TEST

STK. NO. D-1-082

10-122-170 (REV 5/68)

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE FEB. 78 PROGRAM NO. POWER MODULE PROGRAM PROGRAMMED BY 2

7 SEVENTH CARDS

```
A         0.91          0.25   } FORMAT(A1, 9X, 2(F10.4, 10X))
TEST      PSPACE        PCA
```

8 EIGHTH CARDS

```
A         0.07          0.76          0.003  } FORMAT(A1, 9X, 3(F10.4, 10X))
TEST      PALPHA        EMTA          PDEG

A         0.07          0.76          0.006  } ADDITIONAL SURFACE
A         0.07          0.76          0.009  } PROPERTY CARDS.
```

STK. NO. D-1-083

```
2 5 K W   P O W E R   M O D U L E   P R O G R A M .

ALTITUDE (N.MI.), LOWEST =   235  HIGHEST =   270  INCREMENT =    35

ORBIT INCLINATION (DEG.), LOWEST =    10  HIGHEST =    90  INCREMENT =    20

DISSIPATION (KW.), LOWEST =    12  HIGHEST =    12  INCREMENT =     1

MONTHS DEGRADATION FOR PLATE RADIATOR =    60  INCREMENT =     1

SHADING COEFFICIENTS
PLATE, SOLAR =   0.900000  EARTHSHINE =   0.900000  ALBEDO =   0.900000

PLATE, SHAPE FACTOR TO SPACE =   0.910000  FLUID CP =     0.2500  BTU/LBM-R.

RADIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE =    0.07000  EMITTANCE =    0.76000  MONTHLY CHANGE IN ABSORPTANCE =   0.003000
```

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS OF POOR QUALITY

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 1901.293 ALBEDO = 1129.185

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-13.26	-75.98	960.16	0.070000	1901.29	1129.18	0.25	15
1	94.60	-13.02	-75.60	962.35	0.073000	1982.78	1177.58	0.25	15
2	94.60	-12.78	-75.21	964.53	0.076000	2064.26	1225.97	0.25	15
3	94.60	-12.54	-74.83	966.71	0.079000	2145.74	1274.36	0.25	15
4	94.60	-12.30	-74.45	968.87	0.082000	2227.22	1322.76	0.25	15
5	94.60	-12.06	-74.07	971.04	0.085000	2308.71	1371.15	0.25	15
6	94.60	-11.82	-73.69	973.20	0.088000	2390.19	1419.54	0.25	15
7	94.60	-11.58	-73.30	975.49	0.091000	2471.67	1467.94	0.25	15
8	94.60	-11.34	-72.93	977.64	0.094000	2553.16	1516.33	0.25	15
9	94.60	-11.11	-72.54	979.93	0.097000	2634.64	1564.72	0.25	15
10	94.60	-10.87	-72.17	982.06	0.100000	2716.12	1613.11	0.25	15
11	94.60	-10.63	-71.79	984.34	0.103000	2797.61	1661.51	0.25	15
12	94.60	-10.40	-71.41	986.61	0.106000	2879.09	1709.90	0.25	15
13	94.60	-10.16	-71.05	988.72	0.108999	2960.57	1758.29	0.25	15
14	94.60	-9.93	-70.67	990.98	0.111999	3042.05	1806.69	0.25	15
15	94.60	-9.69	-70.30	993.23	0.114999	3123.54	1855.08	0.25	15
16	94.60	-9.46	-69.93	995.49	0.117999	3205.02	1903.47	0.25	15
17	94.60	-9.22	-69.56	997.73	0.120999	3286.50	1951.87	0.25	15
18	94.60	-8.99	-69.19	999.97	0.123999	3367.99	2000.26	0.25	15
19	94.60	-8.76	-68.82	1002.21	0.126999	3449.47	2048.65	0.25	15
20	94.60	-8.52	-68.44	1004.59	0.129999	3530.95	2097.05	0.25	15
21	94.60	-8.29	-68.08	1006.82	0.132999	3612.44	2145.44	0.25	15
22	94.60	-8.06	-67.71	1009.03	0.135999	3693.92	2193.83	0.25	15
23	94.60	-7.83	-67.34	1011.41	0.138999	3775.40	2242.22	0.25	15
24	94.60	-7.59	-66.98	1013.62	0.141999	3856.88	2290.62	0.25	15
25	94.60	-7.36	-66.61	1015.98	0.144999	3938.37	2339.01	0.26	15
26	94.60	-7.13	-66.24	1018.34	0.147999	4019.85	2387.40	0.26	15
27	94.60	-6.90	-65.89	1020.55	0.150999	4101.33	2435.80	0.26	15
28	94.60	-6.67	-65.52	1022.89	0.153999	4182.81	2484.19	0.26	15
29	94.60	-6.44	-65.15	1025.23	0.156999	4264.30	2532.58	0.26	15
30	94.60	-6.21	-64.79	1027.58	0.159999	4345.78	2580.98	0.26	15
31	94.60	-5.98	-64.43	1029.92	0.162999	4427.26	2629.37	0.26	15
32	94.60	-5.75	-64.07	1032.25	0.165999	4508.75	2677.76	0.26	15
33	94.60	-5.52	-63.71	1034.58	0.168999	4590.23	2726.16	0.26	15
34	94.60	-5.29	-63.36	1036.91	0.171999	4671.71	2774.55	0.26	15
35	94.60	-5.07	-63.00	1039.24	0.174999	4753.20	2822.94	0.26	15
36	94.60	-4.84	-62.65	1041.56	0.177999	4834.68	2871.33	0.26	15
37	94.60	-4.61	-62.28	1044.04	0.180999	4916.16	2919.73	0.26	15
38	94.60	-4.39	-61.93	1046.36	0.183999	4997.64	2968.12	0.26	15
39	94.60	-4.16	-61.58	1048.66	0.186998	5079.13	3016.51	0.26	15
40	94.60	-3.93	-61.22	1051.13	0.189998	5160.61	3064.91	0.26	15
41	94.60	-3.71	-60.86	1053.60	0.192998	5242.09	3113.30	0.26	15
42	94.60	-3.48	-60.51	1055.90	0.195998	5323.57	3161.69	0.26	15
43	94.60	-3.26	-60.16	1058.36	0.198998	5405.06	3210.08	0.26	15
44	94.60	-3.03	-59.82	1060.65	0.201998	5486.54	3258.48	0.26	15
45	94.60	-2.81	-59.46	1063.10	0.204998	5568.03	3306.87	0.26	15

46	94.60	-2.58	-59.11	1065.56	0.207998	5649.51	3355.26	0.26	15
47	94.60	-2.36	-58.76	1068.01	0.210998	5730.99	3403.66	0.26	15
48	94.60	-2.14	-58.41	1070.46	0.213998	5812.47	3452.05	0.26	15
49	94.60	-1.91	-58.06	1072.90	0.216998	5893.96	3500.44	0.26	15
50	94.60	-1.69	-57.71	1075.34	0.219998	5975.44	3548.84	0.26	15
51	94.60	-1.47	-57.37	1077.78	0.222998	6056.92	3597.23	0.26	15
52	94.60	-1.25	-57.02	1080.22	0.225998	6138.41	3645.62	0.26	15
53	94.60	-1.02	-56.68	1082.66	0.228998	6219.89	3694.02	0.26	15
54	94.60	-0.80	-56.34	1085.09	0.231998	6301.37	3742.41	0.26	15
55	94.60	-0.58	-55.99	1087.69	0.234998	6382.86	3790.80	0.26	15
56	94.60	-0.36	-55.65	1090.12	0.237998	6464.34	3839.19	0.26	15
57	94.60	-0.14	-55.31	1092.54	0.240998	6545.82	3887.59	0.26	15
58	94.60	0.08	-54.96	1095.13	0.243998	6627.30	3935.98	0.26	15
59	94.60	0.30	-54.63	1097.56	0.246998	6708.79	3984.37	0.26	15
60	94.60	0.52	-54.28	1100.15	0.249998	6790.27	4032.77	0.26	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 293.88 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.25000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.003000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 1.00000

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 5769.063 ALBEDO = 992.988

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-6.50	-65.25	1024.68	0.070000	5769.06	992.99	0.26	15
1	94.60	-5.99	-64.44	1029.82	0.073000	6016.30	1035.54	0.26	15
2	94.60	-5.48	-63.65	1034.95	0.076000	6263.55	1078.10	0.26	15
3	94.60	-4.97	-62.85	1040.21	0.079000	6510.79	1120.66	0.26	15
4	94.60	-4.46	-62.05	1045.61	0.082000	6758.03	1163.21	0.26	15
5	94.60	-3.96	-61.26	1050.83	0.085000	7005.27	1205.77	0.26	15
6	94.60	-3.46	-60.47	1056.21	0.088000	7252.52	1248.32	0.26	15
7	94.60	-2.95	-59.69	1061.57	0.091000	7499.76	1290.88	0.26	15
8	94.60	-2.45	-58.91	1066.92	0.094000	7747.00	1333.44	0.26	15
9	94.60	-1.95	-58.13	1072.41	0.097000	7994.25	1375.99	0.26	15
10	94.60	-1.46	-57.35	1077.90	0.100000	8241.48	1418.55	0.26	15
11	94.60	-0.96	-56.58	1083.37	0.103000	8488.73	1461.11	0.26	15
12	94.60	-0.47	-55.82	1088.84	0.106000	8735.97	1503.66	0.26	15
13	94.60	0.02	-55.05	1094.46	0.108999	8983.21	1546.22	0.26	15
14	94.60	0.52	-54.29	1100.07	0.111999	9230.46	1588.77	0.26	15
15	94.60	1.00	-53.53	1105.67	0.114999	9477.70	1631.33	0.27	15
16	94.60	1.49	-52.78	1111.27	0.117999	9724.94	1673.89	0.27	15
17	94.60	1.98	-52.03	1117.03	0.120999	9972.18	1716.44	0.27	15
18	94.60	2.46	-51.28	1122.78	0.123999	10219.42	1759.00	0.27	15
19	94.60	2.94	-50.53	1128.53	0.126999	10466.67	1801.55	0.27	15
20	94.60	3.43	-49.80	1134.27	0.129999	10713.91	1844.11	0.27	15
21	94.60	3.91	-49.05	1140.18	0.132999	10961.15	1886.67	0.27	15
22	94.60	4.39	-48.31	1146.08	0.135999	11208.39	1929.22	0.27	15
23	94.60	4.86	-47.58	1151.99	0.138999	11455.63	1971.78	0.27	15
24	94.60	5.34	-46.85	1157.90	0.141999	11702.87	2014.33	0.27	15
25	94.60	5.81	-46.13	1163.79	0.144999	11950.12	2056.89	0.27	15
26	94.60	6.28	-45.40	1169.86	0.147999	12197.36	2099.45	0.27	15
27	94.60	6.76	-44.68	1175.94	0.150999	12444.61	2142.00	0.27	15
28	94.60	7.22	-43.96	1182.02	0.153999	12691.84	2184.56	0.27	15
29	94.60	7.69	-43.25	1188.10	0.156999	12939.09	2227.12	0.27	15
30	94.60	8.16	-42.53	1194.35	0.159999	13186.34	2269.67	0.27	15
31	94.60	8.63	-41.82	1200.61	0.162999	13433.58	2312.23	0.28	15
32	94.60	9.09	-41.11	1206.88	0.165999	13680.82	2354.78	0.28	15
33	94.60	9.55	-40.41	1213.14	0.168999	13928.06	2397.34	0.28	15
34	94.60	10.01	-39.71	1219.42	0.171999	14175.30	2439.90	0.28	15
35	94.60	10.47	-39.01	1225.87	0.174999	14422.54	2482.45	0.28	15
36	94.60	10.93	-38.31	1232.33	0.177999	14669.78	2525.01	0.28	15
37	94.60	11.39	-37.61	1238.81	0.180999	14917.03	2567.56	0.28	15
38	94.60	11.85	-36.92	1245.29	0.183999	15164.27	2610.12	0.28	15
39	94.60	12.30	-36.23	1251.95	0.186998	15411.51	2652.68	0.28	15
40	94.60	12.76	-35.54	1258.44	0.189998	15658.75	2695.23	0.28	15
41	94.60	13.21	-34.86	1265.13	0.192998	15906.00	2737.79	0.28	15
42	94.60	13.66	-34.17	1272.00	0.195998	16153.25	2780.34	0.28	15
43	94.60	14.11	-33.49	1278.71	0.198998	16400.49	2822.90	0.28	15
44	94.60	14.56	-32.81	1285.42	0.201998	16647.73	2865.46	0.28	15
45	94.60	15.00	-32.14	1292.34	0.204998	16894.97	2908.01	0.28	15

46	94.60	15.45	-31.46	1299.27	0.207998	17142.21	2950.57	0.29	15
47	94.60	15.89	-30.79	1306.21	0.210998	17389.45	2993.13	0.29	15
48	94.60	16.34	-30.12	1313.16	0.213998	17636.70	3035.68	0.29	15
49	94.60	16.78	-29.45	1320.31	0.216998	17883.94	3078.24	0.29	15
50	94.60	17.22	-28.78	1327.48	0.219998	18131.18	3120.79	0.29	15
51	94.60	17.66	-28.13	1334.47	0.222998	18378.42	3163.35	0.29	15
52	94.60	18.10	-27.46	1341.87	0.225998	18625.66	3205.91	0.29	15
53	94.60	18.53	-26.81	1349.08	0.228998	18872.91	3248.46	0.29	15
54	94.60	18.97	-26.15	1356.32	0.231998	19120.16	3291.02	0.29	15
55	94.60	19.40	-25.50	1363.76	0.234998	19367.39	3333.57	0.29	15
56	94.60	19.84	-24.84	1371.23	0.237998	19614.64	3376.13	0.29	15
57	94.60	20.27	-24.20	1378.70	0.240998	19861.88	3418.69	0.29	15
58	94.60	20.70	-23.55	1386.20	0.243998	20109.12	3461.24	0.29	15
59	94.60	21.13	-22.90	1393.92	0.246998	20356.37	3503.80	0.29	15
60	94.60	21.56	-22.25	1401.66	0.249998	20603.61	3546.36	0.29	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 347.88 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.25000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.003000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.81059

FLAT PLANE RACIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 50.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 10192.910 ALBEDO = 737.028

EFFECT OF DEGRACATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	0.70	-54.01	1102.11	0.070000	10192.91	737.03	0.27	15
1	94.60	1.49	-52.78	1111.26	0.073000	10629.74	768.61	0.27	15
2	94.60	2.28	-51.57	1120.56	0.076000	11066.57	800.20	0.27	15
3	94.60	3.06	-50.36	1129.85	0.079000	11503.41	831.79	0.27	15
4	94.60	3.83	-49.16	1139.30	0.082000	11940.24	863.37	0.27	15
5	94.60	4.61	-47.98	1148.75	0.085000	12377.08	894.96	0.27	15
6	94.60	5.38	-46.80	1158.35	0.088000	12813.91	926.55	0.27	15
7	94.60	6.14	-45.63	1167.95	0.091000	13250.74	958.13	0.27	15
8	94.60	6.90	-44.45	1177.91	0.094000	13687.58	989.72	0.27	15
9	94.60	7.66	-43.30	1187.70	0.097000	14124.41	1021.31	0.27	15
10	94.60	8.41	-42.14	1197.83	0.100000	14561.24	1052.89	0.28	15
11	94.60	9.16	-41.00	1207.80	0.103000	14998.08	1084.48	0.28	15
12	94.60	9.91	-39.86	1218.15	0.106000	15434.91	1116.07	0.28	15
13	94.60	10.65	-38.72	1228.50	0.108999	15871.75	1147.65	0.28	15
14	94.60	11.40	-37.60	1238.86	0.111999	16308.58	1179.24	0.28	15
15	94.60	12.13	-36.49	1249.44	0.114999	16745.41	1210.83	0.28	15
16	94.60	12.86	-35.37	1260.21	0.117999	17182.25	1242.41	0.28	15
17	94.60	13.59	-34.26	1271.02	0.120999	17619.08	1274.00	0.28	15
18	94.60	14.32	-33.17	1281.84	0.123999	18055.91	1305.59	0.28	15
19	94.60	15.04	-32.07	1293.07	0.126999	18492.75	1337.17	0.28	15
20	94.60	15.76	-30.99	1304.14	0.129999	18929.58	1368.76	0.29	15
21	94.60	16.48	-29.91	1315.43	0.132999	19366.42	1400.34	0.29	15
22	94.60	17.19	-28.83	1326.95	0.135999	19803.25	1431.93	0.29	15
23	94.60	17.90	-27.76	1338.51	0.138999	20240.08	1463.52	0.29	15
24	94.60	18.61	-26.69	1350.30	0.141999	20676.91	1495.10	0.29	15
25	94.60	19.31	-25.64	1362.14	0.144999	21113.75	1526.69	0.29	15
26	94.60	20.02	-24.58	1374.22	0.147999	21550.58	1558.28	0.29	15
27	94.60	20.71	-23.53	1386.54	0.150999	21987.42	1589.86	0.29	15
28	94.60	21.41	-22.48	1398.92	0.153999	22424.25	1621.45	0.29	15
29	94.60	22.10	-21.45	1411.35	0.156999	22861.09	1653.04	0.30	15
30	94.60	22.79	-20.41	1424.04	0.159999	23297.93	1684.62	0.30	15
31	94.60	23.47	-19.39	1436.79	0.162999	23734.75	1716.21	0.30	15
32	94.60	24.16	-18.37	1449.80	0.165999	24171.59	1747.80	0.30	15
33	94.60	24.84	-17.34	1463.10	0.168999	24608.42	1779.38	0.30	15
34	94.60	25.51	-16.33	1476.66	0.171999	25045.25	1810.97	0.30	14
35	94.60	26.19	-15.31	1490.29	0.174999	25482.09	1842.56	0.30	14
36	94.60	26.86	-14.31	1504.00	0.177999	25918.93	1874.14	0.30	14
37	94.60	27.53	-13.32	1517.79	0.180999	26355.76	1905.73	0.30	14
38	94.60	28.19	-12.31	1532.08	0.183999	26792.59	1937.32	0.31	14
39	94.60	28.86	-11.32	1546.46	0.186998	27229.42	1968.90	0.31	14
40	94.60	29.52	-10.34	1560.93	0.189998	27666.25	2000.49	0.31	14
41	94.60	30.17	-9.36	1575.47	0.192998	28103.09	2032.08	0.31	14
42	94.60	30.83	-8.38	1590.55	0.195998	28539.93	2063.66	0.31	14
43	94.60	31.48	-7.41	1605.74	0.198998	28976.76	2095.25	0.31	14
44	94.60	32.13	-6.44	1621.00	0.201998	29413.59	2126.83	0.31	14
45	94.60	32.78	-5.47	1636.85	0.204998	29850.43	2158.42	0.31	14

46	94.60	33.42	-4.50	1652.78	0.207998	30287.27	2190.01	0.31	14
47	94.60	34.07	-3.55	1668.83	0.210998	30724.09	2221.59	0.32	14
48	94.60	34.71	-2.58	1685.47	0.213998	31160.93	2253.18	0.32	14
49	94.60	35.34	-1.65	1701.75	0.216998	31597.76	2284.77	0.32	14
50	94.60	35.98	-0.68	1719.09	0.219998	32034.59	2316.35	0.32	14
51	94.60	36.61	0.25	1736.08	0.222998	32471.43	2347.94	0.32	14
52	94.60	37.24	1.20	1753.69	0.225998	32908.27	2379.53	0.32	14
53	94.60	37.87	2.14	1771.43	0.228998	33345.09	2411.11	0.32	14
54	94.60	38.49	3.06	1789.31	0.231998	33781.93	2442.70	0.32	14
55	94.60	39.12	4.00	1807.83	0.234998	34218.76	2474.29	0.33	14
56	94.60	39.74	4.93	1826.49	0.237998	34655.60	2505.87	0.33	14
57	94.60	40.36	5.86	1845.83	0.240998	35092.43	2537.46	0.33	14
58	94.60	40.97	6.77	1864.80	0.243998	35529.27	2569.05	0.33	14
59	94.60	41.59	7.69	1884.47	0.246998	35966.10	2600.63	0.33	14
60	94.60	42.20	8.61	1904.80	0.249998	36402.93	2632.22	0.33	14

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 439.29 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.25000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.003000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.50149

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 16608.746 ALBEDO = 392.166

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	10.63	-38.78	1227.96	0.070000	16608.75	392.17	0.28	15
1	94.60	11.78	-37.02	1244.40	0.073000	17320.54	408.97	0.28	15
2	94.60	12.92	-35.30	1260.88	0.076000	18032.33	425.78	0.28	15
3	94.60	14.05	-33.58	1277.79	0.079000	18744.12	442.59	0.28	15
4	94.60	15.18	-31.88	1294.95	0.082000	19455.92	459.39	0.28	15
5	94.60	16.29	-30.18	1312.58	0.085000	20167.71	476.20	0.29	15
6	94.60	17.40	-28.52	1330.29	0.088000	20879.52	493.01	0.29	15
7	94.60	18.50	-26.86	1348.48	0.091000	21591.30	509.81	0.29	15
8	94.60	19.60	-25.20	1367.16	0.094000	22303.11	526.62	0.29	15
9	94.60	20.68	-23.57	1385.96	0.097000	23014.90	543.43	0.29	15
10	94.60	21.76	-21.95	1405.27	0.100000	23726.69	560.23	0.29	15
11	94.60	22.84	-20.34	1424.91	0.103000	24438.48	577.04	0.30	15
12	94.60	23.90	-18.75	1444.92	0.106000	25150.28	593.85	0.30	15
13	94.60	24.96	-17.16	1465.48	0.108999	25862.07	610.66	0.30	15
14	94.60	26.01	-15.59	1486.43	0.111999	26573.87	627.46	0.30	14
15	94.60	27.05	-14.03	1507.75	0.114999	27285.66	644.27	0.30	14
16	94.60	28.09	-12.47	1529.69	0.117999	27997.46	661.08	0.31	14
17	94.60	29.12	-10.92	1552.27	0.120999	28709.25	677.88	0.31	14
18	94.60	30.15	-9.40	1575.06	0.123999	29421.05	694.69	0.31	14
19	94.60	31.16	-7.87	1598.50	0.126999	30132.84	711.50	0.31	14
20	94.60	32.18	-6.37	1622.18	0.129999	30844.63	728.30	0.31	14
21	94.60	33.18	-4.87	1646.56	0.132999	31556.43	745.11	0.31	14
22	94.60	34.18	-3.38	1671.66	0.135999	32268.22	761.92	0.32	14
23	94.60	35.18	-1.89	1697.51	0.138999	32980.02	778.72	0.32	14
24	94.60	36.16	-0.42	1723.65	0.141999	33691.81	795.53	0.32	14
25	94.60	37.15	1.06	1751.06	0.144999	34403.61	812.34	0.32	14
26	94.60	38.12	2.51	1778.77	0.147999	35115.41	829.14	0.32	14
27	94.60	39.09	3.95	1806.85	0.150999	35827.20	845.95	0.33	14
28	94.60	40.06	5.40	1836.29	0.153999	36538.99	862.76	0.33	14
29	94.60	41.01	6.83	1866.10	0.156999	37250.79	879.57	0.33	14
30	94.60	41.97	8.27	1897.33	0.159999	37962.58	896.37	0.33	14
31	94.60	42.92	9.69	1929.01	0.162999	38674.38	913.18	0.33	14
32	94.60	43.86	11.10	1961.65	0.165999	39386.17	929.99	0.34	14
33	94.60	44.80	12.51	1995.30	0.168999	40097.97	946.79	0.34	14
34	94.60	45.73	13.91	2030.00	0.171999	40809.76	963.60	0.34	14
35	94.60	46.66	15.29	2065.22	0.174999	41521.55	980.41	0.34	14
36	94.60	47.58	16.68	2102.12	0.177999	42233.34	997.21	0.34	14
37	94.60	48.49	18.07	2140.18	0.180999	42945.14	1014.02	0.35	14
38	94.60	49.41	19.45	2179.47	0.183999	43656.94	1030.83	0.35	14
39	94.60	50.31	20.82	2220.01	0.186998	44368.74	1047.63	0.35	14
40	94.60	51.22	22.18	2261.85	0.189998	45080.53	1064.44	0.35	14
41	94.60	52.11	23.54	2305.05	0.192998	45792.33	1081.25	0.35	14
42	94.60	53.01	24.89	2349.68	0.195998	46504.12	1098.06	0.36	14
43	94.60	53.90	26.25	2396.40	0.198998	47215.91	1114.86	0.36	14
44	94.60	54.78	27.60	2444.69	0.201998	47927.70	1131.67	0.36	14
45	94.60	55.66	28.94	2494.61	0.204998	48639.50	1148.48	0.36	14

46	94.60	56.53	30.27	2546.20	0.207998	49351.29	1165.28	0.36	14
47	94.60	57.41	31.61	2600.27	0.210998	50063.09	1182.09	0.37	14
48	94.60	58.27	32.94	2656.25	0.213998	50774.89	1198.90	0.37	14
49	94.60	59.13	34.27	2714.91	0.216998	51486.68	1215.70	0.37	14
50	94.60	59.99	35.59	2775.65	0.219998	52198.48	1232.51	0.37	14
51	94.60	60.84	36.91	2839.36	0.222998	52910.27	1249.32	0.38	14
52	94.60	61.69	38.23	2905.43	0.225998	53622.06	1266.12	0.38	14
53	94.60	62.54	39.54	2974.71	0.228998	54333.85	1282.93	0.38	14
54	94.60	63.38	40.85	3047.50	0.231998	55045.65	1299.74	0.38	14
55	94.60	64.21	42.15	3123.05	0.234998	55757.45	1316.55	0.38	14
56	94.60	65.05	43.47	3203.32	0.237998	56469.25	1333.35	0.39	14
57	94.60	65.88	44.77	3286.86	0.240998	57181.04	1350.16	0.39	14
58	94.60	66.70	46.06	3374.68	0.243998	57892.84	1366.97	0.39	13
59	94.60	67.52	47.38	3469.11	0.246998	58604.63	1383.77	0.39	13
60	94.60	68.34	48.67	3566.55	0.249998	59316.42	1400.58	0.40	13

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 732.25 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.25000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.003000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32241

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 17675.902 ALBEDO = 0.000

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	11.69	-37.15	1243.15	0.070000	17675.90	0.00	0.28	15
1	94.60	12.88	-35.35	1260.39	0.073000	18433.43	0.00	0.28	15
2	94.60	14.06	-33.57	1277.88	0.076000	19190.95	0.00	0.28	15
3	94.60	15.23	-31.80	1295.81	0.079000	19948.48	0.00	0.28	15
4	94.60	16.39	-30.04	1314.02	0.082000	20706.01	0.00	0.29	15
5	94.60	17.54	-28.30	1332.70	0.085000	21463.55	0.00	0.29	15
6	94.60	18.68	-26.59	1351.49	0.088000	22221.07	0.00	0.29	15
7	94.60	19.82	-24.87	1370.97	0.091000	22978.60	0.00	0.29	15
8	94.60	20.95	-23.18	1390.58	0.094000	23736.13	0.00	0.29	15
9	94.60	22.07	-21.50	1410.72	0.097000	24493.66	0.00	0.30	15
10	94.60	23.18	-19.82	1431.43	0.100000	25251.18	0.00	0.30	15
11	94.60	24.28	-18.17	1452.29	0.103000	26008.72	0.00	0.30	15
12	94.60	25.38	-16.53	1473.93	0.106000	26766.25	0.00	0.30	14
13	94.60	26.47	-14.90	1495.76	0.108999	27523.78	0.00	0.30	14
14	94.60	27.55	-13.28	1518.21	0.111999	28281.30	0.00	0.30	14
15	94.60	28.63	-11.67	1541.29	0.114999	29038.83	0.00	0.31	14
16	94.60	29.70	-10.06	1565.04	0.117999	29796.36	0.00	0.31	14
17	94.60	30.76	-8.48	1589.03	0.120999	30553.90	0.00	0.31	14
18	94.60	31.81	-6.90	1613.70	0.123999	31311.43	0.00	0.31	14
19	94.60	32.86	-5.35	1638.64	0.126999	32068.95	0.00	0.31	14
20	94.60	33.90	-3.79	1664.77	0.129999	32826.47	0.00	0.32	14
21	94.60	34.94	-2.25	1691.19	0.132999	33584.01	0.00	0.32	14
22	94.60	35.97	-0.71	1718.40	0.135999	34341.54	0.00	0.32	14
23	94.60	36.99	0.81	1746.41	0.138999	35099.07	0.00	0.32	14
24	94.60	38.00	2.34	1775.25	0.141999	35856.59	0.00	0.32	14
25	94.60	39.01	3.85	1804.96	0.144999	36614.13	0.00	0.33	14
26	94.60	40.02	5.34	1835.07	0.147999	37371.66	0.00	0.33	14
27	94.60	41.01	6.83	1866.06	0.150999	38129.18	0.00	0.33	14
28	94.60	42.00	8.32	1898.55	0.153999	38886.71	0.00	0.33	14
29	94.60	42.99	9.80	1931.47	0.156999	39644.25	0.00	0.33	14
30	94.60	43.97	11.26	1965.41	0.159999	40401.77	0.00	0.34	14
31	94.60	44.94	12.72	2000.42	0.162999	41159.30	0.00	0.34	14
32	94.60	45.91	14.18	2036.52	0.165999	41916.82	0.00	0.34	14
33	94.60	46.87	15.63	2074.29	0.168999	42674.36	0.00	0.34	14
34	94.60	47.83	17.07	2112.69	0.171999	43431.89	0.00	0.34	14
35	94.60	48.78	18.50	2152.29	0.174999	44189.42	0.00	0.35	14
36	94.60	49.73	19.94	2193.76	0.177999	44946.95	0.00	0.35	14
37	94.60	50.67	21.35	2235.95	0.180999	45704.48	0.00	0.35	14
38	94.60	51.61	22.77	2280.14	0.183999	46462.00	0.00	0.35	14
39	94.60	52.54	24.19	2326.41	0.186998	47219.53	0.00	0.35	14
40	94.60	53.47	25.59	2373.55	0.189998	47977.07	0.00	0.36	14
41	94.60	54.39	27.00	2422.94	0.192998	48734.60	0.00	0.36	14
42	94.60	55.30	28.39	2473.99	0.195998	49492.13	0.00	0.36	14
43	94.60	56.22	29.78	2526.77	0.198998	50249.65	0.00	0.36	14
44	94.60	57.12	31.17	2582.05	0.201998	51007.18	0.00	0.37	14
45	94.60	58.02	32.56	2639.99	0.204998	51764.71	0.00	0.37	14

46	94.60	58.92	33.94	2700.01	0.207998	52522.25	0.00	0.37	14
47	94.60	59.81	35.32	2762.90	0.210998	53279.77	0.00	0.37	14
48	94.60	60.70	36.68	2828.08	0.213998	54037.30	0.00	0.37	14
49	94.60	61.58	38.05	2896.50	0.216998	54794.82	0.00	0.38	14
50	94.60	62.46	39.42	2968.28	0.219998	55552.36	0.00	0.38	14
51	94.60	63.34	40.79	3043.62	0.222998	56309.89	0.00	0.38	14
52	94.60	64.21	42.15	3122.80	0.225998	57067.42	0.00	0.38	14
53	94.60	65.07	43.50	3205.12	0.228998	57824.94	0.00	0.39	14
54	94.60	65.93	44.85	3292.62	0.231998	58582.48	0.00	0.39	13
55	94.60	66.79	46.22	3385.60	0.234998	59340.00	0.00	0.39	13
56	94.60	67.64	47.57	3483.57	0.237998	60097.53	0.00	0.39	13
57	94.60	68.49	48.93	3586.88	0.240998	60855.06	0.00	0.40	13
58	94.60	69.34	50.28	3695.88	0.243998	61612.60	0.00	0.40	13
59	94.60	70.18	51.62	3810.96	0.246998	62370.12	0.00	0.40	13
60	94.60	71.02	52.97	3934.96	0.249998	63127.65	0.00	0.40	13

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 795.32 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.25000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.003000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.31010

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 1918.344 ALBEDO = 1072.563

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-14.85	-78.55	945.93	0.070000	1918.34	1072.56	0.25	15
1	94.60	-14.61	-78.17	947.98	0.073000	2000.56	1118.53	0.25	15
2	94.60	-14.37	-77.78	950.17	0.076000	2082.77	1164.50	0.25	15
3	94.60	-14.13	-77.40	952.21	0.079000	2164.99	1210.46	0.25	15
4	94.60	-13.89	-77.01	954.39	0.082000	2247.20	1256.43	0.25	15
5	94.60	-13.66	-76.63	956.57	0.085000	2329.41	1302.40	0.25	15
6	94.60	-13.42	-76.24	958.73	0.088000	2411.63	1348.36	0.25	15
7	94.60	-13.18	-75.86	960.88	0.091000	2493.84	1394.33	0.25	15
8	94.60	-12.94	-75.48	963.04	0.094000	2576.05	1440.29	0.25	15
9	94.60	-12.71	-75.10	965.18	0.097000	2658.27	1486.26	0.25	15
10	94.60	-12.47	-74.72	967.32	0.100000	2740.48	1532.23	0.25	15
11	94.60	-12.24	-74.35	969.44	0.103000	2822.70	1578.19	0.25	15
12	94.60	-12.00	-73.98	971.57	0.106000	2904.91	1624.16	0.25	15
13	94.60	-11.77	-73.59	973.84	0.108999	2987.12	1670.13	0.25	15
14	94.60	-11.53	-73.22	975.95	0.111999	3069.34	1716.09	0.25	15
15	94.60	-11.30	-72.85	978.06	0.114999	3151.55	1762.06	0.25	15
16	94.60	-11.06	-72.48	980.31	0.117999	3233.76	1808.03	0.25	15
17	94.60	-10.83	-72.10	982.56	0.120999	3315.98	1853.99	0.25	15
18	94.60	-10.60	-71.74	984.64	0.123999	3398.19	1899.96	0.25	15
19	94.60	-10.36	-71.36	986.88	0.126999	3480.41	1945.92	0.25	15
20	94.60	-10.13	-70.99	989.11	0.129999	3562.62	1991.89	0.25	15
21	94.60	-9.90	-70.62	991.33	0.132999	3644.83	2037.86	0.25	15
22	94.60	-9.67	-70.25	993.55	0.135999	3727.05	2083.82	0.25	15
23	94.60	-9.43	-69.88	995.77	0.138999	3809.26	2129.79	0.25	15
24	94.60	-9.20	-69.52	997.98	0.141999	3891.47	2175.76	0.25	15
25	94.60	-8.97	-69.15	1000.18	0.144999	3973.69	2221.72	0.25	15
26	94.60	-8.74	-68.79	1002.38	0.147999	4055.90	2267.69	0.25	15
27	94.60	-8.51	-68.42	1004.73	0.150999	4138.11	2313.66	0.25	15
28	94.60	-8.28	-68.06	1006.92	0.153999	4220.33	2359.62	0.25	15
29	94.60	-8.05	-67.70	1009.11	0.156999	4302.54	2405.59	0.25	15
30	94.60	-7.82	-67.33	1011.44	0.159999	4384.75	2451.56	0.25	15
31	94.60	-7.59	-66.98	1013.62	0.162999	4466.97	2497.52	0.25	15
32	94.60	-7.36	-66.61	1015.95	0.165999	4549.18	2543.49	0.26	15
33	94.60	-7.14	-66.25	1018.27	0.168999	4631.39	2589.45	0.26	15
34	94.60	-6.91	-65.90	1020.43	0.171999	4713.61	2635.42	0.26	15
35	94.60	-6.68	-65.54	1022.75	0.174999	4795.82	2681.39	0.26	15
36	94.60	-6.46	-65.18	1025.06	0.177999	4878.04	2727.35	0.26	15
37	94.60	-6.23	-64.82	1027.37	0.180999	4960.25	2773.32	0.26	15
38	94.60	-6.00	-64.47	1029.67	0.183999	5042.46	2819.29	0.26	15
39	94.60	-5.78	-64.11	1031.97	0.186998	5124.68	2865.25	0.26	15
40	94.60	-5.55	-63.76	1034.27	0.189998	5206.89	2911.22	0.26	15
41	94.60	-5.33	-63.41	1036.56	0.192998	5289.11	2957.19	0.26	15
42	94.60	-5.10	-63.05	1038.86	0.195998	5371.32	3003.15	0.26	15
43	94.60	-4.88	-62.69	1041.31	0.198998	5453.53	3049.12	0.26	15
44	94.60	-4.65	-62.34	1043.59	0.201998	5535.75	3095.08	0.26	15
45	94.60	-4.43	-62.00	1045.87	0.204998	5617.96	3141.05	0.26	15

46	94.60	-4.20	-61.64	1048.30	0.207998	5700.18	3187.02	0.26	15
47	94.60	-3.98	-61.30	1050.58	0.210998	5782.39	3232.98	0.26	15
48	94.60	-3.76	-60.94	1053.01	0.213998	5864.60	3278.95	0.26	15
49	94.60	-3.54	-60.60	1055.27	0.216998	5946.82	3324.92	0.26	15
50	94.60	-3.31	-60.25	1057.70	0.219998	6029.03	3370.88	0.26	15
51	94.60	-3.09	-59.90	1060.13	0.222998	6111.24	3416.85	0.26	15
52	94.60	-2.87	-59.56	1062.38	0.225998	6193.46	3462.82	0.26	15
53	94.60	-2.65	-59.21	1064.80	0.228998	6275.67	3508.78	0.26	15
54	94.60	-2.43	-58.87	1067.22	0.231998	6357.88	3554.75	0.26	15
55	94.60	-2.21	-58.52	1069.64	0.234998	6440.10	3600.72	0.26	15
56	94.60	-1.99	-58.18	1072.04	0.237998	6522.31	3646.68	0.26	15
57	94.60	-1.77	-57.84	1074.46	0.240998	6604.52	3692.65	0.26	15
58	94.60	-1.55	-57.49	1076.86	0.243998	6686.74	3738.61	0.26	15
59	94.60	-1.33	-57.15	1079.27	0.246998	6768.95	3784.58	0.26	15
60	94.60	-1.11	-56.81	1081.67	0.249998	6851.17	3830.55	0.26	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 290.65 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.25000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.003000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 1.00000

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FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 5818.160 ALBEDO = 943.200

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-7.96	-67.55	1010.05	0.070000	5818.16	943.20	0.25	15
1	94.60	-7.44	-66.73	1015.25	0.073000	6067.51	983.62	0.25	15
2	94.60	-6.92	-65.91	1020.43	0.076000	6316.85	1024.04	0.26	15
3	94.60	-6.41	-65.10	1025.58	0.079000	6566.20	1064.47	0.26	15
4	94.60	-5.90	-64.30	1030.71	0.082000	6815.55	1104.89	0.26	15
5	94.60	-5.39	-63.50	1035.99	0.085000	7064.89	1145.31	0.26	15
6	94.60	-4.88	-62.70	1041.25	0.088000	7314.24	1185.73	0.26	15
7	94.60	-4.37	-61.91	1046.49	0.091000	7563.59	1226.16	0.26	15
8	94.60	-3.87	-61.13	1051.72	0.094000	7812.93	1266.58	0.26	15
9	94.60	-3.37	-60.34	1057.09	0.097000	8062.28	1307.00	0.26	15
10	94.60	-2.87	-59.55	1062.45	0.100000	8311.63	1347.42	0.26	15
11	94.60	-2.36	-58.77	1067.95	0.103000	8560.97	1387.85	0.26	15
12	94.60	-1.87	-58.00	1073.28	0.106000	8810.32	1428.27	0.26	15
13	94.60	-1.37	-57.22	1078.76	0.108999	9059.67	1468.69	0.26	15
14	94.60	-0.87	-56.44	1084.40	0.111999	9309.02	1509.11	0.26	15
15	94.60	-0.38	-55.68	1089.86	0.114999	9558.36	1549.54	0.26	15
16	94.60	0.11	-54.91	1095.48	0.117999	9807.71	1589.96	0.26	15
17	94.60	0.60	-54.15	1101.09	0.120999	10057.05	1630.38	0.26	15
18	94.60	1.09	-53.40	1106.69	0.123999	10306.39	1670.80	0.27	15
19	94.60	1.58	-52.65	1112.28	0.126999	10555.75	1711.22	0.27	15
20	94.60	2.06	-51.90	1118.04	0.129999	10805.09	1751.65	0.27	15
21	94.60	2.55	-51.15	1123.79	0.132999	11054.44	1792.07	0.27	15
22	94.60	3.03	-50.40	1129.54	0.135999	11303.78	1832.49	0.27	15
23	94.60	3.51	-49.67	1135.28	0.138999	11553.13	1872.91	0.27	15
24	94.60	3.99	-48.92	1141.18	0.141999	11802.48	1913.34	0.27	15
25	94.60	4.47	-48.19	1147.09	0.144999	12051.82	1953.76	0.27	15
26	94.60	4.94	-47.46	1152.99	0.147999	12301.17	1994.18	0.27	15
27	94.60	5.42	-46.73	1158.90	0.150999	12550.51	2034.60	0.27	15
28	94.60	5.89	-46.00	1164.97	0.153999	12799.86	2075.03	0.27	15
29	94.60	6.37	-45.28	1170.87	0.156999	13049.21	2115.45	0.27	15
30	94.60	6.84	-44.56	1176.94	0.159999	13298.55	2155.87	0.27	15
31	94.60	7.31	-43.83	1183.20	0.162999	13547.90	2196.29	0.27	15
32	94.60	7.78	-43.12	1189.28	0.165999	13797.24	2236.72	0.27	15
33	94.60	8.24	-42.41	1195.35	0.168999	14046.59	2277.14	0.28	15
34	94.60	8.71	-41.70	1201.61	0.171999	14295.95	2317.56	0.28	15
35	94.60	9.17	-40.99	1207.88	0.174999	14545.29	2357.98	0.28	15
36	94.60	9.63	-40.28	1214.33	0.177999	14794.64	2398.41	0.28	15
37	94.60	10.10	-39.58	1220.60	0.180999	15043.98	2438.83	0.28	15
38	94.60	10.55	-38.88	1227.06	0.183999	15293.33	2479.25	0.28	15
39	94.60	11.01	-38.18	1233.51	0.186998	15542.68	2519.67	0.28	15
40	94.60	11.47	-37.49	1239.98	0.189998	15792.02	2560.09	0.28	15
41	94.60	11.93	-36.80	1246.47	0.192998	16041.37	2600.52	0.28	15
42	94.60	12.38	-36.10	1253.13	0.195998	16290.72	2640.94	0.28	15
43	94.60	12.83	-35.42	1259.63	0.198998	16540.06	2681.36	0.28	15
44	94.60	13.29	-34.74	1266.32	0.201998	16789.41	2721.78	0.28	15
45	94.60	13.74	-34.06	1273.00	0.204998	17038.76	2762.21	0.28	15

46	94.60	14.18	-33.37	1279.90	0.207998	17288.10	2802.63	0.28	15
47	94.60	14.63	-32.70	1286.62	0.210998	17537.45	2843.05	0.28	15
48	94.60	15.08	-32.02	1293.54	0.213998	17786.79	2883.47	0.28	15
49	94.60	15.53	-31.34	1300.46	0.216998	18036.14	2923.90	0.29	15
50	94.60	15.97	-30.68	1307.40	0.219998	18285.49	2964.32	0.29	15
51	94.60	16.41	-30.01	1314.35	0.222998	18534.84	3004.74	0.29	15
52	94.60	16.85	-29.34	1321.51	0.225998	18784.18	3045.16	0.29	15
53	94.60	17.29	-28.67	1328.69	0.228998	19033.52	3085.59	0.29	15
54	94.60	17.73	-28.01	1335.86	0.231998	19282.88	3126.01	0.29	15
55	94.60	18.17	-27.35	1343.07	0.234998	19532.23	3166.43	0.29	15
56	94.60	18.61	-26.70	1350.28	0.237998	19781.57	3206.85	0.29	15
57	94.60	19.04	-26.04	1357.72	0.240998	20030.92	3247.27	0.29	15
58	94.60	19.48	-25.39	1364.97	0.243998	20280.27	3287.70	0.29	15
59	94.60	19.91	-24.74	1372.43	0.246998	20529.61	3328.12	0.29	15
60	94.60	20.34	-24.08	1380.12	0.249998	20778.96	3368.54	0.29	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 343.97 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.25000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.003000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.81913

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 50.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 10418.582 ALBEDO = 700.074

EFFECT OF CEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-0.36	-55.65	1090.07	0.070000	10418.58	700.07	0.26	15
1	94.60	0.45	-54.40	1099.25	0.073000	10865.09	730.08	0.26	15
2	94.60	1.25	-53.15	1108.57	0.076000	11311.59	760.08	0.27	15
3	94.60	2.05	-51.92	1117.87	0.079000	11758.09	790.08	0.27	15
4	94.60	2.84	-50.69	1127.32	0.082000	12204.60	820.08	0.27	15
5	94.60	3.64	-49.48	1136.77	0.085000	12651.11	850.09	0.27	15
6	94.60	4.42	-48.26	1146.54	0.088000	13097.61	880.09	0.27	15
7	94.60	5.21	-47.06	1156.13	0.091000	13544.12	910.09	0.27	15
8	94.60	5.99	-45.86	1166.08	0.094000	13990.62	940.10	0.27	15
9	94.60	6.76	-44.67	1176.01	0.097000	14437.13	970.10	0.27	15
10	94.60	7.53	-43.49	1186.13	0.100000	14883.64	1000.10	0.27	15
11	94.60	8.30	-42.32	1196.25	0.103000	15330.14	1030.10	0.28	15
12	94.60	9.06	-41.15	1206.56	0.106000	15776.65	1060.11	0.28	15
13	94.60	9.82	-39.99	1216.88	0.108999	16223.15	1090.11	0.28	15
14	94.60	10.58	-38.84	1227.39	0.111999	16669.66	1120.11	0.28	15
15	94.60	11.34	-37.69	1238.11	0.114999	17116.16	1150.11	0.28	15
16	94.60	12.08	-36.55	1248.84	0.117999	17562.67	1180.12	0.28	15
17	94.60	12.83	-35.43	1259.58	0.120999	18009.17	1210.12	0.28	15
18	94.60	13.57	-34.30	1270.73	0.123999	18455.68	1240.12	0.28	15
19	94.60	14.31	-33.18	1281.71	0.126999	18902.18	1270.13	0.28	15
20	94.60	15.05	-32.06	1293.10	0.129999	19348.68	1300.13	0.28	15
21	94.60	15.78	-30.97	1304.33	0.132999	19795.19	1330.13	0.29	15
22	94.60	16.51	-29.86	1315.98	0.135999	20241.70	1360.14	0.29	15
23	94.60	17.23	-28.77	1327.67	0.138999	20688.20	1390.14	0.29	15
24	94.60	17.96	-27.68	1339.40	0.141999	21134.71	1420.14	0.29	15
25	94.60	18.67	-26.60	1351.35	0.144999	21581.21	1450.14	0.29	15
26	94.60	19.39	-25.52	1363.55	0.147999	22027.71	1480.15	0.29	15
27	94.60	20.10	-24.45	1375.80	0.150999	22474.23	1510.15	0.29	15
28	94.60	20.81	-23.38	1388.29	0.153999	22920.73	1540.15	0.29	15
29	94.60	21.52	-22.32	1400.85	0.156999	23367.23	1570.15	0.29	15
30	94.60	22.22	-21.26	1413.66	0.159999	23813.74	1600.16	0.30	15
31	94.60	22.92	-20.21	1426.52	0.162999	24260.25	1630.16	0.30	15
32	94.60	23.62	-19.17	1439.66	0.165999	24706.75	1660.16	0.30	15
33	94.60	24.31	-18.13	1452.85	0.168999	25153.26	1690.17	0.30	15
34	94.60	25.00	-17.10	1466.33	0.171999	25599.76	1720.17	0.30	15
35	94.60	25.69	-16.06	1480.08	0.174999	26046.27	1750.17	0.30	14
36	94.60	26.37	-15.04	1493.90	0.177999	26492.77	1780.17	0.30	14
37	94.60	27.06	-14.03	1507.80	0.180999	26939.28	1810.18	0.30	14
38	94.60	27.74	-13.00	1522.21	0.183999	27385.78	1840.18	0.30	14
39	94.60	28.41	-11.99	1536.71	0.186998	27832.29	1870.18	0.31	14
40	94.60	29.09	-10.98	1551.29	0.189998	28278.79	1900.19	0.31	14
41	94.60	29.76	-9.97	1566.39	0.192998	28725.30	1930.19	0.31	14
42	94.60	30.43	-8.99	1581.15	0.195998	29171.80	1960.19	0.31	14
43	94.60	31.09	-7.99	1596.44	0.198998	29618.30	1990.19	0.31	14
44	94.60	31.75	-6.99	1612.28	0.201998	30064.81	2020.20	0.31	14
45	94.60	32.41	-6.02	1627.79	0.204998	30511.32	2050.20	0.31	14

46	94.60	33.07	-5.04	1643.84	0.207998	30957.82	2080.20	0.31	14
47	94.60	33.73	-4.05	1660.47	0.210998	31404.34	2110.20	0.32	14
48	94.60	34.38	-3.08	1676.76	0.213998	31850.84	2140.21	0.32	14
49	94.60	35.03	-2.11	1693.64	0.216998	32297.34	2170.21	0.32	14
50	94.60	35.67	-1.15	1710.63	0.219998	32743.85	2200.21	0.32	14
51	94.60	36.32	-0.18	1728.24	0.222998	33190.36	2230.22	0.32	14
52	94.60	36.96	0.78	1745.96	0.225998	33636.86	2260.22	0.32	14
53	94.60	37.60	1.74	1763.84	0.228998	34083.36	2290.22	0.32	14
54	94.60	38.24	2.68	1781.84	0.231998	34529.87	2320.22	0.32	14
55	94.60	38.87	3.63	1800.50	0.234998	34976.38	2350.23	0.33	14
56	94.60	39.51	4.57	1819.29	0.237998	35422.88	2380.23	0.33	14
57	94.60	40.14	5.52	1838.75	0.240998	35869.38	2410.23	0.33	14
58	94.60	40.76	6.46	1858.39	0.243998	36315.89	2440.24	0.33	14
59	94.60	41.39	7.39	1878.17	0.246998	36762.39	2470.24	0.33	14
60	94.60	42.01	8.33	1898.67	0.249998	37208.89	2500.24	0.33	14

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 438.16 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.25000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.003000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.49812

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 16608.746 ALBEDO = 372.502

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	9.29	-40.80	1209.59	0.070000	16608.75	372.50	0.28	15
1	94.60	10.45	-39.03	1225.62	0.073000	17320.54	388.47	0.28	15
2	94.60	11.60	-37.29	1241.84	0.076000	18032.33	404.43	0.28	15
3	94.60	12.74	-35.56	1258.31	0.079000	18744.12	420.39	0.28	15
4	94.60	13.88	-33.84	1275.20	0.082000	19455.92	436.36	0.28	15
5	94.60	15.00	-32.14	1292.34	0.085000	20167.71	452.32	0.28	15
6	94.60	16.12	-30.45	1309.74	0.088000	20879.52	468.29	0.29	15
7	94.60	17.23	-28.77	1327.61	0.091000	21591.30	484.25	0.29	15
8	94.60	18.33	-27.12	1345.57	0.094000	22303.11	500.22	0.29	15
9	94.60	19.42	-25.47	1364.02	0.097000	23014.90	516.18	0.29	15
10	94.60	20.51	-23.83	1382.97	0.100000	23726.69	532.14	0.29	15
11	94.60	21.59	-22.22	1402.06	0.103000	24438.48	548.11	0.29	15
12	94.60	22.66	-20.60	1421.68	0.106000	25150.28	564.07	0.30	15
13	94.60	23.73	-19.01	1441.62	0.108999	25862.07	580.04	0.30	15
14	94.60	24.78	-17.42	1462.14	0.111999	26573.87	596.00	0.30	15
15	94.60	25.83	-15.84	1483.05	0.114999	27285.66	611.96	0.30	14
16	94.60	26.88	-14.28	1504.33	0.117999	27997.46	627.93	0.30	14
17	94.60	27.92	-12.72	1526.22	0.120999	28709.25	643.89	0.31	14
18	94.60	28.95	-11.19	1548.30	0.123999	29421.05	659.86	0.31	14
19	94.60	29.97	-9.66	1571.03	0.126999	30132.84	675.82	0.31	14
20	94.60	30.99	-8.13	1594.44	0.129999	30844.63	691.79	0.31	14
21	94.60	32.00	-6.63	1618.05	0.132999	31556.43	707.75	0.31	14
22	94.60	33.01	-5.13	1642.35	0.135999	32268.22	723.71	0.31	14
23	94.60	34.01	-3.63	1667.41	0.138999	32980.02	739.68	0.32	14
24	94.60	35.00	-2.14	1693.19	0.141999	33691.81	755.64	0.32	14
25	94.60	35.99	-0.67	1719.26	0.144999	34403.61	771.61	0.32	14
26	94.60	36.97	0.79	1746.10	0.147999	35115.41	787.57	0.32	14
27	94.60	37.95	2.25	1773.75	0.150999	35827.20	803.53	0.32	14
28	94.60	38.92	3.70	1801.75	0.153999	36538.99	819.50	0.33	14
29	94.60	39.88	5.15	1831.08	0.156999	37250.79	835.46	0.33	14
30	94.60	40.84	6.58	1860.82	0.159999	37962.58	851.43	0.33	14
31	94.60	41.79	8.00	1891.43	0.162999	38674.38	867.39	0.33	14
32	94.60	42.74	9.42	1923.01	0.165999	39386.17	883.35	0.33	14
33	94.60	43.68	10.84	1955.54	0.168999	40097.97	899.32	0.33	14
34	94.60	44.62	12.24	1988.55	0.171999	40809.76	915.28	0.34	14
35	94.60	45.55	13.64	2023.10	0.174999	41521.55	931.25	0.34	14
36	94.60	46.48	15.04	2058.77	0.177999	42233.34	947.21	0.34	14
37	94.60	47.40	16.42	2094.98	0.180999	42945.14	963.18	0.34	14
38	94.60	48.32	17.81	2132.91	0.183999	43656.94	979.14	0.34	14
39	94.60	49.23	19.17	2171.45	0.186998	44368.74	995.10	0.35	14
40	94.60	50.14	20.55	2211.83	0.189998	45080.53	1011.07	0.35	14
41	94.60	51.04	21.92	2253.51	0.192998	45792.33	1027.03	0.35	14
42	94.60	51.94	23.28	2296.54	0.195998	46504.12	1043.00	0.35	14
43	94.60	52.83	24.63	2340.98	0.198998	47215.91	1058.96	0.36	14
44	94.60	53.72	25.98	2386.86	0.201998	47927.70	1074.93	0.36	14
45	94.60	54.60	27.33	2434.93	0.204998	48639.50	1090.89	0.36	14

46	94.60	55.48	28.66	2483.96	0.207998	49351.29	1106.85	0.36	14
47	94.60	56.36	30.00	2535.31	0.210998	50063.09	1122.82	0.36	14
48	94.60	57.23	31.34	2589.15	0.213998	50774.89	1138.78	0.37	14
49	94.60	58.09	32.67	2644.81	0.216998	51486.68	1154.75	0.37	14
50	94.60	58.95	33.99	2702.47	0.219998	52198.48	1170.71	0.37	14
51	94.60	59.81	35.32	2762.90	0.222998	52910.27	1186.67	0.37	14
52	94.60	60.67	36.63	2825.50	0.225998	53622.06	1202.64	0.37	14
53	94.60	61.51	37.95	2891.17	0.228998	54333.85	1218.60	0.38	14
54	94.60	62.36	39.27	2960.10	0.231998	55045.65	1234.57	0.38	14
55	94.60	63.20	40.57	3031.62	0.234998	55757.45	1250.53	0.38	14
56	94.60	64.04	41.88	3106.72	0.237998	56469.25	1266.50	0.38	14
57	94.60	64.87	43.18	3185.62	0.240998	57181.04	1282.46	0.39	14
58	94.60	65.70	44.50	3269.44	0.243998	57892.84	1298.42	0.39	13
59	94.60	66.52	45.80	3356.77	0.246998	58604.63	1314.39	0.39	13
60	94.60	67.34	47.10	3448.65	0.249998	59316.42	1330.35	0.39	13

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 711.81 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.25000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.003000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32615

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 17675.902 ALBEDO = 0.000

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	10.40	-39.11	1224.96	0.070000	17675.90	0.00	0.28	15
1	94.60	11.60	-37.30	1241.78	0.073000	18433.43	0.00	0.28	15
2	94.60	12.79	-35.49	1259.02	0.076000	19190.95	0.00	0.28	15
3	94.60	13.96	-33.71	1276.51	0.079000	19948.48	0.00	0.28	15
4	94.60	15.13	-31.93	1294.43	0.082000	20706.01	0.00	0.28	15
5	94.60	16.30	-30.18	1312.63	0.085000	21463.55	0.00	0.29	15
6	94.60	17.45	-28.44	1331.11	0.088000	22221.07	0.00	0.29	15
7	94.60	18.59	-26.72	1350.08	0.091000	22978.60	0.00	0.29	15
8	94.60	19.73	-25.01	1369.37	0.094000	23736.13	0.00	0.29	15
9	94.60	20.86	-23.30	1389.17	0.097000	24493.66	0.00	0.29	15
10	94.60	21.98	-21.63	1409.09	0.100000	25251.18	0.00	0.30	15
11	94.60	23.09	-19.95	1429.79	0.103000	26008.72	0.00	0.30	15
12	94.60	24.20	-18.30	1450.63	0.106000	26766.25	0.00	0.30	15
13	94.60	25.30	-16.66	1472.05	0.108999	27523.78	0.00	0.30	15
14	94.60	26.39	-15.02	1494.09	0.111999	28281.30	0.00	0.30	14
15	94.60	27.47	-13.40	1516.50	0.114999	29038.83	0.00	0.30	14
16	94.60	28.55	-11.79	1539.58	0.117999	29796.36	0.00	0.31	14
17	94.60	29.61	-10.20	1562.87	0.120999	30553.90	0.00	0.31	14
18	94.60	30.68	-8.62	1586.83	0.123999	31311.43	0.00	0.31	14
19	94.60	31.73	-7.04	1611.48	0.126999	32068.95	0.00	0.31	14
20	94.60	32.78	-5.47	1636.86	0.129999	32826.47	0.00	0.31	14
21	94.60	33.82	-3.92	1662.50	0.132999	33584.01	0.00	0.32	14
22	94.60	34.86	-2.36	1689.38	0.135999	34341.54	0.00	0.32	14
23	94.60	35.88	-0.82	1716.56	0.138999	35099.07	0.00	0.32	14
24	94.60	36.91	0.69	1744.06	0.141999	35856.59	0.00	0.32	14
25	94.60	37.92	2.21	1772.88	0.144999	36614.13	0.00	0.32	14
26	94.60	38.93	3.73	1802.56	0.147999	37371.66	0.00	0.33	14
27	94.60	39.94	5.23	1832.62	0.150999	38129.18	0.00	0.33	14
28	94.60	40.93	6.71	1863.59	0.153999	38886.71	0.00	0.33	14
29	94.60	41.93	8.21	1896.03	0.156999	39644.25	0.00	0.33	14
30	94.60	42.91	9.68	1928.93	0.159999	40401.77	0.00	0.33	14
31	94.60	43.89	11.15	1962.84	0.162999	41159.30	0.00	0.34	14
32	94.60	44.87	12.61	1997.81	0.165999	41916.82	0.00	0.34	14
33	94.60	45.84	14.07	2033.85	0.168999	42674.36	0.00	0.34	14
34	94.60	46.80	15.51	2071.00	0.171999	43431.89	0.00	0.34	14
35	94.60	47.76	16.95	2109.36	0.174999	44189.42	0.00	0.34	14
36	94.60	48.71	18.40	2149.50	0.177999	44946.95	0.00	0.35	14
37	94.60	49.66	19.82	2190.33	0.180999	45704.48	0.00	0.35	14
38	94.60	50.60	21.25	2233.08	0.183999	46462.00	0.00	0.35	14
39	94.60	51.54	22.66	2276.59	0.186998	47219.53	0.00	0.35	14
40	94.60	52.47	24.08	2322.79	0.189998	47977.07	0.00	0.35	14
41	94.60	53.39	25.48	2369.86	0.192998	48734.60	0.00	0.36	14
42	94.60	54.31	26.88	2418.50	0.195998	49492.13	0.00	0.36	14
43	94.60	55.23	28.28	2469.47	0.198998	50249.65	0.00	0.36	14
44	94.60	56.14	29.68	2522.81	0.201998	51007.18	0.00	0.36	14
45	94.60	57.05	31.07	2578.04	0.204998	51764.71	0.00	0.37	14

46	94.60	57.95	32.45	2635.20	0.207998	52522.25	0.00	0.37	14
47	94.60	58.85	33.83	2695.09	0.210998	53279.77	0.00	0.37	14
48	94.60	59.74	35.21	2757.84	0.213998	54037.30	0.00	0.37	14
49	94.60	60.63	36.58	2822.91	0.216998	54794.82	0.00	0.37	14
50	94.60	61.51	37.95	2891.17	0.219998	55552.36	0.00	0.38	14
51	94.60	62.39	39.32	2962.81	0.222998	56309.89	0.00	0.38	14
52	94.60	63.27	40.67	3037.20	0.225998	57067.42	0.00	0.38	14
53	94.60	64.14	42.04	3116.18	0.228998	57824.94	0.00	0.38	14
54	94.60	65.01	43.40	3199.19	0.231998	58582.48	0.00	0.39	14
55	94.60	65.87	44.75	3285.57	0.234998	59340.00	0.00	0.39	14
56	94.60	66.72	46.10	3377.47	0.237998	60097.53	0.00	0.39	13
57	94.60	67.58	47.46	3475.15	0.240998	60855.06	0.00	0.39	13
58	94.60	68.43	48.82	3578.12	0.243998	61612.60	0.00	0.40	13
59	94.60	69.27	50.17	3686.76	0.246998	62370.12	0.00	0.40	13
60	94.60	70.11	51.51	3801.59	0.249998	63127.65	0.00	0.40	13

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 772.57 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.25000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.003000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.31333

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 1901.293 ALBEDO = 1129.185

EFFECT OF DEGRACATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-13.26	-75.98	960.16	0.070000	1901.29	1129.18	0.25	15
1	94.60	-12.78	-75.21	964.53	0.076000	2064.26	1225.97	0.25	15
2	94.60	-12.30	-74.45	968.87	0.082000	2227.23	1322.76	0.25	15
3	94.60	-11.82	-73.69	973.20	0.088000	2390.20	1419.55	0.25	15
4	94.60	-11.34	-72.93	977.64	0.094000	2553.16	1516.33	0.25	15
5	94.60	-10.87	-72.17	982.06	0.100000	2716.13	1613.12	0.25	15
6	94.60	-10.40	-71.41	986.61	0.106000	2879.10	1709.91	0.25	15
7	94.60	-9.93	-70.67	990.98	0.112000	3042.07	1806.69	0.25	15
8	94.60	-9.46	-69.93	995.49	0.118000	3205.03	1903.48	0.25	15
9	94.60	-8.99	-69.19	999.97	0.124000	3368.00	2000.27	0.25	15
10	94.60	-8.52	-68.44	1004.59	0.130000	3530.97	2097.05	0.25	15
11	94.60	-8.06	-67.70	1009.19	0.136000	3693.94	2193.84	0.25	15
12	94.60	-7.59	-66.98	1013.62	0.142000	3856.90	2290.63	0.25	15
13	94.60	-7.13	-66.24	1018.34	0.148000	4019.87	2387.42	0.26	15
14	94.60	-6.67	-65.52	1022.90	0.154000	4182.84	2484.20	0.26	15
15	94.60	-6.21	-64.79	1027.58	0.160000	4345.80	2580.99	0.26	15
16	94.60	-5.75	-64.07	1032.25	0.166000	4508.77	2677.78	0.26	15
17	94.60	-5.29	-63.36	1036.92	0.172000	4671.74	2774.56	0.26	15
18	94.60	-4.84	-62.65	1041.56	0.178000	4834.71	2871.35	0.26	15
19	94.60	-4.39	-61.93	1046.36	0.184000	4997.68	2968.14	0.26	15
20	94.60	-3.93	-61.22	1051.13	0.190000	5160.64	3064.93	0.26	15
21	94.60	-3.48	-60.51	1055.90	0.196000	5323.61	3161.71	0.26	15
22	94.60	-3.03	-59.82	1060.65	0.202000	5486.58	3258.50	0.26	15
23	94.60	-2.58	-59.11	1065.56	0.208000	5649.54	3355.29	0.26	15
24	94.60	-2.14	-58.41	1070.46	0.214000	5812.51	3452.07	0.26	15
25	94.60	-1.69	-57.71	1075.34	0.220000	5975.48	3548.86	0.26	15
26	94.60	-1.25	-57.02	1080.22	0.226000	6138.45	3645.65	0.26	15
27	94.60	-0.80	-56.34	1085.09	0.232000	6301.41	3742.43	0.26	15
28	94.60	-0.36	-55.65	1090.12	0.237999	6464.38	3839.22	0.26	15
29	94.60	0.08	-54.96	1095.14	0.243999	6627.35	3936.01	0.26	15
30	94.60	0.52	-54.28	1100.15	0.249999	6790.32	4032.80	0.26	15
31	94.60	0.96	-53.60	1105.15	0.255999	6953.29	4129.58	0.27	15
32	94.60	1.40	-52.93	1110.15	0.261999	7116.25	4226.37	0.27	15
33	94.60	1.83	-52.25	1115.32	0.267999	7279.22	4323.15	0.27	15
34	94.60	2.27	-51.58	1120.47	0.273999	7442.19	4419.94	0.27	15
35	94.60	2.70	-50.91	1125.62	0.279999	7605.16	4516.73	0.27	15
36	94.60	3.13	-50.24	1130.77	0.285999	7768.13	4613.52	0.27	15
37	94.60	3.56	-49.58	1135.92	0.291999	7931.09	4710.30	0.27	15
38	94.60	3.99	-48.92	1141.23	0.297999	8094.06	4807.09	0.27	15
39	94.60	4.42	-48.26	1146.54	0.303999	8257.03	4903.88	0.27	15
40	94.60	4.85	-47.61	1151.68	0.309999	8419.99	5000.66	0.27	15
41	94.60	5.28	-46.94	1157.16	0.315999	8582.96	5097.45	0.27	15
42	94.60	5.70	-46.29	1162.48	0.321999	8745.93	5194.24	0.27	15
43	94.60	6.13	-45.65	1167.78	0.327999	8908.90	5291.02	0.27	15
44	94.60	6.55	-45.00	1173.26	0.333999	9071.86	5387.81	0.27	15
45	94.60	6.97	-44.35	1178.75	0.339999	9234.83	5484.60	0.27	15

46	94.60	7.39	-43.71	1184.23	0.345999	9397.80	5581.39	0.27	15
47	94.60	7.81	-43.07	1189.71	0.351999	9560.77	5678.17	0.27	15
48	94.60	8.23	-42.43	1195.20	0.357999	9723.73	5774.96	0.28	15
49	94.60	8.65	-41.79	1200.86	0.363999	9886.70	5871.75	0.28	15
50	94.60	9.06	-41.15	1206.54	0.369999	10049.67	5968.54	0.28	15
51	94.60	9.48	-40.53	1212.03	0.375999	10212.63	6065.32	0.28	15
52	94.60	9.89	-39.89	1217.89	0.381999	10375.60	6162.11	0.28	15
53	94.60	10.30	-39.26	1223.57	0.387999	10538.57	6258.89	0.28	15
54	94.60	10.72	-38.64	1229.25	0.393999	10701.53	6355.68	0.28	15
55	94.60	11.13	-38.01	1235.12	0.399999	10864.50	6452.47	0.28	15
56	94.60	11.53	-37.40	1240.81	0.405999	11027.47	6549.26	0.28	15
57	94.60	11.94	-36.77	1246.70	0.411999	11190.44	6646.04	0.28	15
58	94.60	12.35	-36.15	1252.58	0.417999	11353.40	6742.83	0.28	15
59	94.60	12.76	-35.54	1258.49	0.423999	11516.38	6839.62	0.28	15
60	94.60	13.16	-34.92	1264.57	0.429999	11679.34	6936.41	0.28	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 323.15 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.43000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.006000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 1.00000

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2 5 K W   P O W E R   M O D U L E   P R O G R A M .

ALTITUDE (N.MI.), LOWEST =   235  HIGHEST =   270  INCREMENT =    35

ORBIT INCLINATION (DEG.), LOWEST =    10  HIGHEST =    90  INCREMENT =    20

DISSIPATION (KW.), LOWEST =    12  HIGHEST =    12  INCREMENT =     1

MONTHS DEGRACATION FOR PLATE RADIATOR =    60  INCREMENT =     1

SHADING COEFFICIENTS
PLATE, SOLAR =   0.900000  EARTHSHINE =   0.900000  ALBEDO =   0.900000

PLATE, SHAPE FACTOR TO SPACE =   0.910000  FLUID CP =    0.2500  BTU/LBM-R.

RADIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE =    0.07000  EMITTANCE =    0.76000  MONTHLY CHANGE IN ABSORPTANCE =   0.006000
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FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 5769.063 ALBEDO = 992.988

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-6.50	-65.25	1024.68	0.070000	5769.06	992.99	0.26	15
1	94.60	-5.48	-63.65	1034.95	0.076000	6263.55	1078.10	0.26	15
2	94.60	-4.46	-62.05	1045.61	0.082000	6758.04	1163.21	0.26	15
3	94.60	-3.46	-60.47	1056.21	0.088000	7252.53	1248.33	0.26	15
4	94.60	-2.45	-58.91	1066.92	0.094000	7747.02	1333.44	0.26	15
5	94.60	-1.46	-57.35	1077.90	0.100000	8241.51	1418.55	0.26	15
6	94.60	-0.47	-55.82	1088.84	0.106000	8736.00	1503.67	0.26	15
7	94.60	0.52	-54.29	1100.07	0.112000	9230.49	1588.78	0.26	15
8	94.60	1.49	-52.78	1111.27	0.118000	9724.98	1673.89	0.27	15
9	94.60	2.46	-51.28	1122.78	0.124000	10219.46	1759.01	0.27	15
10	94.60	3.43	-49.80	1134.27	0.130000	10713.96	1844.12	0.27	15
11	94.60	4.39	-48.31	1146.08	0.136000	11208.45	1929.23	0.27	15
12	94.60	5.34	-46.85	1157.90	0.142000	11702.94	2014.35	0.27	15
13	94.60	6.28	-45.40	1169.86	0.148000	12197.42	2099.46	0.27	15
14	94.60	7.22	-43.96	1182.02	0.154000	12691.91	2184.57	0.27	15
15	94.60	8.16	-42.53	1194.36	0.160000	13186.40	2269.68	0.27	15
16	94.60	9.09	-41.11	1206.88	0.166000	13680.89	2354.80	0.28	15
17	94.60	10.01	-39.71	1219.42	0.172000	14175.39	2439.91	0.28	15
18	94.60	10.93	-38.31	1232.34	0.178000	14669.88	2525.02	0.28	15
19	94.60	11.85	-36.92	1245.28	0.184000	15164.37	2610.14	0.28	15
20	94.60	12.76	-35.54	1258.44	0.190000	15658.85	2695.25	0.28	15
21	94.60	13.66	-34.18	1271.81	0.196000	16153.34	2780.36	0.28	15
22	94.60	14.56	-32.81	1285.43	0.202000	16647.83	2865.48	0.28	15
23	94.60	15.45	-31.46	1299.27	0.208000	17142.32	2950.59	0.29	15
24	94.60	16.34	-30.12	1313.16	0.214000	17636.82	3035.70	0.29	15
25	94.60	17.22	-28.78	1327.49	0.220000	18131.31	3120.82	0.29	15
26	94.60	18.10	-27.46	1341.87	0.226000	18625.79	3205.93	0.29	15
27	94.60	18.97	-26.15	1356.32	0.232000	19120.28	3291.04	0.29	15
28	94.60	19.84	-24.84	1371.23	0.237999	19614.77	3376.15	0.29	15
29	94.60	20.70	-23.55	1386.21	0.243999	20109.26	3461.27	0.29	15
30	94.60	21.56	-22.25	1401.67	0.249999	20603.75	3546.38	0.29	15
31	94.60	22.41	-20.97	1417.21	0.255999	21098.25	3631.49	0.30	15
32	94.60	23.27	-19.70	1433.03	0.261999	21592.74	3716.61	0.30	15
33	94.60	24.11	-18.43	1448.96	0.267999	22087.23	3801.72	0.30	15
34	94.60	24.95	-17.17	1465.40	0.273999	22581.71	3886.83	0.30	15
35	94.60	25.79	-15.92	1481.94	0.279999	23076.20	3971.95	0.30	14
36	94.60	26.62	-14.68	1498.81	0.285999	23570.69	4057.06	0.30	14
37	94.60	27.45	-13.43	1516.20	0.291999	24065.18	4142.17	0.30	14
38	94.60	28.27	-12.20	1533.74	0.297999	24559.68	4227.29	0.31	14
39	94.60	29.09	-10.98	1551.39	0.303999	25054.17	4312.39	0.31	14
40	94.60	29.91	-9.75	1569.61	0.309999	25548.65	4397.51	0.31	14
41	94.60	30.72	-8.55	1587.96	0.315999	26043.14	4482.62	0.31	14
42	94.60	31.53	-7.33	1606.91	0.321999	26537.63	4567.73	0.31	14
43	94.60	32.33	-6.13	1626.03	0.327999	27032.12	4652.85	0.31	14
44	94.60	33.13	-4.95	1645.28	0.333999	27526.61	4737.96	0.31	14
45	94.60	33.93	-3.76	1665.16	0.339999	28021.11	4823.07	0.32	14

46	94.60	34.72	-2.57	1685.69	0.345999	28515.59	4908.19	0.32	14
47	94.60	35.51	-1.39	1706.40	0.351999	29010.08	4993.30	0.32	14
48	94.60	36.29	-0.22	1727.29	0.357999	29504.57	5078.41	0.32	14
49	94.60	37.07	0.94	1748.85	0.363999	29999.06	5163.53	0.32	14
50	94.60	37.85	2.10	1770.61	0.369999	30493.55	5248.64	0.32	14
51	94.60	38.62	3.26	1793.08	0.375999	30988.04	5333.75	0.32	14
52	94.60	39.39	4.42	1816.28	0.381999	31482.54	5418.87	0.33	14
53	94.60	40.16	5.56	1839.70	0.387999	31977.03	5503.98	0.33	14
54	94.60	40.92	6.70	1863.38	0.393999	32471.51	5589.09	0.33	14
55	94.60	41.68	7.84	1887.81	0.399999	32966.00	5674.21	0.33	14
56	94.60	42.44	8.96	1912.49	0.405999	33460.49	5759.32	0.33	14
57	94.60	43.19	10.10	1938.53	0.411999	33954.98	5844.43	0.33	14
58	94.60	43.94	11.22	1964.32	0.417999	34449.47	5929.54	0.34	14
59	94.60	44.69	12.33	1990.91	0.423999	34943.96	6014.66	0.34	14
60	94.60	45.43	13.45	2018.39	0.429999	35438.45	6099.77	0.34	14

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 459.87 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.43000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.006000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.81059

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FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 50.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 10192.910 ALBEDO = 737.028

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	0.70	-54.01	1102.11	0.070000	10192.91	737.03	0.27	15
1	94.60	2.28	-51.57	1120.56	0.076000	11066.58	800.20	0.27	15
2	94.60	3.83	-49.16	1139.30	0.082000	11940.26	863.38	0.27	15
3	94.60	5.38	-46.80	1158.35	0.088000	12813.93	926.55	0.27	15
4	94.60	6.90	-44.45	1177.91	0.094000	13687.61	989.72	0.27	15
5	94.60	8.41	-42.14	1197.83	0.100000	14561.29	1052.90	0.28	15
6	94.60	9.91	-39.86	1218.15	0.106000	15434.96	1116.07	0.28	15
7	94.60	11.40	-37.60	1238.87	0.112000	16308.64	1179.24	0.28	15
8	94.60	12.86	-35.37	1260.21	0.118000	17182.31	1242.42	0.28	15
9	94.60	14.32	-33.17	1281.84	0.124000	18055.99	1305.59	0.28	15
10	94.60	15.76	-30.99	1304.14	0.130000	18929.67	1368.76	0.29	15
11	94.60	17.19	-28.83	1326.95	0.136000	19803.35	1431.94	0.29	15
12	94.60	18.61	-26.69	1350.30	0.142000	20677.02	1495.11	0.29	15
13	94.60	20.02	-24.58	1374.22	0.148000	21550.70	1558.29	0.29	15
14	94.60	21.41	-22.49	1398.72	0.154000	22424.38	1621.46	0.29	15
15	94.60	22.79	-20.41	1424.04	0.160000	23298.05	1684.63	0.30	15
16	94.60	24.16	-18.37	1449.80	0.166000	24171.73	1747.81	0.30	15
17	94.60	25.51	-16.33	1476.66	0.172000	25045.40	1810.98	0.30	14
18	94.60	26.86	-14.31	1504.01	0.178000	25919.08	1874.15	0.30	14
19	94.60	28.19	-12.31	1532.09	0.184000	26792.76	1937.33	0.31	14
20	94.60	29.52	-10.34	1560.93	0.190000	27666.43	2000.50	0.31	14
21	94.60	30.83	-8.38	1590.56	0.196000	28540.11	2063.68	0.31	14
22	94.60	32.13	-6.44	1621.02	0.202000	29413.78	2126.85	0.31	14
23	94.60	33.42	-4.50	1652.79	0.208000	30287.46	2190.02	0.31	14
24	94.60	34.71	-2.58	1685.48	0.214000	31161.14	2253.20	0.32	14
25	94.60	35.98	-0.68	1719.09	0.220000	32034.81	2316.37	0.32	14
26	94.60	37.24	1.20	1753.70	0.226000	32908.49	2379.54	0.32	14
27	94.60	38.49	3.06	1789.31	0.232000	33782.16	2442.72	0.32	14
28	94.60	39.74	4.93	1826.50	0.237999	34655.84	2505.89	0.33	14
29	94.60	40.97	6.77	1864.81	0.243999	35529.52	2569.06	0.33	14
30	94.60	42.20	8.61	1904.81	0.249999	36403.19	2632.24	0.33	14
31	94.60	43.41	10.43	1946.05	0.255999	37276.87	2695.41	0.33	14
32	94.60	44.62	12.24	1988.58	0.261999	38150.55	2758.59	0.34	14
33	94.60	45.82	14.05	2033.57	0.267999	39024.23	2821.76	0.34	14
34	94.60	47.01	15.83	2079.41	0.273999	39897.90	2884.93	0.34	14
35	94.60	48.19	17.61	2127.34	0.279999	40771.58	2948.11	0.34	14
36	94.60	49.37	19.38	2177.43	0.285999	41645.25	3011.28	0.35	14
37	94.60	50.53	21.15	2229.80	0.291999	42518.93	3074.45	0.35	14
38	94.60	51.69	22.90	2284.58	0.297999	43392.61	3137.63	0.35	14
39	94.60	52.84	24.64	2341.26	0.303999	44266.28	3200.80	0.36	14
40	94.60	53.98	26.39	2401.17	0.309999	45139.96	3263.98	0.36	14
41	94.60	55.12	28.11	2463.29	0.315999	46013.63	3327.15	0.36	14
42	94.60	56.25	29.83	2529.01	0.321999	46887.30	3390.32	0.36	14
43	94.60	57.37	31.55	2597.88	0.327999	47760.98	3453.50	0.37	14
44	94.60	58.48	33.26	2670.10	0.333999	48634.66	3516.67	0.37	14
45	94.60	59.59	34.96	2746.58	0.339999	49508.34	3579.84	0.37	14

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 16608.746 ALBEDO = 392.166

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	10.63	-38.78	1227.96	0.070000	16608.75	392.17	0.28	15
1	94.60	12.92	-35.30	1260.88	0.076000	18032.35	425.78	0.28	15
2	94.60	15.18	-31.88	1294.96	0.082000	19455.95	459.39	0.28	15
3	94.60	17.40	-28.52	1330.29	0.088000	20879.55	493.01	0.29	15
4	94.60	19.60	-25.20	1367.16	0.094000	22303.16	526.62	0.29	15
5	94.60	21.76	-21.95	1405.27	0.100000	23726.77	560.24	0.29	15
6	94.60	23.90	-18.75	1444.92	0.106000	25150.37	593.85	0.30	15
7	94.60	26.01	-15.59	1486.43	0.112000	26573.97	627.46	0.30	14
8	94.60	28.09	-12.47	1529.70	0.118000	27997.57	661.08	0.31	14
9	94.60	30.15	-9.40	1575.06	0.124000	29421.18	694.69	0.31	14
10	94.60	32.18	-6.37	1622.18	0.130000	30844.79	728.31	0.31	14
11	94.60	34.18	-3.38	1671.66	0.136000	32268.39	761.92	0.32	14
12	94.60	36.16	-0.42	1723.65	0.142000	33691.99	795.53	0.32	14
13	94.60	38.12	2.52	1778.78	0.148000	35115.59	829.15	0.32	14
14	94.60	40.06	5.40	1836.29	0.154000	36539.19	862.76	0.33	14
15	94.60	41.97	8.27	1897.34	0.160000	37962.79	896.38	0.33	14
16	94.60	43.86	11.10	1961.66	0.166000	39386.39	929.99	0.34	14
17	94.60	45.73	13.91	2030.00	0.172000	40810.00	963.61	0.34	14
18	94.60	47.58	16.68	2102.12	0.178000	42233.60	997.22	0.34	14
19	94.60	49.41	19.45	2179.48	0.184000	43657.21	1030.83	0.35	14
20	94.60	51.22	22.18	2261.85	0.190000	45080.81	1064.45	0.35	14
21	94.60	53.01	24.89	2349.69	0.196000	46504.41	1098.06	0.36	14
22	94.60	54.78	27.60	2444.70	0.202000	47928.01	1131.68	0.36	14
23	94.60	56.53	30.27	2546.21	0.208000	49351.61	1165.29	0.36	14
24	94.60	58.27	32.94	2656.26	0.214000	50775.23	1198.90	0.37	14
25	94.60	59.99	35.59	2775.69	0.220000	52198.83	1232.52	0.37	14
26	94.60	61.69	38.23	2905.43	0.226000	53622.43	1266.13	0.38	14
27	94.60	63.38	40.85	3047.51	0.232000	55046.03	1299.75	0.38	14
28	94.60	65.05	43.47	3203.34	0.237999	56469.64	1333.36	0.39	14
29	94.60	66.70	46.06	3374.69	0.243999	57893.24	1366.98	0.39	13
30	94.60	68.34	48.67	3566.56	0.249999	59316.84	1400.59	0.40	13
31	94.60	69.96	51.26	3779.86	0.255999	60740.45	1434.20	0.40	13
32	94.60	71.57	53.85	4020.19	0.261999	62164.05	1467.82	0.41	13
33	94.60	73.17	56.46	4294.74	0.267999	63587.66	1501.43	0.41	13
34	94.60	74.75	59.04	4607.10	0.273999	65011.26	1535.05	0.42	13
35	94.60	76.31	61.63	4967.70	0.279999	66434.81	1568.66	0.42	13
36	94.60	77.86	64.23	5394.21	0.285999	67858.44	1602.27	0.43	13
37	94.60	79.40	66.83	5899.70	0.291999	69282.06	1635.89	0.43	13
38	94.60	80.93	69.44	6510.37	0.297999	70705.63	1669.50	0.44	13
39	94.60	82.44	72.05	7264.70	0.303999	72129.25	1703.12	0.45	13
40	94.60	83.94	74.68	8221.82	0.309999	73552.88	1736.73	0.45	13
41	94.60	85.43	77.31	9477.11	0.315999	74976.44	1770.34	0.46	13
42	94.60	86.91	79.98	11206.45	0.321999	76400.06	1803.96	0.46	13
43	94.60	88.37	82.66	13719.14	0.327999	77823.69	1837.57	0.47	13
44	94.60	89.82	85.37	17749.24	0.333999	79247.25	1871.19	0.48	13
45	94.60	91.26	88.09	25181.19	0.339999	80670.88	1904.80	0.48	13

46	94.60	60.69	36.66	2826.88	0.345999	50382.00	3643.02	0.37	14
47	94.60	61.78	38.35	2912.06	0.351999	51255.68	3706.19	0.38	14
48	94.60	62.86	40.05	3002.44	0.357999	52129.36	3769.36	0.38	14
49	94.60	63.94	41.73	3098.37	0.363999	53003.04	3832.54	0.38	14
50	94.60	65.01	43.41	3199.48	0.369999	53876.71	3895.71	0.39	14
51	94.60	66.08	45.09	3308.82	0.375999	54750.39	3958.89	0.39	13
52	94.60	67.14	46.75	3423.45	0.381999	55624.07	4022.06	0.39	13
53	94.60	68.19	48.44	3548.50	0.387999	56497.74	4085.23	0.40	13
54	94.60	69.24	50.10	3681.09	0.393999	57371.42	4148.41	0.40	13
55	94.60	70.28	51.76	3823.89	0.399999	58245.09	4211.58	0.40	13
56	94.60	71.31	53.44	3980.32	0.405999	59118.77	4274.75	0.41	13
57	94.60	72.34	55.10	4147.04	0.411999	59992.45	4337.93	0.41	13
58	94.60	73.36	56.77	4330.14	0.417999	60866.12	4401.10	0.41	13
59	94.60	74.37	58.43	4528.93	0.423999	61739.80	4464.27	0.42	13
60	94.60	75.39	60.10	4748.35	0.429999	62613.47	4527.45	0.42	13

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 934.77 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.43000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.006000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.50149

47	94.60	94.11	93.65	172719.44	0.351999	83518.06	1972.03	0.49	13

SOLUTION TERMINATED DUE TO RADIATOR MEAN TEMPERATURE BEING GREATER THAN FLUID INLET TEMPERATURE.

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.32241

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 17675.902 ALBEDO = 0.000

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	11.69	-37.15	1243.15	0.070000	17675.90	0.00	0.28	15
1	94.60	14.06	-33.57	1277.88	0.076000	19190.97	0.00	0.28	15
2	94.60	16.39	-30.04	1314.02	0.082000	20706.04	0.00	0.29	15
3	94.60	18.68	-26.59	1351.49	0.088000	22221.11	0.00	0.29	15
4	94.60	20.95	-23.18	1390.58	0.094000	23736.19	0.00	0.29	15
5	94.60	23.18	-19.82	1431.43	0.100000	25251.27	0.00	0.30	15
6	94.60	25.38	-16.53	1473.93	0.106000	26766.34	0.00	0.30	14
7	94.60	27.55	-13.28	1518.21	0.112000	28281.41	0.00	0.30	14
8	94.60	29.70	-10.06	1565.05	0.118000	29796.48	0.00	0.31	14
9	94.60	31.81	-6.90	1613.70	0.124000	31311.56	0.00	0.31	14
10	94.60	33.90	-3.79	1664.77	0.130000	32826.63	0.00	0.32	14
11	94.60	35.97	-0.71	1718.40	0.136000	34341.71	0.00	0.32	14
12	94.60	38.00	2.34	1775.25	0.142000	35856.78	0.00	0.32	14
13	94.60	40.02	5.34	1835.07	0.148000	37371.85	0.00	0.33	14
14	94.60	42.01	8.32	1898.55	0.154000	38886.93	0.00	0.33	14
15	94.60	43.97	11.26	1965.41	0.160000	40402.00	0.00	0.34	14
16	94.60	45.91	14.18	2036.53	0.166000	41917.07	0.00	0.34	14
17	94.60	47.83	17.07	2112.70	0.172000	43432.15	0.00	0.34	14
18	94.60	49.73	19.94	2193.76	0.178000	44947.21	0.00	0.35	14
19	94.60	51.61	22.77	2280.16	0.184000	46462.30	0.00	0.35	14
20	94.60	53.47	25.59	2373.56	0.190000	47977.37	0.00	0.36	14
21	94.60	55.30	28.39	2473.99	0.196000	49492.43	0.00	0.36	14
22	94.60	57.12	31.17	2582.06	0.202000	51007.52	0.00	0.37	14
23	94.60	58.92	33.94	2700.02	0.208000	52522.59	0.00	0.37	14
24	94.60	60.70	36.68	2828.09	0.214000	54037.66	0.00	0.37	14
25	94.60	62.46	39.42	2968.30	0.220000	55552.73	0.00	0.38	14
26	94.60	64.21	42.15	3122.80	0.226000	57067.80	0.00	0.38	14
27	94.60	65.93	44.85	3292.63	0.232000	58582.88	0.00	0.39	13
28	94.60	67.65	47.58	3483.62	0.237999	60097.96	0.00	0.39	13
29	94.60	69.34	50.28	3695.92	0.243999	61613.03	0.00	0.40	13
30	94.60	71.02	52.97	3934.98	0.249999	63128.10	0.00	0.40	13
31	94.60	72.68	55.65	4205.31	0.255999	64643.17	0.00	0.41	13
32	94.60	74.33	58.35	4518.15	0.261999	66158.19	0.00	0.42	13
33	94.60	75.96	61.05	4882.38	0.267999	67673.31	0.00	0.42	13
34	94.60	77.57	63.75	5309.89	0.273999	69188.38	0.00	0.43	13
35	94.60	79.18	66.44	5816.36	0.279999	70703.44	0.00	0.43	13
36	94.60	80.76	69.15	6437.68	0.285999	72218.50	0.00	0.44	13
37	94.60	82.34	71.87	7206.47	0.291999	73733.56	0.00	0.44	13
38	94.60	83.90	74.60	8190.87	0.297999	75248.69	0.00	0.45	13
39	94.60	85.45	77.35	9495.98	0.303999	76763.75	0.00	0.46	13
40	94.60	86.98	80.13	11318.60	0.309999	78278.81	0.00	0.46	13
41	94.60	88.50	82.90	14001.85	0.315999	79793.88	0.00	0.47	13
42	94.60	90.01	85.72	18443.99	0.321999	81308.94	0.00	0.48	13
43	94.60	91.51	88.55	27103.99	0.327999	82824.00	0.00	0.48	13
44	94.60	92.99	91.44	51815.64	0.333999	84339.13	0.00	0.49	13

SOLUTION OUTSIDE TO/TI RANGE, SOLUTION TERMINATED.

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.31010

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 1918.344 ALBEDO = 1072.563

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-14.85	-78.55	945.93	0.070000	1918.34	1072.56	0.25	15
1	94.60	-14.37	-77.78	950.17	0.076000	2082.77	1164.50	0.25	15
2	94.60	-13.89	-77.01	954.39	0.082000	2247.20	1256.43	0.25	15
3	94.60	-13.42	-76.24	958.73	0.088000	2411.63	1348.36	0.25	15
4	94.60	-12.94	-75.48	963.04	0.094000	2576.06	1440.30	0.25	15
5	94.60	-12.47	-74.72	967.32	0.100000	2740.49	1532.23	0.25	15
6	94.60	-12.00	-73.98	971.57	0.106000	2904.92	1624.17	0.25	15
7	94.60	-11.53	-73.22	975.95	0.112000	3069.35	1716.10	0.25	15
8	94.60	-11.06	-72.48	980.31	0.118000	3233.78	1808.03	0.25	15
9	94.60	-10.60	-71.74	984.65	0.124000	3398.21	1899.97	0.25	15
10	94.60	-10.13	-70.99	989.11	0.130000	3562.64	1991.90	0.25	15
11	94.60	-9.66	-70.25	993.55	0.136000	3727.06	2083.83	0.25	15
12	94.60	-9.20	-69.52	997.98	0.142000	3891.49	2175.77	0.25	15
13	94.60	-8.74	-68.79	1002.38	0.148000	4055.92	2267.70	0.25	15
14	94.60	-8.28	-68.06	1006.92	0.154000	4220.35	2359.64	0.25	15
15	94.60	-7.82	-67.33	1011.44	0.160000	4384.78	2451.57	0.25	15
16	94.60	-7.36	-66.61	1015.95	0.166000	4549.21	2543.50	0.26	15
17	94.60	-6.91	-65.90	1020.43	0.172000	4713.64	2635.44	0.26	15
18	94.60	-6.45	-65.18	1025.06	0.178000	4878.07	2727.37	0.26	15
19	94.60	-6.00	-64.47	1029.67	0.184000	5042.50	2819.30	0.26	15
20	94.60	-5.55	-63.76	1034.27	0.190000	5206.93	2911.24	0.26	15
21	94.60	-5.10	-63.05	1038.86	0.196000	5371.36	3003.17	0.26	15
22	94.60	-4.65	-62.34	1043.59	0.202000	5535.78	3095.10	0.26	15
23	94.60	-4.20	-61.64	1048.30	0.208000	5700.21	3187.04	0.26	15
24	94.60	-3.76	-60.94	1053.01	0.214000	5864.64	3278.97	0.26	15
25	94.60	-3.31	-60.25	1057.70	0.220000	6029.07	3370.91	0.26	15
26	94.60	-2.87	-59.56	1062.38	0.226000	6193.50	3462.84	0.26	15
27	94.60	-2.43	-58.87	1067.23	0.232000	6357.93	3554.77	0.26	15
28	94.60	-1.99	-58.18	1072.04	0.237999	6522.36	3646.71	0.26	15
29	94.60	-1.55	-57.49	1076.87	0.243999	6686.79	3738.64	0.26	15
30	94.60	-1.11	-56.81	1081.67	0.249999	6851.21	3830.57	0.26	15
31	94.60	-0.67	-56.13	1086.63	0.255999	7015.64	3922.51	0.26	15
32	94.60	-0.23	-55.45	1091.59	0.261999	7180.07	4014.44	0.26	15
33	94.60	0.20	-54.78	1096.38	0.267999	7344.50	4106.38	0.26	15
34	94.60	0.64	-54.10	1101.49	0.273999	7508.93	4198.31	0.26	15
35	94.60	1.07	-53.43	1106.42	0.279999	7673.36	4290.24	0.27	15
36	94.60	1.50	-52.77	1111.34	0.285999	7837.79	4382.18	0.27	15
37	94.60	1.93	-52.10	1116.45	0.291999	8002.22	4474.11	0.27	15
38	94.60	2.36	-51.44	1121.54	0.297999	8166.65	4566.04	0.27	15
39	94.60	2.78	-50.78	1126.62	0.303999	8331.08	4657.98	0.27	15
40	94.60	3.21	-50.13	1131.70	0.309999	8495.51	4749.91	0.27	15
41	94.60	3.64	-49.47	1136.78	0.315999	8659.94	4841.84	0.27	15
42	94.60	4.06	-48.82	1142.02	0.321999	8824.36	4933.78	0.27	15
43	94.60	4.48	-48.16	1147.27	0.327999	8988.79	5025.71	0.27	15
44	94.60	4.91	-47.52	1152.51	0.333999	9153.22	5117.64	0.27	15
45	94.60	5.33	-46.87	1157.76	0.339999	9317.65	5209.58	0.27	15

46	94.60	5.74	-46.23	1163.00	0.345999	9482.08	5301.51	0.27	15
47	94.60	6.16	-45.58	1168.41	0.351999	9646.51	5393.45	0.27	15
48	94.60	6.58	-44.95	1173.65	0.357999	9810.94	5485.38	0.27	15
49	94.60	7.00	-44.31	1179.06	0.363999	9975.37	5577.31	0.27	15
50	94.60	7.41	-43.68	1184.48	0.369999	10139.80	5669.25	0.27	15
51	94.60	7.82	-43.05	1189.90	0.375999	10304.22	5761.18	0.27	15
52	94.60	8.24	-42.42	1195.32	0.381999	10468.65	5853.12	0.28	15
53	94.60	8.65	-41.78	1200.91	0.387999	10633.09	5945.05	0.28	15
54	94.60	9.06	-41.15	1206.52	0.393999	10797.51	6036.98	0.28	15
55	94.60	9.47	-40.54	1211.95	0.399999	10961.94	6128.92	0.28	15
56	94.60	9.88	-39.92	1217.55	0.405999	11126.37	6220.85	0.28	15
57	94.60	10.29	-39.29	1223.34	0.411999	11290.80	6312.79	0.28	15
58	94.60	10.69	-38.67	1228.96	0.417999	11455.23	6404.72	0.28	15
59	94.60	11.10	-38.06	1234.58	0.423999	11619.66	6496.65	0.28	15
60	94.60	11.50	-37.44	1240.39	0.429999	11784.08	6588.59	0.28	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 318.82 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.43000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.006000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 1.00000

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 5818.160 ALBEDO = 943.200

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-7.96	-67.55	1010.05	0.070000	5818.16	943.20	0.25	15
1	94.60	-6.92	-65.91	1020.43	0.076000	6316.86	1024.05	0.26	15
2	94.60	-5.90	-64.30	1030.71	0.082000	6815.56	1104.89	0.26	15
3	94.60	-4.88	-62.70	1041.25	0.088000	7314.25	1185.74	0.26	15
4	94.60	-3.87	-61.13	1051.72	0.094000	7812.95	1266.58	0.26	15
5	94.60	-2.87	-59.55	1062.45	0.100000	8311.65	1347.43	0.26	15
6	94.60	-1.87	-58.00	1073.28	0.106000	8810.35	1428.27	0.26	15
7	94.60	-0.87	-56.44	1084.40	0.112000	9309.05	1509.12	0.26	15
8	94.60	0.11	-54.91	1095.48	0.118000	9807.75	1589.96	0.26	15
9	94.60	1.09	-53.40	1106.69	0.124000	10306.45	1670.81	0.27	15
10	94.60	2.06	-51.90	1118.04	0.130000	10805.14	1751.66	0.27	15
11	94.60	3.03	-50.40	1129.54	0.136000	11303.84	1832.50	0.27	15
12	94.60	3.99	-48.92	1141.18	0.142000	11802.54	1913.35	0.27	15
13	94.60	4.94	-47.46	1152.99	0.148000	12301.23	1994.19	0.27	15
14	94.60	5.89	-46.00	1164.97	0.154000	12799.93	2075.04	0.27	15
15	94.60	6.84	-44.56	1176.94	0.160000	13298.63	2155.88	0.27	15
16	94.60	7.78	-43.12	1189.28	0.166000	13797.33	2236.73	0.27	15
17	94.60	8.71	-41.70	1201.62	0.172000	14296.02	2317.57	0.28	15
18	94.60	9.63	-40.28	1214.33	0.178000	14794.72	2398.42	0.28	15
19	94.60	10.55	-38.88	1227.06	0.184000	15293.42	2479.26	0.28	15
20	94.60	11.47	-37.49	1239.98	0.190000	15792.13	2560.11	0.28	15
21	94.60	12.38	-36.10	1253.14	0.196000	16290.82	2640.96	0.28	15
22	94.60	13.29	-34.74	1266.32	0.202000	16789.52	2721.80	0.28	15
23	94.60	14.18	-33.37	1279.90	0.208000	17288.22	2802.65	0.28	15
24	94.60	15.08	-32.02	1293.54	0.214000	17786.92	2883.49	0.28	15
25	94.60	15.97	-30.68	1307.40	0.220000	18285.61	2964.34	0.29	15
26	94.60	16.85	-29.34	1321.51	0.226000	18784.31	3045.18	0.29	15
27	94.60	17.73	-28.01	1335.88	0.232000	19283.01	3126.03	0.29	15
28	94.60	18.61	-26.70	1350.28	0.237999	19781.71	3206.88	0.29	15
29	94.60	19.48	-25.39	1364.97	0.243999	20280.40	3287.72	0.29	15
30	94.60	20.34	-24.08	1380.13	0.249999	20779.11	3368.57	0.29	15
31	94.60	21.21	-22.79	1395.14	0.255999	21277.80	3449.41	0.29	15
32	94.60	22.06	-21.51	1410.64	0.261999	21776.50	3530.26	0.30	15
33	94.60	22.91	-20.22	1426.44	0.267999	22275.20	3611.10	0.30	15
34	94.60	23.76	-18.96	1442.33	0.273999	22773.90	3691.95	0.30	15
35	94.60	24.60	-17.69	1458.52	0.279999	23272.60	3772.79	0.30	15
36	94.60	25.44	-16.43	1475.22	0.285999	23771.29	3853.64	0.30	14
37	94.60	26.28	-15.18	1492.04	0.291999	24269.99	3934.48	0.30	14
38	94.60	27.11	-13.95	1508.97	0.297999	24768.69	4015.33	0.30	14
39	94.60	27.93	-12.71	1526.45	0.303999	25267.39	4096.17	0.31	14
40	94.60	28.75	-11.48	1544.04	0.309999	25766.08	4177.02	0.31	14
41	94.60	29.57	-10.25	1562.21	0.315999	26264.79	4257.86	0.31	14
42	94.60	30.38	-9.04	1580.50	0.321999	26763.48	4338.71	0.31	14
43	94.60	31.19	-7.84	1598.94	0.327999	27262.19	4419.55	0.31	14
44	94.60	32.00	-6.63	1617.97	0.333999	27760.88	4500.40	0.31	14
45	94.60	32.80	-5.44	1637.17	0.339999	28259.58	4581.25	0.31	14

46	94.60	33.60	-4.25	1656.99	0.345999	28758.28	4662.09	0.32	14
47	94.60	34.39	-3.07	1676.97	0.351999	29256.98	4742.94	0.32	14
48	94.60	35.18	-1.88	1697.59	0.357999	29755.67	4823.79	0.32	14
49	94.60	35.97	-0.71	1718.40	0.363999	30254.37	4904.63	0.32	14
50	94.60	36.75	0.46	1739.88	0.369999	30753.07	4985.48	0.32	14
51	94.60	37.53	1.62	1761.57	0.375999	31251.77	5066.32	0.32	14
52	94.60	38.30	2.78	1783.94	0.381999	31750.46	5147.17	0.32	14
53	94.60	39.07	3.93	1806.56	0.387999	32249.17	5228.01	0.33	14
54	94.60	39.84	5.09	1829.87	0.393999	32747.87	5308.86	0.33	14
55	94.60	40.60	6.23	1853.45	0.399999	33246.57	5389.70	0.33	14
56	94.60	41.37	7.37	1877.77	0.405999	33745.26	5470.55	0.33	14
57	94.60	42.12	8.50	1902.35	0.411999	34243.96	5551.39	0.33	14
58	94.60	42.88	9.63	1927.74	0.417999	34742.66	5632.24	0.33	14
59	94.60	43.63	10.75	1953.40	0.423999	35241.36	5713.09	0.33	14
60	94.60	44.37	11.87	1979.88	0.429999	35740.05	5793.93	0.34	14

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 452.89 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.43000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.006000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.81913

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 50.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 10418.582 ALBEDO = 700.074

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EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-0.36	-55.65	1090.07	0.070000	10418.58	700.07	0.26	15
1	94.60	1.25	-53.15	1108.57	0.076000	11311.60	760.08	0.27	15
2	94.60	2.84	-50.69	1127.32	0.082000	12204.62	820.09	0.27	15
3	94.60	4.42	-48.26	1146.54	0.088000	13097.64	880.09	0.27	15
4	94.60	5.99	-45.86	1166.08	0.094000	13990.66	940.10	0.27	15
5	94.60	7.53	-43.49	1186.13	0.100000	14883.68	1000.10	0.27	15
6	94.60	9.06	-41.15	1206.57	0.106000	15776.70	1060.11	0.28	15
7	94.60	10.58	-38.84	1227.39	0.112000	16669.71	1120.12	0.28	15
8	94.60	12.08	-36.55	1248.84	0.118000	17562.74	1180.12	0.28	15
9	94.60	13.57	-34.31	1270.54	0.124000	18455.76	1240.13	0.28	15
10	94.60	15.05	-32.06	1293.11	0.130000	19348.78	1300.14	0.28	15
11	94.60	16.51	-29.86	1315.98	0.136000	20241.79	1360.14	0.29	15
12	94.60	17.96	-27.68	1339.40	0.142000	21134.82	1420.15	0.29	15
13	94.60	19.39	-25.52	1363.55	0.148000	22027.83	1480.15	0.29	15
14	94.60	20.81	-23.38	1388.29	0.154000	22920.86	1540.16	0.29	15
15	94.60	22.22	-21.26	1413.67	0.160000	23813.87	1600.17	0.30	15
16	94.60	23.62	-19.17	1439.66	0.166000	24706.89	1660.17	0.30	15
17	94.60	25.00	-17.10	1466.33	0.172000	25599.91	1720.18	0.30	15
18	94.60	26.38	-15.04	1493.90	0.178000	26492.93	1780.18	0.30	14
19	94.60	27.74	-13.00	1522.21	0.184000	27385.95	1840.19	0.30	14
20	94.60	29.09	-10.98	1551.29	0.190000	28278.97	1900.20	0.31	14
21	94.60	30.43	-8.99	1581.16	0.196000	29171.98	1960.20	0.31	14
22	94.60	31.75	-6.99	1612.29	0.202000	30065.01	2020.21	0.31	14
23	94.60	33.07	-5.04	1643.85	0.208000	30958.02	2080.22	0.31	14
24	94.60	34.38	-3.08	1676.77	0.214000	31851.05	2140.22	0.32	14
25	94.60	35.67	-1.15	1710.63	0.220000	32744.06	2200.23	0.32	14
26	94.60	36.96	0.78	1745.97	0.226000	33637.09	2260.23	0.32	14
27	94.60	38.24	2.68	1781.85	0.232000	34530.10	2320.24	0.32	14
28	94.60	39.51	4.57	1819.29	0.237999	35423.13	2380.25	0.33	14
29	94.60	40.76	6.46	1858.40	0.243999	36316.14	2440.25	0.33	14
30	94.60	42.01	8.33	1898.69	0.249999	37209.17	2500.26	0.33	14
31	94.60	43.25	10.18	1940.21	0.255999	38102.18	2560.27	0.33	14
32	94.60	44.48	12.03	1983.59	0.261999	38995.20	2620.27	0.34	14
33	94.60	45.70	13.87	2028.89	0.267999	39888.23	2680.28	0.34	14
34	94.60	46.91	15.69	2075.64	0.273999	40781.24	2740.28	0.34	14
35	94.60	48.12	17.50	2124.49	0.279999	41674.26	2800.29	0.34	14
36	94.60	49.31	19.30	2174.99	0.285999	42567.28	2860.30	0.35	14
37	94.60	50.50	21.10	2228.37	0.291999	43460.30	2920.30	0.35	14
38	94.60	51.68	22.87	2283.55	0.297999	44353.32	2980.31	0.35	14
39	94.60	52.85	24.65	2341.33	0.303999	45246.34	3040.31	0.36	14
40	94.60	54.01	26.42	2402.39	0.309999	46139.36	3100.32	0.36	14
41	94.60	55.16	28.17	2465.69	0.315999	47032.38	3160.33	0.36	14
42	94.60	56.31	29.93	2532.67	0.321999	47925.40	3220.33	0.36	14
43	94.60	57.45	31.67	2602.90	0.327999	48818.41	3280.34	0.37	14
44	94.60	58.58	33.42	2677.22	0.333999	49711.44	3340.35	0.37	14
45	94.60	59.70	35.15	2755.25	0.339999	50604.45	3400.35	0.37	14

46	94.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
47	94.60	61.93	38.60	2924.84	0.351999	52390.49	3520.36	0.38	14
48	94.60	63.03	40.31	3017.07	0.357999	53283.52	3580.37	0.38	14
49	94.60	64.13	42.02	3114.99	0.363999	54176.53	3640.38	0.38	14
50	94.60	65.22	43.73	3220.03	0.369999	55069.55	3700.38	0.39	14
51	94.60	66.30	45.44	3331.80	0.375999	55962.57	3760.39	0.39	13
52	94.60	67.38	47.14	3451.81	0.381999	56855.59	3820.40	0.39	13
53	94.60	68.45	48.83	3578.86	0.387999	57748.61	3880.40	0.40	13
54	94.60	69.51	50.54	3717.76	0.393999	58641.63	3940.41	0.40	13
55	94.60	70.56	52.24	3867.49	0.399999	59534.65	4000.41	0.40	13
56	94.60	71.61	53.92	4026.88	0.405999	60427.67	4060.42	0.41	13
57	94.60	72.66	55.62	4201.83	0.411999	61320.70	4120.43	0.41	13
58	94.60	73.69	57.32	4394.12	0.417999	62213.71	4180.43	0.41	13
59	94.60	74.73	59.01	4603.36	0.423999	63106.73	4240.44	0.42	13
60	94.60	75.75	60.70	4831.36	0.429999	63999.75	4300.44	0.42	13

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 949.46 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.43000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.006000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.49812

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 16608.746 ALBEDO = 372.502

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	9.29	-40.80	1209.59	0.070000	16608.75	372.50	0.28	15
1	94.60	11.60	-37.29	1241.84	0.076000	18032.35	404.43	0.28	15
2	94.60	13.88	-33.84	1275.20	0.082000	19455.95	436.36	0.28	15
3	94.60	16.12	-30.45	1309.74	0.088000	20879.55	468.29	0.29	15
4	94.60	18.33	-27.12	1345.57	0.094000	22303.16	500.22	0.29	15
5	94.60	20.51	-23.83	1382.98	0.100000	23726.77	532.15	0.29	15
6	94.60	22.66	-20.60	1421.68	0.106000	25150.37	564.07	0.30	15
7	94.60	24.78	-17.42	1462.14	0.112000	26573.97	596.00	0.30	15
8	94.60	26.88	-14.28	1504.33	0.118000	27997.57	627.93	0.30	14
9	94.60	28.95	-11.19	1548.31	0.124000	29421.18	659.86	0.31	14
10	94.60	30.99	-8.13	1594.44	0.130000	30844.79	691.79	0.31	14
11	94.60	33.01	-5.13	1642.35	0.136000	32268.39	723.72	0.31	14
12	94.60	35.00	-2.16	1692.71	0.142000	33691.99	755.65	0.32	14
13	94.60	36.97	0.79	1746.10	0.148000	35115.59	787.57	0.32	14
14	94.60	38.92	3.70	1801.75	0.154000	36539.19	819.50	0.33	14
15	94.60	40.84	6.58	1860.82	0.160000	37962.79	851.43	0.33	14
16	94.60	42.74	9.42	1923.01	0.166000	39386.39	883.36	0.33	14
17	94.60	44.62	12.24	1988.55	0.172000	40810.00	915.29	0.34	14
18	94.60	46.48	15.04	2058.77	0.178000	42233.60	947.22	0.34	14
19	94.60	48.32	17.81	2132.92	0.184000	43657.21	979.15	0.34	14
20	94.60	50.14	20.55	2211.85	0.190000	45080.81	1011.07	0.35	14
21	94.60	51.94	23.28	2296.54	0.196000	46504.41	1043.00	0.35	14
22	94.60	53.72	25.98	2386.87	0.202000	47928.01	1074.93	0.36	14
23	94.60	55.48	28.66	2483.97	0.208000	49351.61	1106.86	0.36	14
24	94.60	57.23	31.34	2589.16	0.214000	50775.23	1138.79	0.37	14
25	94.60	58.96	33.99	2702.48	0.220000	52198.83	1170.72	0.37	14
26	94.60	60.67	36.63	2825.50	0.226000	53622.43	1202.65	0.37	14
27	94.60	62.36	39.25	2959.32	0.232000	55046.03	1234.58	0.38	14
28	94.60	64.04	41.88	3106.73	0.237999	56469.64	1266.50	0.38	14
29	94.60	65.70	44.50	3269.45	0.243999	57893.24	1298.43	0.39	13
30	94.60	67.34	47.10	3448.69	0.249999	59316.84	1330.36	0.39	13
31	94.60	68.98	49.69	3647.41	0.255999	60740.45	1362.29	0.40	13
32	94.60	70.59	52.28	3870.82	0.261999	62164.05	1394.22	0.40	13
33	94.60	72.19	54.87	4123.01	0.267999	63587.66	1426.15	0.41	13
34	94.60	73.78	57.45	4408.88	0.273999	65011.26	1458.08	0.41	13
35	94.60	75.35	60.04	4740.57	0.279999	66434.81	1490.00	0.42	13
36	94.60	76.91	62.63	5124.63	0.285999	67858.44	1521.93	0.42	13
37	94.60	78.45	65.23	5576.92	0.291999	69282.06	1553.86	0.43	13
38	94.60	79.99	67.81	6114.88	0.297999	70705.63	1585.79	0.44	13
39	94.60	81.51	70.43	6777.47	0.303999	72129.25	1617.72	0.44	13
40	94.60	83.01	73.05	7602.11	0.309999	73552.88	1649.65	0.45	13
41	94.60	84.50	75.68	8658.36	0.315999	74976.44	1681.58	0.45	13
42	94.60	85.99	78.33	10070.00	0.321999	76400.06	1713.51	0.46	13
43	94.60	87.46	80.99	12037.61	0.327999	77823.69	1745.43	0.47	13
44	94.60	88.92	83.67	14987.37	0.333999	79247.25	1777.36	0.47	13
45	94.60	90.36	86.37	19917.69	0.339999	80670.88	1809.29	0.48	13

46	94.60	91.80	89.11	29850.78	0.345999	82094.50	1841.22	0.49	13
47	94.60	93.22	91.88	60250.84	0.351999	83518.06	1873.15	0.49	13

SOLUTION TERMINATED DUE TO RADIATOR MEAN TEMPERATURE BEING GREATER THAN FLUID INLET TEMPERATURE.

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.32615

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 17675.902 ALBEDO = 0.000

EFFECT OF DEGRACATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	10.40	-39.11	1224.96	0.070000	17675.90	0.00	0.28	15
1	94.60	12.79	-35.49	1259.02	0.076000	19190.97	0.00	0.28	15
2	94.60	15.13	-31.93	1294.43	0.082000	20706.04	0.00	0.28	15
3	94.60	17.45	-28.44	1331.12	0.088000	22221.11	0.00	0.29	15
4	94.60	19.73	-25.01	1369.37	0.094000	23736.19	0.00	0.29	15
5	94.60	21.98	-21.63	1409.10	0.100000	25251.27	0.00	0.30	15
6	94.60	24.20	-18.30	1450.63	0.106000	26766.34	0.00	0.30	15
7	94.60	26.39	-15.02	1494.09	0.112000	28281.41	0.00	0.30	14
8	94.60	28.55	-11.79	1539.58	0.118000	29796.48	0.00	0.31	14
9	94.60	30.68	-8.61	1586.84	0.124000	31311.56	0.00	0.31	14
10	94.60	32.78	-5.47	1636.86	0.130000	32826.63	0.00	0.31	14
11	94.60	34.86	-2.36	1689.38	0.136000	34341.71	0.00	0.32	14
12	94.60	36.91	0.69	1744.06	0.142000	35856.78	0.00	0.32	14
13	94.60	38.93	3.73	1802.56	0.148000	37371.85	0.00	0.33	14
14	94.60	40.93	6.71	1863.59	0.154000	38886.93	0.00	0.33	14
15	94.60	42.91	9.68	1928.93	0.160000	40402.00	0.00	0.33	14
16	94.60	44.87	12.61	1997.81	0.166000	41917.07	0.00	0.34	14
17	94.60	46.80	15.51	2071.02	0.172000	43432.15	0.00	0.34	14
18	94.60	48.71	18.40	2149.50	0.178000	44947.21	0.00	0.35	14
19	94.60	50.60	21.25	2233.08	0.184000	46462.30	0.00	0.35	14
20	94.60	52.47	24.07	2322.17	0.190000	47977.37	0.00	0.35	14
21	94.60	54.31	26.89	2419.19	0.196000	49492.43	0.00	0.36	14
22	94.60	56.14	29.68	2522.81	0.202000	51007.52	0.00	0.36	14
23	94.60	57.95	32.45	2635.21	0.208000	52522.59	0.00	0.37	14
24	94.60	59.74	35.21	2757.85	0.214000	54037.66	0.00	0.37	14
25	94.60	61.51	37.95	2891.18	0.220000	55552.73	0.00	0.38	14
26	94.60	63.27	40.67	3037.21	0.226000	57067.80	0.00	0.38	14
27	94.60	65.01	43.40	3199.20	0.232000	58582.88	0.00	0.39	14
28	94.60	66.73	46.10	3377.48	0.237999	60097.96	0.00	0.39	13
29	94.60	68.43	48.82	3578.15	0.243999	61613.03	0.00	0.40	13
30	94.60	70.11	51.51	3801.60	0.249999	63128.10	0.00	0.40	13
31	94.60	71.78	54.21	4055.97	0.255999	64643.17	0.00	0.41	13
32	94.60	73.44	56.90	4344.55	0.261999	66158.19	0.00	0.41	13
33	94.60	75.08	59.59	4679.22	0.267999	67673.31	0.00	0.42	13
34	94.60	76.70	62.29	5070.20	0.273999	69188.38	0.00	0.42	13
35	94.60	78.31	64.98	5530.94	0.279999	70703.44	0.00	0.43	13
36	94.60	79.91	67.69	6088.11	0.285999	72218.50	0.00	0.44	13
37	94.60	81.49	70.41	6771.39	0.291999	73733.56	0.00	0.44	13
38	94.60	83.06	73.13	7630.26	0.297999	75248.69	0.00	0.45	13
39	94.60	84.61	75.86	8743.70	0.303999	76763.75	0.00	0.45	13
40	94.60	86.16	78.62	10252.87	0.309999	78278.81	0.00	0.46	13
41	94.60	87.68	81.40	12410.92	0.315999	79793.88	0.00	0.47	13
42	94.60	89.20	84.19	15741.69	0.321999	81308.94	0.00	0.47	13
43	94.60	90.70	87.02	21610.86	0.327999	82824.00	0.00	0.48	13
44	94.60	92.19	89.88	34711.56	0.333999	84339.13	0.00	0.49	13
45	94.60	93.67	92.77	89626.25	0.339999	85854.19	0.00	0.49	13

SOLUTION TERMINATED DUE TO RADIATOR MEAN TEMPERATURE BEING GREATER THAN FLUID INLET TEMPERATURE.

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.31333

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2 5 K W   P O W E R   M O D U L E   P R O G R A M .

ALTITUDE (N.MI.), LOWEST =   235  HIGHEST =   270  INCREMENT =    35

ORBIT INCLINATION (DEG.), LOWEST =    10  HIGHEST =    90  INCREMENT =    20

DISSIPATION (KW.), LOWEST =    12  HIGHEST =    12  INCREMENT =     1

MONTHS DEGRADATION FOR PLATE RADIATOR =    60  INCREMENT =     1

SHADING COEFFICIENTS
PLATE, SOLAR =   0.900000  EARTHSHINE =   0.900000  ALBEDO =   0.900000

PLATE, SHAPE FACTOR TO SPACE =   0.910000  FLUID CP =     0.2500  BTU/LBM-R.

RADIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE =    0.07000  EMITTANCE =    0.76000  MONTHLY CHANGE IN ABSORPTANCE =   0.009000
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FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 1901.293 ALBEDO = 1129.185

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-13.26	-75.98	960.16	0.070000	1901.29	1129.18	0.25	15
1	94.60	-12.54	-74.83	966.71	0.079000	2145.74	1274.36	0.25	15
2	94.60	-11.82	-73.69	973.20	0.088000	2390.19	1419.54	0.25	15
3	94.60	-11.11	-72.54	979.93	0.097000	2634.64	1564.72	0.25	15
4	94.60	-10.40	-71.41	986.61	0.106000	2879.09	1709.90	0.25	15
5	94.60	-9.69	-70.30	993.23	0.115000	3123.55	1855.08	0.25	15
6	94.60	-8.99	-69.19	999.97	0.124000	3368.00	2000.26	0.25	15
7	94.60	-8.29	-68.08	1006.82	0.133000	3612.45	2145.44	0.25	15
8	94.60	-7.59	-66.98	1013.62	0.142000	3856.90	2290.63	0.25	15
9	94.60	-6.90	-65.89	1020.55	0.150999	4101.35	2435.80	0.26	15
10	94.60	-6.21	-64.79	1027.58	0.159999	4345.80	2580.99	0.26	15
11	94.60	-5.52	-63.71	1034.58	0.168999	4590.25	2726.17	0.26	15
12	94.60	-4.84	-62.65	1041.56	0.177999	4834.70	2871.34	0.26	15
13	94.60	-4.16	-61.58	1048.66	0.186999	5079.15	3016.53	0.26	15
14	94.60	-3.48	-60.51	1055.90	0.195999	5323.60	3161.71	0.26	15
15	94.60	-2.81	-59.46	1063.10	0.204999	5568.05	3306.89	0.26	15
16	94.60	-2.14	-58.41	1070.46	0.213999	5812.50	3452.07	0.26	15
17	94.60	-1.47	-57.37	1077.78	0.222999	6056.95	3597.25	0.26	15
18	94.60	-0.80	-56.34	1085.09	0.231999	6301.40	3742.43	0.26	15
19	94.60	-0.14	-55.31	1092.54	0.240999	6545.85	3887.61	0.26	15
20	94.60	0.52	-54.28	1100.15	0.249999	6790.30	4032.79	0.26	15
21	94.60	1.18	-53.26	1107.73	0.258999	7034.75	4177.96	0.27	15
22	94.60	1.83	-52.25	1115.32	0.267999	7279.20	4323.14	0.27	15
23	94.60	2.48	-51.24	1123.05	0.276999	7523.65	4468.32	0.27	15
24	94.60	3.13	-50.24	1130.77	0.285999	7768.11	4613.50	0.27	15
25	94.60	3.78	-49.25	1138.66	0.294999	8012.55	4758.68	0.27	15
26	94.60	4.42	-48.26	1146.54	0.303999	8257.00	4903.86	0.27	15
27	94.60	5.06	-47.28	1154.42	0.312998	8501.46	5049.04	0.27	15
28	94.60	5.70	-46.29	1162.47	0.321998	8745.91	5194.22	0.27	15
29	94.60	6.34	-45.32	1170.52	0.330998	8990.36	5339.41	0.27	15
30	94.60	6.97	-44.35	1178.75	0.339998	9234.81	5484.59	0.27	15
31	94.60	7.60	-43.39	1186.97	0.348998	9479.26	5629.77	0.27	15
32	94.60	8.23	-42.43	1195.20	0.357998	9723.71	5774.95	0.28	15
33	94.60	8.86	-41.48	1203.61	0.366998	9968.16	5920.13	0.28	15
34	94.60	9.48	-40.52	1212.21	0.375998	10212.61	6065.30	0.28	15
35	94.60	10.10	-39.58	1220.63	0.384998	10457.06	6210.48	0.28	15
36	94.60	10.72	-38.64	1229.25	0.393998	10701.50	6355.66	0.28	15
37	94.60	11.33	-37.71	1237.87	0.402998	10945.96	6500.84	0.28	15
38	94.60	11.94	-36.77	1246.70	0.411998	11190.41	6646.03	0.28	15
39	94.60	12.55	-35.85	1255.53	0.420998	11434.86	6791.21	0.28	15
40	94.60	13.16	-34.92	1264.57	0.429998	11679.31	6936.39	0.28	15
41	94.60	13.77	-34.00	1273.62	0.438998	11923.76	7081.57	0.28	15
42	94.60	14.37	-33.09	1282.69	0.447998	12168.21	7226.75	0.28	15
43	94.60	14.97	-32.19	1291.79	0.456998	12412.66	7371.93	0.28	15
44	94.60	15.57	-31.27	1301.28	0.465998	12657.11	7517.11	0.29	15
45	94.60	16.17	-30.37	1310.59	0.474997	12901.56	7662.29	0.29	15

46	94.60	16.77	-29.47	1320.13	0.483997	13146.01	7807.46	0.29	15
47	94.60	17.36	-28.58	1329.70	0.492997	13390.46	7952.64	0.29	15
48	94.60	17.95	-27.69	1339.29	0.501997	13634.91	8097.83	0.29	15
49	94.60	18.54	-26.80	1349.10	0.510997	13879.36	8243.01	0.29	15
50	94.60	19.12	-25.92	1358.94	0.519997	14123.82	8388.19	0.29	15
51	94.60	19.70	-25.04	1369.02	0.528997	14368.26	8533.37	0.29	15
52	94.60	20.29	-24.17	1378.91	0.537997	14612.71	8678.55	0.29	15
53	94.60	20.86	-23.30	1389.25	0.546997	14857.17	8823.73	0.29	15
54	94.60	21.44	-22.44	1399.43	0.555997	15101.61	8968.91	0.29	15
55	94.60	22.02	-21.57	1409.84	0.564997	15346.07	9114.09	0.30	15
56	94.60	22.59	-20.70	1420.49	0.573997	15590.52	9259.27	0.30	15
57	94.60	23.16	-19.85	1430.98	0.582997	15834.96	9404.45	0.30	15
58	94.60	23.73	-19.00	1441.71	0.591997	16079.41	9549.63	0.30	15
59	94.60	24.30	-18.15	1452.70	0.600997	16323.87	9694.81	0.30	15
60	94.60	24.86	-17.29	1463.93	0.609997	16568.31	9839.99	0.30	14

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 359.13 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.61000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.009000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 1.00000

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 5769.063 ALBEDO = 992.988

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-6.50	-65.25	1024.68	0.070000	5769.06	992.99	0.26	15
1	94.60	-4.97	-62.85	1040.21	0.079000	6510.79	1120.66	0.26	15
2	94.60	-3.46	-60.47	1056.21	0.088000	7252.53	1248.33	0.26	15
3	94.60	-1.95	-58.13	1072.41	0.097000	7994.26	1376.00	0.26	15
4	94.60	-0.47	-55.82	1088.84	0.106000	8735.99	1503.66	0.26	15
5	94.60	1.00	-53.53	1105.67	0.115000	9477.72	1631.33	0.27	15
6	94.60	2.46	-51.28	1122.78	0.124000	10219.45	1759.00	0.27	15
7	94.60	3.91	-49.05	1140.18	0.133000	10961.19	1886.67	0.27	15
8	94.60	5.34	-46.85	1157.90	0.142000	11702.91	2014.34	0.27	15
9	94.60	6.76	-44.68	1175.94	0.150999	12444.65	2142.01	0.27	15
10	94.60	8.16	-42.53	1194.36	0.159999	13186.39	2269.68	0.27	15
11	94.60	9.55	-40.41	1213.15	0.168999	13928.12	2397.35	0.28	15
12	94.60	10.93	-38.31	1232.34	0.177999	14669.85	2525.02	0.28	15
13	94.60	12.30	-36.23	1251.96	0.186999	15411.58	2652.69	0.28	15
14	94.60	13.66	-34.17	1272.00	0.195999	16153.31	2780.36	0.28	15
15	94.60	15.00	-32.14	1292.34	0.204999	16895.05	2908.03	0.28	15
16	94.60	16.34	-30.12	1313.16	0.213999	17636.78	3035.70	0.29	15
17	94.60	17.66	-28.13	1334.47	0.222999	18378.51	3163.36	0.29	15
18	94.60	18.97	-26.15	1356.32	0.231999	19120.24	3291.03	0.29	15
19	94.60	20.27	-24.20	1378.70	0.240999	19861.97	3418.70	0.29	15
20	94.60	21.56	-22.25	1401.66	0.249999	20603.71	3546.37	0.29	15
21	94.60	22.84	-20.34	1425.00	0.258999	21345.44	3674.04	0.30	15
22	94.60	24.11	-18.43	1448.96	0.267999	22087.17	3801.71	0.30	15
23	94.60	25.37	-16.54	1473.76	0.276999	22828.90	3929.38	0.30	14
24	94.60	26.62	-14.68	1498.81	0.285999	23570.64	4057.05	0.30	14
25	94.60	27.86	-12.81	1524.95	0.294999	24312.37	4184.71	0.30	14
26	94.60	29.09	-10.98	1551.39	0.303999	25054.10	4312.39	0.31	14
27	94.60	30.31	-9.16	1578.54	0.312998	25795.83	4440.05	0.31	14
28	94.60	31.53	-7.33	1606.91	0.321998	26537.56	4567.72	0.31	14
29	94.60	32.73	-5.54	1635.63	0.330998	27279.30	4695.39	0.31	14
30	94.60	33.93	-3.76	1665.16	0.339998	28021.03	4823.06	0.32	14
31	94.60	35.11	-1.98	1696.01	0.348998	28762.76	4950.73	0.32	14
32	94.60	36.29	-0.23	1727.27	0.357998	29504.49	5078.40	0.32	14
33	94.60	37.46	1.53	1759.95	0.366998	30246.22	5206.07	0.32	14
34	94.60	38.62	3.26	1793.08	0.375998	30987.96	5333.74	0.32	14
35	94.60	39.78	4.99	1827.70	0.384998	31729.69	5461.41	0.33	14
36	94.60	40.92	6.70	1863.37	0.393998	32471.42	5589.08	0.33	14
37	94.60	42.06	8.40	1900.12	0.402998	33213.15	5716.75	0.33	14
38	94.60	43.19	10.10	1938.52	0.411998	33954.89	5844.42	0.33	14
39	94.60	44.31	11.78	1977.57	0.420998	34696.62	5972.09	0.34	14
40	94.60	45.43	13.45	2018.38	0.429998	35438.35	6099.75	0.34	14
41	94.60	46.54	15.11	2060.49	0.438998	36180.08	6227.42	0.34	14
42	94.60	47.64	16.77	2104.51	0.447998	36921.82	6355.09	0.34	14
43	94.60	48.73	18.42	2149.93	0.456998	37663.55	6482.76	0.35	14
44	94.60	49.82	20.06	2197.47	0.465998	38405.28	6610.43	0.35	14
45	94.60	50.90	21.69	2246.53	0.474997	39147.02	6738.10	0.35	14

46	94.60	51.97	23.32	2297.86	0.483997	39888.74	6865.77	0.35	14
47	94.60	53.03	24.95	2351.58	0.492997	40630.48	6993.44	0.36	14
48	94.60	54.09	26.55	2407.13	0.501997	41372.21	7121.11	0.36	14
49	94.60	55.15	28.16	2465.30	0.510997	42113.95	7248.78	0.36	14
50	94.60	56.19	29.75	2525.54	0.519997	42855.68	7376.45	0.36	14
51	94.60	57.23	31.34	2589.28	0.528997	43597.41	7504.12	0.37	14
52	94.60	58.27	32.93	2656.17	0.537997	44339.14	7631.79	0.37	14
53	94.60	59.29	34.52	2726.24	0.546997	45080.88	7759.45	0.37	14
54	94.60	60.32	36.10	2799.74	0.555997	45822.61	7887.13	0.37	14
55	94.60	61.33	37.67	2876.91	0.564997	46564.34	8014.79	0.38	14
56	94.60	62.34	39.24	2958.78	0.573997	47306.07	8142.46	0.38	14
57	94.60	63.35	40.80	3044.75	0.582997	48047.76	8270.13	0.38	14
58	94.60	64.34	42.36	3135.26	0.591997	48789.52	8397.80	0.38	14
59	94.60	65.34	43.92	3232.25	0.600997	49531.27	8525.47	0.39	14
60	94.60	66.32	45.48	3334.52	0.609997	50272.97	8653.14	0.39	13

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 692.24 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.61000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.009000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.81059

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 50.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 10192.910 ALBEDO = 737.028

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	0.70	-54.01	1102.11	0.070000	10192.91	737.03	0.27	15
1	94.60	3.06	-50.36	1129.85	0.079000	11503.42	831.79	0.27	15
2	94.60	5.38	-46.80	1158.35	0.088000	12813.93	926.55	0.27	15
3	94.60	7.66	-43.30	1187.70	0.097000	14124.44	1021.31	0.27	15
4	94.60	9.91	-39.86	1218.15	0.106000	15434.94	1116.07	0.28	15
5	94.60	12.13	-36.49	1249.44	0.115000	16745.46	1210.83	0.28	15
6	94.60	14.32	-33.17	1281.84	0.124000	18055.96	1305.59	0.28	15
7	94.60	16.48	-29.91	1315.43	0.133000	19366.48	1400.35	0.29	15
8	94.60	18.61	-26.69	1350.30	0.142000	20676.98	1495.11	0.29	15
9	94.60	20.71	-23.53	1386.54	0.150999	21987.50	1589.87	0.29	15
10	94.60	22.79	-20.41	1424.04	0.159999	23298.00	1684.63	0.30	15
11	94.60	24.84	-17.34	1463.10	0.168999	24608.52	1779.39	0.30	15
12	94.60	26.86	-14.31	1504.01	0.177999	25919.02	1874.15	0.30	14
13	94.60	28.86	-11.32	1546.46	0.186999	27229.54	1968.91	0.31	14
14	94.60	30.83	-8.38	1590.55	0.195999	28540.05	2063.67	0.31	14
15	94.60	32.78	-5.47	1636.85	0.204999	29850.55	2158.43	0.31	14
16	94.60	34.71	-2.58	1685.48	0.213999	31161.07	2253.19	0.32	14
17	94.60	36.61	0.25	1736.09	0.222999	32471.57	2347.95	0.32	14
18	94.60	38.49	3.06	1789.31	0.231999	33782.09	2442.71	0.32	14
19	94.60	40.36	5.86	1845.84	0.240999	35092.59	2537.47	0.33	14
20	94.60	42.20	8.61	1904.81	0.249999	36403.11	2632.23	0.33	14
21	94.60	44.02	11.35	1967.48	0.258999	37713.61	2726.99	0.34	14
22	94.60	45.82	14.05	2033.56	0.267999	39024.13	2821.75	0.34	14
23	94.60	47.60	16.73	2103.26	0.276999	40334.64	2916.51	0.34	14
24	94.60	49.37	19.38	2177.43	0.285999	41645.14	3011.27	0.35	14
25	94.60	51.11	22.03	2257.01	0.294999	42955.66	3106.03	0.35	14
26	94.60	52.84	24.64	2341.24	0.303999	44266.16	3200.79	0.36	14
27	94.60	54.55	27.25	2431.71	0.312998	45576.68	3295.55	0.36	14
28	94.60	56.25	29.83	2529.01	0.321998	46887.18	3390.31	0.36	14
29	94.60	57.92	32.41	2633.72	0.330998	48197.70	3485.07	0.37	14
30	94.60	59.59	34.96	2746.58	0.339998	49508.20	3579.83	0.37	14
31	94.60	61.23	37.51	2869.13	0.348998	50818.71	3674.59	0.38	14
32	94.60	62.86	40.05	3002.43	0.357998	52129.22	3769.35	0.38	14
33	94.60	64.48	42.57	3147.65	0.366998	53439.73	3864.11	0.39	14
34	94.60	66.08	45.09	3308.82	0.375998	54750.24	3958.87	0.39	13
35	94.60	67.66	47.59	3484.37	0.384998	56060.75	4053.64	0.39	13
36	94.60	69.24	50.10	3681.09	0.393998	57371.26	4148.39	0.40	13
37	94.60	70.79	52.60	3900.03	0.402998	58681.77	4243.15	0.40	13
38	94.60	72.34	55.10	4147.02	0.411998	59992.29	4337.91	0.41	13
39	94.60	73.87	57.60	4426.78	0.420998	61302.79	4432.68	0.41	13
40	94.60	75.39	60.10	4748.34	0.429998	62613.31	4527.43	0.42	13
41	94.60	76.89	62.59	5117.08	0.438998	63923.81	4622.20	0.42	13
42	94.60	78.38	65.10	5553.81	0.447998	65234.33	4716.96	0.43	13
43	94.60	79.86	67.60	6067.88	0.456998	66544.81	4811.71	0.44	13
44	94.60	81.33	70.13	6694.67	0.465998	67855.31	4906.48	0.44	13
45	94.60	82.79	72.66	7464.85	0.474997	69165.81	5001.23	0.45	13

46	94.60	84.23	75.18	8436.81	0.483997	70476.31	5096.00	0.45	13
47	94.60	85.66	77.75	9721.24	0.492997	71786.81	5190.76	0.46	13
48	94.60	87.09	80.31	11460.81	0.501997	73097.38	5285.52	0.46	13
49	94.60	88.50	82.90	14000.25	0.510997	74407.88	5380.28	0.47	13
50	94.60	89.90	85.50	17995.38	0.519997	75718.38	5475.04	0.48	13
51	94.60	91.29	88.13	25332.65	0.528997	77028.88	5569.80	0.48	13
52	94.60	92.67	90.80	43106.87	0.537997	78339.38	5664.56	0.49	13
53	94.60	94.03	93.48	147088.19	0.546997	79649.88	5759.32	0.49	13

SOLUTION TERMINATED DUE TO RADIATOR MEAN TEMPERATURE BEING GREATER THAN FLUID INLET TEMPERATURE.

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.50149

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 16608.746 ALBEDO = 392.166

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	10.63	-38.78	1227.96	0.070000	16608.75	392.17	0.28	15
1	94.60	14.05	-33.58	1277.79	0.079000	18744.14	442.59	0.28	15
2	94.60	17.40	-28.52	1330.29	0.088000	20879.54	493.01	0.29	15
3	94.60	20.68	-23.57	1385.96	0.097000	23014.94	543.43	0.29	15
4	94.60	23.90	-18.75	1444.92	0.106000	25150.33	593.85	0.30	15
5	94.60	27.05	-14.03	1507.75	0.115000	27285.73	644.27	0.30	14
6	94.60	30.15	-9.40	1575.06	0.124000	29421.13	694.69	0.31	14
7	94.60	33.18	-4.87	1646.56	0.133000	31556.53	745.11	0.31	14
8	94.60	36.16	-0.42	1723.65	0.142000	33691.93	795.53	0.32	14
9	94.60	39.09	3.95	1806.86	0.150999	35827.33	845.95	0.33	14
10	94.60	41.97	8.27	1897.33	0.159999	37962.72	896.38	0.33	14
11	94.60	44.80	12.51	1995.30	0.168999	40098.13	946.80	0.34	14
12	94.60	47.58	16.68	2102.12	0.177999	42233.52	997.22	0.34	14
13	94.60	50.31	20.82	2220.01	0.186999	44368.92	1047.64	0.35	14
14	94.60	53.01	24.89	2349.69	0.195999	46504.31	1098.06	0.36	14
15	94.60	55.66	28.94	2494.61	0.204999	48639.71	1148.48	0.36	14
16	94.60	58.27	32.94	2656.25	0.213999	50775.11	1198.90	0.37	14
17	94.60	60.84	36.91	2839.37	0.222999	52910.51	1249.32	0.38	14
18	94.60	63.38	40.85	3047.50	0.231999	55045.91	1299.74	0.38	14
19	94.60	65.88	44.77	3286.87	0.240999	57181.30	1350.17	0.39	14
20	94.60	68.34	48.67	3566.55	0.249999	59316.71	1400.59	0.40	13
21	94.60	70.77	52.56	3896.70	0.258999	61452.10	1451.01	0.40	13
22	94.60	73.16	56.46	4294.73	0.267999	63587.50	1501.43	0.41	13
23	94.60	75.53	60.33	4779.97	0.276999	65722.88	1551.85	0.42	13
24	94.60	77.86	64.23	5394.20	0.285999	67858.25	1602.27	0.43	13
25	94.60	80.17	68.13	6187.94	0.294999	69993.69	1652.69	0.44	13
26	94.60	82.44	72.05	7264.70	0.303999	72129.06	1703.11	0.45	13
27	94.60	84.69	75.99	8803.72	0.312998	74264.44	1753.53	0.45	13
28	94.60	86.91	79.98	11206.43	0.321998	76399.88	1803.95	0.46	13
29	94.60	89.10	84.00	15462.10	0.330998	78535.25	1854.38	0.47	13
30	94.60	91.26	88.09	25181.16	0.339998	80670.63	1904.80	0.48	13
31	94.60	93.40	92.25	69685.38	0.348998	82806.06	1955.22	0.49	13

SOLUTION TERMINATED DUE TO RADIATOR MEAN TEMPERATURE BEING GREATER THAN FLUID INLET TEMPERATURE.

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.32241

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 16296.418 SOLAR = 17675.902 ALBEDO = 0.000

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	11.69	-37.15	1243.15	0.070000	17675.90	0.00	0.28	15
1	94.60	15.23	-31.80	1295.81	0.079000	19948.50	0.00	0.28	15
2	94.60	18.68	-26.59	1351.49	0.088000	22221.10	0.00	0.29	15
3	94.60	22.07	-21.50	1410.72	0.097000	24493.71	0.00	0.30	15
4	94.60	25.38	-16.53	1473.93	0.106000	26766.30	0.00	0.30	14
5	94.60	28.63	-11.67	1541.30	0.115000	29038.91	0.00	0.31	14
6	94.60	31.81	-6.90	1613.70	0.124000	31311.51	0.00	0.31	14
7	94.60	34.94	-2.25	1691.19	0.133000	33584.12	0.00	0.32	14
8	94.60	38.00	2.34	1775.25	0.142000	35856.72	0.00	0.32	14
9	94.60	41.01	6.83	1866.07	0.150999	38129.32	0.00	0.33	14
10	94.60	43.97	11.26	1965.41	0.159999	40401.92	0.00	0.34	14
11	94.60	46.87	15.63	2074.30	0.168999	42674.52	0.00	0.34	14
12	94.60	49.73	19.94	2193.76	0.177999	44947.13	0.00	0.35	14
13	94.60	52.54	24.19	2326.41	0.186999	47219.73	0.00	0.35	14
14	94.60	55.30	28.39	2473.99	0.195999	49492.34	0.00	0.36	14
15	94.60	58.02	32.56	2640.00	0.204999	51764.93	0.00	0.37	14
16	94.60	60.70	36.68	2828.09	0.213999	54037.54	0.00	0.37	14
17	94.60	63.34	40.79	3043.62	0.222999	56310.14	0.00	0.38	14
18	94.60	65.93	44.85	3292.62	0.231999	58582.75	0.00	0.39	13
19	94.60	68.49	48.93	3586.89	0.240999	60855.34	0.00	0.40	13
20	94.60	71.02	52.97	3934.97	0.249999	63127.96	0.00	0.40	13
21	94.60	73.50	57.01	4358.22	0.258999	65400.55	0.00	0.41	13
22	94.60	75.96	61.05	4882.38	0.267999	67673.13	0.00	0.42	13
23	94.60	78.38	65.08	5549.80	0.276999	69945.75	0.00	0.43	13
24	94.60	80.76	69.15	6437.66	0.285999	72218.31	0.00	0.44	13
25	94.60	83.12	73.23	7666.00	0.294999	74490.94	0.00	0.45	13
26	94.60	85.45	77.35	9495.97	0.303999	76763.56	0.00	0.46	13
27	94.60	87.74	81.51	12514.82	0.312998	79036.13	0.00	0.47	13
28	94.60	90.01	85.72	18443.45	0.321998	81308.75	0.00	0.48	13
29	94.60	92.25	89.99	35542.77	0.330998	83581.38	0.00	0.49	13

SOLUTION OUTSIDE TO/TI RANGE, SOLUTION TERMINATED.

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.31010

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 1918.344 ALBEDO = 1072.563

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-14.85	-78.55	945.93	0.070000	1918.34	1072.56	0.25	15
1	94.60	-14.13	-77.40	952.21	0.079000	2164.99	1210.46	0.25	15
2	94.60	-13.42	-76.24	958.73	0.088000	2411.63	1348.36	0.25	15
3	94.60	-12.71	-75.10	965.18	0.097000	2658.27	1486.26	0.25	15
4	94.60	-12.00	-73.98	971.57	0.106000	2904.92	1624.16	0.25	15
5	94.60	-11.30	-72.85	978.06	0.115000	3151.56	1762.06	0.25	15
6	94.60	-10.60	-71.74	984.65	0.124000	3398.20	1899.96	0.25	15
7	94.60	-9.90	-70.62	991.33	0.133000	3644.84	2037.86	0.25	15
8	94.60	-9.20	-69.52	997.98	0.142000	3891.49	2175.76	0.25	15
9	94.60	-8.51	-68.42	1004.74	0.150999	4138.13	2313.66	0.25	15
10	94.60	-7.82	-67.33	1011.44	0.159999	4384.77	2451.56	0.25	15
11	94.60	-7.14	-66.25	1018.27	0.168999	4631.41	2589.46	0.26	15
12	94.60	-6.45	-65.18	1025.06	0.177999	4878.05	2727.36	0.26	15
13	94.60	-5.78	-64.11	1031.97	0.186999	5124.70	2865.26	0.26	15
14	94.60	-5.10	-63.05	1038.86	0.195999	5371.34	3003.16	0.26	15
15	94.60	-4.43	-62.00	1045.87	0.204999	5617.98	3141.06	0.26	15
16	94.60	-3.76	-60.94	1053.01	0.213999	5864.63	3278.96	0.26	15
17	94.60	-3.09	-59.90	1060.13	0.222999	6111.27	3416.86	0.26	15
18	94.60	-2.43	-58.87	1067.23	0.231999	6357.91	3554.77	0.26	15
19	94.60	-1.77	-57.84	1074.46	0.240999	6604.55	3692.67	0.26	15
20	94.60	-1.11	-56.81	1081.67	0.249999	6851.20	3830.57	0.26	15
21	94.60	-0.45	-55.79	1089.03	0.258999	7097.84	3968.47	0.26	15
22	94.60	0.20	-54.78	1096.38	0.267999	7344.48	4106.36	0.26	15
23	94.60	0.85	-53.77	1103.86	0.276999	7591.13	4244.27	0.27	15
24	94.60	1.50	-52.77	1111.34	0.285999	7837.77	4382.16	0.27	15
25	94.60	2.14	-51.77	1118.99	0.294999	8084.41	4520.06	0.27	15
26	94.60	2.78	-50.78	1126.62	0.303999	8331.05	4657.96	0.27	15
27	94.60	3.42	-49.80	1134.24	0.312998	8577.70	4795.86	0.27	15
28	94.60	4.06	-48.82	1142.02	0.321998	8824.34	4933.77	0.27	15
29	94.60	4.70	-47.85	1149.80	0.330998	9070.98	5071.66	0.27	15
30	94.60	5.33	-46.87	1157.76	0.339998	9317.63	5209.57	0.27	15
31	94.60	5.95	-45.91	1165.70	0.348998	9564.27	5347.46	0.27	15
32	94.60	6.58	-44.95	1173.65	0.357998	9810.91	5485.37	0.27	15
33	94.60	7.20	-43.99	1181.77	0.366998	10057.55	5623.27	0.27	15
34	94.60	7.82	-43.05	1189.90	0.375998	10304.20	5761.16	0.27	15
35	94.60	8.44	-42.10	1198.20	0.384998	10550.84	5899.07	0.28	15
36	94.60	9.06	-41.15	1206.52	0.393998	10797.48	6036.96	0.28	15
37	94.60	9.67	-40.22	1214.84	0.402998	11044.12	6174.87	0.28	15
38	94.60	10.29	-39.29	1223.34	0.411998	11290.76	6312.77	0.28	15
39	94.60	10.90	-38.36	1231.87	0.420998	11537.41	6450.67	0.28	15
40	94.60	11.50	-37.44	1240.39	0.429998	11784.05	6588.57	0.28	15
41	94.60	12.11	-36.52	1249.11	0.438998	12030.70	6726.47	0.28	15
42	94.60	12.71	-35.61	1257.86	0.447998	12277.34	6864.37	0.28	15
43	94.60	13.31	-34.71	1266.61	0.456998	12523.98	7002.27	0.28	15
44	94.60	13.91	-33.80	1275.57	0.465998	12770.63	7140.17	0.28	15
45	94.60	14.50	-32.89	1284.74	0.474997	13017.27	7278.07	0.28	15

46	94.60	15.09	-32.00	1293.72	0.483997	13263.91	7415.97	0.28	15
47	94.60	15.69	-31.11	1302.93	0.492997	13510.55	7553.87	0.29	15
48	94.60	16.27	-30.22	1312.15	0.501997	13757.19	7691.77	0.29	15
49	94.60	16.86	-29.33	1321.59	0.510997	14003.84	7829.67	0.29	15
50	94.60	17.44	-28.45	1331.05	0.519997	14250.48	7967.57	0.29	15
51	94.60	18.03	-27.57	1340.55	0.528997	14497.12	8105.47	0.29	15
52	94.60	18.61	-26.70	1350.26	0.537997	14743.76	8243.37	0.29	15
53	94.60	19.19	-25.83	1360.00	0.546997	14990.40	8381.27	0.29	15
54	94.60	19.76	-24.96	1369.97	0.555997	15237.05	8519.17	0.29	15
55	94.60	20.33	-24.10	1379.78	0.564997	15483.70	8657.07	0.29	15
56	94.60	20.91	-23.23	1390.01	0.573997	15730.34	8794.97	0.29	15
57	94.60	21.48	-22.38	1400.09	0.582997	15976.97	8932.87	0.29	15
58	94.60	22.04	-21.53	1410.40	0.591997	16223.62	9070.77	0.30	15
59	94.60	22.61	-20.68	1420.74	0.600997	16470.27	9208.67	0.30	15
60	94.60	23.17	-19.83	1431.33	0.609997	16716.90	9346.57	0.30	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 353.25 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.61000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.009000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 1.00000

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 5818.160 ALBEDO = 943.200

EFFECT OF DEGRACATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-7.96	-67.55	1010.05	0.070000	5818.16	943.20	0.25	15
1	94.60	-6.41	-65.10	1025.58	0.079000	6566.20	1064.47	0.26	15
2	94.60	-4.88	-62.70	1041.25	0.088000	7314.25	1185.74	0.26	15
3	94.60	-3.37	-60.34	1057.09	0.097000	8062.30	1307.00	0.26	15
4	94.60	-1.87	-58.00	1073.28	0.106000	8810.34	1428.27	0.26	15
5	94.60	-0.38	-55.68	1089.86	0.115000	9558.39	1549.54	0.26	15
6	94.60	1.09	-53.40	1106.69	0.124000	10306.43	1670.81	0.27	15
7	94.60	2.55	-51.15	1123.79	0.133000	11054.48	1792.08	0.27	15
8	94.60	3.99	-48.92	1141.18	0.142000	11802.52	1913.34	0.27	15
9	94.60	5.42	-46.73	1158.90	0.150999	12550.56	2034.61	0.27	15
10	94.60	6.84	-44.56	1176.94	0.159999	13298.60	2155.88	0.27	15
11	94.60	8.24	-42.40	1195.54	0.168999	14046.65	2277.15	0.28	15
12	94.60	9.63	-40.28	1214.33	0.177999	14794.70	2398.42	0.28	15
13	94.60	11.01	-38.18	1233.52	0.186999	15542.75	2519.68	0.28	15
14	94.60	12.38	-36.10	1253.14	0.195999	16290.79	2640.95	0.28	15
15	94.60	13.74	-34.06	1273.00	0.204999	17038.83	2762.22	0.28	15
16	94.60	15.08	-32.02	1293.54	0.213999	17786.88	2883.49	0.28	15
17	94.60	16.41	-30.01	1314.35	0.222999	18534.92	3004.75	0.29	15
18	94.60	17.73	-28.01	1335.87	0.231999	19282.96	3126.02	0.29	15
19	94.60	19.04	-26.04	1357.72	0.240999	20031.02	3247.29	0.29	15
20	94.60	20.34	-24.08	1380.13	0.249999	20779.05	3368.56	0.29	15
21	94.60	21.63	-22.15	1402.88	0.258999	21527.10	3489.83	0.29	15
22	94.60	22.91	-20.22	1426.44	0.267999	22275.15	3611.09	0.30	15
23	94.60	24.18	-18.32	1450.41	0.276999	23023.19	3732.36	0.30	15
24	94.60	25.44	-16.43	1475.22	0.285999	23771.23	3853.63	0.30	14
25	94.60	26.69	-14.57	1500.27	0.294999	24519.29	3974.90	0.30	14
26	94.60	27.93	-12.71	1526.45	0.303999	25267.32	4096.16	0.31	14
27	94.60	29.16	-10.87	1552.88	0.312998	26015.38	4217.43	0.31	14
28	94.60	30.38	-9.04	1580.50	0.321998	26763.42	4338.70	0.31	14
29	94.60	31.60	-7.23	1608.45	0.330998	27511.46	4459.97	0.31	14
30	94.60	32.80	-5.44	1637.17	0.339998	28259.50	4581.23	0.31	14
31	94.60	33.99	-3.65	1667.18	0.348998	29007.55	4702.50	0.32	14
32	94.60	35.18	-1.88	1697.59	0.357998	29755.59	4823.77	0.32	14
33	94.60	36.36	-0.12	1729.36	0.366998	30503.64	4945.04	0.32	14
34	94.60	37.53	1.62	1761.56	0.375998	31251.69	5066.30	0.32	14
35	94.60	38.69	3.36	1795.22	0.384998	31999.73	5187.57	0.32	14
36	94.60	39.84	5.09	1829.87	0.393998	32747.78	5308.84	0.33	14
37	94.60	40.99	6.80	1865.58	0.402998	33495.82	5430.11	0.33	14
38	94.60	42.12	8.50	1902.34	0.411998	34243.86	5551.38	0.33	14
39	94.60	43.25	10.19	1940.26	0.420998	34991.91	5672.65	0.33	14
40	94.60	44.37	11.87	1979.88	0.429998	35739.96	5793.91	0.34	14
41	94.60	45.49	13.55	2020.73	0.438998	36488.00	5915.18	0.34	14
42	94.60	46.60	15.22	2063.44	0.447998	37236.05	6036.45	0.34	14
43	94.60	47.70	16.86	2106.94	0.456998	37984.09	6157.72	0.34	14
44	94.60	48.79	18.52	2153.00	0.465998	38732.13	6278.98	0.35	14
45	94.60	49.88	20.15	2199.96	0.474997	39480.18	6400.25	0.35	14

46	94.60	50.95	21.79	2249.70	0.483997	40228.23	6521.52	0.35	14
47	94.60	52.03	23.40	2300.47	0.492997	40976.28	6642.79	0.35	14
48	94.60	53.09	25.03	2354.26	0.501997	41724.32	6764.06	0.36	14
49	94.60	54.15	26.63	2409.87	0.510997	42472.36	6885.32	0.36	14
50	94.60	55.20	28.24	2468.10	0.519997	43220.40	7006.59	0.36	14
51	94.60	56.25	29.84	2529.06	0.528997	43968.45	7127.86	0.36	14
52	94.60	57.29	31.43	2592.90	0.537997	44716.50	7249.13	0.37	14
53	94.60	58.32	33.02	2659.88	0.546997	45464.54	7370.40	0.37	14
54	94.60	59.35	34.60	2730.05	0.555997	46212.59	7491.66	0.37	14
55	94.60	60.37	36.18	2803.65	0.564997	46960.63	7612.93	0.37	14
56	94.60	61.39	37.75	2880.96	0.573997	47708.68	7734.20	0.38	14
57	94.60	62.40	39.32	2962.91	0.582997	48456.67	7855.47	0.38	14
58	94.60	63.40	40.88	3049.07	0.591997	49204.75	7976.74	0.38	14
59	94.60	64.40	42.44	3140.50	0.600997	49952.82	8098.00	0.39	14
60	94.60	65.39	44.00	3236.83	0.609997	50700.83	8219.27	0.39	14

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 675.45 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.61000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.009000 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.81913

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 50.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 10418.582 ALBEDO = 700.074

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-0.36	-55.65	1090.07	0.070000	10418.58	700.07	0.26	15
1	94.60	2.05	-51.92	1117.87	0.079000	11758.11	790.08	0.27	15
2	94.60	4.42	-48.26	1146.54	0.088000	13097.64	880.09	0.27	15
3	94.60	6.76	-44.67	1176.01	0.097000	14437.15	970.10	0.27	15
4	94.60	9.06	-41.15	1206.57	0.106000	15776.68	1060.11	0.28	15
5	94.60	11.34	-37.69	1238.11	0.115000	17116.21	1150.12	0.28	15
6	94.60	13.57	-34.31	1270.54	0.124000	18455.72	1240.13	0.28	15
7	94.60	15.78	-30.97	1304.33	0.133000	19795.25	1330.14	0.29	15
8	94.60	17.96	-27.68	1339.40	0.142000	21134.78	1420.15	0.29	15
9	94.60	20.10	-24.45	1375.80	0.150999	22474.30	1510.15	0.29	15
10	94.60	22.22	-21.26	1413.66	0.159999	23813.83	1600.16	0.30	15
11	94.60	24.31	-18.13	1452.86	0.168999	25153.36	1690.17	0.30	15
12	94.60	26.38	-15.04	1493.90	0.177999	26492.88	1780.18	0.30	14
13	94.60	28.41	-11.99	1536.71	0.186999	27832.40	1870.19	0.31	14
14	94.60	30.43	-8.99	1581.15	0.195999	29171.93	1960.20	0.31	14
15	94.60	32.41	-6.02	1627.79	0.204999	30511.45	2050.21	0.31	14
16	94.60	34.38	-3.08	1676.76	0.213999	31850.98	2140.22	0.32	14
17	94.60	36.32	-0.18	1728.24	0.222999	33190.50	2230.23	0.32	14
18	94.60	38.24	2.68	1781.85	0.231999	34530.03	2320.23	0.32	14
19	94.60	40.14	5.52	1838.77	0.240999	35869.55	2410.24	0.33	14
20	94.60	42.01	8.33	1898.69	0.249999	37209.08	2500.25	0.33	14
21	94.60	43.86	11.11	1961.79	0.258999	38548.60	2590.26	0.34	14
22	94.60	45.70	13.87	2028.88	0.267999	39888.12	2680.27	0.34	14
23	94.60	47.51	16.59	2099.66	0.276999	41227.65	2770.28	0.34	14
24	94.60	49.31	19.30	2174.99	0.285999	42567.18	2860.29	0.35	14
25	94.60	51.09	21.99	2255.80	0.294999	43906.70	2950.30	0.35	14
26	94.60	52.85	24.65	2341.33	0.303999	45246.22	3040.31	0.36	14
27	94.60	54.59	27.30	2433.84	0.312998	46585.75	3130.32	0.36	14
28	94.60	56.31	29.93	2532.65	0.321998	47925.27	3220.32	0.36	14
29	94.60	58.01	32.55	2639.78	0.330998	49264.80	3310.33	0.37	14
30	94.60	59.70	35.15	2755.25	0.339998	50604.32	3400.34	0.37	14
31	94.60	61.38	37.74	2880.65	0.348998	51943.86	3490.35	0.38	14
32	94.60	63.03	40.31	3017.07	0.357998	53283.37	3580.36	0.38	14
33	94.60	64.68	42.88	3166.58	0.366998	54622.90	3670.37	0.39	14
34	94.60	66.30	45.44	3331.80	0.375998	55962.43	3760.38	0.39	13
35	94.60	67.91	47.98	3513.72	0.384998	57301.94	3850.39	0.40	13
36	94.60	69.51	50.54	3717.76	0.393998	58641.47	3940.40	0.40	13
37	94.60	71.09	53.08	3945.08	0.402998	59981.00	4030.41	0.41	13
38	94.60	72.66	55.62	4201.83	0.411998	61320.52	4120.41	0.41	13
39	94.60	74.21	58.16	4495.77	0.420998	62660.05	4210.42	0.42	13
40	94.60	75.75	60.70	4831.35	0.429998	63999.57	4300.43	0.42	13
41	94.60	77.28	63.24	5223.58	0.438998	65339.09	4390.44	0.43	13
42	94.60	78.80	65.79	5685.96	0.447998	66678.56	4480.45	0.43	13
43	94.60	80.30	68.35	6241.19	0.456998	68018.13	4570.46	0.44	13
44	94.60	81.79	70.92	6916.61	0.465998	69357.63	4660.46	0.44	13
45	94.60	83.26	73.49	7758.35	0.474997	70697.19	4750.48	0.45	13

46	94.60	84.73	76.08	8845.88	0.483997	72036.69	4840.48	0.45	13
47	94.60	86.18	78.67	10285.63	0.492997	73376.19	4930.49	0.46	13
48	94.60	87.63	81.29	12308.97	0.501997	74715.75	5020.50	0.47	13
49	94.60	89.06	83.93	15356.16	0.510997	76055.25	5110.51	0.47	13
50	94.60	90.48	86.59	20454.88	0.519997	77394.81	5200.52	0.48	13
51	94.60	91.88	89.28	30832.82	0.528997	78734.31	5290.53	0.49	13
52	94.60	93.28	92.01	63194.55	0.537997	80073.81	5380.54	0.49	13

SOLUTION TERMINATED DUE TO RADIATOR MEAN TEMPERATURE BEING GREATER THAN FLUID INLET TEMPERATURE.

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.49812

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 16608.746 ALBEDO = 372.502

EFFECT OF DEGRACATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	9.29	-40.80	1209.59	0.070000	16608.75	372.50	0.28	15
1	94.60	12.74	-35.56	1258.31	0.079000	18744.14	420.39	0.28	15
2	94.60	16.12	-30.45	1309.74	0.088000	20879.54	468.29	0.29	15
3	94.60	19.42	-25.47	1364.02	0.097000	23014.94	516.18	0.29	15
4	94.60	22.66	-20.60	1421.68	0.106000	25150.33	564.07	0.30	15
5	94.60	25.83	-15.84	1483.05	0.115000	27285.73	611.97	0.30	14
6	94.60	28.95	-11.19	1548.30	0.124000	29421.13	659.86	0.31	14
7	94.60	32.00	-6.63	1618.05	0.133000	31556.53	707.75	0.31	14
8	94.60	35.00	-2.16	1692.71	0.142000	33691.93	755.64	0.32	14
9	94.60	37.95	2.25	1773.75	0.150999	35827.33	803.54	0.32	14
10	94.60	40.84	6.58	1860.82	0.159999	37962.72	851.43	0.33	14
11	94.60	43.68	10.84	1955.55	0.168999	40098.13	899.32	0.33	14
12	94.60	46.48	15.04	2058.77	0.177999	42233.52	947.22	0.34	14
13	94.60	49.23	19.17	2171.46	0.186999	44368.92	995.11	0.35	14
14	94.60	51.94	23.28	2296.54	0.195999	46504.31	1043.00	0.35	14
15	94.60	54.60	27.33	2434.96	0.204999	48639.71	1090.89	0.36	14
16	94.60	57.23	31.34	2589.15	0.213999	50775.11	1138.79	0.37	14
17	94.60	59.81	35.32	2762.91	0.222999	52910.51	1186.68	0.37	14
18	94.60	62.36	39.27	2960.11	0.231999	55045.91	1234.57	0.38	14
19	94.60	64.87	43.18	3185.63	0.240999	57181.30	1282.47	0.39	14
20	94.60	67.34	47.10	3448.65	0.249999	59316.71	1330.36	0.39	13
21	94.60	69.78	50.98	3755.01	0.258999	61452.10	1378.25	0.40	13
22	94.60	72.19	54.87	4123.01	0.267999	63587.50	1426.14	0.41	13
23	94.60	74.56	58.75	4569.49	0.276999	65722.88	1474.04	0.42	13
24	94.60	76.91	62.63	5124.63	0.285999	67858.25	1521.93	0.42	13
25	94.60	79.22	66.53	5835.28	0.294999	69993.69	1569.82	0.43	13
26	94.60	81.51	70.43	6777.47	0.303999	72129.06	1617.72	0.44	13
27	94.60	83.76	74.35	8091.18	0.312998	74264.44	1665.61	0.45	13
28	94.60	85.99	78.32	10060.58	0.321998	76399.88	1713.50	0.46	13
29	94.60	88.19	82.32	13346.46	0.330998	78535.25	1761.39	0.47	13
30	94.60	90.36	86.37	19917.67	0.339998	80670.63	1809.29	0.48	13
31	94.60	92.51	90.50	39956.53	0.348998	82806.06	1857.18	0.49	13

SOLUTION TERMINATED DUE TO RADIATOR MEAN TEMPERATURE BEING GREATER THAN FLUID INLET TEMPERATURE.

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.32615

FLAT PLANE RADIATOR FOR CASE OF 40944.0 BTU/HR. DISSIPATION = 12.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 2999.57

PLATFORM AREA IN FT2 = 634.2000

ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE = 270.0 NAUTICAL MILES.

EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 15479.301 SOLAR = 17675.902 ALBEDO = 0.000

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	10.40	-39.11	1224.96	0.070000	17675.90	0.00	0.28	15
1	94.60	13.96	-33.71	1276.51	0.079000	19948.50	0.00	0.28	15
2	94.60	17.45	-28.44	1331.12	0.088000	22221.10	0.00	0.29	15
3	94.60	20.86	-23.30	1389.17	0.097000	24493.71	0.00	0.29	15
4	94.60	24.20	-18.30	1450.63	0.106000	26766.30	0.00	0.30	15
5	94.60	27.47	-13.40	1516.51	0.115000	29038.91	0.00	0.30	14
6	94.60	30.68	-8.61	1586.84	0.124000	31311.51	0.00	0.31	14
7	94.60	33.82	-3.92	1662.50	0.133000	33584.12	0.00	0.32	14
8	94.60	36.91	0.69	1744.06	0.142000	35856.72	0.00	0.32	14
9	94.60	39.94	5.23	1832.63	0.150999	38129.32	0.00	0.33	14
10	94.60	42.91	9.68	1928.93	0.159999	40401.92	0.00	0.33	14
11	94.60	45.84	14.07	2033.86	0.168999	42674.52	0.00	0.34	14
12	94.60	48.71	18.40	2149.50	0.177999	44947.13	0.00	0.35	14
13	94.60	51.54	22.66	2276.59	0.186999	47219.73	0.00	0.35	14
14	94.60	54.31	26.89	2419.19	0.195999	49492.34	0.00	0.36	14
15	94.60	57.05	31.07	2578.04	0.204999	51764.93	0.00	0.37	14
16	94.60	59.74	35.21	2757.84	0.213999	54037.54	0.00	0.37	14
17	94.60	62.39	39.32	2962.81	0.222999	56310.14	0.00	0.38	14
18	94.60	65.01	43.40	3199.20	0.231999	58582.75	0.00	0.39	14
19	94.60	67.58	47.46	3475.16	0.240999	60855.34	0.00	0.39	13
20	94.60	70.11	51.51	3801.60	0.249999	63127.96	0.00	0.40	13
21	94.60	72.61	55.55	4194.68	0.258999	65400.55	0.00	0.41	13
22	94.60	75.08	59.59	4679.21	0.267999	67673.13	0.00	0.42	13
23	94.60	77.51	63.63	5288.76	0.276999	69945.75	0.00	0.43	13
24	94.60	79.91	67.69	6088.10	0.285999	72218.31	0.00	0.44	13
25	94.60	82.28	71.77	7173.91	0.294999	74490.94	0.00	0.44	13
26	94.60	84.61	75.86	8743.68	0.303999	76763.56	0.00	0.45	13
27	94.60	86.92	80.01	11230.89	0.312998	79036.13	0.00	0.46	13
28	94.60	89.20	84.19	15741.67	0.321998	81308.75	0.00	0.47	13
29	94.60	91.45	88.45	26652.45	0.330998	83581.38	0.00	0.48	13
30	94.60	93.67	92.77	89626.13	0.339998	85853.94	0.00	0.49	13

SOLUTION TERMINATED DUE TO RADIATOR MEAN TEMPERATURE BEING GREATER THAN FLUID INLET TEMPERATURE.

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.31333

Appendix C

LEO SPACE STATION PROGRAM SAMPLE CASE

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A sample case of the LEO general space station program inputs and outputs will be presented. The following inputs will be used as a sample case of the program use:

1. A single altitude of 235 nautical miles will be considered.

2. The β angle will be varied from a value of 10 degrees to a value of 90 degrees at 20-degree intervals.

3. The dissipation value will range from 35 kW to a total station value of 70 kW at intervals of 35 kW. The break point between flat-plate and cylindrical radiators will be 35 kW.

4. The total time duration will be 60 months (5 years), with solution intervals of one month. These values will be used for both flat-plate and cylindrical radiators.

5. The fluid inlet and mix temperatures will be set at 94.6^{o}F and 40^{o}F, respectively. These values will be used for both flat-plate and cylindrical radiators.

6. All external-input blockage factors for the flat-plate radiators will be given a value of 0.9, while all those for the cylindrical radiators will be given a value of 0.8.

7. The view factor to space for the flat-plate radiators will be given a value of 0.9, while for the cylindrical radiators the value will be 0.8. The specific heat for the coolant of both radiator systems will be specified as 0.25 BTA/lbm-^{o}R (Freon 21).

8. The initial α_s value will be 0.07, the emittance value will be 0.76, and the degradation rates will be varied from 0.003 to 0.009 $\Delta\alpha_s$/month at intervals of 0.003 $\Delta\alpha_s$/month. These values will be used for both flat-plate and cylindrical radiators.

For many radiator parameters, the same values have been given to both types of radiators. This does not need to be the case. The program is capable of handling all radiator parameters for each type of radiator independently, as some of the parameter differences already indicate.

The succeeding pages will present these inputs written on a coding form, followed by the program output.

NO.198-198 (REV. 9/68)

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE FEB. 78 PROGRAM NO. SPACE STATION PROGRAM PROGRAMMED BY 1.

INPUT FORMATS

1 FIRST CARD:

235 235 1 } FORMAT(3I10)

MAL1 NAL2 NAL3

2 SECOND CARD:

10 90 20 } FORMAT(3I10)

NB1 NB2 NB3

3 THIRD CARD:

35 70 35 35.0 } FORMAT(3I10, F10.4)

ND1 ND2 ND3 BREAK

4 FOURTH CARD:

60 60 1 1 } FORMAT(4I10)

MDP MDC MODIP MODIC

5 FIFTH CARD:

P 94.6 40.0 } FORMAT(A1, 9X, 2(F10.4, 10X))

TEST PTI PTM

6 SIXTH CARD:

C 94.6 40.0 } FORMAT(A1, 9X, 2(F10.4, 10X))

TEST CTI CTM

STK. NO. D-1-083

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE FEB. 78 PROGRAM NO. SPACE STATION PROGRAM PROGRAMMED BY 2.

```
7  SEVENTH CARD:
   P        0.9                 0.9                0.9   } FORMAT(A1, 9X, 3(F10.4,10X))
   TEST     PSHDS               PSHDE              PSHDA

8  EIGHTH CARD:
   C        0.8                 0.8                0.8   } FORMAT(A1, 9X, 3(F10.4,10X))
   TEST     CSHDS               CSADE              CSHDA

9  NINTH CARD:
   P        0.9                 0.25  } FORMAT(A1, 9X, 2(F10.4, 10X))
   TEST     PSPACE              PCP

10 TENTH CARD:
   C        0.8                 0.25  } FORMAT(A1, 9X, 2(F10.4, 10X))
   TEST     CSPACE              CCP

11 ELEVENTH CARD:
   P        0.07                0.76               0.003 } FORMAT(A1, 9X, 3(F10.4,10X))
   TEST     PALPHA              EMTP               ADEG

12 TWELFTH CARD:
   C        0.07                0.76               0.003 } FORMAT(A1, 9X, 3(F10.4,10X))
   TEST     CALPHA              EMTC               CDEG
   P        0.07                0.76               0.006 }
   C        0.07                0.76               0.006 } ADDITIONAL SURFACE
   P        0.07                0.76               0.009 } PROPERTY CARDS
   C        0.07                0.76               0.009 }
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STK. NO. D-1-003

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S P A C E   S T A T I O N   R A D I A T O R   P R O G R A M

ALTITUDE (N.MI.), LOWEST =   235  HIGHEST =   235  INCREMENT =     1

ORBIT INCLINATION (DEG.), LOWEST =    10  HIGHEST =    90  INCREMENT =    20

DISSIPATION (KW.), LOWEST =    35  HIGHEST =    70  INCREMENT =    35

BREAK POINT FROM PLATE TO CYLINDRICAL RADIATORS (KW.) =   35.00

MONTHS DEGRADATION FOR FLAT PLATE RADIATOR  =    60  INCREMENT =     1
MONTHS DEGRADATION FOR CYLINDRICAL RADIATOR =    60  INCREMENT =     1

SHADING COEFFICIENTS
PLATE, SOLAR =    0.900000  EARTHSHINE =    0.900000  ALBEDO =    0.900000
CYL. , SOLAR =    0.800000  EARTHSHINE =    0.800000  ALBEDO =    0.800000

PLATE, SHAPE FACTOR TO SPACE =   0.900000  FLUID CP =     0.2500  BTU/LBM-R.
CYL. , SHAPE FACTOR TO SPACE =   0.800000  FLUID CP =     0.2500  BTU/LBM-R.

RADIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE =    0.07000  EMITTANCE =    0.76000  MONTHLY CHANGE IN ABSORPTANCE =   0.003000
CYL. , ABSORPTANCE =    0.07000  EMITTANCE =    0.76000  MONTHLY CHANGE IN ABSORPTANCE =   0.003000
```

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.CO

PLATFORM AREA IN FT2 = 869.7061

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7344

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 22347.992 SOLAR = 2607.326 ALBEDO = 1548.500

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 1.00000

MAXIMUM ABSORPTANCE VALUE = 0.25000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	56.34	23.57	6725.71	0.070000	2607.33	1548.50	0.41	15
1	94.60	56.49	23.85	6751.92	0.073000	2719.07	1614.86	0.41	15
2	94.60	56.65	24.12	6778.09	0.076000	2830.81	1681.23	0.41	15
3	94.60	56.81	24.41	6805.84	0.079000	2942.55	1747.59	0.41	15
4	94.60	56.97	24.68	6832.24	0.082000	3054.29	1813.95	0.41	15
5	94.60	57.12	24.96	6860.06	0.085000	3166.03	1880.32	0.41	15
6	94.60	57.28	25.25	6888.07	0.088000	3277.77	1946.68	0.41	15
7	94.60	57.43	25.53	6916.02	0.091000	3389.51	2013.04	0.41	15
8	94.60	57.59	25.81	6944.16	0.094000	3501.26	2079.41	0.41	15
9	94.60	57.75	26.08	6972.32	0.097000	3613.00	2145.77	0.41	15
10	94.60	57.90	26.36	7000.59	0.100000	3724.74	2212.13	0.41	15
11	94.60	58.06	26.64	7028.85	0.103000	3836.48	2278.50	0.41	15
12	94.60	58.21	26.91	7057.18	0.106000	3948.22	2344.86	0.41	15
13	94.60	58.37	27.19	7087.16	0.108999	4059.96	2411.23	0.41	15
14	94.60	58.53	27.47	7115.77	0.111999	4171.70	2477.59	0.41	15
15	94.60	58.68	27.75	7145.92	0.114999	4283.44	2543.95	0.42	15
16	94.60	58.84	28.02	7174.63	0.117999	4395.18	2610.32	0.42	15
17	94.60	58.99	28.30	7204.96	0.120999	4506.92	2676.68	0.42	15
18	94.60	59.15	28.58	7235.47	0.123999	4618.66	2743.04	0.42	15
19	94.60	59.30	28.85	7265.96	0.126999	4730.41	2809.41	0.42	15
20	94.60	59.46	29.13	7296.61	0.129999	4842.14	2875.77	0.42	15
21	94.60	59.61	29.40	7327.41	0.132999	4953.89	2942.13	0.42	15
22	94.60	59.77	29.68	7358.22	0.135999	5065.63	3008.50	0.42	15
23	94.60	59.92	29.95	7389.13	0.138999	5177.37	3074.86	0.42	15
24	94.60	60.07	30.22	7420.15	0.141999	5289.11	3141.22	0.42	15
25	94.60	60.23	30.50	7452.92	0.144999	5400.86	3207.59	0.42	15
26	94.60	60.38	30.77	7484.20	0.147999	5512.59	3273.95	0.42	15
27	94.60	60.53	31.05	7517.24	0.150999	5624.34	3340.31	0.42	15
28	94.60	60.69	31.32	7548.64	0.153999	5736.07	3406.68	0.42	15
29	94.60	60.84	31.59	7581.91	0.156999	5847.82	3473.04	0.42	15
30	94.60	61.00	31.87	7615.26	0.159999	5959.56	3539.40	0.42	15
31	94.60	61.15	32.14	7648.81	0.162999	6071.30	3605.77	0.42	15
32	94.60	61.30	32.42	7682.46	0.165999	6183.04	3672.13	0.42	15
33	94.60	61.45	32.69	7716.12	0.168999	6294.78	3738.50	0.42	15
34	94.60	61.61	32.96	7750.03	0.171999	6406.52	3804.86	0.42	15
35	94.60	61.76	33.24	7785.84	0.174999	6518.27	3871.22	0.42	15
36	94.60	61.91	33.51	7819.96	0.177999	6630.00	3937.59	0.42	15
37	94.60	62.07	33.78	7854.21	0.180999	6741.75	4003.95	0.42	15

38	94.60	62.22	34.06	7890.43	0.183999	6853.49	4070.31	0.42	15
39	94.60	62.37	34.33	7926.78	0.186998	6965.23	4136.67	0.42	15
40	94.60	62.52	34.60	7961.45	0.189998	7076.97	4203.04	0.42	15
41	94.60	62.67	34.87	7998.13	0.192998	7188.71	4269.40	0.42	15
42	94.60	62.83	35.14	8034.92	0.195998	7300.45	4335.77	0.42	15
43	94.60	62.98	35.42	8071.91	0.198998	7412.20	4402.13	0.42	15
44	94.60	63.13	35.69	8109.07	0.201998	7523.93	4468.49	0.42	15
45	94.60	63.28	35.96	8146.34	0.204998	7635.68	4534.86	0.42	15
46	94.60	63.43	36.23	8183.79	0.207998	7747.42	4601.22	0.42	15
47	94.60	63.58	36.49	8221.35	0.210998	7859.16	4667.58	0.43	15
48	94.60	63.73	36.77	8261.11	0.213998	7970.90	4733.95	0.43	15
49	94.60	63.88	37.04	8299.04	0.216998	8082.64	4800.31	0.43	15
50	94.60	64.04	37.31	8339.08	0.219998	8194.38	4866.67	0.43	15
51	94.60	64.19	37.58	8377.44	0.222998	8306.13	4933.04	0.43	15
52	94.60	64.34	37.85	8417.87	0.225998	8417.86	4999.40	0.43	15
53	94.60	64.49	38.12	8458.47	0.228998	8529.61	5065.76	0.43	15
54	94.60	64.64	38.39	8499.34	0.231998	8641.35	5132.13	0.43	15
55	94.60	64.79	38.66	8540.40	0.234998	8753.09	5198.49	0.43	15
56	94.60	64.94	38.93	8581.55	0.237998	8864.83	5264.85	0.43	15
57	94.60	65.09	39.20	8623.03	0.240998	8976.57	5331.21	0.43	15
58	94.60	65.24	39.47	8664.70	0.243998	9088.31	5397.58	0.43	15
59	94.60	65.39	39.73	8706.55	0.246998	9200.05	5463.94	0.43	15
60	94.60	65.53	40.01	8750.67	0.249998	9311.79	5530.31	0.43	15

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATICN = 35.0 KW.

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2241.5945

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 25597.375 SOLAR = 7916.133 ALBEDO = 1576.585

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.89504

MAXIMUM ABSORPTANCE VALUE = 0.25000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	46.29	7.15	5462.45	0.070000	7916.13	1576.59	0.38	15
1	94.60	46.62	7.72	5498.81	0.073000	8255.39	1644.15	0.39	15
2	94.60	46.95	8.30	5535.26	0.076000	8594.65	1711.72	0.39	15
3	94.60	47.28	8.86	5571.80	0.079000	8933.91	1779.29	0.39	15
4	94.60	47.61	9.44	5609.52	0.082000	9273.17	1846.85	0.39	15
5	94.60	47.94	10.01	5647.29	0.085000	9612.43	1914.42	0.39	15
6	94.60	48.27	10.57	5685.17	0.088000	9951.68	1981.99	0.39	15
7	94.60	48.60	11.15	5724.20	0.091000	10290.94	2049.56	0.39	15
8	94.60	48.93	11.71	5763.37	0.094000	10630.20	2117.12	0.39	15
9	94.60	49.26	12.28	5802.71	0.097000	10969.46	2184.69	0.39	15
10	94.60	49.58	12.84	5843.23	0.100000	11308.72	2252.26	0.39	15
11	94.60	49.91	13.41	5883.88	0.103000	11647.98	2319.82	0.39	15
12	94.60	50.24	13.97	5924.71	0.106000	11987.23	2387.39	0.39	15
13	94.60	50.56	14.53	5965.71	0.108999	12326.50	2454.96	0.39	15
14	94.60	50.88	15.09	6007.95	0.111999	12665.75	2522.53	0.39	15
15	94.60	51.21	15.65	6050.40	0.114999	13005.01	2590.09	0.39	15
16	94.60	51.53	16.21	6094.12	0.117999	13344.27	2657.66	0.39	15
17	94.60	51.85	16.76	6136.97	0.120999	13683.53	2725.23	0.40	15
18	94.60	52.18	17.32	6181.13	0.123999	14022.79	2792.79	0.40	15
19	94.60	52.50	17.88	6226.67	0.126999	14362.04	2860.36	0.40	15
20	94.60	52.82	18.44	6272.40	0.129999	14701.30	2927.93	0.40	15
21	94.60	53.14	18.99	6318.41	0.132999	15040.57	2995.50	0.40	15
22	94.60	53.46	19.54	6364.62	0.135999	15379.82	3063.06	0.40	15
23	94.60	53.78	20.10	6412.29	0.138999	15719.08	3130.63	0.40	15
24	94.60	54.10	20.64	6459.02	0.141999	16058.34	3198.20	0.40	15
25	94.60	54.41	21.20	6508.41	0.144999	16397.60	3265.76	0.40	15
26	94.60	54.73	21.74	6556.91	0.147999	16736.86	3333.33	0.40	15
27	94.60	55.05	22.30	6606.93	0.150999	17076.11	3400.90	0.40	15
28	94.60	55.36	22.84	6657.20	0.153999	17415.37	3468.46	0.40	15
29	94.60	55.68	23.40	6709.12	0.156999	17754.63	3536.03	0.40	15
30	94.60	55.99	23.93	6760.08	0.159999	18093.89	3603.60	0.40	15
31	94.60	56.31	24.48	6812.64	0.162999	18433.15	3671.17	0.40	15
32	94.60	56.62	25.03	6866.79	0.165999	18772.41	3738.73	0.40	15
33	94.60	56.93	25.57	6920.02	0.168999	19111.67	3806.30	0.41	15
34	94.60	57.25	26.12	6976.32	0.171999	19450.93	3873.87	0.41	15
35	94.60	57.56	26.66	7031.69	0.174999	19790.18	3941.44	0.41	15
36	94.60	57.87	27.20	7087.38	0.177999	20129.44	4009.00	0.41	15
37	94.60	58.18	27.74	7144.87	0.180999	20468.70	4076.57	0.41	15

38	94.60	58.49	28.28	7202.83	0.183999	20807.96	4144.14	0.41	15
39	94.60	58.80	28.82	7262.58	0.186998	21147.22	4211.70	0.41	15
40	94.60	59.11	29.36	7322.76	0.189998	21486.48	4279.27	0.41	15
41	94.60	59.42	29.90	7383.54	0.192998	21825.74	4346.84	0.41	15
42	94.60	59.73	30.44	7446.12	0.195998	22165.00	4414.40	0.41	15
43	94.60	60.04	30.97	7507.79	0.198998	22504.25	4481.97	0.41	15
44	94.60	60.34	31.51	7571.48	0.201998	22843.51	4549.54	0.41	15
45	94.60	60.65	32.05	7637.15	0.204998	23182.77	4617.11	0.41	15
46	94.60	60.95	32.58	7701.88	0.207998	23522.03	4684.67	0.41	15
47	94.60	61.26	33.12	7770.25	0.210998	23861.29	4752.24	0.41	15
48	94.60	61.57	33.65	7837.69	0.213998	24200.55	4819.81	0.41	15
49	94.60	61.87	34.19	7907.31	0.216998	24539.80	4887.38	0.42	15
50	94.60	62.17	34.72	7977.53	0.219998	24879.07	4954.94	0.42	15
51	94.60	62.48	35.25	8048.39	0.222998	25218.32	5022.51	0.42	15
52	94.60	62.78	35.79	8123.25	0.225998	25557.58	5090.07	0.42	14
53	94.60	63.08	36.32	8197.17	0.228998	25896.84	5157.64	0.42	14
54	94.60	63.38	36.84	8271.86	0.231998	26236.10	5225.21	0.42	14
55	94.60	63.68	37.37	8347.22	0.234998	26575.36	5292.78	0.42	14
56	94.60	63.99	37.91	8426.78	0.237998	26914.62	5360.34	0.42	14
57	94.60	64.29	38.42	8503.67	0.240998	27253.87	5427.91	0.42	14
58	94.60	64.58	38.95	8584.89	0.243998	27593.14	5495.48	0.42	14
59	94.60	64.88	39.48	8667.07	0.246998	27932.39	5563.05	0.42	14
60	94.60	65.18	40.00	8750.02	0.249998	28271.65	5630.61	0.42	14

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 1032.3584

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7344

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 26527.512 SOLAR = 9390.949 ALBEDO = 1616.398

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.79983

MAXIMUM ABSORPTANCE VALUE = 0.25000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	43.77	3.24	5228.71	0.070000	9390.95	1616.40	0.38	15
1	94.60	44.15	3.88	5265.70	0.073000	9793.41	1685.67	0.38	15
2	94.60	44.53	4.53	5303.70	0.076000	10195.88	1754.95	0.38	15
3	94.60	44.91	5.17	5341.77	0.079000	10598.34	1824.22	0.38	15
4	94.60	45.28	5.81	5379.98	0.082000	11000.81	1893.49	0.38	15
5	94.60	45.66	6.45	5419.23	0.085000	11403.27	1962.77	0.38	15
6	94.60	46.03	7.09	5458.57	0.088000	11805.73	2032.04	0.38	15
7	94.60	46.40	7.73	5499.01	0.091000	12208.20	2101.31	0.38	15
8	94.60	46.78	8.37	5539.59	0.094000	12610.67	2170.58	0.38	15
9	94.60	47.15	9.01	5581.28	0.097000	13013.13	2239.86	0.38	15
10	94.60	47.52	9.63	5622.18	0.100000	13415.59	2309.13	0.39	15
11	94.60	47.89	10.28	5665.16	0.103000	13818.05	2378.40	0.39	15
12	94.60	48.25	10.90	5707.37	0.106000	14220.52	2447.68	0.39	15
13	94.60	48.62	11.53	5750.73	0.108999	14622.99	2516.95	0.39	15
14	94.60	48.99	12.17	5795.37	0.111999	15025.45	2586.23	0.39	15
15	94.60	49.36	12.79	5839.12	0.114999	15427.91	2655.50	0.39	15
16	94.60	49.72	13.42	5884.14	0.117999	15830.38	2724.77	0.39	15
17	94.60	50.09	14.05	5930.36	0.120999	16232.84	2794.05	0.39	15
18	94.60	50.45	14.67	5976.92	0.123999	16635.29	2863.32	0.39	15
19	94.60	50.81	15.29	6023.68	0.126999	17037.77	2932.59	0.39	15
20	94.60	51.18	15.91	6070.68	0.129999	17440.23	3001.87	0.39	15
21	94.60	51.54	16.53	6119.05	0.132999	17842.70	3071.14	0.39	15
22	94.60	51.90	17.16	6168.72	0.135999	18245.16	3140.41	0.39	15
23	94.60	52.26	17.77	6217.66	0.138999	18647.62	3209.69	0.39	15
24	94.60	52.62	18.39	6267.95	0.141999	19050.08	3278.96	0.39	15
25	94.60	52.98	19.01	6319.76	0.144999	19452.55	3348.23	0.40	15
26	94.60	53.33	19.63	6371.77	0.147999	19855.02	3417.51	0.40	15
27	94.60	53.69	20.24	6424.22	0.150999	20257.48	3486.78	0.40	15
28	94.60	54.05	20.86	6478.12	0.153999	20659.94	3556.05	0.40	15
29	94.60	54.40	21.47	6532.45	0.156999	21062.40	3625.33	0.40	15
30	94.60	54.76	22.08	6587.09	0.159999	21464.88	3694.60	0.40	15
31	94.60	55.11	22.69	6643.32	0.162999	21867.34	3763.87	0.40	15
32	94.60	55.47	23.30	6700.00	0.165999	22269.80	3833.15	0.40	15
33	94.60	55.82	23.90	6757.13	0.168999	22672.27	3902.42	0.40	15
34	94.60	56.17	24.51	6815.86	0.171999	23074.73	3971.69	0.40	15
35	94.60	56.52	25.13	6876.32	0.174999	23477.19	4040.97	0.40	15
36	94.60	56.87	25.73	6935.96	0.177999	23879.65	4110.24	0.40	15
37	94.60	57.22	26.33	6997.37	0.180999	24282.13	4179.51	0.40	15

38	94.60	57.57	26.94	7060.58	0.183999	24684.59	4248.79	0.40	15
39	94.60	57.92	27.54	7123.07	0.186998	25087.05	4318.06	0.41	15
40	94.60	58.27	28.14	7187.38	0.189998	25489.51	4387.33	0.41	15
41	94.60	58.62	28.74	7253.56	0.192998	25891.99	4456.61	0.41	15
42	94.60	58.96	29.34	7320.30	0.195998	26294.45	4525.88	0.41	15
43	94.60	59.31	29.94	7387.64	0.198998	26696.91	4595.15	0.41	15
44	94.60	59.65	30.54	7457.06	0.201998	27099.38	4664.43	0.41	14
45	94.60	60.00	31.14	7528.53	0.204998	27501.84	4733.70	0.41	14
46	94.60	60.34	31.74	7600.73	0.207998	27904.30	4802.97	0.41	14
47	94.60	60.68	32.32	7670.68	0.210998	28306.76	4872.25	0.41	14
48	94.60	61.03	32.93	7747.17	0.213998	28709.24	4941.52	0.41	14
49	94.60	61.37	33.52	7821.47	0.216998	29111.70	5010.79	0.41	14
50	94.60	61.71	34.10	7896.58	0.219998	29514.16	5080.06	0.41	14
51	94.60	62.05	34.70	7975.43	0.222998	29916.62	5149.34	0.41	14
52	94.60	62.39	35.29	8055.16	0.225998	30319.08	5218.61	0.42	14
53	94.60	62.73	35.88	8135.75	0.228998	30721.54	5287.89	0.42	14
54	94.60	63.07	36.48	8220.30	0.231998	31124.02	5357.16	0.42	14
55	94.60	63.40	37.06	8302.79	0.234998	31526.48	5426.43	0.42	14
56	94.60	63.74	37.65	8389.30	0.237998	31928.95	5495.70	0.42	14
57	94.60	64.08	38.24	8476.81	0.240998	32331.41	5564.98	0.42	14
58	94.60	64.41	38.83	8565.48	0.243998	32733.87	5634.25	0.42	14
59	94.60	64.75	39.42	8658.51	0.246998	33136.35	5703.52	0.42	14
60	94.60	65.08	40.00	8749.27	0.249998	33538.81	5772.80	0.42	14

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = −40.00

PLATFORM AREA IN FT2 = 2337.9158

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 26697.316 SOLAR = 9844.277 ALBEDO = 1445.998

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.78487

MAXIMUM ABSORPTANCE VALUE = 0.25000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	43.32	2.53	5188.77	0.070000	9844.28	1446.00	0.38	15
1	94.60	43.71	3.19	5225.86	0.073000	10266.17	1507.97	0.38	15
2	94.60	44.09	3.85	5263.96	0.076000	10688.06	1569.94	0.38	15
3	94.60	44.48	4.50	5302.14	0.079000	11109.95	1631.91	0.38	15
4	94.60	44.86	5.16	5341.32	0.082000	11531.85	1693.88	0.38	15
5	94.60	45.24	5.82	5380.64	0.085000	11953.74	1755.85	0.38	15
6	94.60	45.63	6.46	5420.08	0.088000	12375.63	1817.82	0.38	15
7	94.60	46.01	7.12	5460.59	0.091000	12797.52	1879.79	0.38	15
8	94.60	46.39	7.77	5501.24	0.094000	13219.42	1941.76	0.38	15
9	94.60	46.77	8.42	5543.00	0.097000	13641.31	2003.73	0.38	15
10	94.60	47.14	9.07	5584.93	0.100000	14063.20	2065.70	0.38	15
11	94.60	47.52	9.71	5627.02	0.103000	14485.09	2127.67	0.38	15
12	94.60	47.90	10.35	5670.23	0.106000	14906.99	2189.64	0.39	15
13	94.60	48.27	10.99	5713.66	0.108999	15328.88	2251.61	0.39	15
14	94.60	48.65	11.64	5758.29	0.111999	15750.77	2313.58	0.39	15
15	94.60	49.02	12.28	5803.11	0.114999	16172.66	2375.55	0.39	15
16	94.60	49.40	12.92	5848.16	0.117999	16594.55	2437.53	0.39	15
17	94.60	49.77	13.56	5894.46	0.120999	17016.45	2499.50	0.39	15
18	94.60	50.14	14.20	5942.03	0.123999	17438.34	2561.47	0.39	15
19	94.60	50.51	14.83	5988.80	0.126999	17860.23	2623.44	0.39	15
20	94.60	50.88	15.47	6036.88	0.129999	18282.12	2685.41	0.39	15
21	94.60	51.25	16.10	6085.28	0.132999	18704.02	2747.38	0.39	15
22	94.60	51.62	16.73	6134.99	0.135999	19125.91	2809.35	0.39	15
23	94.60	51.99	17.36	6185.04	0.138999	19547.80	2871.32	0.39	15
24	94.60	52.35	18.00	6236.43	0.141999	19969.69	2933.29	0.39	15
25	94.60	52.72	18.62	6287.09	0.144999	20391.59	2995.26	0.39	15
26	94.60	53.08	19.25	6340.25	0.147999	20813.48	3057.23	0.40	15
27	94.60	53.45	19.87	6392.73	0.150999	21235.37	3119.20	0.40	15
28	94.60	53.81	20.50	6446.64	0.153999	21657.26	3181.17	0.40	15
29	94.60	54.18	21.13	6502.03	0.156999	22079.16	3243.14	0.40	15
30	94.60	54.54	21.74	6556.73	0.159999	22501.05	3305.11	0.40	15
31	94.60	54.90	22.37	6614.16	0.162999	22922.94	3367.08	0.40	15
32	94.60	55.26	22.99	6670.81	0.165999	23344.83	3429.05	0.40	15
33	94.60	55.62	23.61	6729.09	0.168999	23766.73	3491.02	0.40	15
34	94.60	55.98	24.23	6789.04	0.171999	24188.62	3553.00	0.40	15
35	94.60	56.34	24.84	6848.23	0.174999	24610.51	3614.97	0.40	15
36	94.60	56.70	25.47	6910.40	0.177999	25032.40	3676.94	0.40	15
37	94.60	57.05	26.08	6971.80	0.180999	25454.30	3738.91	0.40	15

38	94.60	57.41	26.70	7034.99	0.183999	25876.19	3800.88	0.40	15
39	94.60	57.76	27.31	7098.73	0.186998	26298.08	3862.85	0.40	15
40	94.60	58.12	27.92	7164.34	0.189998	26719.97	3924.82	0.41	15
41	94.60	58.47	28.54	7231.80	0.192998	27141.87	3986.79	0.41	15
42	94.60	58.83	29.15	7298.63	0.195998	27563.76	4048.76	0.41	15
43	94.60	59.18	29.76	7367.34	0.198998	27985.65	4110.73	0.41	14
44	94.60	59.53	30.37	7438.13	0.201998	28407.54	4172.70	0.41	14
45	94.60	59.88	30.98	7509.61	0.204998	28829.44	4234.67	0.41	14
46	94.60	60.23	31.59	7581.73	0.207998	29251.33	4296.64	0.41	14
47	94.60	60.58	32.19	7654.60	0.210998	29673.22	4358.61	0.41	14
48	94.60	60.93	32.80	7731.06	0.213998	30095.11	4420.58	0.41	14
49	94.60	61.28	33.40	7805.40	0.216998	30517.00	4482.55	0.41	14
50	94.60	61.63	34.00	7883.45	0.219998	30938.90	4544.52	0.41	14
51	94.60	61.97	34.60	7962.35	0.222998	31360.79	4606.50	0.41	14
52	94.60	62.32	35.22	8045.11	0.225998	31782.68	4668.46	0.41	14
53	94.60	62.66	35.81	8125.75	0.228998	32204.57	4730.43	0.42	14
54	94.60	63.01	36.41	8210.41	0.231998	32626.46	4792.41	0.42	14
55	94.60	63.35	37.01	8296.05	0.234998	33048.36	4854.38	0.42	14
56	94.60	63.70	37.61	8382.72	0.237998	33470.25	4916.35	0.42	14
57	94.60	64.04	38.22	8473.63	0.240998	33892.14	4978.32	0.42	14
58	94.60	64.38	38.81	8562.34	0.243998	34314.04	5040.29	0.42	14
59	94.60	64.72	39.41	8655.37	0.246998	34735.93	5102.26	0.42	14
60	94.60	65.06	40.00	8749.81	0.249998	35157.82	5164.23	0.42	14

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATICN = 50.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 1309.8665

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7344

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 33658.367 SOLAR = 21052.281 ALBEDO = 1522.245

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.49483

MAXIMUM ABSORPTANCE VALUE = 0.25000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	28.22	-19.17	4198.82	0.070000	21052.28	1522.25	0.34	15
1	94.60	28.89	-18.09	4239.21	0.073000	21954.49	1587.48	0.34	15
2	94.60	29.56	-16.99	4280.88	0.076000	22856.72	1652.72	0.34	15
3	94.60	30.23	-15.91	4322.70	0.079000	23758.96	1717.96	0.34	15
4	94.60	30.89	-14.83	4365.25	0.082000	24661.19	1783.20	0.34	15
5	94.60	31.55	-13.76	4408.59	0.085000	25563.42	1848.44	0.34	15
6	94.60	32.20	-12.69	4452.73	0.088000	26465.65	1913.68	0.34	15
7	94.60	32.86	-11.63	4496.96	0.091000	27367.86	1978.91	0.34	15
8	94.60	33.51	-10.56	4542.74	0.094000	28270.12	2044.15	0.34	15
9	94.60	34.16	-9.50	4588.75	0.097000	29172.33	2109.39	0.35	15
10	94.60	34.81	-8.45	4635.59	0.100000	30074.56	2174.63	0.35	15
11	94.60	35.45	-7.40	4683.37	0.103000	30976.79	2239.87	0.35	15
12	94.60	36.09	-6.36	4731.33	0.106000	31879.02	2305.11	0.35	15
13	94.60	36.73	-5.32	4780.99	0.108999	32781.26	2370.34	0.35	15
14	94.60	37.37	-4.29	4830.89	0.111999	33683.49	2435.58	0.35	15
15	94.60	38.00	-3.25	4881.83	0.114999	34585.70	2500.82	0.35	15
16	94.60	38.63	-2.23	4933.77	0.117999	35487.95	2566.06	0.35	15
17	94.60	39.26	-1.21	4986.05	0.120999	36390.16	2631.30	0.35	15
18	94.60	39.89	-0.18	5040.15	0.123999	37292.40	2696.54	0.36	15
19	94.60	40.51	0.83	5094.58	0.126999	38194.63	2761.77	0.36	15
20	94.60	41.14	1.84	5150.17	0.129999	39096.86	2827.01	0.36	15
21	94.60	41.76	2.85	5206.92	0.132999	39999.09	2892.25	0.36	15
22	94.60	42.37	3.85	5264.13	0.135999	40901.32	2957.49	0.36	15
23	94.60	42.99	4.86	5323.30	0.138999	41803.54	3022.73	0.36	15
24	94.60	43.60	5.86	5382.96	0.141999	42705.77	3087.97	0.36	15
25	94.60	44.21	6.85	5443.90	0.144999	43608.00	3153.20	0.36	15
26	94.60	44.82	7.84	5506.21	0.147999	44510.23	3218.44	0.36	14
27	94.60	45.43	8.83	5569.84	0.150999	45412.46	3283.68	0.37	14
28	94.60	46.03	9.81	5634.05	0.153999	46314.70	3348.92	0.37	14
29	94.60	46.63	10.80	5700.54	0.156999	47216.93	3414.16	0.37	14
30	94.60	47.24	11.77	5767.63	0.159999	48119.16	3479.40	0.37	14
31	94.60	47.83	12.76	5837.12	0.162999	49021.38	3544.63	0.37	14
32	94.60	48.43	13.73	5907.30	0.165999	49923.61	3609.87	0.37	14
33	94.60	49.02	14.69	5978.20	0.168999	50825.84	3675.11	0.37	14
34	94.60	49.61	15.66	6051.64	0.171999	51728.07	3740.35	0.37	14
35	94.60	50.20	16.64	6127.70	0.174999	52630.30	3805.59	0.38	14
36	94.60	50.79	17.60	6204.57	0.177999	53532.54	3870.82	0.38	14
37	94.60	51.38	18.56	6282.36	0.180999	54434.77	3936.06	0.38	14

38	94.60	51.96	19.52	6362.95	0.183999	55337.00	4001.30	0.38	14
39	94.60	52.54	20.47	6444.45	0.186998	56239.21	4066.54	0.38	14
40	94.60	53.12	21.41	6526.93	0.189998	57141.44	4131.78	0.38	14
41	94.60	53.70	22.37	6614.39	0.192998	58043.68	4197.02	0.38	14
42	94.60	54.27	23.31	6700.97	0.195998	58945.91	4262.25	0.38	14
43	94.60	54.85	24.25	6790.70	0.198998	59848.14	4327.49	0.39	14
44	94.60	55.42	25.20	6883.70	0.201998	60750.37	4392.73	0.39	14
45	94.60	55.99	26.14	6977.93	0.204998	61652.61	4457.97	0.39	14
46	94.60	56.56	27.08	7075.70	0.207998	62554.84	4523.21	0.39	14
47	94.60	57.13	28.01	7174.82	0.210998	63457.05	4588.45	0.39	14
48	94.60	57.69	28.95	7277.63	0.213998	64359.28	4653.68	0.39	14
49	94.60	58.25	29.88	7381.94	0.216998	65261.51	4718.92	0.39	14
50	94.60	58.81	30.80	7487.76	0.219998	66163.69	4784.16	0.39	14
51	94.60	59.37	31.74	7600.05	0.222998	67065.94	4849.40	0.40	14
52	94.60	59.93	32.65	7711.61	0.225998	67968.19	4914.64	0.40	14
53	94.60	60.48	33.59	7829.90	0.228998	68870.38	4979.88	0.40	14
54	94.60	61.04	34.51	7950.15	0.231998	69772.63	5045.11	0.40	14
55	94.60	61.59	35.42	8072.48	0.234998	70674.88	5110.35	0.40	14
56	94.60	62.14	36.34	8199.45	0.237998	71577.06	5175.59	0.40	14
57	94.60	62.69	37.26	8331.30	0.240998	72479.31	5240.83	0.40	14
58	94.60	63.23	38.17	8465.66	0.243998	73381.56	5306.07	0.40	14
59	94.60	63.78	39.08	8605.19	0.246998	74283.81	5371.30	0.41	14
60	94.60	64.32	40.00	8750.21	0.249998	75186.00	5436.54	0.41	14

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 50.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2529.0322

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 28879.730 SOLAR = 13685.371 ALBEDO = 1160.989

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.64567

MAXIMUM ABSORPTANCE VALUE = 0.25000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	37.97	-5.52	4771.25	0.070000	13685.38	1160.99	0.36	15
1	94.60	38.46	-4.71	4810.30	0.073000	14271.89	1210.74	0.36	15
2	94.60	38.94	-3.89	4850.25	0.076000	14858.39	1260.50	0.36	15
3	94.60	39.42	-3.08	4890.29	0.079000	15444.90	1310.26	0.37	15
4	94.60	39.90	-2.27	4931.25	0.082000	16031.41	1360.01	0.37	15
5	94.60	40.38	-1.47	4972.28	0.085000	16617.92	1409.77	0.37	15
6	94.60	40.86	-0.67	5014.25	0.088000	17204.43	1459.52	0.37	15
7	94.60	41.33	0.13	5056.41	0.091000	17790.94	1509.28	0.37	15
8	94.60	41.81	0.94	5100.36	0.094000	18377.45	1559.03	0.37	15
9	94.60	42.28	1.73	5143.62	0.097000	18963.96	1608.79	0.37	15
10	94.60	42.76	2.52	5187.89	0.100000	19550.46	1658.55	0.37	15
11	94.60	43.23	3.31	5233.21	0.103000	20136.97	1708.30	0.37	15
12	94.60	43.70	4.10	5278.73	0.106000	20723.48	1758.06	0.37	15
13	94.60	44.16	4.89	5325.34	0.108999	21309.99	1807.82	0.37	15
14	94.60	44.63	5.68	5372.17	0.111999	21896.50	1857.57	0.37	15
15	94.60	45.10	6.46	5420.10	0.114999	22483.01	1907.33	0.38	15
16	94.60	45.56	7.24	5468.27	0.117999	23069.52	1957.08	0.38	15
17	94.60	46.02	8.02	5517.62	0.120999	23656.03	2006.84	0.38	15
18	94.60	46.49	8.79	5567.26	0.123999	24242.54	2056.60	0.38	15
19	94.60	46.95	9.57	5618.08	0.126999	24829.04	2106.35	0.38	15
20	94.60	47.41	10.35	5670.16	0.129999	25415.55	2156.11	0.38	15
21	94.60	47.86	11.12	5722.57	0.132999	26002.06	2205.86	0.38	15
22	94.60	48.32	11.89	5775.30	0.135999	26588.57	2255.62	0.38	15
23	94.60	48.78	12.65	5829.35	0.138999	27175.08	2305.38	0.38	15
24	94.60	49.23	13.42	5884.69	0.141999	27761.59	2355.13	0.38	15
25	94.60	49.68	14.18	5940.45	0.144999	28348.10	2404.89	0.38	15
26	94.60	50.13	14.95	5997.62	0.147999	28934.61	2454.64	0.39	15
27	94.60	50.59	15.71	6055.23	0.150999	29521.11	2504.40	0.39	15
28	94.60	51.03	16.47	6114.21	0.153999	30107.62	2554.16	0.39	15
29	94.60	51.48	17.22	6173.73	0.156999	30694.14	2603.91	0.39	15
30	94.60	51.93	17.98	6234.76	0.159999	31280.64	2653.67	0.39	15
31	94.60	52.38	18.74	6297.31	0.162999	31867.15	2703.42	0.39	15
32	94.60	52.82	19.49	6360.40	0.165999	32453.66	2753.18	0.39	15
33	94.60	53.26	20.24	6424.02	0.168999	33040.17	2802.94	0.39	15
34	94.60	53.71	21.00	6490.34	0.171999	33626.68	2852.69	0.39	15
35	94.60	54.15	21.74	6557.34	0.174999	34213.19	2902.45	0.39	14
36	94.60	54.59	22.49	6624.85	0.177999	34799.70	2952.20	0.39	14
37	94.60	55.03	23.23	6693.08	0.180999	35386.21	3001.96	0.40	14

38	94.60	55.47	23.97	6764.25	0.183999	35972.71	3051.72	0.40	14
39	94.60	55.90	24.72	6836.10	0.186998	36559.22	3101.47	0.40	14
40	94.60	56.34	25.45	6908.68	0.189998	37145.73	3151.23	0.40	14
41	94.60	56.77	26.20	6984.35	0.192998	37732.25	3200.98	0.40	14
42	94.60	57.21	26.94	7060.87	0.195998	38318.75	3250.74	0.40	14
43	94.60	57.64	27.67	7138.18	0.198998	38905.26	3300.50	0.40	14
44	94.60	58.07	28.40	7216.33	0.201998	39491.77	3350.25	0.40	14
45	94.60	58.50	29.14	7297.84	0.204998	40078.28	3400.01	0.40	14
46	94.60	58.93	29.87	7380.36	0.207998	40664.76	3449.76	0.40	14
47	94.60	59.36	30.61	7466.30	0.210998	41251.29	3499.52	0.40	14
48	94.60	59.79	31.33	7550.76	0.213998	41837.78	3549.28	0.41	14
49	94.60	60.21	32.06	7638.76	0.216998	42424.30	3599.03	0.41	14
50	94.60	60.64	32.78	7727.98	0.219998	43010.80	3648.79	0.41	14
51	94.60	61.06	33.52	7821.02	0.222998	43597.32	3698.54	0.41	14
52	94.60	61.48	34.24	7915.27	0.225998	44183.82	3748.30	0.41	14
53	94.60	61.91	34.96	8010.78	0.228998	44770.34	3798.06	0.41	14
54	94.60	62.33	35.70	8110.41	0.231998	45356.84	3847.81	0.41	14
55	94.60	62.75	36.42	8211.35	0.234998	45943.36	3897.57	0.41	14
56	94.60	63.17	37.14	8313.79	0.237998	46529.85	3947.33	0.41	14
57	94.60	63.58	37.85	8417.69	0.240998	47116.34	3997.08	0.41	14
58	94.60	64.00	38.57	8526.08	0.243998	47702.87	4046.84	0.41	14
59	94.60	64.42	39.28	8636.16	0.246998	48289.40	4096.59	0.42	14
60	94.60	64.83	40.01	8751.04	0.249998	48875.89	4146.35	0.42	14

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.6C , MIX = 40.00

PLATFORM AREA IN FT2 = 2221.4934

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7344

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 57083.559 SOLAR = 58177.594 ALBEDO = 1373.690

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.31813

MAXIMUM ABSORPTANCE VALUE = 0.25000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	0.65	-48.77	3331.86	0.070000	58177.59	1373.69	0.25	15
1	94.60	1.89	-46.94	3375.15	0.073000	60670.88	1432.56	0.25	15
2	94.60	3.12	-45.12	3419.06	0.076000	63164.16	1491.43	0.25	15
3	94.60	4.34	-43.34	3463.08	0.079000	65657.44	1550.30	0.25	15
4	94.60	5.55	-41.56	3508.33	0.082000	68150.75	1609.18	0.26	15
5	94.60	6.75	-39.80	3554.27	0.085000	70644.00	1668.05	0.26	15
6	94.60	7.94	-38.06	3601.02	0.088000	73137.31	1726.92	0.26	15
7	94.60	9.12	-36.34	3648.49	0.091000	75630.63	1785.79	0.26	15
8	94.60	10.29	-34.63	3696.75	0.094000	78123.94	1844.66	0.26	15
9	94.60	11.46	-32.93	3745.87	0.097000	80617.19	1903.53	0.26	15
10	94.60	12.62	-31.26	3795.83	0.100000	83110.50	1962.41	0.26	15
11	94.60	13.76	-29.59	3846.66	0.103000	85603.75	2021.28	0.27	15
12	94.60	14.90	-27.94	3898.40	0.106000	88097.06	2080.15	0.27	15
13	94.60	16.03	-26.31	3951.09	0.108999	90590.38	2139.02	0.27	15
14	94.60	17.16	-24.69	4004.73	0.111999	93083.69	2197.89	0.27	15
15	94.60	18.27	-23.08	4059.36	0.114999	95576.94	2256.76	0.27	14
16	94.60	19.38	-21.49	4115.06	0.117999	98070.25	2315.64	0.27	14
17	94.60	20.48	-19.90	4172.44	0.120999	100563.56	2374.51	0.28	14
18	94.60	21.57	-18.34	4230.25	0.123999	103056.81	2433.38	0.28	14
19	94.60	22.66	-16.77	4289.84	0.126999	105550.13	2492.25	0.28	14
20	94.60	23.74	-15.23	4349.94	0.129999	108043.44	2551.12	0.28	14
21	94.60	24.81	-13.69	4411.93	0.132999	110536.75	2609.99	0.28	14
22	94.60	25.87	-12.17	4474.38	0.135999	113030.00	2668.87	0.29	14
23	94.60	26.93	-10.66	4538.82	0.138999	115523.31	2727.74	0.29	14
24	94.60	27.98	-9.16	4603.89	0.141999	118016.63	2786.61	0.29	14
25	94.60	29.02	-7.67	4670.96	0.144999	120509.94	2845.48	0.29	14
26	94.60	30.06	-6.18	4740.10	0.147999	123003.19	2904.35	0.29	14
27	94.60	31.09	-4.71	4809.95	0.150999	125496.50	2963.23	0.29	14
28	94.60	32.11	-3.25	4881.93	0.153999	127989.75	3022.10	0.30	14
29	94.60	33.13	-1.79	4956.21	0.156999	130483.06	3080.97	0.30	14
30	94.60	34.14	-0.35	5031.27	0.159999	132976.38	3139.84	0.30	14
31	94.60	35.14	1.09	5108.71	0.162999	135469.69	3198.71	0.30	14
32	94.60	36.14	2.52	5188.47	0.165999	137962.94	3257.58	0.30	14
33	94.60	37.14	3.94	5269.20	0.168999	140456.25	3316.45	0.31	14
34	94.60	38.12	5.35	5352.52	0.171999	142949.56	3375.33	0.31	14
35	94.60	39.10	6.76	5438.33	0.174999	145442.81	3434.20	0.31	14
36	94.60	40.08	8.16	5526.85	0.177999	147936.13	3493.07	0.31	14
37	94.60	41.05	9.54	5616.46	0.180999	150429.44	3551.94	0.31	14

38	94.60	42.01	10.94	5710.54	0.183999	152922.75	3610.81	0.32	14
39	94.60	42.97	12.31	5805.89	0.186998	155416.06	3669.68	0.32	14
40	94.60	43.92	13.68	5904.29	0.189998	157909.31	3728.56	0.32	14
41	94.60	44.87	15.04	6004.00	0.192998	160402.63	3787.43	0.32	14
42	94.60	45.81	16.40	6108.58	0.195998	162895.94	3846.30	0.32	14
43	94.60	46.75	17.75	6216.41	0.198998	165389.19	3905.17	0.33	14
44	94.60	47.68	19.10	6327.59	0.201998	167882.50	3964.04	0.33	14
45	94.60	48.61	20.44	6442.44	0.204998	170375.81	4022.91	0.33	14
46	94.60	49.53	21.77	6559.02	0.207998	172869.06	4081.79	0.33	14
47	94.60	50.45	23.10	6681.17	0.210998	175362.38	4140.66	0.33	14
48	94.60	51.36	24.42	6807.15	0.213998	177855.69	4199.53	0.34	14
49	94.60	52.26	25.74	6937.27	0.216998	180348.94	4258.40	0.34	14
50	94.60	53.17	27.06	7073.43	0.219998	182842.25	4317.27	0.34	14
51	94.60	54.06	28.38	7214.13	0.222998	185335.56	4376.14	0.34	14
52	94.60	54.96	29.68	7359.32	0.225998	187828.81	4435.02	0.35	14
53	94.60	55.85	30.98	7509.39	0.228998	190322.13	4493.89	0.35	14
54	94.60	56.73	32.28	7666.41	0.231998	192815.44	4552.76	0.35	14
55	94.60	57.61	33.58	7828.72	0.234998	195308.75	4611.63	0.35	14
56	94.60	58.48	34.86	7996.56	0.237998	197802.06	4670.50	0.36	14
57	94.60	59.35	36.16	8174.46	0.240998	200295.31	4729.37	0.36	14
58	94.60	60.22	37.44	8358.48	0.243998	202788.63	4788.24	0.36	13
59	94.60	61.08	38.73	8551.33	0.246998	205281.94	4847.12	0.36	13
60	94.60	61.94	40.01	8753.17	0.249998	207775.19	4905.99	0.36	13

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATICN = 35.0 KW.

ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 3012.9309

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 34405.496 SOLAR = 23048.375 ALBEDO = 735.951

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.48015

MAXIMUM ABSORPTANCE VALUE = 0.25000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	26.88	-20.94	4134.36	0.070000	23048.38	735.95	0.33	15
1	94.60	27.58	-19.80	4175.63	0.073000	24036.15	767.49	0.33	15
2	94.60	28.27	-18.68	4216.97	0.076000	25023.93	799.03	0.33	15
3	94.60	28.97	-17.56	4259.05	0.079000	26011.70	830.57	0.33	15
4	94.60	29.65	-16.45	4301.84	0.082000	26999.48	862.11	0.34	15
5	94.60	30.34	-15.33	4345.38	0.085000	27987.25	893.65	0.34	15
6	94.60	31.02	-14.22	4389.75	0.088000	28975.03	925.19	0.34	15
7	94.60	31.70	-13.13	4434.25	0.091000	29962.80	956.73	0.34	15
8	94.60	32.38	-12.03	4480.20	0.094000	30950.58	988.27	0.34	15
9	94.60	33.05	-10.94	4526.36	0.097000	31938.36	1019.81	0.34	15
10	94.60	33.72	-9.85	4573.39	0.100000	32926.13	1051.35	0.34	15
11	94.60	34.39	-8.77	4621.32	0.103000	33913.90	1082.89	0.34	15
12	94.60	35.05	-7.69	4670.15	0.106000	34901.68	1114.43	0.35	15
13	94.60	35.72	-6.62	4719.26	0.108999	35889.46	1145.98	0.35	15
14	94.60	36.38	-5.56	4769.32	0.111999	36877.23	1177.52	0.35	15
15	94.60	37.03	-4.49	4821.08	0.114999	37865.00	1209.06	0.35	15
16	94.60	37.69	-3.43	4873.12	0.117999	38852.79	1240.60	0.35	15
17	94.60	38.34	-2.37	4926.24	0.120999	39840.56	1272.14	0.35	15
18	94.60	38.99	-1.33	4979.68	0.123999	40828.33	1303.68	0.35	15
19	94.60	39.64	-0.28	5034.97	0.126999	41816.10	1335.22	0.35	15
20	94.60	40.28	0.76	5090.67	0.129999	42803.88	1366.76	0.35	15
21	94.60	40.93	1.81	5148.25	0.132999	43791.66	1398.30	0.36	15
22	94.60	41.57	2.84	5206.24	0.135999	44779.43	1429.84	0.36	15
23	94.60	42.20	3.88	5265.53	0.138999	45767.20	1461.38	0.36	15
24	94.60	42.84	4.90	5326.02	0.141999	46754.98	1492.92	0.36	14
25	94.60	43.47	5.92	5387.05	0.144999	47742.76	1524.46	0.36	14
26	94.60	44.10	6.95	5450.13	0.147999	48730.53	1556.00	0.36	14
27	94.60	44.73	7.96	5513.82	0.150999	49718.28	1587.54	0.36	14
28	94.60	45.35	8.98	5579.66	0.153999	50706.07	1619.08	0.36	14
29	94.60	45.98	9.99	5646.18	0.156999	51693.86	1650.62	0.37	14
30	94.60	46.60	11.01	5714.97	0.159999	52681.60	1682.16	0.37	14
31	94.60	47.21	12.01	5784.51	0.162999	53669.39	1713.70	0.37	14
32	94.60	47.83	13.00	5854.63	0.165999	54657.14	1745.24	0.37	14
33	94.60	48.45	14.00	5927.32	0.168999	55644.93	1776.78	0.37	14
34	94.60	49.06	14.99	6000.75	0.171999	56632.72	1808.32	0.37	14
35	94.60	49.67	15.99	6076.77	0.174999	57620.51	1839.86	0.37	14
36	94.60	50.27	16.99	6155.42	0.177999	58608.25	1871.40	0.37	14
37	94.60	50.88	17.96	6233.13	0.180999	59596.04	1902.94	0.38	14

38	94.60	51.48	18.96	6315.52	0.183999	60583.84	1934.48	0.38	14
39	94.60	52.08	19.92	6396.95	0.186998	61571.58	1966.02	0.38	14
40	94.60	52.68	20.91	6483.29	0.189998	62559.37	1997.56	0.38	14
41	94.60	53.28	21.89	6570.68	0.192998	63547.16	2029.11	0.38	14
42	94.60	53.87	22.86	6659.18	0.195998	64534.90	2060.64	0.38	14
43	94.60	54.47	23.83	6750.89	0.198998	65522.70	2092.19	0.38	14
44	94.60	55.06	24.80	6843.78	0.201998	66510.44	2123.73	0.38	14
45	94.60	55.65	25.76	6940.12	0.204998	67498.19	2155.27	0.39	14
46	94.60	56.23	26.72	7037.82	0.207998	68486.00	2186.81	0.39	14
47	94.60	56.82	27.68	7138.98	0.210998	69473.75	2218.35	0.39	14
48	94.60	57.40	28.65	7243.88	0.213998	70461.50	2249.89	0.39	14
49	94.60	57.98	29.61	7350.30	0.216998	71449.31	2281.43	0.39	14
50	94.60	58.56	30.56	7460.69	0.219998	72437.13	2312.97	0.39	14
51	94.60	59.14	31.51	7572.80	0.222998	73424.88	2344.51	0.39	14
52	94.60	59.71	32.47	7689.09	0.225998	74412.63	2376.05	0.39	14
53	94.60	60.29	33.41	7807.37	0.228998	75400.44	2407.59	0.40	14
54	94.60	60.85	34.36	7930.04	0.231998	76388.19	2439.13	0.40	14
55	94.60	61.42	35.31	8057.29	0.234998	77375.94	2470.67	0.40	14
56	94.60	61.99	36.25	8186.88	0.237998	78363.75	2502.21	0.40	14
57	94.60	62.56	37.19	8321.31	0.240998	79351.50	2533.75	0.40	14
58	94.60	63.12	38.12	8458.34	0.243998	80339.31	2565.29	0.40	14
59	94.60	63.68	39.07	8603.39	0.246998	81327.06	2596.83	0.40	14
60	94.60	64.24	39.99	8748.52	0.249998	82314.81	2628.37	0.41	14

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2423.2144

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7344

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 62266.984 SOLAR = 67537.813 ALBEDO = 0.001

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.30598

MAXIMUM ABSORPTANCE VALUE = 0.25000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-3.09	-51.52	3269.39	0.070000	67537.81	0.00	0.24	15
1	94.60	-1.77	-49.61	3312.58	0.073000	70432.25	0.00	0.24	15
2	94.60	-0.46	-47.71	3357.04	0.076000	73326.69	0.00	0.24	15
3	94.60	0.84	-45.84	3401.59	0.079000	76221.13	0.00	0.24	15
4	94.60	2.12	-43.98	3447.44	0.082000	79115.56	0.00	0.24	15
5	94.60	3.40	-42.15	3493.44	0.085000	82010.06	0.00	0.24	15
6	94.60	4.66	-40.32	3540.82	0.088000	84904.44	0.00	0.25	15
7	94.60	5.92	-38.53	3588.41	0.091000	87798.88	0.00	0.25	15
8	94.60	7.16	-36.75	3636.82	0.094000	90693.38	0.00	0.25	15
9	94.60	8.40	-34.98	3686.73	0.097000	93587.81	0.00	0.25	15
10	94.60	9.62	-33.24	3736.89	0.100000	96482.19	0.00	0.25	15
11	94.60	10.84	-31.51	3787.97	0.103000	99376.69	0.00	0.25	15
12	94.60	12.05	-29.80	3839.98	0.106000	102271.13	0.00	0.26	15
13	94.60	13.25	-28.10	3893.65	0.108999	105165.56	0.00	0.26	14
14	94.60	14.43	-26.42	3947.68	0.111999	108060.00	0.00	0.26	14
15	94.60	15.61	-24.75	4003.39	0.114999	110954.44	0.00	0.26	14
16	94.60	16.78	-23.09	4059.56	0.117999	113848.88	0.00	0.26	14
17	94.60	17.95	-21.47	4116.07	0.120999	116743.38	0.00	0.26	14
18	94.60	19.10	-19.84	4174.43	0.123999	119637.81	0.00	0.27	14
19	94.60	20.25	-18.22	4234.65	0.126999	122532.19	0.00	0.27	14
20	94.60	21.38	-16.63	4295.38	0.129999	125426.63	0.00	0.27	14
21	94.60	22.51	-15.05	4356.62	0.132999	128321.13	0.00	0.27	14
22	94.60	23.63	-13.46	4421.27	0.135999	131215.56	0.00	0.27	14
23	94.60	24.75	-11.91	4485.06	0.138999	134110.00	0.00	0.27	14
24	94.60	25.85	-10.35	4552.36	0.141999	137004.44	0.00	0.28	14
25	94.60	26.95	-8.82	4618.84	0.144999	139898.88	0.00	0.28	14
26	94.60	28.05	-7.29	4688.91	0.147999	142793.31	0.00	0.28	14
27	94.60	29.13	-5.77	4759.71	0.150999	145687.75	0.00	0.28	14
28	94.60	30.20	-4.26	4832.76	0.153999	148582.19	0.00	0.28	14
29	94.60	31.27	-2.77	4906.62	0.156999	151476.69	0.00	0.29	14
30	94.60	32.34	-1.28	4982.82	0.159999	154371.13	0.00	0.29	14
31	94.60	33.39	0.19	5059.87	0.162999	157265.50	0.00	0.29	14
32	94.60	34.44	1.67	5140.95	0.165999	160159.94	0.00	0.29	14
33	94.60	35.49	3.13	5222.94	0.168999	163054.44	0.00	0.29	14
34	94.60	36.52	4.57	5306.00	0.171999	165948.88	0.00	0.30	14
35	94.60	37.55	6.02	5393.22	0.174999	168843.31	0.00	0.30	14
36	94.60	38.57	7.45	5481.63	0.177999	171737.75	0.00	0.30	14
37	94.60	39.59	8.88	5572.83	0.180999	174632.19	0.00	0.30	14

38	94.60	40.60	10.29	5666.80	0.183999	177526.63	0.00	0.30	14
39	94.60	41.61	11.71	5763.76	0.186998	180421.06	0.00	0.31	14
40	94.60	42.61	13.11	5862.07	0.189998	183315.50	0.00	0.31	14
41	94.60	43.60	14.51	5965.25	0.192998	186210.00	0.00	0.31	14
42	94.60	44.59	15.89	6069.89	0.195998	189104.44	0.00	0.31	14
43	94.60	45.57	17.27	6177.84	0.198998	191998.88	0.00	0.31	14
44	94.60	46.54	18.66	6290.99	0.201998	194893.25	0.00	0.32	14
45	94.60	47.51	20.02	6405.88	0.204998	197787.75	0.00	0.32	14
46	94.60	48.48	21.38	6524.46	0.207998	200682.19	0.00	0.32	14
47	94.60	49.44	22.75	6648.63	0.210998	203576.63	0.00	0.32	14
48	94.60	50.39	24.10	6776.77	0.213998	206471.06	0.00	0.33	14
49	94.60	51.34	25.45	6909.00	0.216998	209365.50	0.00	0.33	14
50	94.60	52.28	26.79	7045.54	0.219998	212259.94	0.00	0.33	14
51	94.60	53.22	28.13	7186.41	0.222998	215154.44	0.00	0.33	14
52	94.60	54.15	29.46	7333.86	0.225998	218048.88	0.00	0.34	14
53	94.60	55.08	30.79	7486.25	0.228998	220943.25	0.00	0.34	14
54	94.60	56.00	32.12	7645.61	0.231998	223837.75	0.00	0.34	14
55	94.60	56.92	33.43	7810.31	0.234998	226732.19	0.00	0.34	13
56	94.60	57.83	34.76	7982.68	0.237998	229626.63	0.00	0.35	13
57	94.60	58.74	36.07	8163.01	0.240998	232521.06	0.00	0.35	13
58	94.60	59.64	37.39	8351.68	0.243998	235415.50	0.00	0.35	13
59	94.60	60.54	38.69	8544.76	0.246998	238309.94	0.00	0.35	13
60	94.60	61.43	40.01	8751.29	0.249998	241204.38	0.00	0.36	13

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.CO

PLATFORM AREA IN FT2 = 3010.4883

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 34377.602 SOLAR = 23739.750 ALBEDO = 0.001

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.48066

MAXIMUM ABSORPTANCE VALUE = 0.25000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	26.93	-20.88	4136.76	0.070000	23739.76	0.00	0.33	15
1	94.60	27.63	-19.74	4178.03	0.073000	24757.16	0.00	0.33	15
2	94.60	28.32	-18.62	4219.37	0.076000	25774.57	0.00	0.33	15
3	94.60	29.01	-17.50	4261.42	0.079000	26791.97	0.00	0.33	15
4	94.60	29.70	-16.39	4304.18	0.082000	27809.38	0.00	0.34	15
5	94.60	30.38	-15.27	4347.74	0.085000	28826.79	0.00	0.34	15
6	94.60	31.06	-14.17	4392.07	0.088000	29844.19	0.00	0.34	15
7	94.60	31.74	-13.07	4436.56	0.091000	30861.59	0.00	0.34	15
8	94.60	32.42	-11.97	4482.52	0.094000	31879.01	0.00	0.34	15
9	94.60	33.09	-10.89	4528.68	0.097000	32896.41	0.00	0.34	15
10	94.60	33.76	-9.80	4575.69	0.100000	33913.81	0.00	0.34	15
11	94.60	34.43	-8.72	4623.61	0.103000	34931.21	0.00	0.34	15
12	94.60	35.09	-7.65	4671.75	0.106000	35948.63	0.00	0.35	15
13	94.60	35.75	-6.58	4721.55	0.108999	36966.03	0.00	0.35	15
14	94.60	36.41	-5.51	4771.58	0.111999	37983.44	0.00	0.35	15
15	94.60	37.07	-4.45	4822.64	0.114999	39000.84	0.00	0.35	15
16	94.60	37.72	-3.38	4875.42	0.117999	40018.25	0.00	0.35	15
17	94.60	38.37	-2.33	4928.50	0.120999	41035.66	0.00	0.35	15
18	94.60	39.02	-1.29	4981.99	0.123999	42053.06	0.00	0.35	15
19	94.60	39.67	-0.23	5037.25	0.126999	43070.46	0.00	0.35	15
20	94.60	40.31	0.80	5092.96	0.129999	44087.87	0.00	0.35	15
21	94.60	40.96	1.85	5150.54	0.132999	45105.28	0.00	0.36	15
22	94.60	41.59	2.88	5208.54	0.135999	46122.68	0.00	0.36	15
23	94.60	42.23	3.90	5267.00	0.138999	47140.08	0.00	0.36	15
24	94.60	42.87	4.94	5328.29	0.141999	48157.49	0.00	0.36	14
25	94.60	43.50	5.96	5389.30	0.144999	49174.88	0.00	0.36	14
26	94.60	44.13	6.98	5452.41	0.147999	50192.27	0.00	0.36	14
27	94.60	44.75	8.00	5516.11	0.150999	51209.67	0.00	0.36	14
28	94.60	45.38	9.01	5581.98	0.153999	52227.07	0.00	0.36	14
29	94.60	46.00	10.02	5648.51	0.156999	53244.52	0.00	0.37	14
30	94.60	46.62	11.02	5715.59	0.159999	54261.92	0.00	0.37	14
31	94.60	47.24	12.02	5785.08	0.162999	55279.32	0.00	0.37	14
32	94.60	47.85	13.03	5856.95	0.165999	56296.72	0.00	0.37	14
33	94.60	48.47	14.03	5929.63	0.168999	57314.12	0.00	0.37	14
34	94.60	49.08	15.02	6003.05	0.171999	58331.52	0.00	0.37	14
35	94.60	49.69	16.01	6079.07	0.174999	59348.91	0.00	0.37	14
36	94.60	50.29	17.00	6155.92	0.177999	60366.32	0.00	0.37	14
37	94.60	50.90	17.99	6235.51	0.180999	61383.76	0.00	0.38	14

38	94.60	51.50	18.97	6316.01	0.183999	62401.16	0.00	0.38	14
39	94.60	52.10	19.95	6399.31	0.186998	63418.56	0.00	0.38	14
40	94.60	52.70	20.92	6483.71	0.189998	64435.96	0.00	0.38	14
41	94.60	53.30	21.90	6571.11	0.192998	65453.36	0.00	0.38	14
42	94.60	53.89	22.87	6659.61	0.195998	66470.75	0.00	0.38	14
43	94.60	54.48	23.84	6751.33	0.198998	67488.13	0.00	0.38	14
44	94.60	55.07	24.82	6846.30	0.201998	68505.50	0.00	0.38	14
45	94.60	55.66	25.77	6940.52	0.204998	69523.00	0.00	0.39	14
46	94.60	56.24	26.74	7040.27	0.207998	70540.38	0.00	0.39	14
47	94.60	56.83	27.70	7141.45	0.210998	71557.75	0.00	0.39	14
48	94.60	57.41	28.66	7244.19	0.213998	72575.19	0.00	0.39	14
49	94.60	57.99	29.61	7350.61	0.216998	73592.56	0.00	0.39	14
50	94.60	58.57	30.57	7460.99	0.219998	74610.00	0.00	0.39	14
51	94.60	59.15	31.52	7573.16	0.222998	75627.38	0.00	0.39	14
52	94.60	59.72	32.47	7689.43	0.225998	76644.81	0.00	0.40	14
53	94.60	60.29	33.41	7807.61	0.228998	77662.19	0.00	0.40	14
54	94.60	60.86	34.36	7930.36	0.231998	78679.63	0.00	0.40	14
55	94.60	61.43	35.31	8057.64	0.234998	79697.00	0.00	0.40	14
56	94.60	62.00	36.25	8187.15	0.237998	80714.44	0.00	0.40	14
57	94.60	62.56	37.19	8321.65	0.240998	81731.81	0.00	0.40	14
58	94.60	63.13	38.12	8458.66	0.243998	82749.25	0.00	0.40	14
59	94.60	63.69	39.07	8603.71	0.246998	83766.69	0.00	0.40	14
60	94.60	64.25	40.01	8751.59	0.249998	84784.06	0.00	0.41	14

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S P A C E   S T A T I O N   R A D I A T O R   P R O G R A M

ALTITUDE (N.MI.), LOWEST =   235  HIGHEST =   235  INCREMENT =     1

ORBIT INCLINATION (DEG.), LOWEST =    10  HIGHEST =    90  INCREMENT =    20

DISSIPATION (KW.), LOWEST =    35  HIGHEST =    70  INCREMENT =   35

BREAK POINT FROM PLATE TO CYLINDRICAL RADIATORS (KW.) =   35.00

MONTHS DEGRACATION FOR FLAT PLATE RADIATOR  =    60  INCREMENT =     1
MONTHS DEGRADATION FOR CYLINCRICAL RADIATOR =    60  INCREMENT =     1

SHACING COEFFICIENTS
PLATE, SOLAR =   0.900000  EARTHSHINE =   0.900000  ALBEDO =   0.900000
CYL. , SOLAR =   0.800000  EARTHSHINE =   0.8C0000  ALBEDO =   0.800000

PLATE, SHAPE FACTOR TO SPACE =   0.900000  FLUID CP =     0.2500  BTU/LBM-R.
CYL. , SHAPE FACTOR TO SPACE =   0.800000  FLUID CP =     0.2500  BTU/LBM-R.

RADIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE =    0.07000  EMITTANCE =    0.76000  MONTHLY CHANGE IN ABSORPTANCE =   0.006000
CYL. , ABSORPTANCE =    0.07000  EMITTANCE =    0.76000  MONTHLY CHANGE IN ABSORPTANCE =   0.006000
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FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 957.7507

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7344

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 24610.391 SOLAR = 2871.279 ALBEDO = 1705.263

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 1.00000

MAXIMUM ABSORPTANCE VALUE = 0.43000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00600 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	46.34	6.84	5443.69	0.070000	2871.28	1705.26	0.39	15
1	94.60	46.68	7.42	5479.25	0.076000	3117.39	1851.43	0.39	15
2	94.60	47.01	8.00	5515.88	0.082000	3363.50	1997.59	0.39	15
3	94.60	47.34	8.58	5553.62	0.088000	3609.61	2143.76	0.39	15
4	94.60	47.67	9.15	5590.34	0.094000	3855.72	2289.92	0.39	15
5	94.60	48.01	9.72	5628.20	0.100000	4101.82	2436.09	0.39	15
6	94.60	48.34	10.31	5667.20	0.106000	4347.93	2582.25	0.39	15
7	94.60	48.67	10.87	5705.19	0.112000	4594.04	2728.42	0.39	15
8	94.60	48.99	11.45	5745.45	0.118000	4840.15	2874.58	0.39	15
9	94.60	49.32	12.02	5784.75	0.124000	5086.26	3020.75	0.39	15
10	94.60	49.65	12.59	5825.22	0.130000	5332.37	3166.91	0.39	15
11	94.60	49.98	13.16	5865.87	0.136000	5578.48	3313.08	0.39	15
12	94.60	50.30	13.72	5906.58	0.142000	5824.58	3459.24	0.39	15
13	94.60	50.63	14.29	5948.59	0.148000	6070.69	3605.41	0.40	15
14	94.60	50.96	14.86	5990.70	0.154000	6316.80	3751.57	0.40	15
15	94.60	51.28	15.42	6032.96	0.160000	6562.91	3897.74	0.40	15
16	94.60	51.61	15.99	6076.56	0.166000	6809.02	4043.90	0.40	15
17	94.60	51.93	16.55	6120.33	0.172000	7055.13	4190.07	0.40	15
18	94.60	52.25	17.12	6165.45	0.178000	7301.24	4336.23	0.40	15
19	94.60	52.57	17.67	6209.61	0.184000	7547.35	4482.39	0.40	15
20	94.60	52.89	18.24	6256.33	0.190000	7793.46	4628.56	0.40	15
21	94.60	53.21	18.80	6302.03	0.196000	8039.57	4774.73	0.40	15
22	94.60	53.54	19.36	6349.22	0.202000	8285.68	4920.89	0.40	15
23	94.60	53.85	19.92	6396.60	0.208000	8531.78	5067.05	0.40	15
24	94.60	54.17	20.47	6444.23	0.214000	8777.89	5213.22	0.40	15
25	94.60	54.49	21.03	6493.35	0.220000	9024.00	5359.39	0.40	15
26	94.60	54.81	21.59	6542.76	0.226000	9270.11	5505.55	0.40	15
27	94.60	55.13	22.14	6592.44	0.232000	9516.22	5651.71	0.40	15
28	94.60	55.45	22.69	6643.64	0.237999	9762.33	5797.88	0.40	15
29	94.60	55.76	23.24	6693.88	0.243999	10008.44	5944.05	0.40	15
30	94.60	56.08	23.80	6747.01	0.249999	10254.55	6090.21	0.41	15
31	94.60	56.39	24.34	6799.17	0.255999	10500.66	6236.38	0.41	15
32	94.60	56.71	24.89	6853.01	0.261999	10746.76	6382.54	0.41	15
33	94.60	57.02	25.44	6907.17	0.267999	10992.88	6528.71	0.41	15
34	94.60	57.33	25.99	6963.05	0.273999	11238.98	6674.87	0.41	15
35	94.60	57.65	26.54	7019.29	0.279999	11485.09	6821.04	0.41	15
36	94.60	57.96	27.09	7075.99	0.285999	11731.20	6967.20	0.41	15
/37	94.60	58.27	27.63	7132.98	0.291999	11977.31	7113.37	0.41	15

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38	94.60	58.58	28.18	7191.82	0.297999	12223.42	7259.53	0.41	15
39	94.60	58.89	28.72	7251.14	0.303999	12469.53	7405.70	0.41	15
40	94.60	59.20	29.27	7312.36	0.309999	12715.64	7551.86	0.41	15
41	94.60	59.51	29.82	7374.04	0.315999	12961.75	7698.03	0.41	15
42	94.60	59.82	30.36	7436.25	0.321999	13207.86	7844.19	0.41	15
43	94.60	60.13	30.90	7498.82	0.327999	13453.96	7990.36	0.41	15
44	94.60	60.44	31.44	7563.58	0.333999	13700.07	8136.52	0.41	15
45	94.60	60.75	31.98	7628.77	0.339999	13946.18	8282.69	0.42	15
46	94.60	61.05	32.52	7694.50	0.345999	14192.29	8428.85	0.42	15
47	94.60	61.36	33.06	7762.42	0.351999	14438.40	8575.02	0.42	15
48	94.60	61.66	33.60	7830.95	0.357999	14684.51	8721.18	0.42	15
49	94.60	61.97	34.13	7900.02	0.363999	14930.62	8867.35	0.42	15
50	94.60	62.27	34.67	7971.42	0.369999	15176.73	9013.51	0.42	15
51	94.60	62.58	35.21	8043.43	0.375999	15422.83	9159.68	0.42	15
52	94.60	62.88	35.74	8116.18	0.381999	15668.93	9305.84	0.42	15
53	94.60	63.18	36.28	8191.26	0.387999	15915.05	9452.01	0.42	15
54	94.60	63.49	36.80	8265.37	0.393999	16161.15	9598.17	0.42	15
55	94.60	63.79	37.35	8343.70	0.399999	16407.27	9744.34	0.42	15
56	94.60	64.09	37.87	8420.98	0.405999	16653.37	9890.50	0.42	15
57	94.60	64.39	38.41	8500.98	0.411999	16899.48	10036.67	0.42	15
58	94.60	64.69	38.95	8583.59	0.417999	17145.59	10182.83	0.42	15
59	94.60	64.99	39.47	8665.16	0.423999	17391.70	10329.00	0.42	15
60	94.60	65.29	40.00	8749.54	0.429999	17637.80	10475.16	0.42	15

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2847.6465

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 32518.074 SOLAR = 10056.387 ALBEDO = 2002.842

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.89504

MAXIMUM ABSORPTANCE VALUE = 0.43000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00600 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	24.06	-26.68	3939.06	0.070000	10056.39	2002.84	0.33	15
1	94.60	24.82	-25.41	3980.49	0.076000	10918.36	2174.51	0.33	15
2	94.60	25.57	-24.18	4021.84	0.082000	11780.34	2346.19	0.33	15
3	94.60	26.33	-22.93	4064.33	0.088000	12642.31	2517.86	0.33	15
4	94.60	27.08	-21.70	4107.40	0.094000	13504.29	2689.53	0.34	15
5	94.60	27.82	-20.46	4151.75	0.100000	14366.26	2861.20	0.34	15
6	94.60	28.57	-19.25	4196.08	0.106000	15228.23	3032.87	0.34	15
7	94.60	29.31	-18.03	4241.08	0.112000	16090.21	3204.54	0.34	15
8	94.60	30.04	-16.82	4287.43	0.118000	16952.18	3376.22	0.34	15
9	94.60	30.77	-15.61	4334.51	0.124000	17814.16	3547.89	0.34	15
10	94.60	31.50	-14.42	4381.70	0.130000	18676.13	3719.56	0.34	15
11	94.60	32.23	-13.23	4430.32	0.136000	19538.11	3891.23	0.34	15
12	94.60	32.95	-12.04	4479.77	0.142000	20400.08	4062.90	0.35	15
13	94.60	33.67	-10.85	4530.05	0.148000	21262.05	4234.57	0.35	15
14	94.60	34.39	-9.68	4581.21	0.154000	22124.03	4406.25	0.35	15
15	94.60	35.10	-8.52	4632.61	0.160000	22986.00	4577.92	0.35	15
16	94.60	35.82	-7.35	4685.63	0.166000	23847.98	4749.59	0.35	15
17	94.60	36.52	-6.19	4739.59	0.172000	24709.95	4921.26	0.35	15
18	94.60	37.23	-5.03	4794.58	0.178000	25571.92	5092.93	0.35	15
19	94.60	37.93	-3.88	4850.63	0.184000	26433.90	5264.60	0.35	15
20	94.60	38.63	-2.74	4907.69	0.190000	27295.88	5436.27	0.36	15
21	94.60	39.32	-1.60	4965.90	0.196000	28157.84	5607.95	0.36	15
22	94.60	40.02	-0.46	5025.23	0.202000	29019.82	5779.62	0.36	15
23	94.60	40.71	0.67	5085.76	0.208000	29881.79	5951.29	0.36	15
24	94.60	41.40	1.80	5147.48	0.214000	30743.77	6122.96	0.36	15
25	94.60	42.08	2.92	5210.45	0.220000	31605.74	6294.64	0.36	15
26	94.60	42.76	4.04	5274.73	0.226000	32467.72	6466.30	0.36	15
27	94.60	43.44	5.15	5340.31	0.232000	33329.69	6637.98	0.36	15
28	94.60	44.11	6.26	5407.28	0.237999	34191.67	6809.65	0.37	15
29	94.60	44.79	7.36	5475.71	0.243999	35053.64	6981.32	0.37	15
30	94.60	45.46	8.47	5546.42	0.249999	35915.61	7152.99	0.37	15
31	94.60	46.13	9.56	5617.79	0.255999	36777.59	7324.66	0.37	15
32	94.60	46.79	10.66	5690.75	0.261999	37639.56	7496.34	0.37	15
33	94.60	47.46	11.75	5766.18	0.267999	38501.54	7668.01	0.37	14
34	94.60	48.12	12.83	5842.38	0.273999	39363.51	7839.68	0.37	14
35	94.60	48.77	13.92	5921.25	0.279999	40225.49	8011.35	0.37	14
36	94.60	49.43	14.99	6001.02	0.285999	41087.46	8183.02	0.38	14
37	94.60	50.08	16.07	6083.49	0.291999	41949.43	8354.70	0.38	14

38	94.60	50.73	17.14	6167.02	0.297999	42811.41	8526.37	0.38	14
39	94.60	51.38	18.21	6253.39	0.303999	43673.38	8698.04	0.38	14
40	94.60	52.02	19.28	6342.80	0.309999	44535.36	8869.71	0.38	14
41	94.60	52.67	20.34	6433.45	0.315999	45397.33	9041.38	0.38	14
42	94.60	53.31	21.39	6525.21	0.321999	46259.26	9213.05	0.38	14
43	94.60	53.95	22.46	6622.36	0.327999	47121.26	9384.73	0.39	14
44	94.60	54.58	23.50	6718.76	0.333999	47983.25	9556.40	0.39	14
45	94.60	55.21	24.56	6820.70	0.339999	48845.20	9728.07	0.39	14
46	94.60	55.85	25.61	6924.22	0.345999	49707.20	9899.74	0.39	14
47	94.60	56.47	26.66	7031.52	0.351999	50569.14	10071.41	0.39	14
48	94.60	57.10	27.69	7140.45	0.357999	51431.14	10243.09	0.39	14
49	94.60	57.72	28.73	7253.36	0.363999	52293.09	10414.76	0.39	14
50	94.60	58.34	29.76	7368.12	0.369999	53155.08	10586.43	0.40	14
51	94.60	58.97	30.79	7487.16	0.375999	54017.03	10758.10	0.40	14
52	94.60	59.58	31.83	7610.71	0.381999	54879.02	10929.77	0.40	14
53	94.60	60.20	32.85	7736.36	0.387999	55741.02	11101.44	0.40	14
54	94.60	60.81	33.89	7869.34	0.393999	56602.97	11273.12	0.40	14
55	94.60	61.42	34.92	8004.85	0.399999	57464.96	11444.79	0.40	14
56	94.60	62.03	35.93	8142.92	0.405999	58326.91	11616.46	0.40	14
57	94.60	62.64	36.95	8286.39	0.411999	59188.91	11788.13	0.41	14
58	94.60	63.24	37.97	8435.45	0.417999	60050.86	11959.80	0.41	14
59	94.60	63.84	38.99	8590.34	0.423999	60912.85	12131.48	0.41	14
60	94.60	64.44	40.00	8748.78	0.429999	61774.80	12303.14	0.41	14

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 1372.7710

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7344

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 35274.762 SOLAR = 12487.547 ALBEDO = 2149.394

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.79983

MAXIMUM ABSORPTANCE VALUE = 0.43000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00600 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	18.14	-34.65	3695.82	0.070000	12487.55	2149.39	0.32	15
1	94.60	19.02	-33.21	3737.85	0.076000	13557.91	2333.63	0.32	15
2	94.60	19.90	-31.78	3779.76	0.082000	14628.27	2517.86	0.32	15
3	94.60	20.77	-30.36	3822.73	0.088000	15698.62	2702.09	0.32	15
4	94.60	21.64	-28.96	3866.17	0.094000	16768.98	2886.33	0.32	15
5	94.60	22.50	-27.55	3910.73	0.100000	17839.34	3070.56	0.32	15
6	94.60	23.36	-26.16	3955.89	0.106000	18909.70	3254.79	0.32	15
7	94.60	24.21	-24.78	4001.62	0.112000	19980.06	3439.03	0.33	15
8	94.60	25.06	-23.41	4048.01	0.118000	21050.41	3623.26	0.33	15
9	94.60	25.91	-22.04	4095.65	0.124000	22120.77	3807.49	0.33	15
10	94.60	26.75	-20.68	4143.98	0.130000	23191.13	3991.73	0.33	15
11	94.60	27.59	-19.33	4193.05	0.136000	24261.49	4175.96	0.33	15
12	94.60	28.42	-17.98	4243.49	0.142000	25331.85	4360.19	0.33	15
13	94.60	29.25	-16.65	4294.10	0.148000	26402.19	4544.43	0.33	15
14	94.60	30.07	-15.32	4346.15	0.154000	27472.55	4728.66	0.33	15
15	94.60	30.89	-13.99	4399.10	0.160000	28542.91	4912.89	0.34	15
16	94.60	31.71	-12.68	4452.90	0.166000	29613.28	5097.13	0.34	15
17	94.60	32.52	-11.38	4507.66	0.172000	30683.64	5281.36	0.34	15
18	94.60	33.33	-10.08	4563.36	0.178000	31754.00	5465.59	0.34	15
19	94.60	34.13	-8.78	4620.72	0.184000	32824.36	5649.82	0.34	15
20	94.60	34.93	-7.49	4679.11	0.190000	33894.70	5834.06	0.34	15
21	94.60	35.73	-6.21	4738.57	0.196000	34965.06	6018.29	0.34	15
22	94.60	36.52	-4.94	4799.16	0.202000	36035.43	6202.52	0.35	15
23	94.60	37.31	-3.67	4860.86	0.208000	37105.79	6386.76	0.35	15
24	94.60	38.09	-2.41	4924.49	0.214000	38176.15	6570.99	0.35	15
25	94.60	38.87	-1.16	4988.62	0.220000	39246.51	6755.23	0.35	15
26	94.60	39.65	0.10	5054.73	0.226000	40316.85	6939.46	0.35	15
27	94.60	40.42	1.34	5122.17	0.232000	41387.21	7123.69	0.35	15
28	94.60	41.19	2.59	5191.72	0.237999	42457.57	7307.93	0.35	15
29	94.60	41.96	3.82	5262.72	0.243999	43527.94	7492.16	0.36	14
30	94.60	42.72	5.05	5334.35	0.249999	44598.30	7676.39	0.36	14
31	94.60	43.48	6.27	5408.34	0.255999	45668.66	7860.63	0.36	14
32	94.60	44.24	7.50	5484.65	0.261999	46739.02	8044.86	0.36	14
33	94.60	44.99	8.71	5561.81	0.267999	47809.38	8229.09	0.36	14
34	94.60	45.74	9.92	5641.44	0.273999	48879.72	8413.32	0.36	14
35	94.60	46.49	11.11	5721.99	0.279999	49950.09	8597.56	0.36	14
36	94.60	47.23	12.31	5805.17	0.285999	51020.45	8781.79	0.37	14
37	94.60	47.97	13.51	5891.11	0.291999	52090.81	8966.02	0.37	14

38	94.60	48.71	14.71	5979.83	0.297999	53161.17	9150.26	0.37	14
39	94.60	49.44	15.89	6069.76	0.303999	54231.53	9334.49	0.37	14
40	94.60	50.17	17.08	6162.66	0.309999	55301.88	9518.73	0.37	14
41	94.60	50.90	18.25	6256.85	0.315999	56372.23	9702.96	0.37	14
42	94.60	51.62	19.42	6354.24	0.321999	57442.60	9887.19	0.38	14
43	94.60	52.34	20.59	6454.85	0.327999	58512.96	10071.43	0.38	14
44	94.60	53.06	21.76	6558.90	0.333999	59583.32	10255.66	0.38	14
45	94.60	53.77	22.92	6664.60	0.339999	60653.68	10439.89	0.38	14
46	94.60	54.48	24.08	6773.96	0.345999	61724.02	10624.13	0.38	14
47	94.60	55.19	25.24	6887.11	0.351999	62794.38	10808.36	0.38	14
48	94.60	55.90	26.40	7004.20	0.357999	63864.75	10992.59	0.38	14
49	94.60	56.60	27.55	7125.43	0.363999	64935.11	11176.82	0.39	14
50	94.60	57.30	28.70	7248.79	0.369999	66005.44	11361.06	0.39	14
51	94.60	58.00	29.84	7376.66	0.375999	67075.81	11545.29	0.39	14
52	94.60	58.69	30.98	7509.00	0.381999	68146.19	11729.52	0.39	14
53	94.60	59.39	32.12	7646.32	0.387999	69216.50	11913.76	0.39	14
54	94.60	60.07	33.25	7786.29	0.393999	70286.88	12097.99	0.39	14
55	94.60	60.76	34.38	7933.79	0.399999	71357.25	12282.23	0.40	14
56	94.60	61.44	35.51	8084.48	0.405999	72427.56	12466.46	0.40	14
57	94.60	62.13	36.63	8240.88	0.411999	73497.94	12650.69	0.40	14
58	94.60	62.80	37.77	8405.88	0.417999	74568.31	12834.93	0.40	14
59	94.60	63.48	38.89	8574.59	0.423999	75638.69	13019.16	0.40	14
60	94.60	64.15	40.00	8749.93	0.429999	76709.00	13203.39	0.40	14

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATICN = 35.0 KW.

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 3136.5125

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 35816.703 SOLAR = 13206.926 ALBEDO = 1939.928

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.78487

MAXIMUM ABSORPTANCE VALUE = 0.43000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00600 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	17.04	-36.07	3655.65	0.070000	13206.93	1939.93	0.31	15
1	94.60	17.95	-34.60	3697.48	0.076000	14338.95	2106.21	0.31	15
2	94.60	18.85	-33.14	3739.71	0.082000	15470.97	2272.49	0.32	15
3	94.60	19.74	-31.69	3782.41	0.088000	16602.99	2438.77	0.32	15
4	94.60	20.63	-30.25	3826.14	0.094000	17735.02	2605.04	0.32	15
5	94.60	21.52	-28.81	3870.98	0.100000	18867.04	2771.32	0.32	15
6	94.60	22.40	-27.39	3915.82	0.106000	19999.05	2937.60	0.32	15
7	94.60	23.28	-25.98	3961.80	0.112000	21131.07	3103.88	0.32	15
8	94.60	24.15	-24.57	4008.41	0.118000	22263.09	3270.16	0.32	15
9	94.60	25.01	-23.17	4056.29	0.124000	23395.11	3436.44	0.33	15
10	94.60	25.88	-21.79	4104.23	0.130000	24527.14	3602.72	0.33	15
11	94.60	26.73	-20.41	4153.53	0.136000	25659.15	3769.00	0.33	15
12	94.60	27.59	-19.03	4204.14	0.142000	26791.17	3935.28	0.33	15
13	94.60	28.43	-17.67	4254.96	0.148000	27923.19	4101.55	0.33	15
14	94.60	29.28	-16.31	4307.23	0.154000	29055.21	4267.84	0.33	15
15	94.60	30.12	-14.96	4360.30	0.160000	30187.23	4434.11	0.33	15
16	94.60	30.95	-13.62	4414.30	0.166000	31319.25	4600.39	0.33	15
17	94.60	31.78	-12.29	4469.21	0.172000	32451.27	4766.67	0.34	15
18	94.60	32.61	-10.97	4525.04	0.178000	33583.29	4932.95	0.34	15
19	94.60	33.43	-9.64	4582.57	0.184000	34715.32	5099.23	0.34	15
20	94.60	34.25	-8.33	4641.11	0.190000	35847.34	5265.51	0.34	15
21	94.60	35.07	-7.02	4700.71	0.196000	36979.36	5431.79	0.34	15
22	94.60	35.88	-5.73	4761.40	0.202000	38111.37	5598.07	0.34	15
23	94.60	36.68	-4.43	4823.93	0.208000	39243.39	5764.35	0.35	15
24	94.60	37.48	-3.15	4886.95	0.214000	40375.42	5930.63	0.35	15
25	94.60	38.28	-1.87	4951.91	0.220000	41507.43	6096.91	0.35	15
26	94.60	39.08	-0.59	5018.11	0.226000	42639.46	6263.18	0.35	15
27	94.60	39.87	0.68	5086.38	0.232000	43771.47	6429.46	0.35	15
28	94.60	40.66	1.94	5155.25	0.237999	44903.50	6595.74	0.35	15
29	94.60	41.44	3.19	5226.34	0.243999	46035.52	6762.02	0.35	14
30	94.60	42.22	4.45	5299.59	0.249999	47167.54	6928.30	0.36	14
31	94.60	43.00	5.70	5373.64	0.255999	48299.55	7094.58	0.36	14
32	94.60	43.77	6.94	5449.98	0.261999	49431.57	7260.86	0.36	14
33	94.60	44.54	8.17	5527.20	0.267999	50563.58	7427.14	0.36	14
34	94.60	45.31	9.40	5606.89	0.273999	51695.60	7593.42	0.36	14
35	94.60	46.07	10.63	5689.14	0.279999	52827.61	7759.70	0.36	14
36	94.60	46.83	11.84	5772.36	0.285999	53959.63	7925.98	0.36	14
37	94.60	47.58	13.07	5859.98	0.291999	55091.65	8092.25	0.37	14

38	94.60	48.33	14.27	5947.02	0.297999	56223.67	8258.54	0.37	14
39	94.60	49.08	15.49	6038.71	0.303999	57355.69	8424.82	0.37	14
40	94.60	49.83	16.69	6131.61	0.309999	58487.70	8591.09	0.37	14
41	94.60	50.57	17.89	6227.66	0.315999	59619.72	8757.37	0.37	14
42	94.60	51.31	19.09	6326.82	0.321999	60751.74	8923.65	0.37	14
43	94.60	52.05	20.27	6427.45	0.327999	61883.76	9089.93	0.38	14
44	94.60	52.78	21.46	6531.57	0.333999	63015.78	9256.21	0.38	14
45	94.60	53.51	22.65	6639.25	0.339999	64147.79	9422.49	0.38	14
46	94.60	54.23	23.83	6750.56	0.345999	65279.81	9588.77	0.38	14
47	94.60	54.96	25.00	6863.66	0.351999	66411.81	9755.05	0.38	14
48	94.60	55.68	26.17	6980.81	0.357999	67543.88	9921.33	0.38	14
49	94.60	56.39	27.34	7102.02	0.363999	68675.88	10087.61	0.38	14
50	94.60	57.11	28.50	7227.43	0.369999	69807.88	10253.89	0.39	14
51	94.60	57.82	29.67	7357.41	0.375999	70939.94	10420.16	0.39	14
52	94.60	58.53	30.83	7492.02	0.381999	72071.94	10586.44	0.39	14
53	94.60	59.23	31.98	7629.27	0.387999	73203.94	10752.72	0.39	14
54	94.60	59.94	33.13	7771.59	0.393999	74336.00	10919.00	0.39	14
55	94.60	60.64	34.29	7921.48	0.399999	75468.00	11085.28	0.39	14
56	94.60	61.33	35.44	8074.67	0.405999	76600.00	11251.56	0.40	14
57	94.60	62.03	36.58	8233.49	0.411999	77732.00	11417.84	0.40	14
58	94.60	62.72	37.72	8398.55	0.417999	78864.06	11584.12	0.40	14
59	94.60	63.41	38.86	8569.96	0.423999	79996.06	11750.40	0.40	14
60	94.60	64.10	40.01	8750.72	0.429999	81128.06	11916.68	0.40	14

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 50.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2878.1399

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7344

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 73956.750 SOLAR = 46257.699 ALBEDO = 3344.796

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.49483

MAXIMUM ABSORPTANCE VALUE = 0.43000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00600 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-25.08	-77.41	2777.15	0.070000	46257.70	3344.80	0.20	15
1	94.60	-23.19	-74.65	2822.60	0.076000	50222.61	3631.49	0.20	15
2	94.60	-21.33	-71.94	2868.34	0.082000	54187.56	3918.19	0.20	15
3	94.60	-19.48	-69.28	2915.11	0.088000	58152.47	4204.88	0.20	15
4	94.60	-17.67	-66.66	2962.25	0.094000	62117.42	4491.58	0.20	15
5	94.60	-15.87	-64.09	3010.55	0.100000	66082.31	4778.27	0.20	15
6	94.60	-14.09	-61.56	3059.43	0.106000	70047.25	5064.97	0.21	15
7	94.60	-12.34	-59.07	3108.89	0.112000	74012.19	5351.66	0.21	15
8	94.60	-10.61	-56.62	3159.05	0.118000	77977.13	5638.36	0.21	15
9	94.60	-8.90	-54.21	3210.59	0.124000	81942.06	5925.06	0.21	15
10	94.60	-7.20	-51.84	3262.22	0.130000	85907.00	6211.76	0.21	15
11	94.60	-5.53	-49.49	3315.37	0.136000	89871.94	6498.45	0.22	15
12	94.60	-3.87	-47.18	3369.41	0.142000	93836.88	6785.15	0.22	15
13	94.60	-2.23	-44.91	3424.35	0.148000	97801.81	7071.84	0.22	15
14	94.60	-0.61	-42.66	3480.24	0.154000	101766.75	7358.54	0.22	15
15	94.60	1.00	-40.45	3537.18	0.160000	105731.69	7645.23	0.22	15
16	94.60	2.58	-38.26	3595.92	0.166000	109696.63	7931.93	0.22	15
17	94.60	4.16	-36.10	3655.02	0.172000	113661.56	8218.63	0.23	15
18	94.60	5.71	-33.96	3716.75	0.178000	117626.50	8505.32	0.23	14
19	94.60	7.25	-31.86	3778.21	0.184000	121591.44	8792.02	0.23	14
20	94.60	8.78	-29.78	3841.65	0.190000	125556.38	9078.72	0.23	14
21	94.60	10.29	-27.73	3905.60	0.196000	129521.31	9365.41	0.23	14
22	94.60	11.78	-25.69	3971.67	0.202000	133486.25	9652.11	0.24	14
23	94.60	13.27	-23.69	4038.34	0.208000	137451.19	9938.80	0.24	14
24	94.60	14.73	-21.69	4108.77	0.214000	141416.13	10225.50	0.24	14
25	94.60	16.19	-19.74	4178.31	0.220000	145381.06	10512.20	0.24	14
26	94.60	17.63	-17.78	4251.79	0.226000	149346.00	10798.89	0.24	14
27	94.60	19.06	-15.87	4324.41	0.232000	153310.88	11085.59	0.25	14
28	94.60	20.47	-13.95	4401.10	0.237999	157275.88	11372.29	0.25	14
29	94.60	21.88	-12.07	4478.59	0.243999	161240.81	11658.98	0.25	14
30	94.60	23.27	-10.20	4558.69	0.249999	165205.69	11945.68	0.25	14
31	94.60	24.65	-8.34	4641.39	0.255999	169170.69	12232.38	0.26	14
32	94.60	26.02	-6.51	4725.12	0.261999	173135.63	12519.07	0.26	14
33	94.60	27.37	-4.69	4811.56	0.267999	177100.56	12805.77	0.26	14
34	94.60	28.72	-2.89	4900.95	0.273999	181065.50	13092.46	0.26	14
35	94.60	30.05	-1.11	4991.41	0.279999	185030.44	13379.16	0.27	14
36	94.60	31.38	0.67	5086.60	0.285999	188995.31	13665.86	0.27	14
37	94.60	32.69	2.43	5183.12	0.291999	192960.31	13952.55	0.27	14

38	94.60	33.99	4.17	5282.83	0.297999	196925.25	14239.25	0.27	14
39	94.60	35.28	5.92	5387.53	0.303999	200890.13	14525.95	0.27	14
40	94.60	36.57	7.63	5493.81	0.309999	204855.13	14812.64	0.28	14
41	94.60	37.84	9.34	5603.52	0.315999	208820.00	15099.34	0.28	14
42	94.60	39.10	11.03	5716.73	0.321999	212784.94	15386.04	0.28	14
43	94.60	40.35	12.71	5833.72	0.327999	216749.94	15672.73	0.29	14
44	94.60	41.60	14.39	5956.39	0.333999	220714.81	15959.43	0.29	14
45	94.60	42.83	16.04	6081.02	0.339999	224679.75	16246.12	0.29	14
46	94.60	44.06	17.70	6211.69	0.345999	228644.69	16532.82	0.29	14
47	94.60	45.27	19.35	6348.58	0.351999	232609.63	16819.52	0.30	14
48	94.60	46.48	20.98	6489.94	0.357999	236574.56	17106.21	0.30	14
49	94.60	47.68	22.60	6635.84	0.363999	240539.50	17392.91	0.30	14
50	94.60	48.87	24.22	6788.61	0.369999	244504.44	17679.60	0.30	14
51	94.60	50.05	25.83	6946.40	0.375999	248469.38	17966.30	0.31	14
52	94.60	51.23	27.42	7111.36	0.381999	252434.38	18252.99	0.31	14
53	94.60	52.39	29.02	7286.32	0.387999	256399.25	18539.69	0.31	13
54	94.60	53.55	30.60	7464.76	0.393999	260364.19	18826.39	0.32	13
55	94.60	54.70	32.19	7655.96	0.399999	264329.13	19113.09	0.32	13
56	94.60	55.84	33.75	7851.45	0.405999	268294.06	19399.78	0.32	13
57	94.60	56.98	35.33	8060.38	0.411999	272259.00	19686.48	0.33	13
58	94.60	58.11	36.89	8279.07	0.417999	276223.94	19973.17	0.33	13
59	94.60	59.23	38.45	8507.69	0.423999	280188.88	20259.87	0.33	13
60	94.60	60.34	40.01	8751.80	0.429999	284153.81	20546.56	0.34	13

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 50.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 3829.5591

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 43730.793 SOLAR = 20722.926 ALBEDO = 1758.014

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.64567

MAXIMUM ABSORPTANCE VALUE = 0.43000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00600 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	3.66	-52.23	3253.57	0.070000	20722.93	1758.01	0.28	15
1	94.60	4.85	-50.35	3295.59	0.076000	22499.18	1908.70	0.28	15
2	94.60	6.04	-48.47	3338.89	0.082000	24275.42	2059.39	0.28	15
3	94.60	7.22	-46.62	3382.53	0.088000	26051.67	2210.07	0.28	15
4	94.60	8.39	-44.79	3427.06	0.094000	27827.92	2360.76	0.28	15
5	94.60	9.56	-42.97	3472.53	0.100000	29604.17	2511.45	0.29	15
6	94.60	10.71	-41.17	3518.47	0.106000	31380.41	2662.13	0.29	15
7	94.60	11.85	-39.38	3565.45	0.112000	33156.66	2812.82	0.29	15
8	94.60	12.99	-37.62	3612.92	0.118000	34932.90	2963.51	0.29	15
9	94.60	14.12	-35.86	3661.55	0.124000	36709.16	3114.19	0.29	15
10	94.60	15.24	-34.13	3710.77	0.130000	38485.40	3264.88	0.29	15
11	94.60	16.35	-32.41	3761.20	0.136000	40261.64	3415.56	0.30	15
12	94.60	17.46	-30.69	3812.87	0.142000	42037.89	3566.25	0.30	15
13	94.60	18.55	-29.00	3864.72	0.148000	43814.14	3716.94	0.30	15
14	94.60	19.64	-27.33	3917.90	0.154000	45590.39	3867.62	0.30	15
15	94.60	20.73	-25.65	3972.43	0.160000	47366.64	4018.31	0.30	15
16	94.60	21.80	-24.00	4027.81	0.166000	49142.88	4169.00	0.30	15
17	94.60	22.87	-22.35	4084.68	0.172000	50919.13	4319.68	0.31	15
18	94.60	23.93	-20.73	4141.88	0.178000	52695.37	4470.37	0.31	15
19	94.60	24.99	-19.11	4201.21	0.184000	54471.63	4621.05	0.31	15
20	94.60	26.03	-17.51	4260.96	0.190000	56247.87	4771.74	0.31	15
21	94.60	27.07	-15.91	4322.95	0.196000	58024.11	4922.43	0.31	15
22	94.60	28.10	-14.33	4385.41	0.202000	59800.36	5073.11	0.31	15
23	94.60	29.13	-12.76	4449.63	0.208000	61576.57	5223.80	0.32	15
24	94.60	30.15	-11.19	4515.64	0.214000	63352.86	5374.49	0.32	15
25	94.60	31.17	-9.65	4582.25	0.220000	65129.09	5525.18	0.32	14
26	94.60	32.18	-8.10	4652.06	0.226000	66905.31	5675.86	0.32	14
27	94.60	33.18	-6.56	4722.54	0.232000	68681.50	5826.55	0.32	14
28	94.60	34.17	-5.05	4793.71	0.237999	70457.81	5977.23	0.32	14
29	94.60	35.16	-3.53	4868.36	0.243999	72234.06	6127.92	0.33	14
30	94.60	36.15	-2.03	4943.79	0.249999	74010.25	6278.61	0.33	14
31	94.60	37.13	-0.54	5021.41	0.255999	75786.50	6429.29	0.33	14
32	94.60	38.10	0.95	5101.34	0.261999	77562.81	6579.98	0.33	14
33	94.60	39.07	2.44	5183.64	0.267999	79339.00	6730.67	0.33	14
34	94.60	40.03	3.90	5266.94	0.273999	81115.25	6881.35	0.34	14
35	94.60	40.98	5.37	5354.22	0.279999	82891.50	7032.04	0.34	14
36	94.60	41.93	6.82	5442.70	0.285999	84667.81	7182.73	0.34	14
37	94.60	42.88	8.27	5533.83	0.291999	86444.00	7333.41	0.34	14

38	94.60	43.82	9.71	5627.76	0.297999	88220.25	7484.10	0.34	14
39	94.60	44.75	11.15	5724.62	0.303999	89996.50	7634.79	0.34	14
40	94.60	45.68	12.58	5824.45	0.309999	91772.75	7785.47	0.35	14
41	94.60	46.61	14.00	5927.43	0.315999	93549.00	7936.16	0.35	14
42	94.60	47.52	15.40	6031.96	0.321999	95325.25	8086.84	0.35	14
43	94.60	48.44	16.81	6141.53	0.327999	97101.50	8237.53	0.35	14
44	94.60	49.35	18.22	6254.54	0.333999	98877.75	8388.22	0.35	14
45	94.60	50.25	19.62	6371.20	0.339999	100654.00	8538.91	0.36	14
46	94.60	51.15	21.01	6491.76	0.345999	102430.19	8689.59	0.36	14
47	94.60	52.05	22.39	6616.19	0.351999	104206.44	8840.28	0.36	14
48	94.60	52.94	23.77	6744.70	0.357999	105982.75	8990.96	0.36	14
49	94.60	53.82	25.14	6877.50	0.363999	107758.94	9141.65	0.36	14
50	94.60	54.70	26.52	7016.71	0.369999	109535.19	9292.34	0.37	14
51	94.60	55.58	27.88	7160.70	0.375999	111311.50	9443.03	0.37	14
52	94.60	56.45	29.25	7309.68	0.381999	113087.75	9593.71	0.37	14
53	94.60	57.32	30.60	7463.73	0.387999	114863.94	9744.40	0.37	14
54	94.60	58.18	31.95	7625.42	0.393999	116640.19	9895.09	0.38	14
55	94.60	59.04	33.31	7795.00	0.399999	118416.50	10045.77	0.38	14
56	94.60	59.90	34.65	7968.57	0.405999	120192.69	10196.46	0.38	14
57	94.60	60.75	35.99	8150.71	0.411999	121968.94	10347.14	0.38	14
58	94.60	61.59	37.33	8342.15	0.417999	123745.19	10497.83	0.38	14
59	94.60	62.44	38.67	8540.62	0.423999	125521.44	10648.52	0.39	14
60	94.60	63.27	40.00	8749.37	0.429999	127297.69	10799.20	0.39	14

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

MAXIMUM SOLAR ABSORPTANCE VALUE OVER INTERVAL EXCEEDS 0.31813 WHICH IS UPPER LIMIT REQUIRING INFINITE RADIATOR AREA

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 7214.0000

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 82378.688 SOLAR = 55185.797 ALBEDO = 1762.122

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.48015

MAXIMUM ABSORPTANCE VALUE = 0.43000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00600 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-29.95	-80.17	2733.39	0.070000	55185.80	1762.12	0.18	15
1	94.60	-27.94	-77.28	2779.23	0.076000	59916.00	1913.16	0.18	15
2	94.60	-25.95	-74.44	2826.12	0.082000	64646.19	2064.20	0.18	15
3	94.60	-23.99	-71.66	2873.43	0.088000	69376.38	2215.24	0.19	15
4	94.60	-22.06	-68.93	2921.31	0.094000	74106.56	2366.27	0.19	15
5	94.60	-20.16	-66.26	2969.72	0.100000	78836.75	2517.31	0.19	15
6	94.60	-18.27	-63.62	3019.52	0.106000	83566.94	2668.35	0.19	15
7	94.60	-16.41	-61.04	3069.32	0.112000	88297.19	2819.39	0.19	15
8	94.60	-14.58	-58.49	3120.58	0.118000	93027.38	2970.43	0.19	15
9	94.60	-12.77	-55.99	3172.67	0.124000	97757.56	3121.47	0.20	15
10	94.60	-10.98	-53.53	3224.91	0.130000	102487.75	3272.50	0.20	15
11	94.60	-9.21	-51.11	3278.83	0.136000	107217.94	3423.54	0.20	15
12	94.60	-7.46	-48.72	3332.99	0.142000	111948.13	3574.58	0.20	15
13	94.60	-5.73	-46.37	3388.94	0.148000	116678.31	3725.62	0.20	15
14	94.60	-4.02	-44.06	3445.22	0.154000	121408.50	3876.66	0.21	15
15	94.60	-2.33	-41.77	3503.39	0.160000	126138.75	4027.70	0.21	15
16	94.60	-0.66	-39.52	3561.94	0.166000	130868.88	4178.73	0.21	15
17	94.60	1.00	-37.30	3621.74	0.172000	135599.06	4329.77	0.21	15
18	94.60	2.63	-35.10	3683.65	0.178000	140329.31	4480.81	0.21	14
19	94.60	4.25	-32.94	3746.04	0.184000	145059.56	4631.85	0.22	14
20	94.60	5.85	-30.82	3808.92	0.190000	149789.75	4782.89	0.22	14
21	94.60	7.44	-28.71	3874.03	0.196000	154519.88	4933.93	0.22	14
22	94.60	9.01	-26.62	3941.52	0.202000	159250.13	5084.97	0.22	14
23	94.60	10.57	-24.56	4009.65	0.208000	163980.31	5236.01	0.22	14
24	94.60	12.10	-22.53	4078.41	0.214000	168710.56	5387.04	0.23	14
25	94.60	13.63	-20.52	4149.70	0.220000	173440.69	5538.08	0.23	14
26	94.60	15.14	-18.53	4223.49	0.226000	178170.88	5689.12	0.23	14
27	94.60	16.63	-16.56	4298.10	0.232000	182901.13	5840.16	0.23	14
28	94.60	18.12	-14.61	4375.42	0.237999	187631.31	5991.20	0.23	14
29	94.60	19.58	-12.69	4453.49	0.243999	192361.44	6142.24	0.24	14
30	94.60	21.04	-10.78	4534.44	0.249999	197091.69	6293.28	0.24	14
31	94.60	22.48	-8.90	4616.38	0.255999	201821.88	6444.32	0.24	14
32	94.60	23.91	-7.03	4701.17	0.261999	206552.13	6595.36	0.24	14
33	94.60	25.32	-5.17	4788.90	0.267999	211282.38	6746.39	0.24	14
34	94.60	26.73	-3.34	4877.84	0.273999	216012.44	6897.43	0.25	14
35	94.60	28.12	-1.53	4969.86	0.279999	220742.69	7048.47	0.25	14
36	94.60	29.50	0.27	5065.04	0.285999	225472.94	7199.51	0.25	14
37	94.60	30.87	2.06	5163.48	0.291999	230203.00	7350.55	0.25	14

38	94.60	32.22	3.83	5263.36	0.297999	234933.25	7501.59	0.26	14
39	94.60	33.57	5.58	5366.58	0.303999	239663.50	7652.63	0.26	14
40	94.60	34.90	7.34	5475.48	0.309999	244393.69	7803.66	0.26	14
41	94.60	36.23	9.06	5585.97	0.315999	249123.94	7954.70	0.26	14
42	94.60	37.54	10.78	5700.01	0.321999	253854.06	8105.74	0.27	14
43	94.60	38.84	12.48	5818.05	0.327999	258584.25	8256.78	0.27	14
44	94.60	40.14	14.17	5940.06	0.333999	263314.50	8407.82	0.27	14
45	94.60	41.42	15.85	6066.08	0.339999	268044.69	8558.86	0.28	14
46	94.60	42.69	17.52	6198.50	0.345999	272774.81	8709.89	0.28	14
47	94.60	43.96	19.18	6335.28	0.351999	277505.06	8860.93	0.28	14
48	94.60	45.21	20.83	6476.63	0.357999	282235.25	9011.97	0.28	14
49	94.60	46.46	22.47	6622.72	0.363999	286965.50	9163.01	0.29	14
50	94.60	47.69	24.10	6775.75	0.369999	291695.75	9314.05	0.29	14
51	94.60	48.92	25.72	6936.13	0.375999	296425.88	9465.09	0.29	13
52	94.60	50.14	27.34	7104.05	0.381999	301156.06	9616.13	0.30	13
53	94.60	51.35	28.94	7275.33	0.387999	305886.31	9767.16	0.30	13
54	94.60	52.55	30.54	7459.33	0.393999	310616.50	9918.20	0.30	13
55	94.60	53.74	32.13	7647.05	0.399999	315346.63	10069.24	0.31	13
56	94.60	54.93	33.72	7848.43	0.405999	320076.88	10220.28	0.31	13
57	94.60	56.10	35.31	8059.09	0.411999	324807.06	10371.32	0.31	13
58	94.60	57.27	36.86	8274.56	0.417999	329537.31	10522.36	0.32	13
59	94.60	58.43	38.45	8509.80	0.423999	334267.56	10673.40	0.32	13
60	94.60	59.58	40.00	8750.98	0.429999	338997.63	10824.43	0.32	13

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

MAXIMUM SOLAR ABSORPTANCE VALUE OVER INTERVAL EXCEEDS 0.30598 WHICH IS UPPER LIMIT REQUIRING INFINITE RADIATOR AREA

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 7183.5469

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 82030.938 SOLAR = 56647.188 ALBEDO = 0.002

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.48066

MAXIMUM ABSORPTANCE VALUE = 0.43000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00600 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-29.76	-80.07	2735.03	0.070000	56647.19	0.00	0.18	15
1	94.60	-27.76	-77.19	2780.86	0.076000	61502.64	0.00	0.18	15
2	94.60	-25.78	-74.35	2827.74	0.082000	66358.06	0.00	0.19	15
3	94.60	-23.82	-71.59	2875.05	0.088000	71213.50	0.00	0.19	15
4	94.60	-21.90	-68.85	2922.89	0.094000	76069.00	0.00	0.19	15
5	94.60	-19.99	-66.18	2971.29	0.100000	80924.44	0.00	0.19	15
6	94.60	-18.12	-63.55	3021.06	0.106000	85779.94	0.00	0.19	15
7	94.60	-16.26	-60.97	3070.80	0.112000	90635.38	0.00	0.19	15
8	94.60	-14.43	-58.43	3122.04	0.118000	95490.81	0.00	0.20	15
9	94.60	-12.62	-55.94	3173.32	0.124000	100346.31	0.00	0.20	15
10	94.60	-10.83	-53.47	3226.27	0.130000	105201.75	0.00	0.20	15
11	94.60	-9.07	-51.05	3280.16	0.136000	110057.19	0.00	0.20	15
12	94.60	-7.32	-48.67	3334.21	0.142000	114912.69	0.00	0.20	15
13	94.60	-5.59	-46.32	3390.14	0.148000	119768.13	0.00	0.20	15
14	94.60	-3.89	-44.01	3446.29	0.154000	124623.56	0.00	0.21	15
15	94.60	-2.20	-41.73	3504.43	0.160000	129479.00	0.00	0.21	15
16	94.60	-0.53	-39.48	3562.90	0.166000	134334.44	0.00	0.21	15
17	94.60	1.12	-37.26	3623.43	0.172000	139189.94	0.00	0.21	15
18	94.60	2.75	-35.07	3684.38	0.178000	144045.31	0.00	0.21	14
19	94.60	4.37	-32.91	3746.68	0.184000	148900.81	0.00	0.22	14
20	94.60	5.97	-30.77	3811.17	0.190000	153756.31	0.00	0.22	14
21	94.60	7.55	-28.67	3876.21	0.196000	158611.81	0.00	0.22	14
22	94.60	9.12	-26.59	3941.85	0.202000	163467.19	0.00	0.22	14
23	94.60	10.67	-24.54	4009.82	0.208000	168322.69	0.00	0.22	14
24	94.60	12.21	-22.50	4080.21	0.214000	173178.19	0.00	0.23	14
25	94.60	13.73	-20.49	4151.31	0.220000	178033.56	0.01	0.23	14
26	94.60	15.23	-18.50	4224.97	0.226000	182889.06	0.01	0.23	14
27	94.60	16.73	-16.53	4299.48	0.232000	187744.56	0.01	0.23	14
28	94.60	18.21	-14.60	4374.76	0.237999	192600.06	0.01	0.23	14
29	94.60	19.67	-12.66	4454.56	0.243999	197455.44	0.01	0.24	14
30	94.60	21.12	-10.77	4533.49	0.249999	202310.94	0.01	0.24	14
31	94.60	22.56	-8.88	4617.06	0.255999	207166.44	0.01	0.24	14
32	94.60	23.99	-7.01	4701.69	0.261999	212021.81	0.01	0.24	14
33	94.60	25.40	-5.16	4789.19	0.267999	216877.31	0.01	0.25	14
34	94.60	26.80	-3.33	4877.89	0.273999	221732.81	0.01	0.25	14
35	94.60	28.19	-1.51	4971.68	0.279999	226588.19	0.01	0.25	14
36	94.60	29.57	0.28	5064.66	0.285999	231443.69	0.01	0.25	14
37	94.60	30.94	2.07	5162.97	0.291999	236299.19	0.01	0.26	14

38	94.60	32.29	3.84	5264.48	0.297999	241154.63	0.01	0.26	14
39	94.60	33.64	5.60	5367.55	0.303999	246010.06	0.01	0.26	14
40	94.60	34.97	7.33	5474.15	0.309999	250865.50	0.01	0.26	14
41	94.60	36.29	9.07	5586.34	0.315999	255721.00	0.01	0.27	14
42	94.60	37.60	10.78	5700.17	0.321999	260576.38	0.01	0.27	14
43	94.60	38.90	12.49	5817.92	0.327999	265431.88	0.01	0.27	14
44	94.60	40.19	14.17	5939.61	0.333999	270287.38	0.01	0.27	14
45	94.60	41.48	15.86	6067.40	0.339999	275142.75	0.01	0.28	14
46	94.60	42.75	17.53	6199.50	0.345999	279998.25	0.01	0.28	14
47	94.60	44.01	19.19	6335.86	0.351999	284853.75	0.01	0.28	14
48	94.60	45.26	20.84	6476.93	0.357999	289709.25	0.01	0.28	14
49	94.60	46.51	22.48	6624.82	0.363999	294564.63	0.01	0.29	14
50	94.60	47.74	24.11	6777.48	0.369999	299420.13	0.01	0.29	14
51	94.60	48.97	25.73	6937.53	0.375999	304275.63	0.01	0.29	13
52	94.60	50.18	27.35	7105.04	0.381999	309131.13	0.01	0.30	13
53	94.60	51.39	28.94	7276.01	0.387999	313986.50	0.01	0.30	13
54	94.60	52.59	30.55	7459.61	0.393999	318842.00	0.01	0.30	13
55	94.60	53.78	32.13	7647.00	0.399999	323697.38	0.01	0.31	13
56	94.60	54.96	33.72	7847.83	0.405999	328552.88	0.01	0.31	13
57	94.60	56.14	35.30	8057.92	0.411999	333408.38	0.01	0.31	13
58	94.60	57.30	36.88	8277.78	0.417999	338263.88	0.01	0.32	13
59	94.60	58.46	38.44	8507.78	0.423999	343119.25	0.01	0.32	13
60	94.60	59.61	40.01	8753.40	0.429999	347974.75	0.01	0.32	13

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SPACE STATION RADIATOR PROGRAM

ALTITUDE (N.MI.), LOWEST =   235  HIGHEST =   235  INCREMENT =     1

ORBIT INCLINATION (DEG.), LOWEST =    10  HIGHEST =    90  INCREMENT =    20

DISSIPATION (KW.), LOWEST =    35  HIGHEST =    70  INCREMENT =    35

BREAK POINT FROM PLATE TO CYLINDRICAL RADIATORS (KW.) =   35.00

MONTHS DEGRADATION FOR FLAT PLATE RADIATOR  =    60  INCREMENT =     1
MONTHS DEGRADATION FOR CYLINDRICAL RADIATOR =    60  INCREMENT =     1

SHADING COEFFICIENTS
PLATE, SOLAR =   0.900000  EARTHSHINE =   0.900000  ALBEDO =   0.900000
CYL. , SOLAR =   0.800000  EARTHSHINE =   0.800000  ALBEDO =   0.800000

PLATE, SHAPE FACTOR TO SPACE =   0.900000  FLUID CP =     0.2500  BTU/LBM-R.
CYL. , SHAPE FACTOR TO SPACE =   0.800000  FLUID CP =     0.2500  BTU/LBM-R.

RADIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE =    0.07000  EMITTANCE =    0.76000  MONTHLY CHANGE IN ABSORPTANCE =   0.009000
CYL. , ABSORPTANCE =    0.07000  EMITTANCE =    0.76000  MONTHLY CHANGE IN ABSORPTANCE =   0.009000
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FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 1066.3511

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7344

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 27400.988 SOLAR = 3196.856 ALBEDO = 1898.624

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 1.00000

MAXIMUM ABSORPTANCE VALUE = 0.61000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00900 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	35.66	-10.20	4558.14	0.070000	3196.86	1898.62	0.36	15
1	94.60	36.19	-9.29	4598.44	0.079000	3607.88	2142.73	0.36	15
2	94.60	36.72	-8.38	4638.67	0.088000	4018.90	2386.84	0.36	15
3	94.60	37.25	-7.48	4679.63	0.097000	4429.92	2630.95	0.36	15
4	94.60	37.78	-6.58	4721.39	0.106000	4840.94	2875.05	0.37	15
5	94.60	38.31	-5.69	4763.13	0.115000	5251.96	3119.16	0.37	15
6	94.60	38.83	-4.79	4806.51	0.124000	5662.98	3363.27	0.37	15
7	94.60	39.35	-3.91	4849.11	0.133000	6074.01	3607.38	0.37	15
8	94.60	39.88	-3.02	4893.36	0.142000	6485.03	3851.48	0.37	15
9	94.60	40.39	-2.13	4938.54	0.150999	6896.05	4095.59	0.37	15
10	94.60	40.91	-1.25	4983.77	0.159999	7307.07	4339.70	0.37	15
11	94.60	41.43	-0.37	5029.97	0.168999	7718.09	4583.80	0.37	15
12	94.60	41.95	0.49	5076.27	0.177999	8129.12	4827.91	0.37	15
13	94.60	42.46	1.38	5124.41	0.186999	8540.14	5072.02	0.37	15
14	94.60	42.97	2.24	5171.88	0.195999	8951.16	5316.13	0.37	15
15	94.60	43.48	3.11	5221.21	0.204999	9362.18	5560.23	0.38	15
16	94.60	43.99	3.97	5270.77	0.213999	9773.21	5804.34	0.38	15
17	94.60	44.50	4.83	5321.40	0.222999	10184.23	6048.45	0.38	15
18	94.60	45.00	5.69	5373.14	0.231999	10595.25	6292.55	0.38	15
19	94.60	45.51	6.56	5426.06	0.240999	11006.27	6536.66	0.38	15
20	94.60	46.01	7.41	5479.25	0.249999	11417.29	6780.77	0.38	15
21	94.60	46.51	8.26	5532.70	0.258999	11828.31	7024.88	0.38	15
22	94.60	47.01	9.12	5588.35	0.267999	12239.34	7268.98	0.38	15
23	94.60	47.51	9.96	5644.32	0.276999	12650.36	7513.09	0.38	15
24	94.60	48.00	10.80	5700.63	0.285999	13061.38	7757.20	0.38	15
25	94.60	48.50	11.65	5759.22	0.294999	13472.40	8001.31	0.39	15
26	94.60	48.99	12.49	5818.22	0.303999	13883.42	8245.41	0.39	15
27	94.60	49.49	13.33	5877.63	0.312998	14294.45	8489.52	0.39	15
28	94.60	49.98	14.17	5939.42	0.321998	14705.47	8733.63	0.39	15
29	94.60	50.47	15.00	6001.75	0.330998	15116.49	8977.74	0.39	15
30	94.60	50.95	15.83	6064.52	0.339998	15527.51	9221.84	0.39	15
31	94.60	51.44	16.67	6129.89	0.348998	15938.54	9465.95	0.39	15
32	94.60	51.93	17.50	6195.78	0.357998	16349.55	9710.06	0.39	15
33	94.60	52.41	18.32	6262.21	0.366998	16760.58	9954.17	0.39	15
34	94.60	52.89	19.15	6331.45	0.375998	17171.59	10198.27	0.39	15
35	94.60	53.38	19.97	6401.29	0.384998	17582.62	10442.38	0.39	15
36	94.60	53.85	20.79	6471.74	0.393998	17993.63	10686.49	0.40	15
37	94.60	54.33	21.61	6545.17	0.402998	18404.66	10930.60	0.40	15

38	94.60	54.81	22.43	6619.32	0.411998	18815.69	11174.70	0.40	15
39	94.60	55.29	23.24	6694.16	0.420998	19226.70	11418.81	0.40	15
40	94.60	55.76	24.06	6772.16	0.429998	19637.72	11662.92	0.40	15
41	94.60	56.23	24.87	6850.96	0.438998	20048.75	11907.03	0.40	15
42	94.60	56.71	25.68	6931.86	0.447998	20459.76	12151.14	0.40	15
43	94.60	57.18	26.49	7013.68	0.456998	20870.79	12395.24	0.40	15
44	94.60	57.65	27.29	7097.63	0.465998	21281.82	12639.35	0.40	15
45	94.60	58.11	28.10	7183.88	0.474997	21692.83	12883.46	0.40	14
46	94.60	58.58	28.90	7271.13	0.483997	22103.86	13127.56	0.41	15
47	94.60	59.05	29.71	7362.05	0.492997	22514.88	13371.67	0.41	14
48	94.60	59.51	30.51	7454.23	0.501997	22925.89	13615.78	0.41	14
49	94.60	59.97	31.30	7547.51	0.510997	23336.92	13859.89	0.41	14
50	94.60	60.44	32.11	7644.73	0.519997	23747.95	14104.00	0.41	14
51	94.60	60.90	32.90	7743.32	0.528997	24158.96	14348.10	0.41	14
52	94.60	61.36	33.69	7843.22	0.537997	24569.99	14592.21	0.41	14
53	94.60	61.81	34.49	7947.45	0.546997	24981.02	14836.32	0.41	14
54	94.60	62.27	35.28	8053.18	0.555997	25392.03	15080.42	0.41	14
55	94.60	62.73	36.08	8163.48	0.564997	25803.05	15324.53	0.41	14
56	94.60	63.18	36.87	8275.48	0.573997	26214.08	15568.64	0.42	14
57	94.60	63.64	37.65	8389.21	0.582997	26625.08	15812.75	0.42	14
58	94.60	64.09	38.43	8504.66	0.591997	27036.11	16056.86	0.42	14
59	94.60	64.54	39.21	8625.18	0.600997	27447.15	16300.96	0.42	14
60	94.60	64.99	40.01	8751.03	0.609997	27858.14	16545.07	0.42	14

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 10.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 3946.4612

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 45065.746 SOLAR = 13936.824 ALBEDO = 2775.674

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.89504

MAXIMUM ABSORPTANCE VALUE = 0.61000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00900 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-2.58	-61.18	3066.54	0.070000	13936.83	2775.67	0.27	15
1	94.60	-1.23	-59.05	3108.88	0.079000	15728.69	3132.54	0.27	15
2	94.60	0.10	-56.93	3152.69	0.088000	17520.56	3489.42	0.27	15
3	94.60	1.43	-54.84	3196.67	0.097000	19312.43	3846.28	0.27	15
4	94.60	2.74	-52.78	3241.34	0.106000	21104.29	4203.15	0.27	15
5	94.60	4.05	-50.73	3287.20	0.115000	22896.16	4560.02	0.28	15
6	94.60	5.34	-48.71	3333.37	0.124000	24688.03	4916.89	0.28	15
7	94.60	6.62	-46.71	3380.43	0.133000	26479.90	5273.77	0.28	15
8	94.60	7.89	-44.74	3428.37	0.142000	28271.76	5630.63	0.28	15
9	94.60	9.15	-42.78	3477.28	0.150999	30063.63	5987.50	0.28	15
10	94.60	10.40	-40.84	3527.20	0.159999	31855.50	6344.38	0.28	15
11	94.60	11.64	-38.92	3577.67	0.168999	33647.37	6701.25	0.29	15
12	94.60	12.88	-37.02	3629.28	0.177999	35439.23	7058.12	0.29	15
13	94.60	14.10	-35.14	3682.03	0.186999	37231.11	7414.99	0.29	15
14	94.60	15.31	-33.27	3736.03	0.195999	39022.96	7771.86	0.29	15
15	94.60	16.51	-31.42	3790.73	0.204999	40814.83	8128.73	0.29	15
16	94.60	17.71	-29.60	3846.20	0.213999	42606.70	8485.60	0.29	15
17	94.60	18.89	-27.78	3903.60	0.222999	44398.57	8842.46	0.30	15
18	94.60	20.07	-25.98	3961.87	0.231999	46190.44	9199.34	0.30	15
19	94.60	21.24	-24.19	4021.59	0.240999	47982.30	9556.21	0.30	15
20	94.60	22.39	-22.42	4082.29	0.249999	49774.17	9913.08	0.30	15
21	94.60	23.55	-20.66	4144.55	0.258999	51566.04	10269.95	0.30	15
22	94.60	24.69	-18.93	4207.89	0.267999	53357.91	10626.82	0.31	15
23	94.60	25.82	-17.20	4272.88	0.276999	55149.77	10983.69	0.31	15
24	94.60	26.95	-15.49	4339.01	0.285999	56941.64	11340.56	0.31	15
25	94.60	28.07	-13.78	4407.57	0.294999	58733.51	11697.43	0.31	15
26	94.60	29.18	-12.10	4477.38	0.303999	60525.37	12054.30	0.31	15
27	94.60	30.28	-10.42	4549.11	0.312998	62317.24	12411.17	0.31	14
28	94.60	31.38	-8.76	4622.19	0.321998	64109.10	12768.04	0.32	14
29	94.60	32.47	-7.10	4697.36	0.330998	65900.94	13124.91	0.32	14
30	94.60	33.55	-5.46	4774.66	0.339998	67692.75	13481.79	0.32	14
31	94.60	34.63	-3.82	4854.14	0.348998	69484.63	13838.65	0.32	14
32	94.60	35.70	-2.21	4934.56	0.357998	71276.56	14195.52	0.32	14
33	94.60	36.76	-0.59	5018.71	0.366998	73068.38	14552.40	0.33	14
34	94.60	37.81	1.00	5103.88	0.375998	74860.25	14909.27	0.33	14
35	94.60	38.86	2.58	5191.55	0.384998	76652.13	15266.14	0.33	14
36	94.60	39.90	4.18	5283.38	0.393998	78444.00	15623.00	0.33	14
37	94.60	40.94	5.74	5376.42	0.402998	80235.88	15979.88	0.33	14

38	94.60	41.97	7.30	5472.22	0.411998	82027.75	16336.75	0.34	14
39	94.60	42.99	8.87	5572.50	0.420998	83819.56	16693.62	0.34	14
40	94.60	44.00	10.41	5674.28	0.429998	85611.50	17050.49	0.34	14
41	94.60	45.01	11.96	5780.74	0.438998	87403.31	17407.36	0.34	14
42	94.60	46.02	13.48	5888.98	0.447998	89195.19	17764.23	0.35	14
43	94.60	47.01	15.01	6002.22	0.456998	90987.06	18121.10	0.35	14
44	94.60	48.01	16.53	6119.09	0.465998	92778.88	18477.97	0.35	14
45	94.60	48.99	18.04	6239.63	0.474997	94570.81	18834.84	0.35	14
46	94.60	49.97	19.53	6364.05	0.483997	96362.69	19191.71	0.35	14
47	94.60	50.95	21.02	6492.63	0.492997	98154.50	19548.58	0.36	14
48	94.60	51.92	22.52	6627.08	0.501997	99946.38	19905.45	0.36	14
49	94.60	52.88	24.00	6766.09	0.510997	101738.31	20262.32	0.36	14
50	94.60	53.84	25.48	6911.68	0.519997	103530.13	20619.17	0.36	14
51	94.60	54.79	26.96	7062.27	0.528997	105322.00	20976.05	0.36	14
52	94.60	55.74	28.42	7217.97	0.537997	107113.88	21332.91	0.37	14
53	94.60	56.68	29.89	7383.23	0.546997	108905.75	21689.78	0.37	14
54	94.60	57.62	31.34	7552.24	0.555997	110697.63	22046.64	0.37	14
55	94.60	58.55	32.80	7729.54	0.564997	112489.44	22403.53	0.37	14
56	94.60	59.48	34.25	7915.36	0.573997	114281.31	22760.39	0.38	14
57	94.60	60.40	35.70	8110.44	0.582997	116073.13	23117.26	0.38	14
58	94.60	61.32	37.13	8312.95	0.591997	117865.00	23474.13	0.38	14
59	94.60	62.23	38.57	8525.56	0.600997	119656.94	23831.01	0.38	14
60	94.60	63.14	40.00	8749.02	0.609997	121448.75	24187.88	0.39	14

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2094.6462

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7344

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 53824.090 SOLAR = 19054.160 ALBEDO = 3279.658

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.79983

MAXIMUM ABSORPTANCE VALUE = 0.61000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00900 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRADATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-13.99	-72.95	2851.05	0.070000	19054.16	3279.66	0.24	15
1	94.60	-12.37	-70.42	2894.85	0.079000	21503.96	3701.33	0.24	15
2	94.60	-10.76	-67.93	2939.09	0.088000	23953.77	4122.99	0.24	15
3	94.60	-9.17	-65.48	2984.38	0.097000	26403.58	4544.66	0.24	15
4	94.60	-7.59	-63.07	3029.81	0.106000	28853.38	4966.33	0.24	15
5	94.60	-6.03	-60.68	3076.41	0.115000	31303.19	5388.00	0.25	15
6	94.60	-4.49	-58.34	3123.30	0.124000	33752.96	5809.66	0.25	15
7	94.60	-2.96	-56.02	3171.51	0.133000	36202.80	6231.33	0.25	15
8	94.60	-1.45	-53.73	3220.62	0.142000	38652.57	6653.00	0.25	15
9	94.60	0.05	-51.48	3270.16	0.150999	41102.41	7074.67	0.25	15
10	94.60	1.53	-49.25	3320.72	0.159999	43552.22	7496.34	0.26	15
11	94.60	3.00	-47.05	3372.36	0.168999	46002.02	7918.00	0.26	15
12	94.60	4.46	-44.88	3425.15	0.177999	48451.83	8339.67	0.26	15
13	94.60	5.90	-42.73	3478.55	0.186999	50901.63	8761.34	0.26	15
14	94.60	7.33	-40.61	3533.26	0.195999	53351.44	9183.01	0.26	15
15	94.60	8.74	-38.51	3588.65	0.204999	55801.25	9604.68	0.27	15
16	94.60	10.15	-36.44	3645.41	0.213999	58251.05	10026.34	0.27	15
17	94.60	11.54	-34.39	3703.57	0.222999	60700.86	10448.01	0.27	15
18	94.60	12.91	-32.36	3762.61	0.231999	63150.66	10869.68	0.27	15
19	94.60	14.28	-30.35	3823.20	0.240999	65600.44	11291.35	0.27	15
20	94.60	15.63	-28.35	3885.37	0.249999	68050.25	11713.02	0.27	15
21	94.60	16.98	-26.39	3948.51	0.258999	70500.06	12134.68	0.28	15
22	94.60	18.31	-24.44	4012.79	0.267999	72949.88	12556.35	0.28	15
23	94.60	19.63	-22.50	4080.01	0.276999	75399.69	12978.02	0.28	14
24	94.60	20.94	-20.60	4146.58	0.285999	77849.44	13399.69	0.28	14
25	94.60	22.24	-18.70	4216.23	0.294999	80299.25	13821.36	0.28	14
26	94.60	23.53	-16.82	4287.86	0.303999	82749.06	14243.02	0.29	14
27	94.60	24.81	-14.97	4360.16	0.312998	85198.88	14664.69	0.29	14
28	94.60	26.08	-13.12	4434.54	0.321998	87648.69	15086.36	0.29	14
29	94.60	27.33	-11.30	4510.98	0.330998	90098.50	15508.03	0.29	14
30	94.60	28.58	-9.48	4589.63	0.339998	92548.31	15929.70	0.30	14
31	94.60	29.82	-7.68	4670.54	0.348998	94998.13	16351.36	0.30	14
32	94.60	31.05	-5.89	4753.73	0.357998	97447.94	16773.03	0.30	14
33	94.60	32.27	-4.12	4839.43	0.366998	99897.69	17194.70	0.30	14
34	94.60	33.48	-2.35	4927.68	0.375998	102347.50	17616.37	0.30	14
35	94.60	34.69	-0.62	5016.98	0.384998	104797.31	18038.04	0.31	14
36	94.60	35.88	1.12	5110.44	0.393998	107247.13	18459.70	0.31	14
37	94.60	37.07	2.84	5206.67	0.402998	109696.94	18881.37	0.31	14

38	94.60	38.24	4.56	5305.84	0.411998	112146.75	19303.04	0.31	14
39	94.60	39.41	6.26	5407.99	0.420998	114596.56	19724.71	0.32	14
40	94.60	40.57	7.95	5513.23	0.429998	117046.38	20146.38	0.32	14
41	94.60	41.73	9.62	5621.65	0.438998	119496.13	20568.04	0.32	14
42	94.60	42.87	11.28	5733.49	0.447998	121946.00	20989.71	0.32	14
43	94.60	44.01	12.94	5850.36	0.456998	124395.75	21411.38	0.33	14
44	94.60	45.14	14.59	5970.88	0.465998	126845.56	21833.05	0.33	14
45	94.60	46.26	16.24	6096.95	0.474997	129295.44	22254.71	0.33	14
46	94.60	47.38	17.86	6225.28	0.483997	131745.19	22676.38	0.33	14
47	94.60	48.48	19.50	6361.18	0.492997	134195.00	23098.05	0.34	14
48	94.60	49.58	21.10	6499.63	0.501997	136644.81	23519.72	0.34	14
49	94.60	50.68	22.72	6646.36	0.510997	139094.63	23941.39	0.34	14
50	94.60	51.76	24.32	6797.82	0.519997	141544.44	24363.05	0.34	14
51	94.60	52.84	25.91	6954.48	0.528997	143994.25	24784.72	0.35	14
52	94.60	53.91	27.50	7120.14	0.537997	146444.06	25206.39	0.35	14
53	94.60	54.98	29.08	7291.53	0.546997	148893.88	25628.06	0.35	14
54	94.60	56.04	30.65	7470.87	0.555997	151343.69	26049.73	0.35	14
55	94.60	57.09	32.22	7658.59	0.564997	153793.44	26471.39	0.36	14
56	94.60	58.14	33.79	7855.27	0.573997	156243.25	26893.06	0.36	14
57	94.60	59.18	35.35	8063.27	0.582997	158692.94	27314.73	0.36	14
58	94.60	60.21	36.90	8279.09	0.591997	161142.81	27736.40	0.36	14
59	94.60	61.24	38.46	8509.98	0.600997	163592.69	28158.07	0.37	14
60	94.60	62.26	40.00	8749.78	0.609997	166042.38	28579.73	0.37	13

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 30.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 4887.4922

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 55811.641 SOLAR = 20579.801 ALBEDO = 3022.906

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.78487

MAXIMUM ABSORPTANCE VALUE = 0.61000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00900 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRACATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-16.20	-75.00	2816.63	0.070000	20579.80	3022.91	0.23	15
1	94.60	-14.52	-72.41	2860.41	0.079000	23225.75	3411.56	0.23	15
2	94.60	-12.85	-69.84	2905.13	0.088000	25871.71	3800.22	0.24	15
3	94.60	-11.21	-67.32	2950.41	0.097000	28517.67	4188.88	0.24	15
4	94.60	-9.58	-64.84	2996.30	0.106000	31163.63	4577.53	0.24	15
5	94.60	-7.97	-62.40	3042.90	0.115000	33809.59	4966.19	0.24	15
6	94.60	-6.38	-59.99	3090.24	0.124000	36455.54	5354.85	0.24	15
7	94.60	-4.80	-57.61	3138.43	0.133000	39101.51	5743.50	0.24	15
8	94.60	-3.24	-55.27	3187.53	0.142000	41747.46	6132.16	0.25	15
9	94.60	-1.70	-52.96	3237.59	0.150999	44393.42	6520.82	0.25	15
10	94.60	-0.17	-50.68	3288.15	0.159999	47039.38	6909.47	0.25	15
11	94.60	1.34	-48.43	3339.79	0.168999	49685.34	7298.13	0.25	15
12	94.60	2.84	-46.21	3392.58	0.177999	52331.29	7686.79	0.25	15
13	94.60	4.33	-44.01	3446.56	0.186999	54977.26	8075.45	0.26	15
14	94.60	5.80	-41.84	3501.25	0.195999	57623.21	8464.11	0.26	15
15	94.60	7.25	-39.69	3557.26	0.204999	60269.17	8852.76	0.26	15
16	94.60	8.70	-37.58	3614.11	0.213999	62915.13	9241.42	0.26	15
17	94.60	10.13	-35.48	3672.37	0.222999	65561.06	9630.07	0.26	15
18	94.60	11.54	-33.41	3732.08	0.231999	68207.00	10018.73	0.27	15
19	94.60	12.95	-31.36	3792.75	0.240999	70853.00	10407.39	0.27	15
20	94.60	14.34	-29.34	3854.46	0.249999	73498.94	10796.05	0.27	15
21	94.60	15.72	-27.33	3917.77	0.258999	76144.88	11184.71	0.27	15
22	94.60	17.09	-25.34	3982.80	0.267999	78790.81	11573.36	0.27	15
23	94.60	18.44	-23.38	4048.98	0.276999	81436.81	11962.02	0.28	14
24	94.60	19.79	-21.43	4117.61	0.285999	84082.69	12350.68	0.28	14
25	94.60	21.12	-19.50	4186.88	0.294999	86728.69	12739.34	0.28	14
26	94.60	22.44	-17.59	4258.05	0.303999	89374.63	13127.99	0.28	14
27	94.60	23.75	-15.70	4331.27	0.312998	92020.63	13516.65	0.28	14
28	94.60	25.06	-13.82	4406.54	0.321998	94666.56	13905.31	0.29	14
29	94.60	26.35	-11.97	4482.63	0.330998	97312.56	14293.96	0.29	14
30	94.60	27.63	-10.12	4562.33	0.339998	99958.50	14682.62	0.29	14
31	94.60	28.90	-8.29	4642.87	0.348998	102604.44	15071.28	0.29	14
32	94.60	30.16	-6.48	4725.83	0.357998	105250.44	15459.93	0.29	14
33	94.60	31.41	-4.67	4812.59	0.366998	107896.31	15848.59	0.30	14
34	94.60	32.65	-2.89	4900.48	0.375998	110542.31	16237.25	0.30	14
35	94.60	33.88	-1.12	4990.95	0.384998	113188.25	16625.91	0.30	14
36	94.60	35.10	0.64	5084.17	0.393998	115834.25	17014.56	0.30	14
37	94.60	36.32	2.38	5180.15	0.402998	118480.19	17403.22	0.31	14

38	94.60	37.52	4.12	5280.56	0.411998	121126.19	17791.88	0.31	14
39	94.60	38.72	5.84	5382.45	0.420998	123772.13	18180.54	0.31	14
40	94.60	39.91	7.56	5489.03	0.429998	126418.06	18569.20	0.31	14
41	94.60	41.09	9.25	5597.27	0.438998	129064.06	18957.85	0.32	14
42	94.60	42.26	10.94	5710.44	0.447998	131709.94	19346.51	0.32	14
43	94.60	43.42	12.62	5827.11	0.456998	134355.94	19735.16	0.32	14
44	94.60	44.58	14.30	5949.13	0.465998	137001.88	20123.82	0.32	14
45	94.60	45.72	15.96	6075.03	0.474997	139647.88	20512.48	0.33	14
46	94.60	46.86	17.61	6204.85	0.483997	142293.81	20901.13	0.33	14
47	94.60	47.99	19.25	6340.58	0.492997	144939.81	21289.78	0.33	14
48	94.60	49.12	20.88	6480.68	0.501997	147585.75	21678.44	0.33	14
49	94.60	50.23	22.51	6627.23	0.510997	150231.75	22067.09	0.34	14
50	94.60	51.34	24.14	6780.34	0.519997	152877.69	22455.75	0.34	14
51	94.60	52.45	25.75	6938.67	0.528997	155523.56	22844.41	0.34	14
52	94.60	53.54	27.35	7104.21	0.537997	158169.56	23233.07	0.34	14
53	94.60	54.63	28.95	7277.35	0.546997	160815.50	23621.72	0.35	14
54	94.60	55.71	30.55	7458.47	0.555997	163461.50	24010.40	0.35	14
55	94.60	56.79	32.14	7648.09	0.564997	166107.44	24399.04	0.35	14
56	94.60	57.85	33.72	7846.56	0.573997	168753.44	24787.69	0.36	14
57	94.60	58.91	35.29	8054.37	0.582997	171399.19	25176.35	0.36	14
58	94.60	59.97	36.86	8274.26	0.591997	174045.19	25565.00	0.36	14
59	94.60	61.02	38.43	8504.73	0.600997	176691.31	25953.66	0.36	13
60	94.60	62.06	40.00	8751.18	0.609997	179337.13	26342.32	0.37	13

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 50.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

MAXIMUM SOLAR ABSORPTANCE VALUE OVER INTERVAL EXCEEDS 0.49483 WHICH IS UPPER LIMIT REQUIRING INFINITE RADIATOR AREA

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 50.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.6C , MIX = 40.00

PLATFORM AREA IN FT2 = 9435.6719

COOLANT MASS FLOW RATE (LBM/HR.) = 8748.7383

INITIAL EXTERNAL HEAT INPUTS (BTU/HR.), EARTHSHINE = 107748.563 SOLAR = 51059.359 ALBEDO = 4331.578

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.64567

MAXIMUM ABSORPTANCE VALUE = C.61000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00900 DELTA ABSORPTANCE PER MONTH

EFFECT OF DEGRACATION

MONTH	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	ABSORPTANCE	SOL(BTU/HR)	AL(BTU/HR)	ETA	ITN
0	94.60	-48.90	-95.98	2506.73	0.070000	51059.36	4331.58	0.14	15
1	94.60	-46.34	-92.36	2555.80	0.079000	57624.08	4888.49	0.14	15
2	94.60	-43.82	-88.85	2604.15	0.088000	64188.83	5445.41	0.15	15
3	94.60	-41.35	-85.42	2653.82	0.097000	70753.50	6002.32	0.15	15
4	94.60	-38.92	-82.08	2704.00	0.106000	77318.25	6559.23	0.15	15
5	94.60	-36.53	-78.82	2754.81	0.115000	83883.00	7116.15	0.15	15
6	94.60	-34.18	-75.63	2806.37	0.124000	90447.69	7673.06	0.15	15
7	94.60	-31.87	-72.52	2858.74	0.133000	97012.44	8229.98	0.15	15
8	94.60	-29.60	-69.47	2912.22	0.142000	103577.19	8786.89	0.15	15
9	94.60	-27.36	-66.49	2965.47	0.150999	110141.94	9343.80	0.16	15
10	94.60	-25.16	-63.57	3021.11	0.159999	116706.69	9900.72	0.16	15
11	94.60	-22.99	-60.72	3075.60	0.168999	123271.44	10457.63	0.16	15
12	94.60	-20.85	-57.91	3132.53	0.177999	129836.13	11014.55	0.16	15
13	94.60	-18.74	-55.16	3189.74	0.186999	136400.88	11571.46	0.16	15
14	94.60	-16.66	-52.46	3248.34	0.195999	142965.63	12128.38	0.16	15
15	94.60	-14.61	-49.80	3308.54	0.204999	149530.31	12685.29	0.17	15
16	94.60	-12.59	-47.20	3369.09	0.213999	156095.00	13242.21	0.17	15
17	94.60	-10.60	-44.64	3431.30	0.222999	162659.75	13799.12	0.17	15
18	94.60	-8.63	-42.12	3493.87	0.231999	169224.56	14356.03	0.17	15
19	94.60	-6.69	-39.65	3558.33	0.240999	175789.19	14912.95	0.17	15
20	94.60	-4.77	-37.21	3624.60	0.249999	182353.94	15469.86	0.18	14
21	94.60	-2.88	-34.80	3692.87	0.258999	188918.69	16026.78	0.18	14
22	94.60	-1.01	-32.44	3761.65	0.267999	195483.50	16583.69	0.18	14
23	94.60	0.84	-30.12	3831.25	0.276999	202048.13	17140.61	0.18	14
24	94.60	2.67	-27.82	3904.19	0.285999	208612.88	17697.52	0.18	14
25	94.60	4.47	-25.55	3977.93	0.294999	215177.69	18254.43	0.19	14
26	94.60	6.25	-23.33	4052.31	0.303999	221742.31	18811.35	0.19	14
27	94.60	8.02	-21.14	4127.68	0.312998	228307.06	19368.26	0.19	14
28	94.60	9.76	-18.97	4206.68	0.321998	234871.81	19925.18	0.19	14
29	94.60	11.49	-16.82	4289.51	0.330998	241436.63	20482.09	0.19	14
30	94.60	13.19	-14.71	4370.46	0.339998	248001.25	21038.99	0.20	14
31	94.60	14.88	-12.62	4455.17	0.348998	254566.00	21595.91	0.20	14
32	94.60	16.55	-10.55	4543.99	0.357998	261130.75	22152.82	0.20	14
33	94.60	18.20	-8.51	4633.75	0.366998	267695.56	22709.74	0.20	14
34	94.60	19.84	-6.50	4724.83	0.375998	274260.19	23266.64	0.20	14
35	94.60	21.46	-4.51	4819.93	0.384998	280824.94	23823.57	0.21	14
36	94.60	23.06	-2.53	4919.28	0.393998	287389.75	24380.47	0.21	14
37	94.60	24.65	-0.58	5020.00	0.402998	293954.50	24937.40	0.21	14

38	94.60	26.22	1.35	5125.16	0.411998	300519.13	25494.30	0.21	14
39	94.60	27.77	3.26	5231.59	0.420998	307083.88	26051.22	0.22	14
40	94.60	29.32	5.16	5342.71	0.429998	313648.69	26608.15	0.22	14
41	94.60	30.84	7.02	5455.39	0.438998	320213.44	27165.05	0.22	14
42	94.60	32.36	8.88	5572.69	0.447998	326778.06	27721.98	0.23	14
43	94.60	33.85	10.72	5694.82	0.456998	333342.81	28278.88	0.23	14
44	94.60	35.34	12.54	5821.70	0.465998	339907.63	28835.80	0.23	14
45	94.60	36.81	14.35	5953.48	0.474997	346472.38	29392.71	0.23	14
46	94.60	38.27	16.15	6090.43	0.483997	353037.00	29949.63	0.24	14
47	94.60	39.72	17.93	6232.62	0.492997	359601.75	30506.53	0.24	14
48	94.60	41.15	19.69	6377.06	0.501997	366166.56	31063.46	0.24	14
49	94.60	42.58	21.44	6529.96	0.510997	372731.31	31620.36	0.25	13
50	94.60	43.99	23.17	6688.37	0.519997	379295.94	32177.29	0.25	13
51	94.60	45.38	24.91	6855.79	0.528997	385860.75	32734.19	0.25	13
52	94.60	46.77	26.63	7031.80	0.537997	392425.50	33291.11	0.26	13
53	94.60	48.15	28.33	7211.30	0.546997	398990.13	33848.02	0.26	13
54	94.60	49.51	30.02	7400.15	0.555997	405554.88	34404.94	0.26	13
55	94.60	50.86	31.71	7598.84	0.564997	412119.69	34961.86	0.27	13
56	94.60	52.21	33.39	7807.47	0.573997	418684.44	35518.77	0.27	13
57	94.60	53.54	35.05	8026.27	0.582997	425248.75	36075.69	0.27	13
58	94.60	54.86	36.71	8255.93	0.591997	431813.69	36632.59	0.28	13
59	94.60	56.17	38.36	8496.84	0.600997	438378.63	37189.52	0.28	13
60	94.60	57.47	40.00	8749.13	0.609997	444943.13	37746.42	0.29	13

FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION = 35.0 KW.
ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

MAXIMUM SOLAR ABSORPTANCE VALUE OVER INTERVAL EXCEEDS 0.31813 WHICH IS UPPER LIMIT REQUIRING INFINITE RADIATOR AREA

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATICN = 35.0 KW.

ORBIT INCLINATION = 70.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

MAXIMUM SOLAR ABSORPTANCE VALUE OVER INTERVAL EXCEEDS 0.48015 WHICH IS UPPER LIMIT REQUIRING INFINITE RADIATOR AREA

```
FLAT PLANE RADIATOR FOR CASE OF 119419.9 BTU/HR. DISSIPATION =  35.0 KW.
ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE =  235.0 NAUTICAL MILES.

MAXIMUM SOLAR ABSORPTANCE VALUE OVER INTERVAL EXCEEDS 0.30598  WHICH IS UPPER LIMIT REQUIRING INFINITE RADIATOR AREA
```

CYLINDRICAL RADIATOR FOR CASE OF 119420.0 BTU/HR. DISSIPATION = 35.0 KW.

ORBIT INCLINATION = 90.0 DEGREES, ALTITUDE = 235.0 NAUTICAL MILES.

MAXIMUM SOLAR ABSORPTANCE VALUE OVER INTERVAL EXCEEDS 0.48066 WHICH IS UPPER LIMIT REQUIRING INFINITE RADIATOR AREA

Appendix D

GEO 25kW POWER MODULE PROGRAM SAMPLE CASE

A sample case of the GEO power module program inputs and outputs will be presented. The following inputs will be used as a sample case of the program use:

1. A synchronous altitude of 19,370 nautical miles will be considered.

2. The β angle considered will be 23.5 degrees.

3. The dissipation value will be set at 20 kW instead of being varied through a range of values.

4. The total on-orbit time duration will be 60 months (5 years), with complete orbital solution intervals of ten months. The orbital increments for the solution orbits will be ten degrees.

5. The fluid inlet and mix temperatures will be set at 94.6^{o}F and 40^{o}F, respectively. The radiator area will be set at a value of 634.2 ft.^{2}

6. The internal head load inputs will consist of direct solar, earthshine and albedo shape factor tabular inputs (up to 50 values per table), in that order. Tables one through three will designate the proper tables. The radiator will be oriented in the orbit plane and space oriented.

7. The view factor to space will be 0.92, and the specific heat of the coolant will be 0.25 BTU/lm-^{o}R (Freon 21).

8. White paint will be given initial α_s and emittance values of 0.15 and 0.88, respectively. Silvered Teflon (2mil) will be given initial α_s and emittance values of 0.07 and 0.76, respectively.

A set of cases will be run to provide samples of program output. The following cases will be considered:

1. A silvered Teflon covered radiator with a degradation rate of 0.005 $\Delta\alpha_s$/Mo.
2. A white paint covered radiator with a degradation rate of 0.005 $\Delta\alpha_s$/Mo.
3. A silvered Teflon covered radiator with a degradation rate of 0.015 $\Delta\alpha_s$/Mo.

The succeeding pages will present these inputs written out on a coding form, followed by program output.

10-132-199 (REV. 8/68)

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE ______ PROGRAM NO. POWER MODULE PROGRAM PROGRAMMED BY ______ 1.

INPUT FORMATS

```
1 FIRST CARD:
    23.5 | 3 FORMAT(5X,F5.2)
    BETA

2 SECOND CARD:
          20        20        1 | 3 FORMAT(3I10)
          ND1       ND2       ND3

3 THIRD CARD:
          60        10        10 | 3 FORMAT(3I10)
          MDP       MODI      INTR

4 FOURTH CARD: START OF TABLE 1, 3 TABLES REQUIRED
    1    SOLAR FS FOR B= 23.5 DEGREES, PLANAR RAD IN ORBIT PLANE. 3 FORMAT(I5,2X,10A4)
   NUM

ADDITIONAL TABLE CARDS FOLLOW:
              0.0                 0.39875 3 FORMAT(10X,E10.4,5X,E12.6)
            360.0                 0.39875
    2    EARTHSHINE FE FOR GEO PLANAR RAD IN ORBIT PLANE.
              0.0                 0.00071
            360.0                 0.00071
    3    ALBEDO FA FOR B= 23.5 DEGREES, PLANAR RAD IN ORBIT PLANE.
```

STK. NO. D-1-083

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10-192-190 (REV. 9/60)

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE______ PROGRAM NO.______ PROGRAMMED BY______ 2

0.0	0.00046
10.0	0.00045
20.0	0.00043
30.0	0.00040
40.0	0.00036
50.0	0.00032
60.0	0.00027
70.0	0.00022
80.0	0.00018
90.0	0.00014
100.0	0.00010
110.0	0.00007
120.0	0.00005
130.0	0.00003
140.0	0.00002
150.0	0.00001
160.0	0.0
200.0	0.0
210.0	0.00001
220.0	0.00002
230.0	0.00003
240.0	0.00005
250.0	0.00007
260.0	0.00010
270.0	0.00014
280.0	0.00018

STK. NO. D-1-063

10-155-150 (REV. 8/68)

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE ____________ PROGRAM NO. ____________ PROGRAMMED BY ____________ 3.

```
          290.0            0.00022
          300.0            0.00027
          310.0            0.00032
          320.0            0.00036
          330.0            0.00040
          340.0            0.00043
          350.0            0.00045
          360.0            0.00046

NEXT CARD:
P         94.6      40.0      634.2    } FORMAT(1A4,6X,3F10.4)
TEST      PTI       PTM       PAREA

NEXT CARD:
P         0.92      0.25     } FORMAT(1A4,6X,2F10.4)
TEST      PSPACE    PCP

NEXT CARD:
P         0.07      0.76      0.005    } FORMAT(1A4,6X,3F10.4)
TEST      PALPHA    EMTP      PDEG

P         0.15      0.88      0.005  } ADDITIONAL SURFACE
P         0.07      0.76      0.015  } PROPERTY CARDS
```

STK. NO. D-1-083

```
G E O S Y N C H R O N O U S   2 5 K W   P O W E R   M O D U L E   P R O G R A M .

ALTITUDE (N.MI.) =   19370.0

ORBIT INCLINATICN BETA ANGLE (DEGREES) =  23.50

DISSIPATION (KW.), LOWEST =    20  HIGHEST =    20  INCREMENT =     1

MONTHS DEGRACATION FOR PLATE RADIATOR =    60  INCREMENT =    10

ORBIT PRINT INTERVAL (DEGREES) =    10

PLATE, SHAPE FACTOR TO SPACE =   0.920000  FLUID CP =     0.2500  BTU/LBM-R.

RACIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE =     0.07000  EMITTANCE =     0.76000  MONTHLY CHANGE IN ABSORPTANCE =    0.00500

EXTERNAL HEAT INPUT TABLES.

    1    SCLAR  FS  FOR  B= 23.5 DEGREES, PLANAR RAD IN ORBIT PLANE.
            0.0        0.398750
          360.00       0.398750
    2    EARTHSHINE FE FOR GEO PLANAR RAD IN ORBIT PLANE.
            0.0        0.000710
          360.00       0.000710
    3    ALBEDO  FA  FOR  B= 23.5 DEGREES, PLANAR RAD IN ORBIT PLANE.
            0.0        0.000460
           10.00       0.000450
           20.00       0.000430
           30.00       0.C00400
           40.00       0.000360
           50.00       0.000320
           60.00       0.000270
           70.00       0.000220
           80.00       0.000180
           90.00       0.000140
          100.00       0.000100
          110.00       0.000070
          120.00       0.000050
          130.00       0.000030
          140.00       0.000020
          150.00       0.000010
          160.00       0.C
          200.00       0.0
          210.00       0.000010
          220.00       0.C00020
          230.00       0.000030
          240.00       0.000050
          250.00       0.000070
          260.00       0.000100
          270.00       0.000140
          280.00       0.000180
          290.00       0.000220
          300.00       0.000270
          310.00       0.000320
          320.00       0.000360
          330.00       0.000400
          340.00       0.000430
```

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350.00 0.000450
360.00 0.000460

ORIGINAL PAGE IS
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FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 0 , SOLAR ABSORPTANCE VALUE = 0.07000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	12.29	-48.93	1901.87	7831.41	45.42	7.23	68239.94	0.32	16
10.00	94.60	12.29	-48.93	1901.86	7831.41	45.42	7.07	68239.94	0.32	16
20.00	94.60	12.29	-48.93	1901.84	7831.41	45.42	6.76	68239.94	0.32	16
30.00	94.60	12.29	-48.93	1901.81	7831.41	45.42	6.28	68239.94	0.32	16
40.00	94.60	12.29	-48.93	1901.77	7831.41	45.42	5.66	68239.94	0.32	16
50.00	94.60	12.28	-48.94	1901.72	7831.41	45.42	5.03	68239.94	0.32	16
60.00	94.60	12.28	-48.94	1901.68	7831.41	45.42	4.24	68239.94	0.32	16
70.00	94.60	12.28	-48.94	1901.63	7831.41	45.42	3.46	68239.94	0.32	16
80.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	2.83	68239.94	0.32	16
90.00	94.60	12.28	-48.94	1901.71	7831.41	45.42	2.20	68239.94	0.32	16
100.00	94.60	12.28	-48.94	1901.66	7831.41	45.42	1.57	68239.94	0.32	16
110.00	94.60	12.28	-48.94	1901.63	7831.41	45.42	1.10	68239.94	0.32	16
120.00	94.60	12.28	-48.95	1901.62	7831.41	45.42	0.79	68239.94	0.32	16
130.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	0.47	68239.94	0.32	16
140.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	0.31	68239.94	0.32	16
150.00	94.60	12.28	-48.95	1901.58	7831.41	45.42	0.16	68239.94	0.32	16
160.00	94.60	12.28	-48.95	1901.57	7831.41	45.42	0.0	68239.94	0.32	16
170.00	94.60	12.28	-48.95	1901.57	7831.41	45.42	0.0	68239.94	0.32	16
180.00	94.60	12.28	-48.95	1901.57	7831.41	45.42	0.0	68239.94	0.32	16
190.00	94.60	12.28	-48.95	1901.57	7831.41	45.42	0.0	68239.94	0.32	16
200.00	94.60	12.28	-48.95	1901.57	7831.41	45.42	0.0	68239.94	0.32	16
210.00	94.60	12.28	-48.95	1901.58	7831.41	45.42	0.16	68239.94	0.32	16
220.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	0.31	68239.94	0.32	16
230.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	0.47	68239.94	0.32	16
240.00	94.60	12.28	-48.95	1901.62	7831.41	45.42	0.79	68239.94	0.32	16
250.00	94.60	12.28	-48.94	1901.63	7831.41	45.42	1.10	68239.94	0.32	16
260.00	94.60	12.28	-48.94	1901.66	7831.41	45.42	1.57	68239.94	0.32	16
270.00	94.60	12.28	-48.94	1901.71	7831.41	45.42	2.20	68239.94	0.32	16
280.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	2.83	68239.94	0.32	16
290.00	94.60	12.28	-48.94	1901.63	7831.41	45.42	3.46	68239.94	0.32	16
300.00	94.60	12.28	-48.94	1901.68	7831.41	45.42	4.24	68239.94	0.32	16
310.00	94.60	12.28	-48.94	1901.72	7831.41	45.42	5.03	68239.94	0.32	16
320.00	94.60	12.29	-48.93	1901.77	7831.41	45.42	5.66	68239.94	0.32	16
330.00	94.60	12.29	-48.93	1901.81	7831.41	45.42	6.28	68239.94	0.32	16
340.00	94.60	12.29	-48.93	1901.84	7831.41	45.42	6.76	68239.94	0.32	16
350.00	94.60	12.29	-48.93	1901.86	7831.41	45.42	7.07	68239.94	0.32	16
360.00	94.60	12.29	-48.93	1901.87	7831.41	45.42	7.23	68239.94	0.32	16

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 578.15 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.37000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 10 , SOLAR ABSORPTANCE VALUE = 0.12000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	20.74	-34.46	2115.21	13425.25	45.42	12.39	68239.94	0.33	15
10.00	94.60	20.74	-34.46	2115.19	13425.25	45.42	12.12	68239.94	0.33	15
20.00	94.60	20.74	-34.46	2115.17	13425.25	45.42	11.58	68239.94	0.33	15
30.00	94.60	20.73	-34.46	2115.13	13425.25	45.42	10.77	68239.94	0.33	15
40.00	94.60	20.73	-34.46	2115.07	13425.25	45.42	9.70	68239.94	0.33	15
50.00	94.60	20.73	-34.47	2115.01	13425.25	45.42	8.62	68239.94	0.33	15
60.00	94.60	20.73	-34.47	2114.95	13425.25	45.42	7.27	68239.94	0.33	15
70.00	94.60	20.73	-34.48	2114.88	13425.25	45.42	5.93	68239.94	0.33	15
80.00	94.60	20.73	-34.48	2114.82	13425.25	45.42	4.85	68239.94	0.33	15
90.00	94.60	20.72	-34.48	2114.76	13425.25	45.42	3.77	68239.94	0.33	15
100.00	94.60	20.72	-34.49	2114.71	13425.25	45.42	2.69	68239.94	0.33	15
110.00	94.60	20.72	-34.49	2114.66	13425.25	45.42	1.89	68239.94	0.33	15
120.00	94.60	20.72	-34.49	2114.64	13425.25	45.42	1.35	68239.94	0.33	15
130.00	94.60	20.72	-34.49	2114.61	13425.25	45.42	0.81	68239.94	0.33	15
140.00	94.60	20.72	-34.49	2114.60	13425.25	45.42	0.54	68239.94	0.33	15
150.00	94.60	20.72	-34.49	2114.58	13425.25	45.42	0.27	68239.94	0.33	15
160.00	94.60	20.72	-34.49	2114.57	13425.25	45.42	0.0	68239.94	0.33	15
170.00	94.60	20.72	-34.49	2114.57	13425.25	45.42	0.0	68239.94	0.33	15
180.00	94.60	20.72	-34.49	2114.57	13425.25	45.42	0.0	68239.94	0.33	15
190.00	94.60	20.72	-34.49	2114.57	13425.25	45.42	0.0	68239.94	0.33	15
200.00	94.60	20.72	-34.49	2114.57	13425.25	45.42	0.0	68239.94	0.33	15
210.00	94.60	20.72	-34.49	2114.58	13425.25	45.42	0.27	68239.94	0.33	15
220.00	94.60	20.72	-34.49	2114.60	13425.25	45.42	0.54	68239.94	0.33	15
230.00	94.60	20.72	-34.49	2114.61	13425.25	45.42	0.81	68239.94	0.33	15
240.00	94.60	20.72	-34.49	2114.64	13425.25	45.42	1.35	68239.94	0.33	15
250.00	94.60	20.72	-34.49	2114.66	13425.25	45.42	1.89	68239.94	0.33	15
260.00	94.60	20.72	-34.49	2114.71	13425.25	45.42	2.69	68239.94	0.33	15
270.00	94.60	20.72	-34.48	2114.76	13425.25	45.42	3.77	68239.94	0.33	15
280.00	94.60	20.73	-34.48	2114.82	13425.25	45.42	4.85	68239.94	0.33	15
290.00	94.60	20.73	-34.48	2114.88	13425.25	45.42	5.93	68239.94	0.33	15
300.00	94.60	20.73	-34.47	2114.95	13425.25	45.42	7.27	68239.94	0.33	15
310.00	94.60	20.73	-34.47	2115.01	13425.25	45.42	8.62	68239.94	0.33	15
320.00	94.60	20.73	-34.46	2115.07	13425.25	45.42	9.70	68239.94	0.33	15
330.00	94.60	20.73	-34.46	2115.13	13425.25	45.42	10.77	68239.94	0.33	15
340.00	94.60	20.74	-34.46	2115.17	13425.25	45.42	11.58	68239.94	0.33	15
350.00	94.60	20.74	-34.46	2115.19	13425.25	45.42	12.12	68239.94	0.33	15
360.00	94.60	20.74	-34.46	2115.21	13425.25	45.42	12.39	68239.94	0.33	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 578.15 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.37000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 20 , SOLAR ABSORPTANCE VALUE = 0.17000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	28.76	-20.87	2364.09	19019.12	45.42	17.55	68239.94	0.35	15
10.00	94.60	28.76	-20.88	2363.69	19019.12	45.42	17.17	68239.94	0.35	15
20.00	94.60	28.76	-20.89	2363.66	19019.12	45.42	16.41	68239.94	0.35	15
30.00	94.60	28.76	-20.89	2363.60	19019.12	45.42	15.26	68239.94	0.35	15
40.00	94.60	28.76	-20.89	2363.53	19019.12	45.42	13.74	68239.94	0.35	15
50.00	94.60	28.75	-20.90	2363.46	19019.12	45.42	12.21	68239.94	0.35	15
60.00	94.60	28.75	-20.90	2363.37	19019.12	45.42	10.30	68239.94	0.35	15
70.00	94.60	28.75	-20.90	2363.28	19019.12	45.42	8.39	68239.94	0.35	15
80.00	94.60	28.75	-20.91	2363.21	19019.12	45.42	6.87	68239.94	0.35	15
90.00	94.60	28.75	-20.91	2363.14	19019.12	45.42	5.34	68239.94	0.35	15
100.00	94.60	28.74	-20.92	2363.08	19019.12	45.42	3.82	68239.94	0.35	15
110.00	94.60	28.74	-20.92	2363.02	19019.12	45.42	2.67	68239.94	0.35	15
120.00	94.60	28.74	-20.92	2362.98	19019.12	45.42	1.91	68239.94	0.35	15
130.00	94.60	28.74	-20.92	2362.95	19019.12	45.42	1.14	68239.94	0.35	15
140.00	94.60	28.74	-20.92	2362.93	19019.12	45.42	0.76	68239.94	0.35	15
150.00	94.60	29.74	-20.92	2362.91	19019.12	45.42	0.38	68239.94	0.35	15
160.00	94.60	28.74	-20.92	2362.90	19019.12	45.42	0.0	68239.94	0.35	15
170.00	94.60	28.74	-20.92	2362.90	19019.12	45.42	0.0	68239.94	0.35	15
180.00	94.60	28.74	-20.92	2362.90	19019.12	45.42	0.0	68239.94	0.35	15
190.00	94.60	28.74	-20.92	2362.90	19019.12	45.42	0.0	68239.94	0.35	15
200.00	94.60	28.74	-20.92	2362.90	19019.12	45.42	0.0	68239.94	0.35	15
210.00	94.60	28.74	-20.92	2362.91	19019.12	45.42	0.38	68239.94	0.35	15
220.00	94.60	28.74	-20.92	2362.93	19019.12	45.42	0.76	68239.94	0.35	15
230.00	94.60	28.74	-20.92	2362.95	19019.12	45.42	1.14	68239.94	0.35	15
240.00	94.60	28.74	-20.92	2362.98	19019.12	45.42	1.91	68239.94	0.35	15
250.00	94.60	28.74	-20.92	2363.02	19019.12	45.42	2.67	68239.94	0.35	15
260.00	94.60	28.74	-20.92	2363.08	19019.12	45.42	3.82	68239.94	0.35	15
270.00	94.60	28.75	-20.91	2363.14	19019.12	45.42	5.34	68239.94	0.35	15
280.00	94.60	28.75	-20.91	2363.21	19019.12	45.42	6.87	68239.94	0.35	15
290.00	94.60	28.75	-20.90	2363.28	19019.12	45.42	8.39	68239.94	0.35	15
300.00	94.60	28.75	-20.90	2363.37	19019.12	45.42	10.30	68239.94	0.35	15
310.00	94.60	28.75	-20.90	2363.46	19019.12	45.42	12.21	68239.94	0.35	15
320.00	94.60	28.76	-20.89	2363.53	19019.12	45.42	13.74	68239.94	0.35	15
330.00	94.60	28.76	-20.89	2363.60	19019.12	45.42	15.26	68239.94	0.35	15
340.00	94.60	28.76	-20.89	2363.66	19019.12	45.42	16.41	68239.94	0.35	15
350.00	94.60	28.76	-20.88	2363.69	19019.12	45.42	17.17	68239.94	0.35	15
360.00	94.60	28.76	-20.87	2364.09	19019.12	45.42	17.55	68239.94	0.35	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 578.15 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.37000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 30 , SOLAR ABSORPTANCE VALUE = 0.22000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	36.41	-8.01	2660.18	24612.98	45.42	22.71	68239.94	0.36	15
10.00	94.60	36.41	-8.02	2660.16	24612.98	45.42	22.22	68239.94	0.36	15
20.00	94.60	36.41	-8.02	2660.11	24612.98	45.42	21.23	68239.94	0.36	15
30.00	94.60	36.41	-8.02	2660.04	24612.98	45.42	19.75	68239.94	0.36	15
40.00	94.60	36.40	-8.02	2659.95	24612.98	45.42	17.78	68239.94	0.36	15
50.00	94.60	36.40	-8.03	2659.86	24612.98	45.42	15.80	68239.94	0.36	15
60.00	94.60	36.40	-8.03	2659.75	24612.98	45.42	13.33	68239.94	0.36	15
70.00	94.60	36.40	-8.04	2659.64	24612.98	45.42	10.86	68239.94	0.36	15
80.00	94.60	36.39	-8.04	2659.56	24612.98	45.42	8.89	68239.94	0.36	15
90.00	94.60	36.39	-8.04	2659.48	24612.98	45.42	6.91	68239.94	0.36	15
100.00	94.60	36.39	-8.06	2658.96	24612.98	45.42	4.94	68239.94	0.36	15
110.00	94.60	36.38	-8.06	2658.89	24612.98	45.42	3.46	68239.94	0.36	15
120.00	94.60	36.38	-8.06	2658.85	24612.98	45.42	2.47	68239.94	0.36	15
130.00	94.60	36.38	-8.07	2658.81	24612.98	45.42	1.48	68239.94	0.36	15
140.00	94.60	36.38	-8.06	2659.20	24612.98	45.42	0.99	68239.94	0.36	15
150.00	94.60	36.38	-8.07	2658.77	24612.98	45.42	0.49	68239.94	0.36	15
160.00	94.60	36.38	-8.07	2658.73	24612.98	45.42	0.0	68239.94	0.36	15
170.00	94.60	36.38	-8.07	2658.73	24612.98	45.42	0.0	68239.94	0.36	15
180.00	94.60	36.38	-8.07	2658.73	24612.98	45.42	0.0	68239.94	0.36	15
190.00	94.60	36.38	-8.07	2658.73	24612.98	45.42	0.0	68239.94	0.36	15
200.00	94.60	36.38	-8.07	2658.73	24612.98	45.42	0.0	68239.94	0.36	15
210.00	94.60	36.38	-8.07	2658.77	24612.98	45.42	0.49	68239.94	0.36	15
220.00	94.60	36.38	-8.06	2659.20	24612.98	45.42	0.99	68239.94	0.36	15
230.00	94.60	36.38	-8.07	2658.81	24612.98	45.42	1.48	68239.94	0.36	15
240.00	94.60	36.38	-8.06	2658.85	24612.98	45.42	2.47	68239.94	0.36	15
250.00	94.60	36.38	-8.06	2658.89	24612.98	45.42	3.46	68239.94	0.36	15
260.00	94.60	36.39	-8.06	2658.96	24612.98	45.42	4.94	68239.94	0.36	15
270.00	94.60	36.39	-8.04	2659.48	24612.98	45.42	6.91	68239.94	0.36	15
280.00	94.60	36.39	-8.04	2659.56	24612.98	45.42	8.89	68239.94	0.36	15
290.00	94.60	36.40	-8.04	2659.64	24612.98	45.42	10.86	68239.94	0.36	15
300.00	94.60	36.40	-8.03	2659.75	24612.98	45.42	13.33	68239.94	0.36	15
310.00	94.60	36.40	-8.03	2659.86	24612.98	45.42	15.80	68239.94	0.36	15
320.00	94.60	36.40	-8.02	2659.95	24612.98	45.42	17.78	68239.94	0.36	15
330.00	94.60	36.41	-8.02	2660.04	24612.98	45.42	19.75	68239.94	0.36	15
340.00	94.60	36.41	-8.02	2660.11	24612.98	45.42	21.23	68239.94	0.36	15
350.00	94.60	36.41	-8.02	2660.16	24612.98	45.42	22.22	68239.94	0.36	15
360.00	94.60	36.41	-8.01	2660.18	24612.98	45.42	22.71	68239.94	0.36	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 578.15 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.37000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 40 , SOLAR ABSORPTANCE VALUE = 0.27000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	43.72	4.25	3021.39	30206.83	45.42	27.88	68239.94	0.37	15
10.00	94.60	43.72	4.25	3021.38	30206.83	45.42	27.27	68239.94	0.37	15
20.00	94.60	43.72	4.25	3021.31	30206.83	45.42	26.06	68239.94	0.37	15
30.00	94.60	43.72	4.25	3021.23	30206.83	45.42	24.24	68239.94	0.37	15
40.00	94.60	43.71	4.24	3021.13	30206.83	45.42	21.82	68239.94	0.37	15
50.00	94.60	43.71	4.24	3021.00	30206.83	45.42	19.39	68239.94	0.37	15
60.00	94.60	43.71	4.22	3020.40	30206.83	45.42	16.36	68239.94	0.37	15
70.00	94.60	43.70	4.22	3020.26	30206.83	45.42	13.33	68239.94	0.37	15
80.00	94.60	43.70	4.22	3020.14	30206.83	45.42	10.91	68239.94	0.37	15
90.00	94.60	43.70	4.21	3020.03	30206.83	45.42	8.48	68239.94	0.37	15
100.00	94.60	43.69	4.21	3019.93	30206.83	45.42	6.06	68239.94	0.37	15
110.00	94.60	43.69	4.21	3019.85	30206.83	45.42	4.24	68239.94	0.37	15
120.00	94.60	43.69	4.20	3019.80	30206.83	45.42	3.03	68239.94	0.37	15
130.00	94.60	43.69	4.20	3019.74	30206.83	45.42	1.82	68239.94	0.37	15
140.00	94.60	43.69	4.20	3019.71	30206.83	45.42	1.21	68239.94	0.37	15
150.00	94.60	43.68	4.20	3019.68	30206.83	45.42	0.61	68239.94	0.37	15
160.00	94.60	43.68	4.20	3019.66	30206.83	45.42	0.0	68239.94	0.37	15
170.00	94.60	43.68	4.20	3019.66	30206.83	45.42	0.0	68239.94	0.37	15
180.00	94.60	43.68	4.20	3019.66	30206.83	45.42	0.0	68239.94	0.37	15
190.00	94.60	43.68	4.20	3019.66	30206.83	45.42	0.0	68239.94	0.37	15
200.00	94.60	43.68	4.20	3019.66	30206.83	45.42	0.0	68239.94	0.37	15
210.00	94.60	43.68	4.20	3019.68	30206.83	45.42	0.61	68239.94	0.37	15
220.00	94.60	43.69	4.20	3019.71	30206.83	45.42	1.21	68239.94	0.37	15
230.00	94.60	43.69	4.20	3019.74	30206.83	45.42	1.82	68239.94	0.37	15
240.00	94.60	43.69	4.20	3019.80	30206.83	45.42	3.03	68239.94	0.37	15
250.00	94.60	43.69	4.21	3019.85	30206.83	45.42	4.24	68239.94	0.37	15
260.00	94.60	43.69	4.21	3019.93	30206.83	45.42	6.06	68239.94	0.37	15
270.00	94.60	43.70	4.21	3020.03	30206.83	45.42	8.48	68239.94	0.37	15
280.00	94.60	43.70	4.22	3020.14	30206.83	45.42	10.91	68239.94	0.37	15
290.00	94.60	43.70	4.22	3020.26	30206.83	45.42	13.33	68239.94	0.37	15
300.00	94.60	43.71	4.22	3020.40	30206.83	45.42	16.36	68239.94	0.37	15
310.00	94.60	43.71	4.24	3021.00	30206.83	45.42	19.39	68239.94	0.37	15
320.00	94.60	43.71	4.24	3021.13	30206.83	45.42	21.82	68239.94	0.37	15
330.00	94.60	43.72	4.25	3021.23	30206.83	45.42	24.24	68239.94	0.37	15
340.00	94.60	43.72	4.25	3021.31	30206.83	45.42	26.06	68239.94	0.37	15
350.00	94.60	43.72	4.25	3021.38	30206.83	45.42	27.27	68239.94	0.37	15
360.00	94.60	43.72	4.25	3021.39	30206.83	45.42	27.88	68239.94	0.37	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 578.15 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.37000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 50 , SOLAR ABSORPTANCE VALUE = 0.32000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	50.72	16.04	3474.67	35800.69	45.42	33.04	68239.94	0.39	15
10.00	94.60	50.72	16.04	3474.64	35800.69	45.42	32.32	68239.94	0.39	15
20.00	94.60	50.72	16.04	3474.57	35800.69	45.42	30.89	68239.94	0.39	15
30.00	94.60	50.72	16.03	3474.46	35800.69	45.42	28.73	68239.94	0.39	15
40.00	94.60	50.72	16.02	3473.75	35800.69	45.42	25.86	68239.94	0.39	15
50.00	94.60	50.71	16.01	3473.60	35800.69	45.42	22.98	68239.94	0.39	15
60.00	94.60	50.71	16.01	3473.43	35800.69	45.42	19.39	68239.94	0.39	15
70.00	94.60	50.70	16.01	3473.26	35800.69	45.42	15.80	68239.94	0.39	15
80.00	94.60	50.70	15.99	3472.57	35800.69	45.42	12.93	68239.94	0.39	15
90.00	94.60	50.70	15.99	3472.44	35800.69	45.42	10.06	68239.94	0.39	15
100.00	94.60	50.69	15.98	3472.29	35800.69	45.42	7.18	68239.94	0.39	15
110.00	94.60	50.69	15.98	3472.17	35800.69	45.42	5.03	68239.94	0.39	15
120.00	94.60	50.69	15.98	3472.12	35800.69	45.42	3.59	68239.94	0.39	15
130.00	94.60	50.69	15.97	3471.48	35800.69	45.42	2.15	68239.94	0.39	15
140.00	94.60	50.69	15.97	3471.44	35800.69	45.42	1.44	68239.94	0.39	15
150.00	94.60	50.69	15.97	3471.41	35800.69	45.42	0.72	68239.94	0.39	15
160.00	94.60	50.68	15.96	3471.38	35800.69	45.42	0.0	68239.94	0.39	15
170.00	94.60	50.68	15.96	3471.38	35800.69	45.42	0.0	68239.94	0.39	15
180.00	94.60	50.68	15.96	3471.38	35800.69	45.42	0.0	68239.94	0.39	15
190.00	94.60	50.68	15.96	3471.38	35800.69	45.42	0.0	68239.94	0.39	15
200.00	94.60	50.68	15.96	3471.38	35800.69	45.42	0.0	68239.94	0.39	15
210.00	94.60	50.69	15.97	3471.41	35800.69	45.42	0.72	68239.94	0.39	15
220.00	94.60	50.69	15.97	3471.44	35800.69	45.42	1.44	68239.94	0.39	15
230.00	94.60	50.69	15.97	3471.48	35800.69	45.42	2.15	68239.94	0.39	15
240.00	94.60	50.69	15.98	3472.12	35800.69	45.42	3.59	68239.94	0.39	15
250.00	94.60	50.69	15.98	3472.17	35800.69	45.42	5.03	68239.94	0.39	15
260.00	94.60	50.69	15.98	3472.29	35800.69	45.42	7.18	68239.94	0.39	15
270.00	94.60	50.70	15.99	3472.44	35800.69	45.42	10.06	68239.94	0.39	15
280.00	94.60	50.70	15.99	3472.57	35800.69	45.42	12.93	68239.94	0.39	15
290.00	94.60	50.70	16.01	3473.26	35800.69	45.42	15.80	68239.94	0.39	15
300.00	94.60	50.71	16.01	3473.43	35800.69	45.42	19.39	68239.94	0.39	15
310.00	94.60	50.71	16.01	3473.60	35800.69	45.42	22.98	68239.94	0.39	15
320.00	94.60	50.72	16.02	3473.75	35800.69	45.42	25.86	68239.94	0.39	15
330.00	94.60	50.72	16.03	3474.46	35800.69	45.42	28.73	68239.94	0.39	15
340.00	94.60	50.72	16.04	3474.57	35800.69	45.42	30.89	68239.94	0.39	15
350.00	94.60	50.72	16.04	3474.64	35800.69	45.42	32.32	68239.94	0.39	15
360.00	94.60	50.72	16.04	3474.67	35800.69	45.42	33.04	68239.94	0.39	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 578.15 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.37000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 60 , SOLAR ABSORPTANCE VALUE = 0.37000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	57.45	27.42	4063.44	41394.55	45.42	38.20	68239.94	0.40	14
10.00	94.60	57.45	27.42	4063.39	41394.55	45.42	37.37	68239.94	0.40	14
20.00	94.60	57.45	27.42	4063.31	41394.55	45.42	35.71	68239.94	0.40	14
30.00	94.60	57.45	27.41	4063.21	41394.55	45.42	33.22	68239.94	0.40	14
40.00	94.60	57.44	27.41	4063.05	41394.55	45.42	29.90	68239.94	0.40	14
50.00	94.60	57.44	27.41	4062.83	41394.55	45.42	26.58	68239.94	0.40	14
60.00	94.60	57.43	27.38	4061.25	41394.55	45.42	22.42	68239.94	0.40	14
70.00	94.60	57.43	27.38	4061.01	41394.55	45.42	18.27	68239.94	0.40	14
80.00	94.60	57.42	27.38	4060.83	41394.55	45.42	14.95	68239.94	0.40	14
90.00	94.60	57.42	27.37	4060.65	41394.55	45.42	11.63	68239.94	0.40	14
100.00	94.60	57.42	27.37	4060.50	41394.55	45.42	8.30	68239.94	0.40	14
110.00	94.60	57.41	27.37	4060.36	41394.55	45.42	5.81	68239.94	0.40	14
120.00	94.60	57.41	27.36	4060.29	41394.55	45.42	4.15	68239.94	0.40	14
130.00	94.60	57.41	27.34	4058.85	41394.55	45.42	2.49	68239.94	0.40	14
140.00	94.60	57.41	27.34	4058.80	41394.55	45.42	1.66	68239.94	0.40	14
150.00	94.60	57.41	27.34	4058.74	41394.55	45.42	0.83	68239.94	0.40	14
160.00	94.60	57.41	27.34	4058.71	41394.55	45.42	0.0	68239.94	0.40	14
170.00	94.60	57.41	27.34	4058.71	41394.55	45.42	0.0	68239.94	0.40	14
180.00	94.60	57.41	27.34	4058.71	41394.55	45.42	0.0	68239.94	0.40	14
190.00	94.60	57.41	27.34	4058.71	41394.55	45.42	0.0	68239.94	0.40	14
200.00	94.60	57.41	27.34	4058.71	41394.55	45.42	0.0	68239.94	0.40	14
210.00	94.60	57.41	27.34	4058.74	41394.55	45.42	0.83	68239.94	0.40	14
220.00	94.60	57.41	27.34	4058.80	41394.55	45.42	1.66	68239.94	0.40	14
230.00	94.60	57.41	27.34	4058.85	41394.55	45.42	2.49	68239.94	0.40	14
240.00	94.60	57.41	27.36	4060.29	41394.55	45.42	4.15	68239.94	0.40	14
250.00	94.60	57.41	27.37	4060.36	41394.55	45.42	5.81	68239.94	0.40	14
260.00	94.60	57.42	27.37	4060.50	41394.55	45.42	8.30	68239.94	0.40	14
270.00	94.60	57.42	27.37	4060.65	41394.55	45.42	11.63	68239.94	0.40	14
280.00	94.60	57.42	27.38	4060.83	41394.55	45.42	14.95	68239.94	0.40	14
290.00	94.60	57.43	27.38	4061.01	41394.55	45.42	18.27	68239.94	0.40	14
300.00	94.60	57.43	27.38	4061.25	41394.55	45.42	22.42	68239.94	0.40	14
310.00	94.60	57.44	27.41	4062.83	41394.55	45.42	26.58	68239.94	0.40	14
320.00	94.60	57.44	27.41	4063.05	41394.55	45.42	29.90	68239.94	0.40	14
330.00	94.60	57.45	27.41	4063.21	41394.55	45.42	33.22	68239.94	0.40	14
340.00	94.60	57.45	27.42	4063.31	41394.55	45.42	35.71	68239.94	0.40	14
350.00	94.60	57.45	27.42	4063.39	41394.55	45.42	37.37	68239.94	0.40	14
360.00	94.60	57.45	27.42	4063.44	41394.55	45.42	38.20	68239.94	0.40	14

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 578.15 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.37000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.85367

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G E O S Y N C H R O N O U S   2 5 K W   P O W E R   M O D U L E   P R O G R A M .

ALTITUDE (N.MI.) =   19370.0

ORBIT INCLINATICN BETA ANGLE (DEGREES) =  23.50

DISSIPATION (KW.), LOWEST =    20  HIGHEST =    20  INCREMENT =     1

MONTHS DEGRACATION FOR PLATE RADIATOR =    60  INCREMENT =    10

ORBIT PRINT INTERVAL (DEGREES) =     10

PLATE, SHAPE FACTOR TO SPACE =   0.920000  FLUID CP =     0.2500  BTU/LBM-R.

RACIATOR MATERIAL PROPERTIES
PLATE, ABSURPTANCE =    0.15000  EMITTANCE =    0.88000  MONTHLY CHANGE IN ABSORPTANCE =    0.00500

EXTERNAL HEAT INPUT TABLES.

    1     SOLAR  FS  FOR  B= 23.5 DEGREES, PLANAR RAD IN ORBIT PLANE.
               0.0        0.398750
             360.00       0.398750
    2     EARTHSHINE FE FOR GEO PLANAR RAD IN ORBIT PLANE.
               0.0        0.000710
             360.00       0.000710
    3     ALBEDO  FA  FOR  B= 23.5 DEGREES, PLANAR RAD IN ORBIT PLANE.
               0.0        0.000460
              10.00       0.000450
              20.00       0.000430
              30.00       0.000400
              40.00       0.000360
              50.00       0.000320
              60.00       0.000270
              70.00       0.000220
              80.00       0.000180
              90.00       0.000140
             100.00       0.000100
             110.00       0.000070
             120.00       0.000050
             130.00       0.000030
             140.00       0.000020
             150.00       0.000010
             160.00       0.0
             200.00       0.0
             210.00       0.000010
             220.00       0.000020
             230.00       0.000030
             240.00       0.000050
             250.00       0.000070
             260.00       0.000100
             270.00       0.000140
             280.00       0.000180
             290.00       0.000220
             300.00       0.000270
             310.00       0.000320
             320.00       0.000360
             330.00       0.000400
             340.00       0.000430
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0.000450
0.000460

350.00
360.00

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 0 , SOLAR ABSORPTANCE VALUE = 0.15000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	8.15	-52.24	1859.09	16781.58	52.59	15.49	68239.94	0.30	15
10.00	94.60	8.15	-52.24	1859.08	16781.58	52.59	15.15	68239.94	0.30	15
20.00	94.60	8.14	-52.24	1859.04	16781.58	52.59	14.48	68239.94	0.30	15
30.00	94.60	8.14	-52.24	1859.01	16781.58	52.59	13.47	68239.94	0.30	15
40.00	94.60	8.14	-52.24	1858.95	16781.58	52.59	12.12	68239.94	0.30	15
50.00	94.60	8.14	-52.25	1858.91	16781.58	52.59	10.77	68239.94	0.30	15
60.00	94.60	8.14	-52.25	1858.83	16781.58	52.59	9.09	68239.94	0.30	15
70.00	94.60	8.14	-52.26	1858.77	16781.58	52.59	7.41	68239.94	0.30	15
80.00	94.60	8.13	-52.26	1858.72	16781.58	52.59	6.06	68239.94	0.30	15
90.00	94.60	8.13	-52.27	1858.66	16781.58	52.59	4.71	68239.94	0.30	15
100.00	94.60	8.13	-52.27	1858.61	16781.58	52.59	3.37	68239.94	0.30	15
110.00	94.60	8.13	-52.27	1858.58	16781.58	52.59	2.36	68239.94	0.30	15
120.00	94.60	8.13	-52.27	1858.54	16781.58	52.59	1.68	68239.94	0.30	15
130.00	94.60	8.13	-52.28	1858.52	16781.58	52.59	1.01	68239.94	0.30	15
140.00	94.60	8.13	-52.28	1858.51	16781.58	52.59	0.67	68239.94	0.30	15
150.00	94.60	8.12	-52.28	1858.49	16781.58	52.59	0.34	68239.94	0.30	15
160.00	94.60	8.12	-52.28	1858.48	16781.58	52.59	0.0	68239.94	0.30	15
170.00	94.60	8.12	-52.28	1858.48	16781.58	52.59	0.0	68239.94	0.30	15
180.00	94.60	8.12	-52.28	1858.48	16781.58	52.59	0.0	68239.94	0.30	15
190.00	94.60	8.12	-52.28	1858.48	16781.58	52.59	0.0	68239.94	0.30	15
200.00	94.60	8.12	-52.28	1858.48	16781.58	52.59	0.0	68239.94	0.30	15
210.00	94.60	8.12	-52.28	1858.49	16781.58	52.59	0.34	68239.94	0.30	15
220.00	94.60	8.13	-52.28	1858.51	16781.58	52.59	0.67	68239.94	0.30	15
230.00	94.60	8.13	-52.28	1858.52	16781.58	52.59	1.01	68239.94	0.30	15
240.00	94.60	8.13	-52.27	1858.54	16781.58	52.59	1.68	68239.94	0.30	15
250.00	94.60	8.13	-52.27	1858.58	16781.58	52.59	2.36	68239.94	0.30	15
260.00	94.60	8.13	-52.27	1858.61	16781.58	52.59	3.37	68239.94	0.30	15
270.00	94.60	8.13	-52.27	1858.66	16781.58	52.59	4.71	68239.94	0.30	15
280.00	94.60	8.13	-52.26	1858.72	16781.58	52.59	6.06	68239.94	0.30	15
290.00	94.60	8.14	-52.26	1858.77	16781.58	52.59	7.41	68239.94	0.30	15
300.00	94.60	8.14	-52.25	1858.83	16781.58	52.59	9.09	68239.94	0.30	15
310.00	94.60	8.14	-52.25	1858.91	16781.58	52.59	10.77	68239.94	0.30	15
320.00	94.60	8.14	-52.24	1858.95	16781.58	52.59	12.12	68239.94	0.30	15
330.00	94.60	8.14	-52.24	1859.01	16781.58	52.59	13.47	68239.94	0.30	15
340.00	94.60	8.14	-52.24	1859.04	16781.58	52.59	14.48	68239.94	0.30	15
350.00	94.60	8.15	-52.24	1859.08	16781.58	52.59	15.15	68239.94	0.30	15
360.00	94.60	8.15	-52.24	1859.09	16781.58	52.59	15.49	68239.94	0.30	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 514.16 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.45000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.98846

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 10 , SOLAR ABSORPTANCE VALUE = 0.20000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	15.66	-39.73	2032.08	22375.43	52.59	20.65	68239.94	0.32	15
10.00	94.60	15.66	-39.74	2032.06	22375.43	52.59	20.20	68239.94	0.32	15
20.00	94.60	15.66	-39.74	2032.03	22375.43	52.59	19.30	68239.94	0.32	15
30.00	94.60	15.66	-39.74	2031.99	22375.43	52.59	17.96	68239.94	0.32	15
40.00	94.60	15.65	-39.74	2031.92	22375.43	52.59	16.16	68239.94	0.32	15
50.00	94.60	15.65	-39.75	2031.86	22375.43	52.59	14.37	68239.94	0.32	15
60.00	94.60	15.65	-39.75	2031.78	22375.43	52.59	12.12	68239.94	0.32	15
70.00	94.60	15.65	-39.76	2031.70	22375.43	52.59	9.88	68239.94	0.32	15
80.00	94.60	15.64	-39.76	2031.64	22375.43	52.59	8.08	68239.94	0.32	15
90.00	94.60	15.64	-39.77	2031.57	22375.43	52.59	6.28	68239.94	0.32	15
100.00	94.60	15.64	-39.77	2031.50	22375.43	52.59	4.49	68239.94	0.32	15
110.00	94.60	15.64	-39.77	2031.45	22375.43	52.59	3.14	68239.94	0.32	15
120.00	94.60	15.63	-39.78	2031.42	22375.43	52.59	2.24	68239.94	0.32	15
130.00	94.60	15.63	-39.78	2031.39	22375.43	52.59	1.35	68239.94	0.32	15
140.00	94.60	15.63	-39.78	2031.39	22375.43	52.59	0.90	68239.94	0.32	15
150.00	94.60	15.63	-39.78	2031.36	22375.43	52.59	0.45	68239.94	0.32	15
160.00	94.60	15.63	-39.78	2031.34	22375.43	52.59	0.0	68239.94	0.32	15
170.00	94.60	15.63	-39.78	2031.34	22375.43	52.59	0.0	68239.94	0.32	15
180.00	94.60	15.63	-39.78	2031.34	22375.43	52.59	0.0	68239.94	0.32	15
190.00	94.60	15.63	-39.78	2031.34	22375.43	52.59	0.0	68239.94	0.32	15
200.00	94.60	15.63	-39.78	2031.34	22375.43	52.59	0.0	68239.94	0.32	15
210.00	94.60	15.63	-39.78	2031.36	22375.43	52.59	0.45	68239.94	0.32	15
220.00	94.60	15.63	-39.78	2031.39	22375.43	52.59	0.90	68239.94	0.32	15
230.00	94.60	15.63	-39.78	2031.39	22375.43	52.59	1.35	68239.94	0.32	15
240.00	94.60	15.63	-39.78	2031.42	22375.43	52.59	2.24	68239.94	0.32	15
250.00	94.60	15.64	-39.77	2031.45	22375.43	52.59	3.14	68239.94	0.32	15
260.00	94.60	15.64	-39.77	2031.50	22375.43	52.59	4.49	68239.94	0.32	15
270.00	94.60	15.64	-39.77	2031.57	22375.43	52.59	6.28	68239.94	0.32	15
280.00	94.60	15.64	-39.76	2031.64	22375.43	52.59	8.08	68239.94	0.32	15
290.00	94.60	15.65	-39.76	2031.70	22375.43	52.59	9.88	68239.94	0.32	15
300.00	94.60	15.65	-39.75	2031.78	22375.43	52.59	12.12	68239.94	0.32	15
310.00	94.60	15.65	-39.75	2031.86	22375.43	52.59	14.37	68239.94	0.32	15
320.00	94.60	15.65	-39.74	2031.92	22375.43	52.59	16.16	68239.94	0.32	15
330.00	94.60	15.66	-39.74	2031.99	22375.43	52.59	17.96	68239.94	0.32	15
340.00	94.60	15.66	-39.74	2032.03	22375.43	52.59	19.30	68239.94	0.32	15
350.00	94.60	15.66	-39.74	2032.06	22375.43	52.59	20.20	68239.94	0.32	15
360.00	94.60	15.66	-39.73	2032.08	22375.43	52.59	20.65	68239.94	0.32	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 514.16 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.45000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.98846

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 20 , SOLAR ABSORPTANCE VALUE = 0.25000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	22.83	-27.93	2227.83	27969.29	52.59	25.81	68239.94	0.33	15
10.00	94.60	22.83	-27.93	2227.82	27969.29	52.59	25.25	68239.94	0.33	15
20.00	94.60	22.83	-27.93	2227.79	27969.29	52.59	24.13	68239.94	0.33	15
30.00	94.60	22.83	-27.94	2227.72	27969.29	52.59	22.45	68239.94	0.33	15
40.00	94.60	22.82	-27.94	2227.64	27969.29	52.59	20.20	68239.94	0.33	15
50.00	94.60	22.82	-27.95	2227.57	27969.29	52.59	17.96	68239.94	0.33	15
60.00	94.60	22.82	-27.95	2227.47	27969.29	52.59	15.15	68239.94	0.33	15
70.00	94.60	22.82	-27.96	2227.38	27969.29	52.59	12.35	68239.94	0.33	15
80.00	94.60	22.81	-27.96	2227.29	27969.29	52.59	10.10	68239.94	0.33	15
90.00	94.60	22.81	-27.97	2227.22	27969.29	52.59	7.86	68239.94	0.33	15
100.00	94.60	22.81	-27.97	2227.15	27969.29	52.59	5.61	68239.94	0.33	15
110.00	94.60	22.80	-27.97	2227.09	27969.29	52.59	3.93	68239.94	0.33	15
120.00	94.60	22.80	-27.97	2227.05	27969.29	52.59	2.81	68239.94	0.33	15
130.00	94.60	22.80	-27.98	2227.01	27969.29	52.59	1.68	68239.94	0.33	15
140.00	94.60	22.80	-27.98	2226.99	27969.29	52.59	1.12	68239.94	0.33	15
150.00	94.60	22.80	-27.98	2226.97	27969.29	52.59	0.56	68239.94	0.33	15
160.00	94.60	22.80	-27.98	2226.95	27969.29	52.59	0.0	68239.94	0.33	15
170.00	94.60	22.80	-27.98	2226.95	27969.29	52.59	0.0	68239.94	0.33	15
180.00	94.60	22.80	-27.98	2226.95	27969.29	52.59	0.0	68239.94	0.33	15
190.00	94.60	22.80	-27.98	2226.95	27969.29	52.59	0.0	68239.94	0.33	15
200.00	94.60	22.80	-27.98	2226.95	27969.29	52.59	0.0	68239.94	0.33	15
210.00	94.60	22.80	-27.98	2226.97	27969.29	52.59	0.56	68239.94	0.33	15
220.00	94.60	22.80	-27.98	2226.99	27969.29	52.59	1.12	68239.94	0.33	15
230.00	94.60	22.80	-27.98	2227.01	27969.29	52.59	1.68	68239.94	0.33	15
240.00	94.60	22.80	-27.97	2227.05	27969.29	52.59	2.81	68239.94	0.33	15
250.00	94.60	22.80	-27.97	2227.09	27969.29	52.59	3.93	68239.94	0.33	15
260.00	94.60	22.81	-27.97	2227.15	27969.29	52.59	5.61	68239.94	0.33	15
270.00	94.60	22.81	-27.97	2227.22	27969.29	52.59	7.86	68239.94	0.33	15
280.00	94.60	22.81	-27.96	2227.29	27969.29	52.59	10.10	68239.94	0.33	15
290.00	94.60	22.82	-27.96	2227.38	27969.29	52.59	12.35	68239.94	0.33	15
300.00	94.60	22.82	-27.95	2227.47	27969.29	52.59	15.15	68239.94	0.33	15
310.00	94.60	22.82	-27.95	2227.57	27969.29	52.59	17.96	68239.94	0.33	15
320.00	94.60	22.82	-27.94	2227.64	27969.29	52.59	20.20	68239.94	0.33	15
330.00	94.60	22.83	-27.94	2227.72	27969.29	52.59	22.45	68239.94	0.33	15
340.00	94.60	22.83	-27.93	2227.79	27969.29	52.59	24.13	68239.94	0.33	15
350.00	94.60	22.83	-27.93	2227.82	27969.29	52.59	25.25	68239.94	0.33	15
360.00	94.60	22.83	-27.93	2227.83	27969.29	52.59	25.81	68239.94	0.33	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 514.16 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.45000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.98846

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 30 , SOLAR ABSORPTANCE VALUE = 0.30000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	29.70	-16.71	2452.37	33563.16	52.59	30.97	68239.94	0.34	15
10.00	94.60	29.70	-16.73	2451.98	33563.16	52.59	30.30	68239.94	0.34	15
20.00	94.60	29.70	-16.72	2452.30	33563.16	52.59	28.95	68239.94	0.34	15
30.00	94.60	29.69	-16.72	2452.24	33563.16	52.59	26.93	68239.94	0.34	15
40.00	94.60	29.69	-16.74	2451.78	33563.16	52.59	24.24	68239.94	0.34	15
50.00	94.60	29.69	-16.74	2451.69	33563.16	52.59	21.55	68239.94	0.34	15
60.00	94.60	29.68	-16.74	2451.58	33563.16	52.59	18.18	68239.94	0.34	15
70.00	94.60	29.68	-16.75	2451.46	33563.16	52.59	14.81	68239.94	0.34	15
80.00	94.60	29.68	-16.75	2451.37	33563.16	52.59	12.12	68239.94	0.34	15
90.00	94.60	29.67	-16.76	2451.28	33563.16	52.59	9.43	68239.94	0.34	15
100.00	94.60	29.67	-16.76	2451.19	33563.16	52.59	6.73	68239.94	0.34	15
110.00	94.60	29.67	-16.77	2451.13	33563.16	52.59	4.71	68239.94	0.34	15
120.00	94.60	29.66	-16.77	2451.08	33563.16	52.59	3.37	68239.94	0.34	15
130.00	94.60	29.66	-16.77	2451.04	33563.16	52.59	2.02	68239.94	0.34	15
140.00	94.60	29.66	-16.77	2451.01	33563.16	52.59	1.35	68239.94	0.34	15
150.00	94.60	29.66	-16.77	2450.99	33563.16	52.59	0.67	68239.94	0.34	15
160.00	94.60	29.66	-16.78	2450.97	33563.16	52.59	0.0	68239.94	0.34	15
170.00	94.60	29.66	-16.78	2450.97	33563.16	52.59	0.0	68239.94	0.34	15
180.00	94.60	29.66	-16.78	2450.97	33563.16	52.59	0.0	68239.94	0.34	15
190.00	94.60	29.66	-16.78	2450.97	33563.16	52.59	0.0	68239.94	0.34	15
200.00	94.60	29.66	-16.78	2450.97	33563.16	52.59	0.0	68239.94	0.34	15
210.00	94.60	29.66	-16.77	2450.99	33563.16	52.59	0.67	68239.94	0.34	15
220.00	94.60	29.66	-16.77	2451.01	33563.16	52.59	1.35	68239.94	0.34	15
230.00	94.60	29.66	-16.77	2451.04	33563.16	52.59	2.02	68239.94	0.34	15
240.00	94.60	29.66	-16.77	2451.08	33563.16	52.59	3.37	68239.94	0.34	15
250.00	94.60	29.67	-16.77	2451.13	33563.16	52.59	4.71	68239.94	0.34	15
260.00	94.60	29.67	-16.76	2451.19	33563.16	52.59	6.73	68239.94	0.34	15
270.00	94.60	29.67	-16.76	2451.28	33563.16	52.59	9.43	68239.94	0.34	15
280.00	94.60	29.68	-16.75	2451.37	33563.16	52.59	12.12	68239.94	0.34	15
290.00	94.60	29.68	-16.75	2451.46	33563.16	52.59	14.81	68239.94	0.34	15
300.00	94.60	29.68	-16.74	2451.58	33563.16	52.59	18.18	68239.94	0.34	15
310.00	94.60	29.69	-16.74	2451.69	33563.16	52.59	21.55	68239.94	0.34	15
320.00	94.60	29.69	-16.74	2451.78	33563.16	52.59	24.24	68239.94	0.34	15
330.00	94.60	29.69	-16.72	2452.24	33563.16	52.59	26.93	68239.94	0.34	15
340.00	94.60	29.70	-16.72	2452.30	33563.16	52.59	28.95	68239.94	0.34	15
350.00	94.60	29.70	-16.73	2451.98	33563.16	52.59	30.30	68239.94	0.34	15
360.00	94.60	29.70	-16.71	2452.37	33563.16	52.59	30.97	68239.94	0.34	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 514.16 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.45000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.98846

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 ; MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 40 , SOLAR ABSORPTANCE VALUE = 0.35000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	36.29	-6.00	2713.35	39157.01	52.59	36.14	68239.94	0.35	15
10.00	94.60	36.29	-6.00	2713.32	39157.01	52.59	35.35	68239.94	0.35	15
20.00	94.60	36.28	-6.01	2713.27	39157.01	52.59	33.78	68239.94	0.35	15
30.00	94.60	36.28	-6.01	2713.19	39157.01	52.59	31.42	68239.94	0.35	15
40.00	94.60	36.28	-6.01	2713.08	39157.01	52.59	28.28	68239.94	0.35	15
50.00	94.60	36.27	-6.02	2712.98	39157.01	52.59	25.14	68239.94	0.35	15
60.00	94.60	36.27	-6.02	2712.84	39157.01	52.59	21.21	68239.94	0.35	15
70.00	94.60	36.26	-6.03	2712.70	39157.01	52.59	17.28	68239.94	0.35	15
80.00	94.60	36.26	-6.04	2712.20	39157.01	52.59	14.14	68239.94	0.35	15
90.00	94.60	36.26	-6.05	2712.08	39157.01	52.59	11.00	68239.94	0.35	15
100.00	94.60	36.26	-6.05	2711.98	39157.01	52.59	7.86	68239.94	0.35	15
110.00	94.60	36.25	-6.06	2711.90	39157.01	52.59	5.50	68239.94	0.35	15
120.00	94.60	36.25	-6.06	2711.85	39157.01	52.59	3.93	68239.94	0.35	15
130.00	94.60	36.25	-6.06	2711.79	39157.01	52.59	2.36	68239.94	0.35	15
140.00	94.60	36.25	-6.06	2711.77	39157.01	52.59	1.57	68239.94	0.35	15
150.00	94.60	36.25	-6.06	2711.73	39157.01	52.59	0.79	68239.94	0.35	15
160.00	94.60	36.25	-6.07	2711.70	39157.01	52.59	0.0	68239.94	0.35	15
170.00	94.60	36.25	-6.07	2711.70	39157.01	52.59	0.0	68239.94	0.35	15
180.00	94.60	36.25	-6.07	2711.70	39157.01	52.59	0.0	68239.94	0.35	15
190.00	94.60	36.25	-6.07	2711.70	39157.01	52.59	0.0	68239.94	0.35	15
200.00	94.60	36.25	-6.07	2711.70	39157.01	52.59	0.0	68239.94	0.35	15
210.00	94.60	36.25	-6.06	2711.73	39157.01	52.59	0.79	68239.94	0.35	15
220.00	94.60	36.25	-6.06	2711.77	39157.01	52.59	1.57	68239.94	0.35	15
230.00	94.60	36.25	-6.06	2711.79	39157.01	52.59	2.36	68239.94	0.35	15
240.00	94.60	36.25	-6.06	2711.85	39157.01	52.59	3.93	68239.94	0.35	15
250.00	94.60	36.25	-6.06	2711.90	39157.01	52.59	5.50	68239.94	0.35	15
260.00	94.60	36.26	-6.05	2711.98	39157.01	52.59	7.86	68239.94	0.35	15
270.00	94.60	36.26	-6.05	2712.08	39157.01	52.59	11.00	68239.94	0.35	15
280.00	94.60	36.26	-6.04	2712.20	39157.01	52.59	14.14	68239.94	0.35	15
290.00	94.60	36.26	-6.03	2712.70	39157.01	52.59	17.28	68239.94	0.35	15
300.00	94.60	36.27	-6.02	2712.84	39157.01	52.59	21.21	68239.94	0.35	15
310.00	94.60	36.27	-6.02	2712.98	39157.01	52.59	25.14	68239.94	0.35	15
320.00	94.60	36.28	-6.01	2713.08	39157.01	52.59	28.28	68239.94	0.35	15
330.00	94.60	36.28	-6.01	2713.19	39157.01	52.59	31.42	68239.94	0.35	15
340.00	94.60	36.28	-6.01	2713.27	39157.01	52.59	33.78	68239.94	0.35	15
350.00	94.60	36.29	-6.00	2713.32	39157.01	52.59	35.35	68239.94	0.35	15
360.00	94.60	36.29	-6.00	2713.35	39157.01	52.59	36.14	68239.94	0.35	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 514.16 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.45000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.98846

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 50 , SOLAR ABSORPTANCE VALUE = 0.40000

ORBITAL SCLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	42.62	4.30	3022.98	44750.87	52.59	41.30	68239.94	0.36	15
10.00	94.60	42.62	4.30	3022.96	44750.87	52.59	40.40	68239.94	0.36	15
20.00	94.60	42.62	4.30	3022.88	44750.87	52.59	38.61	68239.94	0.36	15
30.00	94.60	42.62	4.29	3022.80	44750.87	52.59	35.91	68239.94	0.36	15
40.00	94.60	42.61	4.28	3022.24	44750.87	52.59	32.32	68239.94	0.36	15
50.00	94.60	42.61	4.28	3022.10	44750.87	52.59	28.73	68239.94	0.36	15
60.00	94.60	42.60	4.27	3021.94	44750.87	52.59	24.24	68239.94	0.36	15
70.00	94.60	42.60	4.26	3021.79	44750.87	52.59	19.75	68239.94	0.36	15
80.00	94.60	42.59	4.26	3021.64	44750.87	52.59	16.16	68239.94	0.36	15
90.00	94.60	42.59	4.24	3021.08	44750.87	52.59	12.57	68239.94	0.36	15
100.00	94.60	42.59	4.24	3020.95	44750.87	52.59	8.98	68239.94	0.36	15
110.00	94.60	42.58	4.24	3020.85	44750.87	52.59	6.28	68239.94	0.36	15
120.00	94.60	42.58	4.23	3020.78	44750.87	52.59	4.49	68239.94	0.36	15
130.00	94.60	42.58	4.23	3020.71	44750.87	52.59	2.69	68239.94	0.36	15
140.00	94.60	42.58	4.23	3020.68	44750.87	52.59	1.80	68239.94	0.36	15
150.00	94.60	42.58	4.23	3020.65	44750.87	52.59	0.90	68239.94	0.36	15
160.00	94.60	42.58	4.23	3020.62	44750.87	52.59	0.0	68239.94	0.36	15
170.30	94.60	42.58	4.23	3020.62	44750.87	52.59	0.0	68239.94	0.36	15
180.00	94.60	42.58	4.23	3020.62	44750.87	52.59	0.0	68239.94	0.36	15
190.00	94.60	42.58	4.23	3020.62	44750.87	52.59	0.0	68239.94	0.36	15
200.00	94.60	42.58	4.23	3020.62	44750.87	52.59	0.0	68239.94	0.36	15
210.00	94.60	42.58	4.23	3020.65	44750.87	52.59	0.90	68239.94	0.36	15
220.00	94.60	42.58	4.23	3020.68	44750.87	52.59	1.80	68239.94	0.36	15
230.00	94.60	42.58	4.23	3020.71	44750.87	52.59	2.69	68239.94	0.36	15
240.00	94.60	42.58	4.23	3020.78	44750.87	52.59	4.49	68239.94	0.36	15
250.00	94.60	42.58	4.24	3020.85	44750.87	52.59	6.28	68239.94	0.36	15
260.00	94.60	42.59	4.24	3020.95	44750.87	52.59	8.98	68239.94	0.36	15
270.00	94.60	42.59	4.24	3021.08	44750.87	52.59	12.57	68239.94	0.36	15
280.00	94.60	42.59	4.26	3021.64	44750.87	52.59	16.16	68239.94	0.36	15
290.00	94.60	42.60	4.26	3021.79	44750.87	52.59	19.75	68239.94	0.36	15
300.00	94.60	42.60	4.27	3021.94	44750.87	52.59	24.24	68239.94	0.36	15
310.00	94.60	42.61	4.28	3022.10	44750.87	52.59	28.73	68239.94	0.36	15
320.00	94.60	42.61	4.28	3022.24	44750.87	52.59	32.32	68239.94	0.36	15
330.00	94.60	42.62	4.29	3022.80	44750.87	52.59	35.91	68239.94	0.36	15
340.00	94.60	42.62	4.30	3022.88	44750.87	52.59	38.61	68239.94	0.36	15
350.00	94.60	42.62	4.30	3022.96	44750.87	52.59	40.40	68239.94	0.36	15
360.00	94.60	42.62	4.30	3022.98	44750.87	52.59	41.30	68239.94	0.36	15

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 514.16 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.45000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.98846

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 4C.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 60 , SOLAR ABSORPTANCE VALUE = 0.45000

ORBITAL SCLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	48.73	14.25	3397.50	50344.73	52.59	46.46	68239.94	0.37	14
10.00	94.60	48.73	14.25	3397.46	50344.73	52.59	45.45	68239.94	0.37	14
20.00	94.60	48.72	14.25	3397.38	50344.73	52.59	43.43	68239.94	0.37	14
30.00	94.60	48.72	14.24	3397.26	50344.73	52.59	40.40	68239.94	0.37	14
40.00	94.60	48.72	14.24	3397.10	50344.73	52.59	36.36	68239.94	0.37	14
50.00	94.60	48.71	14.22	3395.95	50344.73	52.59	32.32	68239.94	0.37	14
60.00	94.60	48.71	14.21	3395.75	50344.73	52.59	27.27	68239.94	0.37	14
70.00	94.60	48.70	14.21	3395.54	50344.73	52.59	22.22	68239.94	0.37	14
80.00	94.60	48.70	14.20	3395.41	50344.73	52.59	18.18	68239.94	0.37	14
90.00	94.60	48.69	14.20	3395.25	50344.73	52.59	14.14	68239.94	0.37	14
100.00	94.60	48.69	14.19	3395.10	50344.73	52.59	10.10	68239.94	0.37	14
110.00	94.60	48.69	14.19	3394.97	50344.73	52.59	7.07	68239.94	0.37	14
120.00	94.60	48.68	14.19	3394.89	50344.73	52.59	5.05	68239.94	0.37	14
130.00	94.60	48.68	14.17	3393.82	50344.73	52.59	3.03	68239.94	0.37	14
140.00	94.60	48.68	14.17	3393.78	50344.73	52.59	2.02	68239.94	0.37	14
150.00	94.60	48.68	14.16	3393.73	50344.73	52.59	1.01	68239.94	0.37	14
160.00	94.60	48.68	14.16	3393.70	50344.73	52.59	0.0	68239.94	0.37	14
170.00	94.60	48.68	14.16	3393.70	50344.73	52.59	0.0	68239.94	0.37	14
180.00	94.60	48.68	14.16	3393.70	50344.73	52.59	0.0	68239.94	0.37	14
190.00	94.60	48.68	14.16	3393.70	50344.73	52.59	0.0	68239.94	0.37	14
200.00	94.60	48.68	14.16	3393.70	50344.73	52.59	0.0	68239.94	0.37	14
210.00	94.60	48.68	14.16	3393.73	50344.73	52.59	1.01	68239.94	0.37	14
220.00	94.60	48.68	14.17	3393.78	50344.73	52.59	2.02	68239.94	0.37	14
230.00	94.60	48.68	14.17	3393.82	50344.73	52.59	3.03	68239.94	0.37	14
240.00	94.60	48.68	14.19	3394.89	50344.73	52.59	5.05	68239.94	0.37	14
250.00	94.60	48.69	14.19	3394.97	50344.73	52.59	7.07	68239.94	0.37	14
260.00	94.60	48.69	14.19	3395.10	50344.73	52.59	10.10	68239.94	0.37	14
270.00	94.60	48.69	14.20	3395.25	50344.73	52.59	14.14	68239.94	0.37	14
280.00	94.60	48.70	14.20	3395.41	50344.73	52.59	18.18	68239.94	0.37	14
290.00	94.60	48.70	14.21	3395.54	50344.73	52.59	22.22	68239.94	0.37	14
300.00	94.60	48.71	14.21	3395.75	50344.73	52.59	27.27	68239.94	0.37	14
310.00	94.60	48.71	14.22	3395.95	50344.73	52.59	32.32	68239.94	0.37	14
320.00	94.60	48.72	14.24	3397.10	50344.73	52.59	36.36	68239.94	0.37	14
330.00	94.60	48.72	14.24	3397.26	50344.73	52.59	40.40	68239.94	0.37	14
340.00	94.60	48.72	14.25	3397.38	50344.73	52.59	43.43	68239.94	0.37	14
350.00	94.60	48.73	14.25	3397.46	50344.73	52.59	45.45	68239.94	0.37	14
360.00	94.60	48.73	14.25	3397.50	50344.73	52.59	46.46	68239.94	0.37	14

PLATFORM AREA REQUIRED TO REMAIN IN SPEC = 514.16 FT2 FOR 60 MONTHS ON ORBIT.

SOLAR ABSORPTANCE = 0.45000 FOR 60 MONTHS OF LIFE WITH A DEGRADATION RATE OF 0.00500 CHANGE IN ABSORPTANCE PER MONTH.

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.98846

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G E O S Y N C H R O N O U S   2 5 K W   P O W E R   M O D U L E   P R O G R A M .

ALTITUDE (N.MI.) =   19370.0

ORBIT INCLINATICN BETA ANGLE (DEGREES) =  23.50

DISSIPATION (KW.), LOWEST =    20  HIGHEST =    20  INCREMENT =     1

MONTHS DEGRACATION FOR PLATE RADIATOR =    60  INCREMENT =    10

ORBIT PRINT INTERVAL (DEGREES) =    10

PLATE, SHAPE FACTOR TO SPACE =  0.920000  FLUID CP =     0.2500  BTU/LBM-R.

RACIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE =    0.07CCO  EMITTANCE =    0.76000  MONTHLY CHANGE IN ABSORPTANCE =    0.01500

EXTERNAL HEAT INPUT TABLES.

    1    SOLAR  FS  FOR  B= 23.5 DEGREES, PLANAR RAD IN ORBIT PLANE.
              0.0        0.398750
            360.00       0.398750
    2    EARTHSHINE FE FOR GEO PLANAR RAD IN ORBIT PLANE.
              0.0        0.000710
            360.00       0.000710
    3    ALBEDO  FA  FOR  B= 23.5 DEGREES, PLANAR RAD IN ORBIT PLANE.
              0.0        0.000460
             10.00       0.C00450
             20.00       0.000430
             30.00       0.C00400
             40.00       0.000360
             50.00       0.000320
             60.00       0.000270
             70.00       0.000220
             80.00       0.000180
             90.00       0.000140
            100.00       0.000100
            110.00       0.000070
            120.00       0.000050
            130.00       0.C00030
            140.00       0.C00020
            150.00       0.000010
            160.00       0.0
            200.00       0.C
            210.00       0.000010
            220.00       0.000020
            230.00       0.000030
            240.00       0.C00050
            250.00       0.000070
            260.00       0.000100
            270.00       0.000140
            280.00       0.000180
            290.00       0.000220
            300.00       0.000270
            310.00       0.000320
            320.00       0.000360
            330.00       0.000400
            340.00       0.000430
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350.00	0.000450
360.00	0.000460

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 4C.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 0 , SOLAR ABSORPTANCE VALUE = 0.07000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	12.29	-48.93	1901.87	7831.41	45.42	7.23	68239.94	0.32	16
10.00	94.60	12.29	-48.93	1901.86	7831.41	45.42	7.07	68239.94	0.32	16
20.00	94.60	12.29	-48.93	1901.84	7831.41	45.42	6.76	68239.94	0.32	16
30.00	94.60	12.29	-48.93	1901.81	7831.41	45.42	6.28	68239.94	0.32	16
40.00	94.60	12.29	-48.93	1901.77	7831.41	45.42	5.66	68239.94	0.32	16
50.00	94.60	12.28	-48.94	1901.72	7831.41	45.42	5.03	68239.94	0.32	16
60.00	94.60	12.28	-48.94	1901.68	7831.41	45.42	4.24	68239.94	0.32	16
70.00	94.60	12.28	-48.94	1901.63	7831.41	45.42	3.46	68239.94	0.32	16
80.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	2.83	68239.94	0.32	16
90.00	94.60	12.28	-48.94	1901.71	7831.41	45.42	2.20	68239.94	0.32	16
100.00	94.60	12.28	-48.94	1901.66	7831.41	45.42	1.57	68239.94	0.32	16
110.00	94.60	12.28	-48.94	1901.63	7831.41	45.42	1.10	68239.94	0.32	16
120.00	94.60	12.28	-48.95	1901.62	7831.41	45.42	0.79	68239.94	0.32	16
130.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	0.47	68239.94	0.32	16
140.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	0.31	68239.94	0.32	16
150.00	94.60	12.28	-48.95	1901.58	7831.41	45.42	0.16	68239.94	0.32	16
160.00	94.60	12.28	-48.95	1901.57	7831.41	45.42	0.0	68239.94	0.32	16
170.00	94.60	12.28	-48.95	1901.57	7831.41	45.42	0.0	68239.94	0.32	16
180.00	94.60	12.28	-48.95	1901.57	7831.41	45.42	0.0	68239.94	0.32	16
190.00	94.60	12.28	-48.95	1901.57	7831.41	45.42	0.0	68239.94	0.32	16
200.00	94.60	12.28	-48.95	1901.57	7831.41	45.42	0.0	68239.94	0.32	16
210.00	94.60	12.28	-48.95	1901.58	7831.41	45.42	0.16	68239.94	0.32	16
220.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	0.31	68239.94	0.32	16
230.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	0.47	68239.94	0.32	16
240.00	94.60	12.28	-48.95	1901.62	7831.41	45.42	0.79	68239.94	0.32	16
250.00	94.60	12.28	-48.94	1901.63	7831.41	45.42	1.10	68239.94	0.32	16
260.00	94.60	12.28	-48.94	1901.66	7831.41	45.42	1.57	68239.94	0.32	16
270.00	94.60	12.28	-48.94	1901.71	7831.41	45.42	2.20	68239.94	0.32	16
280.00	94.60	12.28	-48.95	1901.59	7831.41	45.42	2.83	68239.94	0.32	16
290.00	94.60	12.28	-48.94	1901.63	7831.41	45.42	3.46	68239.94	0.32	16
300.00	94.60	12.28	-48.94	1901.68	7831.41	45.42	4.24	68239.94	0.32	16
310.00	94.60	12.28	-48.94	1901.72	7831.41	45.42	5.03	68239.94	0.32	16
320.00	94.60	12.29	-48.93	1901.77	7831.41	45.42	5.66	68239.94	0.32	16
330.00	94.60	12.29	-48.93	1901.81	7831.41	45.42	6.28	68239.94	0.32	16
340.00	94.60	12.29	-48.93	1901.84	7831.41	45.42	6.76	68239.94	0.32	16
350.00	94.60	12.29	-48.93	1901.86	7831.41	45.42	7.07	68239.94	0.32	16
360.00	94.60	12.29	-48.93	1901.87	7831.41	45.42	7.23	68239.94	0.32	16

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 10 , SOLAR ABSORPTANCE VALUE = 0.22000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	36.41	-8.01	2660.18	24612.98	45.42	22.71	68239.94	0.36	15
10.00	94.60	36.41	-8.02	2660.16	24612.98	45.42	22.22	68239.94	0.36	15
20.00	94.60	36.41	-8.02	2660.11	24612.98	45.42	21.23	68239.94	0.36	15
30.00	94.60	36.41	-8.02	2660.04	24612.98	45.42	19.75	68239.94	0.36	15
40.00	94.60	36.40	-8.02	2659.95	24612.98	45.42	17.78	68239.94	0.36	15
50.00	94.60	36.40	-8.03	2659.86	24612.98	45.42	15.80	68239.94	0.36	15
60.00	94.60	36.40	-8.03	2659.75	24612.98	45.42	13.33	68239.94	0.36	15
70.00	94.60	36.40	-8.04	2659.64	24612.98	45.42	10.86	68239.94	0.36	15
80.00	94.60	36.39	-8.04	2659.56	24612.98	45.42	8.89	68239.94	0.36	15
90.00	94.60	36.39	-8.04	2659.48	24612.98	45.42	6.91	68239.94	0.36	15
100.00	94.60	36.39	-8.06	2658.96	24612.98	45.42	4.94	68239.94	0.36	15
110.00	94.60	36.38	-8.06	2658.89	24612.98	45.42	3.46	68239.94	0.36	15
120.00	94.60	36.38	-8.06	2658.85	24612.98	45.42	2.47	68239.94	0.36	15
130.00	94.60	36.38	-8.07	2658.81	24612.98	45.42	1.48	68239.94	0.36	15
140.00	94.60	36.38	-8.06	2659.20	24612.98	45.42	0.99	68239.94	0.36	15
150.00	94.60	36.38	-8.07	2658.77	24612.98	45.42	0.49	68239.94	0.36	15
160.00	94.60	36.38	-8.07	2658.73	24612.98	45.42	0.0	68239.94	0.36	15
170.00	94.60	36.38	-8.07	2658.73	24612.98	45.42	0.0	68239.94	0.36	15
180.00	94.60	36.38	-8.07	2658.73	24612.98	45.42	0.0	68239.94	0.36	15
190.00	94.60	36.38	-8.07	2658.73	24612.98	45.42	0.0	68239.94	0.36	15
200.00	94.60	36.38	-8.07	2658.73	24612.98	45.42	0.0	68239.94	0.36	15
210.00	94.60	36.38	-8.07	2658.77	24612.98	45.42	0.49	68239.94	0.36	15
220.00	94.60	36.38	-8.06	2659.20	24612.98	45.42	0.99	68239.94	0.36	15
230.00	94.60	36.38	-8.07	2658.81	24612.98	45.42	1.48	68239.94	0.36	15
240.00	94.60	36.38	-8.06	2658.85	24612.98	45.42	2.47	68239.94	0.36	15
250.00	94.60	36.38	-8.06	2658.89	24612.98	45.42	3.46	68239.94	0.36	15
260.00	94.60	36.39	-8.06	2658.96	24612.98	45.42	4.94	68239.94	0.36	15
270.00	94.60	36.39	-8.04	2659.48	24612.98	45.42	6.91	68239.94	0.36	15
280.00	94.60	36.39	-8.04	2659.56	24612.98	45.42	8.89	68239.94	0.36	15
290.00	94.60	36.40	-8.04	2659.64	24612.98	45.42	10.86	68239.94	0.36	15
300.00	94.60	36.40	-8.03	2659.75	24612.98	45.42	13.33	68239.94	0.36	15
310.00	94.60	36.40	-8.03	2659.86	24612.98	45.42	15.80	68239.94	0.36	15
320.00	94.60	36.40	-8.02	2659.95	24612.98	45.42	17.78	68239.94	0.36	15
330.00	94.60	36.41	-8.02	2660.04	24612.98	45.42	19.75	68239.94	0.36	15
340.00	94.60	36.41	-8.02	2660.11	24612.98	45.42	21.23	68239.94	0.36	15
350.00	94.60	36.41	-8.02	2660.16	24612.98	45.42	22.22	68239.94	0.36	15
360.00	94.60	36.41	-8.01	2660.18	24612.98	45.42	22.71	68239.94	0.36	15

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 20 , SOLAR ABSORPTANCE VALUE = 0.37000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	57.45	27.42	4063.44	41394.56	45.42	38.20	68239.94	0.40	14
10.00	94.60	57.45	27.42	4063.39	41394.56	45.42	37.37	68239.94	0.40	14
20.00	94.60	57.45	27.42	4063.31	41394.56	45.42	35.71	68239.94	0.40	14
30.00	94.60	57.45	27.41	4063.21	41394.56	45.42	33.22	68239.94	0.40	14
40.00	94.60	57.44	27.41	4063.05	41394.56	45.42	29.90	68239.94	0.40	14
50.00	94.60	57.44	27.41	4062.83	41394.56	45.42	26.58	68239.94	0.40	14
60.00	94.60	57.43	27.38	4061.25	41394.56	45.42	22.42	68239.94	0.40	14
70.00	94.60	57.43	27.38	4061.01	41394.56	45.42	18.27	68239.94	0.40	14
80.00	94.60	57.42	27.38	4060.83	41394.56	45.42	14.95	68239.94	0.40	14
90.00	94.60	57.42	27.37	4060.65	41394.56	45.42	11.63	68239.94	0.40	14
100.00	94.60	57.42	27.37	4060.50	41394.56	45.47	8.30	68239.94	0.40	14
110.00	94.60	57.41	27.37	4060.36	41894.56	45.42	5.81	68239.94	0.40	14
120.00	94.60	57.41	27.36	4060.29	41394.56	45.42	4.15	68239.94	0.40	14
130.00	94.60	57.41	27.34	4058.85	41394.56	45.42	2.49	68239.94	0.40	14
140.00	94.60	57.41	27.34	4058.80	41394.56	45.42	1.66	68239.94	0.40	14
150.00	94.60	57.41	27.34	4058.74	41394.56	45.42	0.83	68239.94	0.40	14
160.00	94.60	57.41	27.34	4058.71	41394.56	45.42	0.0	68239.94	0.40	14
170.00	94.60	57.41	27.34	4058.71	41394.56	45.42	0.0	68239.94	0.40	14
180.00	94.60	57.41	27.34	4058.71	41394.56	45.42	0.0	68239.94	0.40	14
190.00	94.60	57.41	27.34	4058.71	41394.56	45.42	0.0	68239.94	0.40	14
200.00	94.60	57.41	27.34	4058.71	41394.56	45.42	0.0	68239.94	0.40	14
210.00	94.60	57.41	27.34	4058.74	41394.56	45.42	0.83	68239.94	0.40	14
220.00	94.60	57.41	27.34	4058.80	41394.56	45.42	1.66	68239.94	0.40	14
230.00	94.60	57.41	27.34	4058.85	41394.56	45.42	2.49	68239.94	0.40	14
240.00	94.60	57.41	27.36	4060.29	41394.56	45.42	4.15	68239.94	0.40	14
250.00	94.60	57.41	27.37	4060.36	41394.56	45.42	5.81	68239.94	0.40	14
260.00	94.60	57.42	27.37	4060.50	41394.56	45.42	8.30	68239.94	0.40	14
270.00	94.60	57.42	27.37	4060.65	41394.56	45.42	11.63	68239.94	0.40	14
280.00	94.60	57.42	27.38	4060.83	41394.56	45.42	14.95	68239.94	0.40	14
290.00	94.60	57.43	27.38	4061.01	41394.56	45.42	18.27	68239.94	0.40	14
300.00	94.60	57.43	27.38	4061.25	41394.56	45.42	22.42	68239.94	0.40	14
310.00	94.60	57.44	27.41	4062.83	41394.56	45.42	26.58	68239.94	0.40	14
320.00	94.60	57.44	27.41	4063.05	41394.56	45.42	29.90	68239.94	0.40	14
330.00	94.60	57.45	27.41	4063.21	41394.56	45.42	33.22	68239.94	0.40	14
340.00	94.60	57.45	27.42	4063.31	41394.56	45.42	35.71	68239.94	0.40	14
350.00	94.60	57.45	27.42	4063.39	41394.56	45.42	37.37	68239.94	0.40	14
360.00	94.60	57.45	27.42	4063.44	41394.56	45.42	38.20	68239.94	0.40	14

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 30 , SOLAR ABSORPTANCE VALUE = 0.52000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	64.80	40.00	4235.46	58176.14	45.42	53.69	57813.93	0.42	1
10.00	94.60	64.80	40.00	4235.55	58176.14	45.42	52.52	57815.09	0.42	1
20.00	94.60	64.80	40.00	4235.72	58176.14	45.42	50.19	57817.43	0.42	1
30.00	94.60	64.80	40.00	4235.98	58176.14	45.42	46.69	57820.93	0.42	1
40.00	94.60	64.80	40.00	4236.32	58176.14	45.42	42.02	57825.59	0.42	1
50.00	94.60	64.80	40.00	4236.66	58176.14	45.42	37.35	57830.27	0.42	1
60.00	94.60	64.80	40.00	4237.09	58176.14	45.42	31.51	57836.11	0.42	1
70.00	94.60	64.80	40.00	4237.52	58176.14	45.42	25.68	57841.94	0.42	1
80.00	94.60	64.80	40.00	4237.86	58176.14	45.42	21.01	57846.61	0.42	1
90.00	94.60	64.80	40.00	4238.20	58176.14	45.42	16.34	57851.28	0.42	1
100.00	94.60	64.80	40.00	4238.54	58176.14	45.42	11.67	57855.94	0.42	1
110.00	94.60	64.80	40.00	4238.80	58176.14	45.42	8.17	57859.45	0.42	1
120.00	94.60	64.80	40.00	4238.97	58176.14	45.42	5.84	57861.78	0.42	1
130.00	94.60	64.80	40.00	4239.14	58176.14	45.42	3.50	57864.12	0.42	1
140.00	94.60	64.80	40.00	4239.22	58176.14	45.42	2.33	57865.28	0.42	1
150.00	94.60	64.80	40.00	4239.31	58176.14	45.42	1.17	57866.45	0.42	1
160.00	94.60	64.80	40.00	4239.39	58176.14	45.42	0.0	57867.61	0.42	1
170.00	94.60	64.80	40.00	4239.39	58176.14	45.42	0.0	57867.61	0.42	1
180.00	94.60	64.80	40.00	4239.39	58176.14	45.42	0.0	57867.61	0.42	1
190.00	94.60	64.80	40.00	4239.39	58176.14	45.42	0.0	57867.61	0.42	1
200.00	94.60	64.80	40.00	4239.39	58176.14	45.42	0.0	57867.61	0.42	1
210.00	94.60	64.80	40.00	4239.31	58176.14	45.42	1.17	57866.45	0.42	1
220.00	94.60	64.80	40.00	4239.22	58176.14	45.42	2.33	57865.28	0.42	1
230.00	94.60	64.80	40.00	4239.14	58176.14	45.42	3.50	57864.12	0.42	1
240.00	94.60	64.80	40.00	4238.97	58176.14	45.42	5.84	57861.78	0.42	1
250.00	94.60	64.80	40.00	4238.80	58176.14	45.42	8.17	57859.45	0.42	1
260.00	94.60	64.80	40.00	4238.54	58176.14	45.42	11.67	57855.94	0.42	1
270.00	94.60	64.80	40.00	4238.20	58176.14	45.42	16.34	57851.28	0.42	1
280.00	94.60	64.80	40.00	4237.86	58176.14	45.42	21.01	57846.61	0.42	1
290.00	94.60	64.80	40.00	4237.52	58176.14	45.42	25.68	57841.94	0.42	1
300.00	94.60	64.80	40.00	4237.09	58176.14	45.42	31.51	57836.11	0.42	1
310.00	94.60	64.80	40.00	4236.66	58176.14	45.42	37.35	57830.27	0.42	1
320.00	94.60	64.80	40.00	4236.32	58176.14	45.42	42.02	57825.59	0.42	1
330.00	94.60	64.80	40.00	4235.98	58176.14	45.42	46.69	57820.93	0.42	1
340.00	94.60	64.80	40.00	4235.72	58176.14	45.42	50.19	57817.43	0.42	1
350.00	94.60	64.80	40.00	4235.55	58176.14	45.42	52.52	57815.09	0.42	1
360.00	94.60	64.80	40.00	4235.46	58176.14	45.42	53.69	57813.93	0.42	1

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 40 , SOLAR ABSORPTANCE VALUE = 0.67000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	64.80	40.00	3004.91	74957.69	45.42	69.18	41016.92	0.42	1
10.00	94.60	64.80	40.00	3005.02	74957.69	45.42	67.67	41018.42	0.42	1
20.00	94.60	64.80	40.00	3005.24	74957.69	45.42	64.67	41021.42	0.42	1
30.00	94.60	64.80	40.00	3005.57	74957.69	45.42	60.15	41025.92	0.42	1
40.00	94.60	64.80	40.00	3006.01	74957.69	45.42	54.14	41031.92	0.42	1
50.00	94.60	64.80	40.00	3006.45	74957.69	45.42	48.12	41037.98	0.42	1
60.00	94.60	64.80	40.00	3007.00	74957.69	45.42	40.60	41045.48	0.42	1
70.00	94.60	64.80	40.00	3007.55	74957.69	45.42	33.08	41052.98	0.42	1
80.00	94.60	64.80	40.00	3007.99	74957.69	45.42	27.07	41058.98	0.42	1
90.00	94.60	64.80	40.00	3008.44	74957.69	45.42	21.05	41065.05	0.42	1
100.00	94.60	64.80	40.00	3008.88	74957.69	45.42	15.04	41071.05	0.42	1
110.00	94.60	64.80	40.00	3009.21	74957.69	45.42	10.53	41075.55	0.42	1
120.00	94.60	64.80	40.00	3009.43	74957.69	45.42	7.52	41078.55	0.42	1
130.00	94.60	64.80	40.00	3009.65	74957.69	45.42	4.51	41081.55	0.42	1
140.00	94.60	64.80	40.00	3009.76	74957.69	45.42	3.01	41083.11	0.42	1
150.00	94.60	64.80	40.00	3009.87	74957.69	45.42	1.50	41084.61	0.42	1
160.00	94.60	64.80	40.00	3009.98	74957.69	45.42	0.0	41086.11	0.42	1
170.00	94.60	64.80	40.00	3009.98	74957.69	45.42	0.0	41086.11	0.42	1
180.00	94.60	64.80	40.00	3009.98	74957.69	45.42	0.0	41086.11	0.42	1
190.00	94.60	64.80	40.00	3009.98	74957.69	45.42	0.0	41086.11	0.42	1
200.00	94.60	64.80	40.00	3009.98	74957.69	45.42	0.0	41086.11	0.42	1
210.00	94.60	64.80	40.00	3009.87	74957.69	45.42	1.50	41084.61	0.42	1
220.00	94.60	64.80	40.00	3009.76	74957.69	45.42	3.01	41083.11	0.42	1
230.00	94.60	64.80	40.00	3009.65	74957.69	45.42	4.51	41081.55	0.42	1
240.00	94.60	64.80	40.00	3009.43	74957.69	45.42	7.52	41078.55	0.42	1
250.00	94.60	64.80	40.00	3009.21	74957.69	45.42	10.53	41075.55	0.42	1
260.00	94.60	64.80	40.00	3008.88	74957.69	45.42	15.04	41071.05	0.42	1
270.00	94.60	64.80	40.00	3008.44	74957.69	45.42	21.05	41065.05	0.42	1
280.00	94.60	64.80	40.00	3007.99	74957.69	45.42	27.07	41058.98	0.42	1
290.00	94.60	64.80	40.00	3007.55	74957.69	45.42	33.08	41052.98	0.42	1
300.00	94.60	64.80	40.00	3007.00	74957.69	45.42	40.60	41045.48	0.42	1
310.00	94.60	64.80	40.00	3006.45	74957.69	45.42	48.12	41037.98	0.42	1
320.00	94.60	64.80	40.00	3006.01	74957.69	45.42	54.14	41031.92	0.42	1
330.00	94.60	64.80	40.00	3005.57	74957.69	45.42	60.15	41025.92	0.42	1
340.00	94.60	64.80	40.00	3005.24	74957.69	45.42	64.67	41021.42	0.42	1
350.00	94.60	64.80	40.00	3005.02	74957.69	45.42	67.67	41018.42	0.42	1
360.00	94.60	64.80	40.00	3004.91	74957.69	45.42	69.18	41016.92	0.42	1

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 50 , SOLAR ABSORPTANCE VALUE = 0.82000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	64.80	40.00	1774.35	91739.25	45.42	84.66	24219.86	0.42	1
10.00	94.60	64.80	40.00	1774.49	91739.25	45.42	82.82	24221.67	0.42	1
20.00	94.60	64.80	40.00	1774.76	91739.25	45.42	79.14	24225.36	0.42	1
30.00	94.60	64.80	40.00	1775.16	91739.25	45.42	73.62	24230.92	0.42	1
40.00	94.60	64.80	40.00	1775.70	91739.25	45.42	66.26	24238.23	0.42	1
50.00	94.60	64.80	40.00	1776.24	91739.25	45.42	58.90	24245.61	0.42	1
60.00	94.60	64.80	40.00	1776.91	91739.25	45.42	49.69	24254.80	0.42	1
70.00	94.60	64.80	40.00	1777.59	91739.25	45.42	40.49	24264.05	0.42	1
80.00	94.60	64.80	40.00	1778.13	91739.25	45.42	33.13	24271.36	0.42	1
90.00	94.60	64.80	40.00	1778.67	91739.25	45.42	25.77	24278.73	0.42	1
100.00	94.60	64.80	40.00	1779.21	91739.25	45.42	18.41	24286.11	0.42	1
110.00	94.60	64.80	40.00	1779.61	91739.25	45.42	12.88	24291.61	0.42	1
120.00	94.60	64.80	40.00	1779.88	91739.25	45.42	9.20	24295.30	0.42	1
130.00	94.60	64.80	40.00	1780.15	91739.25	45.42	5.52	24298.98	0.42	1
140.00	94.60	64.80	40.00	1780.29	91739.25	45.42	3.68	24300.86	0.42	1
150.00	94.60	64.80	40.00	1780.42	91739.25	45.42	1.84	24302.67	0.42	1
160.00	94.60	64.80	40.00	1780.55	91739.25	45.42	0.0	24304.48	0.42	1
170.00	94.60	64.80	40.00	1780.55	91739.25	45.42	0.0	24304.48	0.42	1
180.00	94.60	64.80	40.00	1780.55	91739.25	45.42	0.0	24304.48	0.42	1
190.00	94.60	64.80	40.00	1780.55	91739.25	45.42	0.0	24304.48	0.42	1
200.00	94.60	64.80	40.00	1780.55	91739.25	45.42	0.0	24304.48	0.42	1
210.00	94.60	64.80	40.00	1780.42	91739.25	45.42	1.84	24302.67	0.42	1
220.00	94.60	64.80	40.00	1780.29	91739.25	45.42	3.68	24300.86	0.42	1
230.00	94.60	64.80	40.00	1780.15	91739.25	45.42	5.52	24298.98	0.42	1
240.00	94.60	64.80	40.00	1779.88	91739.25	45.42	9.20	24295.30	0.42	1
250.00	94.60	64.80	40.00	1779.61	91739.25	45.42	12.88	24291.61	0.42	1
260.00	94.60	64.80	40.00	1779.21	91739.25	45.42	18.41	24286.11	0.42	1
270.00	94.60	64.80	40.00	1778.67	91739.25	45.42	25.77	24278.73	0.42	1
280.00	94.60	64.80	40.00	1778.13	91739.25	45.42	33.13	24271.36	0.42	1
290.00	94.60	64.80	40.00	1777.59	91739.25	45.42	40.49	24264.05	0.42	1
300.00	94.60	64.80	40.00	1776.91	91739.25	45.42	49.69	24254.80	0.42	1
310.00	94.60	64.80	40.00	1776.24	91739.25	45.42	58.90	24245.61	0.42	1
320.00	94.60	64.80	40.00	1775.70	91739.25	45.42	66.26	24238.23	0.42	1
330.00	94.60	64.80	40.00	1775.16	91739.25	45.42	73.62	24230.92	0.42	1
340.00	94.60	64.80	40.00	1774.76	91739.25	45.42	79.14	24225.36	0.42	1
350.00	94.60	64.80	40.00	1774.49	91739.25	45.42	82.82	24221.67	0.42	1
360.00	94.60	64.80	40.00	1774.35	91739.25	45.42	84.66	24219.86	0.42	1

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.85367

FLAT PLANE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

TEMPERATURES (F), INLET = 94.60 , MIX = 40.00 , COOLANT FLOW RATE (LBM/HR) = 4999.27

PLATFORM AREA IN FT2 = 634.20

ORBIT BETA ANGLE = 23.50 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

NO ECLIPSING TAKES PLACE IN ORBIT.

TIME AFTER LAUNCH IN MONTHS = 60 , SOLAR ABSORPTANCE VALUE = 0.97000

ORBITAL SCLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	64.80	40.00	543.80	108520.81	45.42	100.15	7422.80	0.42	1
10.00	94.60	64.80	40.00	543.96	108520.81	45.42	97.97	7424.98	0.42	1
20.00	94.60	64.80	40.00	544.28	108520.81	45.42	93.62	7429.36	0.42	1
30.00	94.60	64.80	40.00	544.75	108520.81	45.42	87.09	7435.86	0.42	1
40.00	94.60	64.80	40.00	545.39	108520.81	45.42	78.38	7444.61	0.42	1
50.00	94.60	64.80	40.00	546.03	108520.81	45.42	69.67	7453.30	0.42	1
60.00	94.60	64.80	40.00	546.83	108520.81	45.42	58.78	7464.17	0.42	1
70.00	94.60	64.80	40.00	547.62	108520.81	45.42	47.90	7475.05	0.42	1
80.00	94.60	64.80	40.00	548.26	108520.81	45.42	39.19	7483.80	0.42	1
90.00	94.60	64.80	40.00	548.90	108520.81	45.42	30.48	7492.48	0.42	1
100.00	94.60	64.80	40.00	549.54	108520.81	45.42	21.77	7501.17	0.42	1
110.00	94.60	64.80	40.00	550.02	108520.81	45.42	15.24	7507.73	0.42	1
120.00	94.60	64.80	40.00	550.34	108520.81	45.42	10.89	7512.11	0.42	1
130.00	94.60	64.80	40.00	550.66	108520.81	45.42	6.53	7516.42	0.42	1
140.00	94.60	64.80	40.00	550.82	108520.81	45.42	4.35	7518.61	0.42	1
150.00	94.60	64.80	40.00	550.98	108520.81	45.42	2.18	7520.80	0.42	1
160.00	94.60	64.80	40.00	551.14	108520.81	45.42	0.0	7522.98	0.42	1
170.00	94.60	64.80	40.00	551.14	108520.81	45.42	0.0	7522.98	0.42	1
180.00	94.60	64.80	40.00	551.14	108520.81	45.42	0.0	7522.98	0.42	1
190.00	94.60	64.80	40.00	551.14	108520.81	45.42	0.0	7522.98	0.42	1
200.00	94.60	64.80	40.00	551.14	108520.81	45.42	0.0	7522.98	0.42	1
210.00	94.60	64.80	40.00	550.98	108520.81	45.42	2.18	7520.80	0.42	1
220.00	94.60	64.80	40.00	550.82	108520.81	45.42	4.35	7518.61	0.42	1
230.00	94.60	64.80	40.00	550.66	108520.81	45.42	6.53	7516.42	0.42	1
240.00	94.60	64.80	40.00	550.34	108520.81	45.42	10.89	7512.11	0.42	1
250.00	94.60	64.80	40.00	550.02	108520.81	45.42	15.24	7507.73	0.42	1
260.00	94.60	64.80	40.00	549.54	108520.81	45.42	21.77	7501.17	0.42	1
270.00	94.60	64.80	40.00	548.90	108520.81	45.42	30.48	7492.48	0.42	1
280.00	94.60	64.80	40.00	548.26	108520.81	45.42	39.19	7483.80	0.42	1
290.00	94.60	64.80	40.00	547.62	108520.81	45.42	47.90	7475.05	0.42	1
300.00	94.60	64.80	40.00	546.83	108520.81	45.42	58.78	7464.17	0.42	1
310.00	94.60	64.80	40.00	546.03	108520.81	45.42	69.67	7453.30	0.42	1
320.00	94.60	64.80	40.00	545.39	108520.81	45.42	78.38	7444.61	0.42	1
330.00	94.60	64.80	40.00	544.75	108520.81	45.42	87.09	7435.86	0.42	1
340.00	94.60	64.80	40.00	544.28	108520.81	45.42	93.62	7429.36	0.42	1
350.00	94.60	64.80	40.00	543.96	108520.81	45.42	97.97	7424.98	0.42	1
360.00	94.60	64.80	40.00	543.80	108520.81	45.42	100.15	7422.80	0.42	1

EXTERNAL LOADS ARE TOO LARGE FOR INFINITE RADIATOR TO REMAIN IN SPEC, SOLAR ABSORPTANCE VALUE FOR LIMIT = 0.85367

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Appendix E

GEO SPACE STATION PROGRAM SAMPLE CASE

A sample case of the GEO general space station program inputs and outputs will be presented. The following inputs will be used as a sample of the program use:

1. A synchronous altitude of 19,370 nautical miles will be considered.

2. The β angle will be five degrees.

3. The dissipation value will range from 20kW to a total station value of 40kW at intervals of 20kW. The break point between flat-plate and cylindrical radiators will be 20kW.

4. The total on-orbit time duration will be 60 months (5 years), with complete orbit solution intervals of ten months. The orbital increments for the solution orbits will be 10 degrees. These values will be used for both flat-plate and cylindrical radiators.

5. The fluid inlet and mix temperatures will be set at 94.6°F and 40°F, respectively. These values will be used for both flat-plate and cylindrical radiators.

6. The external heat inputs will consist of direct solar, earthshine and albedo shape factor tabular inputs, in that order. Tables one through three will be for the cylindrical radiator. The flat-plate radiator will be oriented with its plane normal to the orbit plane and it will be earth oriented, while the cylindrical radiator will be earth oriented end toward the earth.

7. The view factor to space for the flat-plate radiator will be given a value of 0.9, while for the cylindrical radiator the value will be 0.95. The specific heat for the coolant of both radiator systems will be specified as 0.25 BTU/emb-$^{\circ}$R (Freon 21).

8. White paint will be given initial α_s and emittance values of 0.15 and 0.88, respectively. Silvered Teflon (2 mil) will be given initial α_s and emittance values of 0.07 0.76, respectively.

A set of cases will be run to provide samples of program output. The following cases will be considered:

1. Silvered Teflon covered flat-plate radiators and a white paint covered cylindrical radiator with degradation rates of 0.0025 and 0.003 $\Delta\alpha_s$/Mo., respectively. The area fraction for each radiator type will be set at 1.0.

2. Silvered Teflon covered cylindrical radiator and white paint covered flat-plate radiators with degradation rates of 0.005 and 0.0035 $\Delta\alpha_s$/Mo., respectively. The area fraction for each radiator type will be 1.5.

3. Silvered Teflon covered flat-plate radiators and a white paint covered cylindrical radiator with degradation rates of 0.004 and 0.005 $\Delta\alpha_s$/Mo., respectively. The area fractions for the flat-plate and cylindrical radiators will be 0.3 and 0.55, respectively.

4. Silvered Teflon covered cylindrical radiator and white paint covered flat-plate radiators with degradation rates of 0.015 and 0.0035 $\Delta\alpha_s$/Mo., respectively. The area fractions for the flat-plate and cylindrical radiators will be 0.1 and 1.0, respectively.

For many radiator parameters, the same values have been given to both types of radiators. This does not need to be the case. The program is capable of handling all radiator parameters for each type of radiator independently, as some of the parameter differences already indicate.

The succeeding pages will present these inputs written on a coding form, followed by the program output.

10-133-190 (REV 9/68)

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE ______ PROGRAM NO. SPACE STATION PROGRAM PROGRAMMED BY ______ 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 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 71 72 73 74 75 76 77 78 79 80

INPUT FORMATS

1 FIRST CARD:

$\underbrace{5.0}_{\text{BETA}}$ 3FORMAT(5X, F5.2)

2 SECOND CARD:

$\underbrace{20}_{\text{ND1}}$ $\underbrace{40}_{\text{ND2}}$ $\underbrace{20}_{\text{ND3}}$ $\underbrace{20.0}_{\text{BREAK}}$ 3FORMAT(3I10, F10.4)

3 THIRD CARD:

$\underbrace{60}_{\text{MDP}}$ $\underbrace{10}_{\text{MODIP}}$ $\underbrace{10}_{\text{INTP}}$ $\underbrace{60}_{\text{MDC}}$ $\underbrace{10}_{\text{MODIC}}$ $\underbrace{10}_{\text{INTC}}$ 3FORMAT(6I10)

4 FOURTH CARD: START OF TABLE 1, 6 TABLES REQUIRED

$\underbrace{1}_{\text{NUM}}$ SOLAR FS, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE. 3FORMAT(I5, 2X, 18A4)

ADDITIONAL TABLE CARDS FOLLOW:

0.0	0.99619	3FORMAT(10X, F10.4, 5X, F12.6)
10.0	0.98106	
20.0	0.93612	
30.0	0.86273	
40.0	0.76313	
50.0	0.64034	

STK. NO. D.1.083

10-133 140 (REV 8/68)

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE ______ PROGRAM NO. ______ PROGRAMMED BY ______ 2

60.0	0.49810
70.0	0.34072
80.0	0.17299
90.0	0.0
100.0	0.17299
110.0	0.34072
120.0	0.49810
130.0	0.64034
140.0	0.76313
150.0	0.86273
160.0	0.93612
170.0	0.98106
180.0	0.99619
190.0	0.98106
200.0	0.93612
210.0	0.86273
220.0	0.76313
230.0	0.64034
240.0	0.49810
250.0	0.34072
260.0	0.17299
270.0	0.0
280.0	0.17299
290.0	0.34072
300.0	0.49810
310.0	0.64034

ORIGINAL PAGE IS OF POOR QUALITY

STK. NO. D-1-083

SD-100-100 (REV. 9/66)

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE ______ PROGRAM NO. ______ PROGRAMMED BY ______ 3.

```
                320.0          0.76313
                330.0          0.86273
                340.0          0.93612
                350.0          0.98106
                360.0          0.99619
   2      EARTHSHINE FE, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.
                  0.0          0.01136
                360.0          0.01136
   3      ALBEDO FA, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.
                  0.0          0.00835
                 10.0          0.00822
                 20.0          0.00786
                 30.0          0.00727
                 40.0          0.00653
                 50.0          0.00567
                 60.0          0.00475
                 70.0          0.00384
                 80.0          0.00297
                 90.0          0.00219
                100.0          0.00152
                110.0          0.00098
                120.0          0.00058
                130.0          0.00030
                140.0          0.00013
                150.0          0.00004
                160.0          0.0
```

STK. NO. D-1-089

30-130-100 (REV. 3/63)

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE ______ PROGRAM NO. ______ PROGRAMMED BY ______ 4.

200.0	0.0
210.0	0.00004
220.0	0.00013
230.0	0.00030
240.0	0.00058
250.0	0.00098
260.0	0.00152
270.0	0.00219
280.0	0.00297
290.0	0.00384
300.0	0.00475
310.0	0.00567
320.0	0.00653
330.0	0.00727
340.0	0.00785
350.0	0.00822
360.0	0.00835

4 SOLAR FS, B=5, CYL. RADIATOR END ON TOWARD EARTH.

0.0	0.02774
10.0	0.06167
20.0	0.11188
30.0	0.16099
40.0	0.20565
50.0	0.24444
60.0	0.27604
70.0	0.29932

STK. NO. D-1-009

SD-190-190 (REV. 6/60)

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE ______ PROGRAM NO. ______ PROGRAMMED BY ______

80.0	0.31358
90.0	0.31838
100.0	0.31358
110.0	0.29932
120.0	0.27604
130.0	0.24444
140.0	0.20565
150.0	0.16099
160.0	0.11188
170.0	0.06167
180.0	0.02774
190.0	0.06167
200.0	0.11188
210.0	0.16099
220.0	0.20565
230.0	0.24444
240.0	0.27604
250.0	0.29932
260.0	0.31358
270.0	0.31838
280.0	0.31358
290.0	0.29932
300.0	0.27604
310.0	0.24444
320.0	0.20565
330.0	0.16099

STK. NO. D-1.083

SD-192-190 (REV 8/65)

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE ______ PROGRAM NO. ______ PROGRAMMED BY ______ 6.

	340.0	0.11188
	350.0	0.06167
	360.0	0.02274
5	EARTHSHINE FE, B=5, CYL. RADIATOR END ON TOWARD EARTH.	
	0.0	0.00231
	360.0	0.00231
6	ALBEDO FA, B=5, CYL. RADIATOR END ON TOWARD EARTH.	
	0.0	0.00155
	10.0	0.00153
	20.0	0.00146
	30.0	0.00135
	40.0	0.00123
	50.0	0.00108
	60.0	0.00093
	70.0	0.00079
	80.0	0.00064
	90.0	0.00050
	100.0	0.00037
	110.0	0.00025
	120.0	0.00016
	130.0	0.00009
	140.0	0.00004
	150.0	0.00001
	160.0	0.0
	200.0	0.0
	210.0	0.00001

STK. NO. D-1-083

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES
80 COLUMN INPUT

DATE ______ PROGRAM NO. ______ PROGRAMMED BY ______ 7

```
               220.0           0.00004
               230.0           0.00009
               240.0           0.00016
               250.0           0.00025
               260.0           0.00037
               270.0           0.00050
               280.0           0.00064
               290.0           0.00079
               300.0           0.00093
               310.0           0.00108
               320.0           0.00123
               330.0           0.00135
               340.0           0.00146
               350.0           0.00153
               360.0           0.00155

NEXT CARD:
P                94.6       40.0     3 FORMAT(1A4,6X,2F10.4)
TEST             ATI        ATM

NEXT CARD:
C                94.6       40.0     3 FORMAT(1A4,6X,2F10.4)
TEST             CTI        CTM

NEXT CARD:
A                 0.9        0.25    3 FORMAT(1A4,6X,2F10.4)
TEST            PSPACE       PCP
```

STR. NO. D-1-003

AEROJET ELECTROSYSTEMS COMPANY

COMPUTING SCIENCES

80 COLUMN INPUT

DATE ____ PROGRAM NO. ____ PROGRAMMED BY ____ 8

```
NEXT CARDS
C           0.95      0.25   3FORMAT(1A4,6X,2F10.4)
TEST        CSPACE    CCP

NEXT CARD:
B           0.07      0.76      0.0025    1.0     3FORMAT(1A4,6X,4F10.4)
TEST        BALPHA    EMTP      PDEG      PFRAC

NEXT CARD:
C           0.15      0.88      0.003     1.0     3FORMAT(1A4,6X,4F10.4)
TEST        CALPHA    EMTC      CDEG      CFRAC

B           0.15      0.88      0.0035    1.5  }
C           0.07      0.76      0.005     1.5  }
B           0.07      0.76      0.004     0.3  }  ADDITIONAL SURFACE
C           0.15      0.88      0.005     0.55 }  PROPERTY CARDS
B           0.15      0.88      0.0035    0.1  }
C           0.07      0.76      0.015     1.0  }
```

STK. NO. D-1-003

GEOSYNCHRONOUS SPACE STATION RADIATOR PROGRAM.

ALTITUDE (N.MI.) = 19370.0

ORBIT INCLINATION BETA ANGLE (DEGREES) = 5.00

DISSIPATION (KW.), LOWEST = 20 HIGHEST = 40 INCREMENT = 20

BREAK POINT FROM PLATE TO CYLINDRICAL RADIATORS (KW.) = 20.00

MONTHS DEGRADATION FOR FLAT PLATE RADIATOR = 60 INCREMENT = 10
MONTHS DEGRADATION FOR CYLINDRICAL RADIATOR = 60 INCREMENT = 10

ORBIT PRINT INTERVAL FOR FLAT PLATE RADIATOR (DEGREES) = 10 ,INTERVAL FOR CYLINDRICAL RADIATOR = 10

AREA FRACTION FOR FLAT PLATE RADIATOR = 1.000 , FOR CYLINDRICAL RADIATOR = 1.000

PLATE, SHAPE FACTOR TO SPACE = 0.900000 FLUID CP = 0.2500 BTU/LBM-R.
CYL. , SHAPE FACTOR TO SPACE = 0.950000 FLUID CP = 0.2500 BTU/LBM-R.

RADIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE = 0.07000 EMITTANCE = 0.76000 MONTHLY CHANGE IN ABSORPTANCE = 0.00250
CYL. , ABSORPTANCE = 0.15000 EMITTANCE = 0.88000 MONTHLY CHANGE IN ABSORPTANCE = 0.00300

EXTERNAL HEAT INPUT TABLES.

1 SOLAR FS, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.

0.0	0.996190
10.00	0.981060
20.00	0.936120
30.00	0.862730
40.00	0.763130
50.00	0.640340
60.00	0.498100
70.00	0.340720
80.00	0.172990
90.00	0.0
100.00	0.172990
110.00	0.340720
120.00	0.498100
130.00	0.640340
140.00	0.763130
150.00	0.862730
160.00	0.936120
170.00	0.981060
180.00	0.996190
190.00	0.981060
200.00	0.936120
210.00	0.862730
220.00	0.763130
230.00	0.640340
240.00	0.498100
250.00	0.340720
260.00	0.172990
270.00	0.0
280.00	0.172990
290.00	0.340720
300.00	0.498100

```
         310.00        0.640340
         320.00        0.763130
         330.00        0.862730
         340.00        0.936120
         350.00        0.981060
         360.00        0.996190
  2    EARTHSHINE FE, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.
           0.0         0.011360
         360.00        0.011360
  3    ALBEDO FA, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.
           0.0         0.008350
          10.00        0.008220
          20.00        0.007850
          30.00        0.007270
          40.00        0.006530
          50.00        0.005670
          60.00        0.004750
          70.00        0.003840
          80.00        0.002970
          90.00        0.002190
         100.00        0.001520
         110.00        0.000980
         120.00        0.000580
         130.00        0.000300
         140.00        0.000130
         150.00        0.000040
         160.00        0.0
         200.00        0.0
         210.00        0.000040
         220.00        0.000130
         230.00        0.000300
         240.00        0.000580
         250.00        0.000980
         260.00        0.001520
         270.00        0.002190
         280.00        0.002970
         290.00        0.003840
         300.00        0.004750
         310.00        0.005670
         320.00        0.006530
         330.00        0.007270
         340.00        0.007850
         350.00        0.008220
         360.00        0.008350
  4    SOLAR FS, B=5, CYL. RADIATOR END ON TOWARD EARTH.
           0.0         0.027740
          10.00        0.061670
          20.00        0.111880
          30.00        0.160990
          40.00        0.205650
          50.00        0.244440
          60.00        0.276040
          70.00        0.299320
          80.00        0.313580
          90.00        0.318380
         100.00        0.313580
         110.00        0.299320
         120.00        0.276040
         130.00        0.244440
         140.00        0.205650
         150.00        0.160990
```

	160.00	0.111880
	170.00	0.061670
	180.00	0.027740
	190.00	0.061670
	200.00	0.111880
	210.00	0.160990
	220.00	0.205650
	230.00	0.244440
	240.00	0.276040
	250.00	0.299320
	260.00	0.313580
	270.00	0.318380
	280.00	0.313580
	290.00	0.299320
	300.00	0.276040
	310.00	0.244440
	320.00	0.205650
	330.00	0.160990
	340.00	0.111880
	350.00	0.061670
	360.00	0.027740
5	EARTHSHINE FE, B=5, CYL. RADIATOR END ON TOWARD EARTH.	
	0.0	0.002310
	360.00	0.002310
6	ALBEDO FA, B=5, CYL. RADIATOR END ON TOWARD EARTH.	
	0.0	0.001550
	10.00	0.001530
	20.00	0.001460
	30.00	0.001350
	40.00	0.001230
	50.00	0.001080
	60.00	0.000930
	70.00	0.000790
	80.00	0.000640
	90.00	0.000500
	100.00	0.000370
	110.00	0.000250
	120.00	0.000160
	130.00	0.000090
	140.00	0.000040
	150.00	0.000010
	160.00	0.0
	200.00	0.0
	210.00	0.000010
	220.00	0.000040
	230.00	0.000090
	240.00	0.000160
	250.00	0.000250
	260.00	0.000370
	270.00	0.000500
	280.00	0.000640
	290.00	0.000790
	300.00	0.000930
	310.00	0.001080
	320.00	0.001230
	330.00	0.001350
	340.00	0.001460
	350.00	0.001530
	360.00	0.001550

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 864.67 , MINIMUM AREA FRACTION ACCEPTABLE = 0.533

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.22000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00250 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 0 , SOLAR ABSORPTANCE VALUE = 0.07000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	5.83	-52.16	1859.98	26674.97	990.78	178.87	68239.94	0.29	15
10.00	94.60	5.33	-52.97	1849.88	26269.82	990.78	176.09	68239.94	0.29	15
20.00	94.60	3.85	-55.37	1820.23	25066.47	990.78	168.16	68239.94	0.29	15
30.00	94.60	1.41	-59.37	1772.89	23101.30	990.78	155.73	68239.94	0.28	15
40.00	94.60	-1.97	-64.94	1710.99	20434.31	990.78	139.88	68239.94	0.28	15
50.00	94.60	-6.24	-72.02	1638.40	17146.37	990.78	121.46	68239.94	0.27	15
60.00	94.60	-11.35	-80.60	1558.00	13337.62	990.78	101.75	68239.94	0.27	16
70.00	94.60	-17.20	-90.61	1473.83	9123.46	990.78	82.26	68239.94	0.26	16
80.00	94.60	-23.70	-101.94	1388.85	4632.15	990.78	63.62	68239.94	0.25	16
90.00	94.60	-30.72	-114.50	1305.46	0.0	990.78	46.91	68239.94	0.25	16
100.00	94.60	-23.75	-102.02	1388.28	4632.15	990.78	32.56	68239.94	0.25	16
110.00	94.60	-17.29	-90.75	1472.75	9123.46	990.78	20.99	68239.94	0.26	16
120.00	94.60	-11.47	-80.81	1556.13	13337.62	990.78	12.42	68239.94	0.27	16
130.00	94.60	-6.39	-72.27	1635.93	17146.37	990.78	6.43	68239.94	0.27	15
140.00	94.60	-2.15	-65.21	1708.12	20434.31	990.78	2.78	68239.94	0.28	15
150.00	94.60	1.21	-59.69	1769.17	23101.30	990.78	0.86	68239.94	0.28	15
160.00	94.60	3.65	-55.72	1815.96	25066.47	990.78	0.0	68239.94	0.29	15
170.00	94.60	5.12	-53.32	1845.48	26269.82	990.78	0.0	68239.94	0.29	15
172.93	94.60	5.26	-53.09	1848.26	26388.43	990.78	0.0	68239.94	0.29	15
180.00	94.60	-30.80	-114.63	1304.59	0.0	990.78	0.0	68239.94	0.25	16
187.07	94.60	5.26	-53.09	1848.26	26388.43	990.78	0.0	68239.94	0.29	15
190.00	94.60	5.12	-53.32	1845.48	26269.82	990.78	0.0	68239.94	0.29	15
200.00	94.60	3.65	-55.72	1815.96	25066.47	990.78	0.0	68239.94	0.29	15
210.00	94.60	1.21	-59.69	1769.17	23101.30	990.78	0.86	68239.94	0.28	15
220.00	94.60	-2.15	-65.21	1708.12	20434.31	990.78	2.78	68239.94	0.28	15
230.00	94.60	-6.39	-72.27	1635.93	17146.37	990.78	6.43	68239.94	0.27	15
240.00	94.60	-11.47	-80.81	1556.13	13337.62	990.78	12.42	68239.94	0.27	16
250.00	94.60	-17.29	-90.75	1472.75	9123.46	990.78	20.99	68239.94	0.26	16
260.00	94.60	-23.75	-102.02	1388.28	4632.15	990.78	32.56	68239.94	0.25	16
270.00	94.60	-30.72	-114.50	1305.46	0.0	990.78	46.91	68239.94	0.25	16
280.00	94.60	-23.70	-101.94	1388.85	4632.15	990.78	63.62	68239.94	0.25	16
290.00	94.60	-17.20	-90.61	1473.83	9123.46	990.78	82.26	68239.94	0.26	16
300.00	94.60	-11.35	-80.60	1558.00	13337.62	990.78	101.75	68239.94	0.27	16
310.00	94.60	-6.24	-72.02	1638.40	17146.37	990.78	121.46	68239.94	0.27	15
320.00	94.60	-1.97	-64.94	1710.99	20434.31	990.78	139.88	68239.94	0.28	15
330.00	94.60	1.41	-59.37	1772.89	23101.30	990.78	155.73	68239.94	0.28	15
340.00	94.60	3.85	-55.37	1820.23	25066.47	990.78	168.16	68239.94	0.29	15
350.00	94.60	5.33	-52.97	1849.88	26269.82	990.78	176.09	68239.94	0.29	15
360.00	94.60	5.83	-52.16	1859.98	26674.97	990.78	178.87	68239.94	0.29	15

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 864.67 , MINIMUM AREA FRACTION ACCEPTABLE = 0.533

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.22000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00250 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 10 , SOLAR ABSORPTANCE VALUE = 0.09500

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	17.03	-34.17	2119.82	36201.73	990.78	242.75	68239.94	0.31	15
10.00	94.60	16.41	-35.16	2103.75	35651.90	990.78	238.97	68239.94	0.31	15
20.00	94.60	14.54	-38.15	2056.28	34018.78	990.78	228.22	68239.94	0.30	15
30.00	94.60	11.43	-43.13	1981.94	31351.76	990.78	211.35	68239.94	0.30	15
40.00	94.60	7.12	-50.08	1886.75	27732.29	990.78	189.84	68239.94	0.29	15
50.00	94.60	1.63	-59.01	1777.01	23270.08	990.78	164.84	68239.94	0.28	15
60.00	94.60	-4.98	-69.91	1659.40	18101.05	990.78	138.09	68239.94	0.28	15
70.00	94.60	-12.63	-82.78	1538.87	12381.83	990.78	111.64	68239.94	0.27	16
80.00	94.60	-21.25	-97.63	1420.01	6286.49	990.78	86.34	68239.94	0.26	16
90.00	94.60	-30.70	-114.45	1305.81	0.0	990.78	63.67	68239.94	0.25	16
100.00	94.60	-21.31	-97.75	1419.12	6286.49	990.78	44.19	68239.94	0.26	16
110.00	94.60	-12.75	-82.98	1537.10	12381.83	990.78	28.49	68239.94	0.27	16
120.00	94.60	-5.13	-70.18	1656.56	18101.05	990.78	16.86	68239.94	0.28	15
130.00	94.60	1.44	-59.32	1773.53	23270.08	990.78	8.72	68239.94	0.28	15
140.00	94.60	6.89	-50.44	1882.14	27732.29	990.78	3.78	68239.94	0.29	15
150.00	94.60	11.18	-43.53	1976.23	31351.76	990.78	1.16	68239.94	0.30	15
160.00	94.60	14.27	-38.57	2049.83	34018.78	990.78	0.0	68239.94	0.30	15
170.00	94.60	16.14	-35.59	2096.73	35651.90	990.78	0.0	68239.94	0.30	15
172.93	94.60	16.32	-35.30	2101.36	35812.86	990.78	0.0	68239.94	0.31	15
180.00	94.60	-30.80	-114.63	1304.59	0.0	990.78	0.0	68239.94	0.25	16
187.07	94.60	16.32	-35.30	2101.36	35812.86	990.78	0.0	68239.94	0.31	15
190.00	94.60	16.14	-35.59	2096.73	35651.90	990.78	0.0	68239.94	0.30	15
200.00	94.60	14.27	-38.57	2049.83	34018.78	990.78	0.0	68239.94	0.30	15
210.00	94.60	11.18	-43.53	1976.23	31351.76	990.78	1.16	68239.94	0.30	15
220.00	94.60	6.89	-50.44	1882.14	27732.29	990.78	3.78	68239.94	0.29	15
230.00	94.60	1.44	-59.32	1773.53	23270.08	990.78	8.72	68239.94	0.28	15
240.00	94.60	-5.13	-70.18	1656.56	18101.05	990.78	16.86	68239.94	0.28	15
250.00	94.60	-12.75	-82.98	1537.10	12381.83	990.78	28.49	68239.94	0.27	16
260.00	94.60	-21.31	-97.75	1419.12	6286.49	990.78	44.19	68239.94	0.26	16
270.00	94.60	-30.70	-114.45	1305.81	0.0	990.78	63.67	68239.94	0.25	16
280.00	94.60	-21.25	-97.63	1420.01	6286.49	990.78	86.34	68239.94	0.26	16
290.00	94.60	-12.63	-82.78	1538.87	12381.83	990.78	111.64	68239.94	0.27	16
300.00	94.60	-4.98	-69.91	1659.40	18101.05	990.78	138.09	68239.94	0.28	15
310.00	94.60	1.63	-59.01	1777.01	23270.08	990.78	164.84	68239.94	0.28	15
320.00	94.60	7.12	-50.08	1886.75	27732.29	990.78	189.84	68239.94	0.29	15
330.00	94.60	11.43	-43.13	1981.94	31351.76	990.78	211.35	68239.94	0.30	15
340.00	94.60	14.54	-38.15	2056.28	34018.78	990.78	228.22	68239.94	0.30	15
350.00	94.60	16.41	-35.16	2103.75	35651.90	990.78	238.97	68239.94	0.31	15
360.00	94.60	17.03	-34.17	2119.82	36201.73	990.78	242.75	68239.94	0.31	15

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 864.67 , MINIMUM AREA FRACTION ACCEPTABLE = 0.533

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.22000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00250 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 20 , SOLAR ABSORPTANCE VALUE = 0.12000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	27.50	-17.58	2433.32	45728.50	990.78	306.63	68239.94	0.32	15
10.00	94.60	26.76	-18.75	2408.14	45033.98	990.78	301.86	68239.94	0.32	15
20.00	94.60	24.54	-22.26	2335.86	42971.08	990.78	288.27	68239.94	0.32	15
30.00	94.60	20.85	-28.10	2224.65	39602.22	990.78	266.97	68239.94	0.31	15
40.00	94.60	15.70	-36.29	2085.58	35030.25	990.78	239.80	68239.94	0.30	15
50.00	94.60	9.12	-46.83	1930.09	29393.77	990.78	208.22	68239.94	0.29	15
60.00	94.60	1.14	-59.81	1767.85	22864.47	990.78	174.43	68239.94	0.28	15
70.00	94.60	-8.20	-75.30	1606.67	15640.20	990.78	141.02	68239.94	0.27	15
80.00	94.60	-18.84	-93.43	1451.73	7940.82	990.78	109.07	68239.94	0.26	16
90.00	94.60	-30.67	-114.41	1306.02	0.0	990.78	80.42	68239.94	0.25	16
100.00	94.60	-18.91	-93.56	1450.71	7940.82	990.78	55.82	68239.94	0.26	16
110.00	94.60	-8.34	-75.54	1604.37	15640.20	990.78	35.99	68239.94	0.27	15
120.00	94.60	0.95	-60.13	1764.16	22864.47	990.78	21.30	68239.94	0.28	15
130.00	94.60	8.89	-47.21	1924.95	29393.77	990.78	11.02	68239.94	0.29	15
140.00	94.60	15.44	-36.71	2078.97	35030.25	990.78	4.77	68239.94	0.30	15
150.00	94.60	20.56	-28.57	2216.25	39602.22	990.78	1.47	68239.94	0.31	15
160.00	94.60	24.23	-22.75	2326.10	42971.08	990.78	0.0	68239.94	0.32	15
170.00	94.60	26.44	-19.26	2397.59	45033.98	990.78	0.0	68239.94	0.32	15
172.93	94.60	26.65	-18.91	2404.79	45237.29	990.78	0.0	68239.94	0.32	15
180.00	94.60	-30.89	-114.63	1304.59	0.0	990.78	0.0	68239.94	0.25	16
187.07	94.60	26.65	-18.91	2404.79	45237.29	990.78	0.0	68239.94	0.32	15
190.00	94.60	26.44	-19.26	2397.59	45033.98	990.78	0.0	68239.94	0.32	15
200.00	94.60	24.23	-22.75	2326.10	42971.08	990.78	0.0	68239.94	0.32	15
210.00	94.60	20.56	-28.57	2216.25	39602.22	990.78	1.47	68239.94	0.31	15
220.00	94.60	15.44	-36.71	2078.97	35030.25	990.78	4.77	68239.94	0.30	15
230.00	94.60	8.89	-47.21	1924.95	29393.77	990.78	11.02	68239.94	0.29	15
240.00	94.60	0.95	-60.13	1764.16	22864.47	990.78	21.30	68239.94	0.28	15
250.00	94.60	-8.34	-75.54	1604.37	15640.20	990.78	35.99	68239.94	0.27	15
260.00	94.60	-18.91	-93.56	1450.71	7940.82	990.78	55.82	68239.94	0.26	16
270.00	94.60	-30.67	-114.41	1306.02	0.0	990.78	80.42	68239.94	0.25	16
280.00	94.60	-18.84	-93.43	1451.73	7940.82	990.78	109.07	68239.94	0.26	16
290.00	94.60	-8.20	-75.30	1606.67	15640.20	990.78	141.02	68239.94	0.27	15
300.00	94.60	1.14	-59.81	1767.85	22864.47	990.78	174.43	68239.94	0.28	15
310.00	94.60	9.12	-46.83	1930.09	29393.77	990.78	208.22	68239.94	0.29	15
320.00	94.60	15.70	-36.29	2085.58	35030.25	990.78	239.80	68239.94	0.30	15
330.00	94.60	20.85	-28.10	2224.65	39602.22	990.78	266.97	68239.94	0.31	15
340.00	94.60	24.54	-22.26	2335.86	42971.08	990.78	288.27	68239.94	0.32	15
350.00	94.60	26.76	-18.75	2408.14	45033.98	990.78	301.86	68239.94	0.32	15
360.00	94.60	27.50	-17.58	2433.32	45728.50	990.78	306.63	68239.94	0.32	15

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 864.67 , MINIMUM AREA FRACTION ACCEPTABLE = 0.533

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.22000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00250 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 30 , SOLAR ABSORPTANCE VALUE = 0.14500

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	37.33	-2.11	2822.50	55255.27	990.78	370.52	68239.94	0.34	14
10.00	94.60	36.49	-3.43	2784.82	54416.07	990.78	364.75	68239.94	0.34	14
20.00	94.60	33.96	-7.41	2675.95	51923.40	990.78	348.33	68239.94	0.33	15
30.00	94.60	29.74	-14.05	2512.42	47852.70	990.78	322.59	68239.94	0.33	15
40.00	94.60	23.85	-23.35	2314.28	42328.23	990.78	289.76	68239.94	0.32	15
50.00	94.60	16.27	-35.38	2100.18	35517.48	990.78	251.60	68239.94	0.31	15
60.00	94.60	7.02	-50.24	1884.72	27627.91	990.78	210.77	68239.94	0.29	15
70.00	94.60	-3.90	-68.12	1677.58	18898.57	990.78	170.39	68239.94	0.28	15
80.00	94.60	-16.47	-89.34	1484.01	9595.16	990.78	131.79	68239.94	0.26	16
90.00	94.60	-30.65	-114.36	1306.30	0.0	990.78	97.18	68239.94	0.25	16
100.00	94.60	-16.56	-89.50	1482.75	9595.16	990.78	67.45	68239.94	0.26	16
110.00	94.60	-4.07	-68.40	1674.64	18898.57	990.78	43.49	68239.94	0.28	15
120.00	94.60	6.79	-50.61	1879.84	27627.91	990.78	25.74	68239.94	0.29	15
130.00	94.60	16.00	-35.81	2093.19	35517.48	990.78	13.31	68239.94	0.30	15
140.00	94.60	23.54	-23.84	2304.68	42328.23	990.78	5.77	68239.94	0.32	15
150.00	94.60	29.41	-14.57	2500.43	47852.70	990.78	1.77	68239.94	0.33	15
160.00	94.60	33.60	-7.97	2661.30	51923.40	990.78	0.0	68239.94	0.33	15
170.00	94.60	36.12	-4.02	2768.12	54416.07	990.78	0.0	68239.94	0.34	14
172.93	94.60	36.37	-3.63	2779.04	54661.73	990.78	0.0	68239.94	0.34	14
180.00	94.60	-30.80	-114.63	1304.59	0.0	990.78	0.0	68239.94	0.25	16
187.07	94.60	36.37	-3.63	2779.04	54661.73	990.78	0.0	68239.94	0.34	14
190.00	94.60	36.12	-4.02	2768.12	54416.07	990.78	0.0	68239.94	0.34	14
200.00	94.60	33.60	-7.97	2661.30	51923.40	990.78	0.0	68239.94	0.33	15
210.00	94.60	29.41	-14.57	2500.43	47852.70	990.78	1.77	68239.94	0.33	15
220.00	94.60	23.54	-23.84	2304.68	42328.23	990.78	5.77	68239.94	0.32	15
230.00	94.60	16.00	-35.81	2093.19	35517.48	990.78	13.31	68239.94	0.30	15
240.00	94.60	6.79	-50.61	1879.84	27627.91	990.78	25.74	68239.94	0.29	15
250.00	94.60	-4.07	-68.40	1674.64	18898.57	990.78	43.49	68239.94	0.28	15
260.00	94.60	-16.56	-89.50	1482.75	9595.16	990.78	67.45	68239.94	0.26	16
270.00	94.60	-30.65	-114.36	1306.30	0.0	990.78	97.18	68239.94	0.25	16
280.00	94.60	-16.47	-89.34	1484.01	9595.16	990.78	131.79	68239.94	0.26	16
290.00	94.60	-3.90	-68.12	1677.58	18898.57	990.78	170.39	68239.94	0.28	15
300.00	94.60	7.02	-50.24	1884.72	27627.91	990.78	210.77	68239.94	0.29	15
310.00	94.60	16.27	-35.38	2100.18	35517.48	990.78	251.60	68239.94	0.31	15
320.00	94.60	23.85	-23.35	2314.28	42328.23	990.78	289.76	68239.94	0.32	15
330.00	94.60	29.74	-14.05	2512.42	47852.70	990.78	322.59	68239.94	0.33	15
340.00	94.60	33.96	-7.41	2675.95	51923.40	990.78	348.33	68239.94	0.33	15
350.00	94.60	36.49	-3.43	2784.82	54416.07	990.78	364.75	68239.94	0.34	14
360.00	94.60	37.33	-2.11	2822.50	55255.27	990.78	370.52	68239.94	0.34	14

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 864.67 , MINIMUM AREA FRACTION ACCEPTABLE = 0.533

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.22000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00250 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 40 , SOLAR ABSORPTANCE VALUE = 0.17000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	46.61	12.52	3325.98	64782.04	990.78	434.40	68239.94	0.36	14
10.00	94.60	45.68	11.03	3266.76	63798.14	990.78	427.64	68239.94	0.36	14
20.00	94.60	42.87	6.61	3102.35	60875.70	990.78	408.39	68239.94	0.35	14
30.00	94.60	38.18	-0.77	2862.44	56103.16	990.78	378.21	68239.94	0.34	14
40.00	94.60	31.60	-11.12	2581.95	49626.19	990.78	339.72	68239.94	0.33	15
50.00	94.60	23.11	-24.52	2291.69	41641.18	990.78	294.98	68239.94	0.32	15
60.00	94.60	12.68	-41.11	2011.40	32391.34	990.78	247.11	68239.94	0.30	15
70.00	94.60	0.28	-61.22	1751.77	22156.95	990.78	199.77	68239.94	0.28	15
80.00	94.60	-14.13	-85.34	1516.97	11249.50	990.78	154.51	68239.94	0.26	16
90.00	94.60	-30.62	-114.32	1306.58	0.0	990.78	113.93	68239.94	0.25	16
100.00	94.60	-14.24	-85.52	1515.49	11249.50	990.78	79.08	68239.94	0.26	16
110.00	94.60	0.10	-61.53	1748.43	22156.95	990.78	50.98	68239.94	0.28	15
120.00	94.60	12.43	-41.51	2005.53	32391.34	990.78	30.17	68239.94	0.30	15
130.00	94.60	22.80	-24.99	2282.56	41641.18	990.78	15.61	68239.94	0.32	15
140.00	94.60	31.26	-11.67	2568.74	49626.19	990.78	6.76	68239.94	0.33	15
150.00	94.60	37.81	-1.35	2845.14	56103.16	990.78	2.08	68239.94	0.34	14
160.00	94.60	42.47	5.98	3080.39	60875.70	990.78	0.0	68239.94	0.35	14
170.00	94.60	45.27	10.39	3241.44	63798.14	990.78	0.0	68239.94	0.36	14
172.93	94.60	45.54	10.83	3258.71	64086.14	990.78	0.0	68239.94	0.36	14
180.00	94.60	-30.80	-114.63	1304.59	0.0	990.78	0.0	68239.94	0.25	16
187.07	94.60	45.54	10.83	3258.71	64086.14	990.78	0.0	68239.94	0.36	14
190.00	94.60	45.27	10.39	3241.44	63798.14	990.78	0.0	68239.94	0.36	14
200.00	94.60	42.47	5.98	3080.39	60875.70	990.78	0.0	68239.94	0.35	14
210.00	94.60	37.81	-1.35	2845.14	56103.16	990.78	2.08	68239.94	0.34	14
220.00	94.60	31.26	-11.67	2568.74	49626.19	990.78	6.76	68239.94	0.33	15
230.00	94.60	22.80	-24.99	2282.56	41641.18	990.78	15.61	68239.94	0.32	15
240.00	94.60	12.43	-41.51	2005.53	32391.34	990.78	30.17	68239.94	0.30	15
250.00	94.60	0.10	-61.53	1748.43	22156.95	990.78	50.98	68239.94	0.28	15
260.00	94.60	-14.24	-85.52	1515.49	11249.50	990.78	79.08	68239.94	0.26	16
270.00	94.60	-30.62	-114.32	1306.58	0.0	990.78	113.93	68239.94	0.25	16
280.00	94.60	-14.13	-85.34	1516.97	11249.50	990.78	154.51	68239.94	0.26	16
290.00	94.60	0.28	-61.22	1751.77	22156.95	990.78	199.77	68239.94	0.28	15
300.00	94.60	12.68	-41.11	2011.40	32391.34	990.78	247.11	68239.94	0.30	15
310.00	94.60	23.11	-24.52	2291.69	41641.18	990.78	294.98	68239.94	0.32	15
320.00	94.60	31.60	-11.12	2581.95	49626.19	990.78	339.72	68239.94	0.33	15
330.00	94.60	38.18	-0.77	2862.44	56103.16	990.78	378.21	68239.94	0.34	14
340.00	94.60	42.87	6.61	3102.35	60875.70	990.78	408.39	68239.94	0.35	14
350.00	94.60	45.68	11.03	3266.76	63798.14	990.78	427.64	68239.94	0.36	14
360.00	94.60	46.61	12.52	3325.98	64782.04	990.78	434.40	68239.94	0.36	14

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 864.67 , MINIMUM AREA FRACTION ACCEPTABLE = 0.533

COOLANT PASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.22000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00250 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 50 , SOLAR ABSORPTANCE VALUE = 0.19500

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	55.41	26.48	4007.55	74308.75	990.78	498.28	68239.94	0.38	14
10.00	94.60	54.39	24.86	3914.19	73180.19	990.78	490.52	68239.94	0.37	14
20.00	94.60	51.33	19.98	3658.04	69828.00	990.78	468.44	68239.94	0.37	14
30.00	94.60	46.21	11.88	3300.23	64353.62	990.78	433.83	68239.94	0.36	14
40.00	94.60	39.00	0.51	2901.29	56924.16	990.78	389.67	68239.94	0.34	14
50.00	94.60	29.67	-14.17	2509.74	47764.88	990.78	338.35	68239.94	0.33	15
60.00	94.60	18.15	-32.39	2149.51	37154.77	990.78	283.45	68239.94	0.31	15
70.00	94.60	4.36	-54.57	1829.98	25415.32	990.78	229.15	68239.94	0.29	15
80.00	94.60	-11.83	-81.42	1550.76	12903.84	990.78	177.23	68239.94	0.27	16
90.00	94.60	-30.59	-114.26	1306.95	0.0	990.78	130.69	68239.94	0.25	16
100.00	94.60	-11.95	-81.63	1548.94	12903.84	990.78	90.71	68239.94	0.27	16
110.00	94.60	4.15	-54.90	1825.95	25415.32	990.78	58.48	68239.94	0.29	15
120.00	94.60	17.87	-32.83	2142.23	37154.77	990.78	34.61	68239.94	0.31	15
130.00	94.60	29.33	-14.69	2497.77	47764.88	990.78	17.90	68239.94	0.33	15
140.00	94.60	38.63	-0.07	2883.64	56924.16	990.78	7.76	68239.94	0.34	14
150.00	94.60	45.80	11.23	3274.56	64353.62	990.78	2.39	68239.94	0.36	14
160.00	94.60	50.90	19.30	3625.61	69828.00	990.78	0.0	68239.94	0.37	14
170.00	94.60	53.95	24.16	3875.41	73180.19	990.78	0.0	68239.94	0.37	14
172.93	94.60	54.25	24.63	3901.71	73510.56	990.78	0.0	68239.94	0.37	14
180.00	94.60	-30.80	-114.63	1304.59	0.0	990.78	0.0	68239.94	0.25	16
187.07	94.60	54.25	24.63	3901.71	73510.56	990.78	0.0	68239.94	0.37	14
190.00	94.60	53.95	24.16	3875.41	73180.19	990.78	0.0	68239.94	0.37	14
200.00	94.60	50.90	19.30	3625.61	69828.00	990.78	0.0	68239.94	0.37	14
210.00	94.60	45.80	11.23	3274.56	64353.62	990.78	2.39	68239.94	0.36	14
220.00	94.60	38.63	-0.07	2883.64	56924.16	990.78	7.76	68239.94	0.34	14
230.00	94.60	29.33	-14.69	2497.77	47764.88	990.78	17.90	68239.94	0.33	15
240.00	94.60	17.87	-32.83	2142.23	37154.77	990.78	34.61	68239.94	0.31	15
250.00	94.60	4.15	-54.90	1825.95	25415.32	990.78	58.48	68239.94	0.29	15
260.00	94.60	-11.95	-81.63	1548.94	12903.84	990.78	90.71	68239.94	0.27	16
270.00	94.60	-30.59	-114.26	1306.95	0.0	990.78	130.69	68239.94	0.25	16
280.00	94.60	-11.83	-81.42	1550.76	12903.84	990.78	177.23	68239.94	0.27	16
290.00	94.60	4.36	-54.57	1829.98	25415.32	990.78	229.15	68239.94	0.29	15
300.00	94.60	18.15	-32.39	2149.51	37154.77	990.78	283.45	68239.94	0.31	15
310.00	94.60	29.67	-14.17	2509.74	47764.88	990.78	338.35	68239.94	0.33	15
320.00	94.60	39.00	0.51	2901.29	56924.16	990.78	389.67	68239.94	0.34	14
330.00	94.60	46.21	11.88	3300.23	64353.62	990.78	433.83	68239.94	0.36	14
340.00	94.60	51.33	19.98	3658.04	69828.00	990.78	468.44	68239.94	0.37	14
350.00	94.60	54.39	24.86	3914.19	73180.19	990.78	490.52	68239.94	0.37	14
360.00	94.60	55.41	26.48	4007.55	74308.75	990.78	498.28	68239.94	0.38	14

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 864.67 , MINIMUM AREA FRACTION ACCEPTABLE = 0.533

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.22000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00250 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 60 , SOLAR ABSORPTANCE VALUE = 0.22000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	63.78	40.00	4999.23	83835.56	990.78	562.16	68239.31	0.40	1
10.00	94.60	62.68	38.22	4842.39	82562.25	990.78	553.41	68239.94	0.39	14
20.00	94.60	59.39	32.88	4423.05	78780.31	990.78	528.50	68239.94	0.39	14
30.00	94.60	53.87	24.03	3867.93	72604.06	990.78	489.45	68239.94	0.37	14
40.00	94.60	46.09	11.69	3292.52	64222.13	990.78	439.63	68239.94	0.36	14
50.00	94.60	35.98	-4.24	2761.64	53888.59	990.78	381.73	68239.94	0.34	15
60.00	94.60	23.44	-24.00	2301.76	41918.21	990.78	319.79	68239.94	0.32	15
70.00	94.60	8.32	-48.13	1912.49	28673.70	990.78	258.53	68239.94	0.29	15
80.00	94.60	-9.57	-77.60	1585.20	14558.18	990.78	199.96	68239.94	0.27	16
90.00	94.60	-30.57	-114.21	1307.27	0.0	990.78	147.44	68239.94	0.25	16
100.00	94.60	-9.70	-77.82	1583.18	14558.18	990.78	102.33	68239.94	0.27	16
110.00	94.60	8.09	-48.49	1907.73	28673.70	990.78	65.98	68239.94	0.29	15
120.00	94.60	23.13	-24.48	2292.26	41918.21	990.78	39.05	68239.94	0.32	15
130.00	94.60	35.61	-4.81	2745.90	53888.59	990.78	20.20	68239.94	0.34	14
140.00	94.60	45.68	11.04	3266.95	64222.13	990.78	8.75	68239.94	0.36	14
150.00	94.60	53.43	23.32	3829.80	72604.06	990.78	2.69	68239.94	0.37	14
160.00	94.60	58.92	32.13	4370.09	78780.31	990.78	0.0	68239.94	0.39	14
170.00	94.60	62.21	37.44	4775.88	82562.25	990.78	0.0	68239.94	0.39	14
172.93	94.60	62.53	37.97	4820.21	82935.00	990.78	0.0	68239.94	0.39	14
180.00	94.60	-30.80	-114.63	1304.59	0.0	990.78	0.0	68239.94	0.25	16
187.07	94.60	62.53	37.97	4820.21	82935.00	990.78	0.0	68239.94	0.39	14
190.00	94.60	62.21	37.44	4775.88	82562.25	990.78	0.0	68239.94	0.39	14
200.00	94.60	58.92	32.13	4370.09	78780.31	990.78	0.0	68239.94	0.39	14
210.00	94.60	53.43	23.32	3829.80	72604.06	990.78	2.69	68239.94	0.37	14
220.00	94.60	45.68	11.04	3266.95	64222.13	990.78	8.75	68239.94	0.36	14
230.00	94.60	35.61	-4.81	2745.90	53888.59	990.78	20.20	68239.94	0.34	14
240.00	94.60	23.13	-24.48	2292.26	41918.21	990.78	39.05	68239.94	0.32	15
250.00	94.60	8.09	-48.49	1907.73	28673.70	990.78	65.98	68239.94	0.29	15
260.00	94.60	-9.70	-77.82	1583.18	14558.18	990.78	102.33	68239.94	0.27	16
270.00	94.60	-30.57	-114.21	1307.27	0.0	990.78	147.44	68239.94	0.25	16
280.00	94.60	-9.57	-77.60	1585.20	14558.18	990.78	199.96	68239.94	0.27	16
290.00	94.60	8.32	-48.13	1912.49	28673.70	990.78	258.53	68239.94	0.29	15
300.00	94.60	23.44	-24.00	2301.76	41918.21	990.78	319.79	68239.94	0.32	15
310.00	94.60	35.98	-4.24	2761.64	53888.59	990.78	381.73	68239.94	0.34	15
320.00	94.60	46.09	11.69	3292.52	64222.13	990.78	439.63	68239.94	0.36	14
330.00	94.60	53.87	24.03	3867.93	72604.06	990.78	489.45	68239.94	0.37	14
340.00	94.60	59.39	32.88	4423.05	78780.31	990.78	528.50	68239.94	0.39	14
350.00	94.60	62.68	38.22	4842.39	82562.25	990.78	553.41	68239.94	0.39	14
360.00	94.60	63.78	40.00	4999.23	83835.56	990.78	562.16	68239.31	0.40	1

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 9.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 1085.98 , MINIMUM AREA FRACTION ACCEPTABLE = 0.706

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.33000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 0 , SOLAR ABSORPTANCE VALUE = 0.15000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	0.29	-69.19	1666.64	1999.10	46.63	14.22	68240.00	0.30	16
10.00	94.60	4.24	-62.27	1740.06	4444.28	46.63	14.04	68240.00	0.31	16
20.00	94.60	9.90	-52.46	1856.20	8062.69	46.63	13.40	68240.00	0.32	16
30.00	94.60	15.25	-43.30	1979.44	11601.84	46.63	12.39	68240.00	0.32	15
40.00	94.60	19.96	-35.30	2101.47	14820.29	46.63	11.29	68240.00	0.33	15
50.00	94.60	23.94	-28.57	2216.23	17615.70	46.63	9.91	68240.00	0.34	15
60.00	94.60	27.11	-23.24	2316.49	19892.97	46.63	8.53	68240.00	0.34	15
70.00	94.60	29.41	-19.38	2395.02	21570.66	46.63	7.25	68240.00	0.35	15
80.00	94.60	30.80	-17.06	2444.76	22598.31	46.63	5.87	68240.00	0.35	15
90.00	94.60	31.26	-16.28	2461.92	22944.24	46.63	4.59	68240.00	0.35	15
100.00	94.60	30.80	-17.06	2444.64	22598.31	46.63	3.39	68240.00	0.35	15
110.00	94.60	29.40	-19.39	2394.79	21570.66	46.63	2.29	68240.00	0.35	15
120.00	94.60	27.10	-23.26	2316.17	19892.97	46.63	1.47	68240.00	0.34	15
130.00	94.60	23.93	-28.59	2215.82	17615.70	46.63	0.83	68240.00	0.34	15
140.00	94.60	19.94	-35.33	2100.94	14820.29	46.63	0.37	68240.00	0.33	15
150.00	94.60	15.23	-43.33	1979.12	11601.84	46.63	0.09	68240.00	0.32	15
160.00	94.60	9.88	-52.50	1855.69	8062.69	46.63	0.0	68240.00	0.32	16
170.00	94.60	4.22	-62.31	1739.65	4444.28	46.63	0.0	68240.00	0.31	16
172.93	94.60	3.07	-64.32	1717.69	3728.52	46.63	0.0	68240.00	0.31	16
180.00	94.60	-3.04	-75.07	1609.00	0.0	46.63	0.0	68240.00	0.30	16
187.07	94.60	3.07	-64.32	1717.69	3728.52	46.63	0.0	68240.00	0.31	16
190.00	94.60	4.22	-62.31	1739.65	4444.28	46.63	0.0	68240.00	0.31	16
200.00	94.60	9.88	-52.50	1855.69	8062.69	46.63	0.0	68240.00	0.32	16
210.00	94.60	15.23	-43.33	1979.12	11601.84	46.63	0.09	68240.00	0.32	15
220.00	94.60	19.94	-35.33	2100.94	14820.29	46.63	0.37	68240.00	0.33	15
230.00	94.60	23.93	-28.59	2215.82	17615.70	46.63	0.83	68240.00	0.34	15
240.00	94.60	27.10	-23.26	2316.17	19892.97	46.63	1.47	68240.00	0.34	15
250.00	94.60	29.40	-19.39	2394.79	21570.66	46.63	2.29	68240.00	0.35	15
260.00	94.60	30.80	-17.06	2444.64	22598.31	46.63	3.39	68240.00	0.35	15
270.00	94.60	31.26	-16.28	2461.92	22944.24	46.63	4.59	68240.00	0.35	15
280.00	94.60	30.80	-17.06	2444.76	22598.31	46.63	5.87	68240.00	0.35	15
290.00	94.60	29.41	-19.38	2395.02	21570.66	46.63	7.25	68240.00	0.35	15
300.00	94.60	27.11	-23.24	2316.49	19892.97	46.63	8.53	68240.00	0.34	15
310.00	94.60	23.94	-28.57	2216.23	17615.70	46.63	9.91	68240.00	0.34	15
320.00	94.60	19.96	-35.30	2101.47	14820.29	46.63	11.29	68240.00	0.33	15
330.00	94.60	15.25	-43.30	1979.44	11601.84	46.63	12.39	68240.00	0.32	15
340.00	94.60	9.90	-52.46	1856.20	8062.69	46.63	13.40	68240.00	0.32	16
350.00	94.60	4.24	-62.27	1740.06	4444.28	46.63	14.04	68240.00	0.31	16
360.00	94.60	0.29	-69.19	1666.64	1999.10	46.63	14.22	68240.00	0.30	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 1085.98 , MINIMUM AREA FRACTION ACCEPTABLE = 0.706

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.33000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 10 , SOLAR ABSORPTANCE VALUE = 0.18000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	0.95	-68.03	1678.44	2398.92	46.63	17.07	68240.00	0.30	16
10.00	94.60	5.65	-59.81	1767.84	5333.14	46.63	16.85	68240.00	0.31	16
20.00	94.60	12.36	-48.24	1911.04	9675.23	46.63	16.08	68240.00	0.32	16
30.00	94.60	18.66	-37.49	2066.64	13922.21	46.63	14.86	68240.00	0.33	15
40.00	94.60	24.18	-28.16	2223.69	17784.33	46.63	13.54	68240.00	0.34	15
50.00	94.60	28.83	-20.36	2374.54	21138.84	46.63	11.89	68240.00	0.34	15
60.00	94.60	32.51	-14.18	2509.44	23871.57	46.63	10.24	68240.00	0.35	15
70.00	94.60	35.18	-9.73	2616.41	25884.80	46.63	8.70	68240.00	0.36	15
80.00	94.60	36.79	-7.04	2685.63	27117.98	46.63	7.05	68240.00	0.36	15
90.00	94.60	37.32	-6.14	2709.64	27533.08	46.63	5.51	68240.00	0.36	15
100.00	94.60	36.78	-7.05	2685.51	27117.98	46.63	4.07	68240.00	0.36	15
110.00	94.60	35.17	-9.74	2616.17	25884.80	46.63	2.75	68240.00	0.36	15
120.00	94.60	32.50	-14.20	2509.07	23871.57	46.63	1.76	68240.00	0.35	15
130.00	94.60	28.81	-20.38	2374.07	21138.84	46.63	0.99	68240.00	0.34	15
140.00	94.60	24.16	-28.19	2223.09	17784.33	46.63	0.44	68240.00	0.34	15
150.00	94.60	18.64	-37.53	2065.91	13922.21	46.63	0.11	68240.00	0.33	15
160.00	94.60	12.34	-48.27	1910.60	9675.23	46.63	0.0	68240.00	0.32	16
170.00	94.60	5.63	-59.87	1767.16	5333.14	46.63	0.0	68240.00	0.31	16
172.93	94.60	4.26	-62.23	1740.48	4474.23	46.63	0.0	68240.00	0.31	16
180.00	94.60	-3.04	-75.07	1609.00	0.0	46.63	0.0	68240.00	0.30	16
187.07	94.60	4.26	-62.23	1740.48	4474.22	46.63	0.0	68240.00	0.31	16
190.00	94.60	5.63	-59.87	1767.16	5333.14	46.63	0.0	68240.00	0.31	16
200.00	94.60	12.34	-48.27	1910.60	9675.23	46.63	0.0	68240.00	0.32	16
210.00	94.60	18.64	-37.53	2065.91	13922.21	46.63	0.11	68240.00	0.33	15
220.00	94.60	24.16	-28.19	2223.09	17784.33	46.63	0.44	68240.00	0.34	15
230.00	94.60	28.81	-20.38	2374.07	21138.84	46.63	0.99	68240.00	0.34	15
240.00	94.60	32.50	-14.20	2509.07	23871.57	46.63	1.76	68240.00	0.35	15
250.00	94.60	35.17	-9.74	2616.17	25884.80	46.63	2.75	68240.00	0.36	15
260.00	94.60	36.78	-7.05	2685.51	27117.98	46.63	4.07	68240.00	0.36	15
270.00	94.60	37.32	-6.14	2709.64	27533.08	46.63	5.51	68240.00	0.36	15
280.00	94.60	36.79	-7.04	2685.63	27117.98	46.63	7.05	68240.00	0.36	15
290.00	94.60	35.18	-9.73	2616.41	25884.80	46.63	8.70	68240.00	0.36	15
300.00	94.60	32.51	-14.18	2509.44	23871.57	46.63	10.24	68240.00	0.35	15
310.00	94.60	28.83	-20.36	2374.54	21138.84	46.63	11.89	68240.00	0.34	15
320.00	94.60	24.18	-28.16	2223.69	17784.33	46.63	13.54	68240.00	0.34	15
330.00	94.60	18.66	-37.49	2066.64	13922.21	46.63	14.86	68240.00	0.33	15
340.00	94.60	12.36	-48.24	1911.04	9675.23	46.63	16.08	68240.00	0.32	16
350.00	94.60	5.65	-59.81	1767.84	5333.14	46.63	16.85	68240.00	0.31	16
360.00	94.60	0.95	-68.03	1678.44	2398.92	46.63	17.07	68240.00	0.30	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 1085.98 , MINIMUM AREA FRACTION ACCEPTABLE = 0.706

COOLANT PASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.33000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 20 , SOLAR ABSORPTANCE VALUE = 0.21000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	1.60	-66.89	1690.34	2798.74	46.63	19.91	68240.00	0.30	16
10.00	94.60	7.06	-57.38	1796.03	6222.00	46.63	19.65	68240.00	0.31	16
20.00	94.60	14.79	-44.08	1968.39	11287.77	46.63	18.76	68240.00	0.32	15
30.00	94.60	22.01	-31.83	2159.17	16242.57	46.63	17.34	68240.00	0.33	15
40.00	94.60	28.30	-21.25	2356.19	20748.39	46.63	15.80	68240.00	0.34	15
50.00	94.60	33.57	-12.42	2550.59	24661.98	46.63	13.87	68240.00	0.35	15
60.00	94.60	37.74	-5.44	2728.59	27850.16	46.63	11.95	68240.00	0.36	15
70.00	94.60	40.75	-0.42	2872.77	30198.93	46.63	10.15	68240.00	0.37	15
80.00	94.60	42.57	2.61	2967.48	31637.63	46.63	8.22	68240.00	0.37	15
90.00	94.60	43.17	3.62	3000.23	32121.93	46.63	6.42	68240.00	0.37	15
100.00	94.60	42.56	2.61	2967.35	31637.63	46.63	4.75	68240.00	0.37	15
110.00	94.60	40.74	-0.43	2872.47	30198.93	46.63	3.21	68240.00	0.37	15
120.00	94.60	37.73	-5.46	2728.16	27850.16	46.63	2.06	68240.00	0.36	15
130.00	94.60	33.55	-12.45	2550.06	24661.98	46.63	1.16	68240.00	0.35	15
140.00	94.60	28.28	-21.29	2355.52	20748.39	46.63	0.51	68240.00	0.34	15
150.00	94.60	21.98	-31.87	2158.37	16242.57	46.63	0.13	68240.00	0.33	15
160.00	94.60	14.76	-44.13	1967.71	11287.77	46.63	0.0	68240.00	0.32	15
170.00	94.60	7.02	-57.44	1795.42	6222.00	46.63	0.0	68240.00	0.31	16
172.93	94.60	5.45	-60.17	1763.64	5219.93	46.63	0.0	68240.00	0.31	16
180.00	94.60	-3.04	-75.07	1609.00	0.0	46.63	0.0	68240.00	0.30	16
187.07	94.60	5.45	-60.17	1763.64	5219.93	46.63	0.0	68240.00	0.31	16
190.00	94.60	7.02	-57.44	1795.42	6222.00	46.63	0.0	68240.00	0.31	16
200.00	94.60	14.76	-44.13	1967.71	11287.77	46.63	0.0	68240.00	0.32	15
210.00	94.60	21.98	-31.87	2158.37	16242.57	46.63	0.13	68240.00	0.33	15
220.00	94.60	28.28	-21.29	2355.52	20748.39	46.63	0.51	68240.00	0.34	15
230.00	94.60	33.55	-12.45	2550.06	24661.98	46.63	1.16	68240.00	0.35	15
240.00	94.60	37.73	-5.46	2728.16	27850.16	46.63	2.06	68240.00	0.36	15
250.00	94.60	40.74	-0.43	2872.47	30198.93	46.63	3.21	68240.00	0.37	15
260.00	94.60	42.56	2.61	2967.35	31637.63	46.63	4.75	68240.00	0.37	15
270.00	94.60	43.17	3.62	3000.23	32121.93	46.63	6.42	68240.00	0.37	15
280.00	94.60	42.57	2.61	2967.48	31637.63	46.63	8.22	68240.00	0.37	15
290.00	94.60	40.75	-0.42	2872.77	30198.93	46.63	10.15	68240.00	0.37	15
300.00	94.60	37.74	-5.44	2728.59	27850.16	46.63	11.95	68240.00	0.36	15
310.00	94.60	33.57	-12.42	2550.59	24661.98	46.63	13.87	68240.00	0.35	15
320.00	94.60	28.30	-21.25	2356.19	20748.39	46.63	15.80	68240.00	0.34	15
330.00	94.60	22.01	-31.83	2159.17	16242.57	46.63	17.34	68240.00	0.33	15
340.00	94.60	14.79	-44.08	1968.39	11287.77	46.63	18.76	68240.00	0.32	15
350.00	94.60	7.06	-57.38	1796.03	6222.00	46.63	19.65	68240.00	0.31	16
360.00	94.60	1.60	-66.89	1690.34	2798.74	46.63	19.91	68240.00	0.30	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 1085.98 , MINIMUM AREA FRACTION ACCEPTABLE = 0.706

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.33000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 30 , SOLAR ABSORPTANCE VALUE = 0.24000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	2.25	-65.74	1702.46	3198.56	46.63	22.76	68240.00	0.31	16
10.00	94.60	8.44	-54.98	1824.87	7110.85	46.63	22.46	68240.00	0.31	16
20.00	94.60	17.18	-40.01	2027.93	12900.30	46.63	21.43	68240.00	0.33	15
30.00	94.60	25.28	-26.31	2257.58	18562.92	46.63	19.82	68240.00	0.34	15
40.00	94.60	32.31	-14.52	2501.77	23712.45	46.63	18.06	68240.00	0.35	15
50.00	94.60	38.18	-4.71	2748.66	28185.12	46.63	15.86	68240.00	0.36	15
60.00	94.60	42.81	3.02	2980.72	31828.76	46.63	13.65	68240.00	0.37	15
70.00	94.60	46.14	8.59	3173.80	34513.05	46.63	11.60	68240.00	0.38	15
80.00	94.60	48.15	11.95	3302.85	36157.30	46.63	9.40	68240.00	0.38	15
90.00	94.60	48.82	13.08	3348.50	36710.77	46.63	7.34	68240.00	0.38	15
100.00	94.60	48.15	11.95	3302.67	36157.30	46.63	5.43	68240.00	0.38	15
110.00	94.60	46.13	8.58	3173.46	34513.05	46.63	3.67	68240.00	0.38	15
120.00	94.60	42.80	3.00	2980.23	31828.76	46.63	2.35	68240.00	0.37	15
130.00	94.60	38.16	-4.75	2747.61	28185.12	46.63	1.32	68240.00	0.36	15
140.00	94.60	32.29	-14.56	2500.62	23712.45	46.63	0.59	68240.00	0.35	15
150.00	94.60	25.25	-26.36	2256.69	18562.92	46.63	0.15	68240.00	0.34	15
160.00	94.60	17.15	-40.06	2027.19	12900.30	46.63	0.0	68240.00	0.33	15
170.00	94.60	8.41	-55.04	1824.16	7110.85	46.63	0.0	68240.00	0.31	16
172.93	94.60	6.62	-58.13	1787.28	5965.63	46.63	0.0	68240.00	0.31	16
180.00	94.60	-3.04	-75.07	1609.00	0.0	46.63	0.0	68240.00	0.30	16
187.07	94.60	6.62	-58.13	1787.28	5965.63	46.63	0.0	68240.00	0.31	16
190.00	94.60	8.41	-55.04	1824.16	7110.85	46.63	0.0	68240.00	0.31	16
200.00	94.60	17.15	-40.06	2027.19	12900.30	46.63	0.0	68240.00	0.33	15
210.00	94.60	25.25	-26.36	2256.69	18562.92	46.63	0.15	68240.00	0.34	15
220.00	94.60	32.29	-14.56	2500.62	23712.45	46.63	0.59	68240.00	0.35	15
230.00	94.60	38.16	-4.75	2747.61	28185.12	46.63	1.32	68240.00	0.36	15
240.00	94.60	42.80	3.00	2980.23	31828.76	46.63	2.35	68240.00	0.37	15
250.00	94.60	46.13	8.58	3173.46	34513.05	46.63	3.67	68240.00	0.38	15
260.00	94.60	48.15	11.95	3302.67	36157.30	46.63	5.43	68240.00	0.38	15
270.00	94.60	48.82	13.08	3348.50	36710.77	46.63	7.34	68240.00	0.38	15
280.00	94.60	48.15	11.95	3302.85	36157.30	46.63	9.40	68240.00	0.38	15
290.00	94.60	46.14	8.59	3173.80	34513.05	46.63	11.60	68240.00	0.38	15
300.00	94.60	42.81	3.02	2980.72	31828.76	46.63	13.65	68240.00	0.37	15
310.00	94.60	38.18	-4.71	2748.66	28185.12	46.63	15.86	68240.00	0.36	15
320.00	94.60	32.31	-14.52	2501.77	23712.45	46.63	18.06	68240.00	0.35	15
330.00	94.60	25.28	-26.31	2257.58	18562.92	46.63	19.82	68240.00	0.34	15
340.00	94.60	17.18	-40.01	2027.93	12900.30	46.63	21.43	68240.00	0.33	15
350.00	94.60	8.44	-54.98	1824.87	7110.85	46.63	22.46	68240.00	0.31	16
360.00	94.60	2.25	-65.74	1702.46	3198.56	46.63	22.76	68240.00	0.31	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 1085.98 , MINIMUM AREA FRACTION ACCEPTABLE = 0.706

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.33000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 40 , SOLAR ABSORPTANCE VALUE = 0.27000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	2.90	-64.61	1714.56	3598.38	46.63	25.60	68240.00	0.31	16
10.00	94.60	9.82	-52.60	1854.44	7999.71	46.63	25.27	68240.00	0.32	16
20.00	94.60	19.53	-36.01	2090.03	14512.84	46.63	24.11	68240.00	0.33	15
30.00	94.60	28.49	-20.92	2363.11	20883.29	46.63	22.30	68240.00	0.34	15
40.00	94.60	36.23	-7.97	2661.47	26676.50	46.63	20.31	68240.00	0.36	15
50.00	94.60	42.67	2.78	2972.85	31708.26	46.63	17.84	68240.00	0.37	15
60.00	94.60	47.73	11.26	3275.30	35807.34	46.63	15.36	68240.00	0.38	15
70.00	94.60	51.37	17.35	3533.87	38827.20	46.63	13.05	68240.00	0.39	15
80.00	94.60	53.56	21.04	3710.87	40676.97	46.63	10.57	68240.00	0.39	14
90.00	94.60	54.29	22.26	3773.68	41299.62	46.63	8.26	68240.00	0.39	14
100.00	94.60	53.56	21.03	3710.66	40676.97	46.63	6.11	68240.00	0.39	14
110.00	94.60	51.36	17.33	3532.87	38827.20	46.63	4.13	68240.00	0.39	15
120.00	94.60	47.72	11.23	3274.22	35807.34	46.63	2.64	68240.00	0.38	15
130.00	94.60	42.65	2.74	2971.66	31708.26	46.63	1.49	68240.00	0.37	15
140.00	94.60	36.20	-8.01	2660.21	26676.50	46.63	0.66	68240.00	0.36	15
150.00	94.60	28.46	-20.97	2362.14	20883.29	46.63	0.17	68240.00	0.34	15
160.00	94.60	19.50	-36.08	2088.86	14512.84	46.63	0.0	68240.00	0.33	15
170.00	94.60	9.78	-52.67	1853.49	7999.71	46.63	0.0	68240.00	0.32	16
172.93	94.60	7.79	-56.11	1811.23	6711.34	46.63	0.0	68240.00	0.31	16
180.00	94.60	-3.04	-75.07	1609.00	0.0	46.63	0.0	68240.00	0.30	16
187.07	94.60	7.79	-56.11	1811.23	6711.34	46.63	0.0	68240.00	0.31	16
190.00	94.60	9.78	-52.67	1853.49	7999.71	46.63	0.0	68240.00	0.32	16
200.00	94.60	19.50	-36.08	2088.86	14512.84	46.63	0.0	68240.00	0.33	15
210.00	94.60	28.46	-20.97	2362.14	20883.29	46.63	0.17	68240.00	0.34	15
220.00	94.60	36.20	-8.01	2660.21	26676.50	46.63	0.66	68240.00	0.36	15
230.00	94.60	42.65	2.74	2971.66	31708.26	46.63	1.49	68240.00	0.37	15
240.00	94.60	47.72	11.23	3274.22	35807.34	46.63	2.64	68240.00	0.38	15
250.00	94.60	51.36	17.33	3532.87	38827.20	46.63	4.13	68240.00	0.39	15
260.00	94.60	53.56	21.03	3710.66	40676.97	46.63	6.11	68240.00	0.39	14
270.00	94.60	54.29	22.26	3773.68	41299.62	46.63	8.26	68240.00	0.39	14
280.00	94.60	53.56	21.04	3710.87	40676.97	46.63	10.57	68240.00	0.39	14
290.00	94.60	51.37	17.35	3533.87	38827.20	46.63	13.05	68240.00	0.39	15
300.00	94.60	47.73	11.26	3275.30	35807.34	46.63	15.36	68240.00	0.38	15
310.00	94.60	42.67	2.78	2972.85	31708.26	46.63	17.84	68240.00	0.37	15
320.00	94.60	36.23	-7.97	2661.47	26676.50	46.63	20.31	68240.00	0.36	15
330.00	94.60	28.49	-20.92	2363.11	20883.29	46.63	22.30	68240.00	0.34	15
340.00	94.60	19.53	-36.01	2090.03	14512.84	46.63	24.11	68240.00	0.33	15
350.00	94.60	9.82	-52.60	1854.44	7999.71	46.63	25.27	68240.00	0.32	16
360.00	94.60	2.90	-64.61	1714.56	3598.38	46.63	25.60	68240.00	0.31	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 1085.98 , MINIMUM AREA FRACTION ACCEPTABLE = 0.706

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.33000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 50 , SOLAR ABSORPTANCE VALUE = 0.30000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	3.55	-63.48	1726.71	3998.20	46.63	28.44	68240.00	0.31	16
10.00	94.60	11.19	-50.25	1884.54	8888.57	46.63	28.08	68240.00	0.32	16
20.00	94.60	21.85	-32.10	2154.50	16125.38	46.63	26.79	68240.00	0.33	15
30.00	94.60	31.64	-15.65	2475.90	23203.66	46.63	24.77	68240.00	0.35	15
40.00	94.60	40.06	-1.58	2838.08	29640.56	46.63	22.57	68240.00	0.36	15
50.00	94.60	47.04	10.09	3230.04	35231.39	46.63	19.82	68240.00	0.38	15
60.00	94.60	52.51	19.28	3624.73	39785.95	46.63	17.07	68240.00	0.39	14
70.00	94.60	56.44	25.89	3972.69	43141.32	46.63	14.50	68240.00	0.40	14
80.00	94.60	58.80	29.90	4219.21	45196.63	46.63	11.74	68240.00	0.40	14
90.00	94.60	59.59	31.22	4307.02	45888.47	46.63	9.18	68240.00	0.40	14
100.00	94.60	58.80	29.87	4217.52	45196.63	46.63	6.79	68240.00	0.40	14
110.00	94.60	56.43	25.87	3972.19	43141.32	46.63	4.59	68240.00	0.40	14
120.00	94.60	52.50	19.25	3622.90	39785.95	46.63	2.94	68240.00	0.39	14
130.00	94.60	47.01	10.04	3228.21	35231.39	46.63	1.65	68240.00	0.38	15
140.00	94.60	40.03	-1.63	2836.68	29640.56	46.63	0.73	68240.00	0.36	15
150.00	94.60	31.61	-15.70	2474.83	23203.66	46.63	0.18	68240.00	0.35	15
160.00	94.60	21.81	-32.15	2153.61	16125.38	46.63	0.0	68240.00	0.33	15
170.00	94.60	11.14	-50.33	1883.51	8888.57	46.63	0.0	68240.00	0.32	16
172.93	94.60	8.95	-54.11	1835.53	7457.04	46.63	0.0	68240.00	0.31	16
180.00	94.60	-3.04	-75.07	1609.00	0.0	46.63	0.0	68240.00	0.30	16
187.07	94.60	8.95	-54.11	1835.53	7457.04	46.63	0.0	68240.00	0.31	16
190.00	94.60	11.14	-50.33	1883.51	8888.57	46.63	0.0	68240.00	0.32	16
200.00	94.60	21.81	-32.15	2153.61	16125.38	46.63	0.0	68240.00	0.33	15
210.00	94.60	31.61	-15.70	2474.83	23203.66	46.63	0.18	68240.00	0.35	15
220.00	94.60	40.03	-1.63	2836.68	29640.56	46.63	0.73	68240.00	0.36	15
230.00	94.60	47.01	10.04	3228.21	35231.39	46.63	1.65	68240.00	0.38	15
240.00	94.60	52.50	19.25	3622.90	39785.95	46.63	2.94	68240.00	0.39	14
250.00	94.60	56.43	25.87	3972.19	43141.32	46.63	4.59	68240.00	0.40	14
260.00	94.60	58.80	29.87	4217.52	45196.63	46.63	6.79	68240.00	0.40	14
270.00	94.60	59.59	31.22	4307.02	45888.47	46.63	9.18	68240.00	0.40	14
280.00	94.60	58.80	29.90	4219.21	45196.63	46.63	11.74	68240.00	0.40	14
290.00	94.60	56.44	25.89	3972.69	43141.32	46.63	14.50	68240.00	0.40	14
300.00	94.60	52.51	19.28	3624.73	39785.95	46.63	17.07	68240.00	0.39	14
310.00	94.60	47.04	10.09	3230.04	35231.39	46.63	19.82	68240.00	0.38	15
320.00	94.60	40.06	-1.58	2838.08	29640.56	46.63	22.57	68240.00	0.36	15
330.00	94.60	31.64	-15.65	2475.90	23203.66	46.63	24.77	68240.00	0.35	15
340.00	94.60	21.85	-32.10	2154.50	16125.38	46.63	26.79	68240.00	0.33	15
350.00	94.60	11.19	-50.25	1884.54	8888.57	46.63	28.08	68240.00	0.32	16
360.00	94.60	3.55	-63.48	1726.71	3998.20	46.63	28.44	68240.00	0.31	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 1085.98 , MINIMUM AREA FRACTION ACCEPTABLE = 0.706

COOLANT PASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.33000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00300 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 60 , SOLAR ABSORPTANCE VALUE = 0.33000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	4.19	-62.36	1739.13	4398.02	46.63	31.29	68240.00	0.31	16
10.00	94.60	12.54	-47.93	1915.28	9777.42	46.63	30.89	68240.00	0.32	15
20.00	94.60	24.14	-28.23	2222.31	17737.91	46.63	29.47	68240.00	0.34	15
30.00	94.60	34.73	-10.48	2597.71	25524.02	46.63	27.25	68240.00	0.35	15
40.00	94.60	43.80	4.67	3035.39	32604.60	46.63	24.83	68240.00	0.37	15
50.00	94.60	51.30	17.22	3528.00	38754.54	46.63	21.80	68240.00	0.39	14
60.00	94.60	57.17	27.12	4045.42	43764.53	46.63	18.77	68240.00	0.40	14
70.00	94.60	61.37	34.25	4523.81	47455.45	46.63	15.95	68240.00	0.41	14
80.00	94.60	63.89	38.56	4870.82	49716.29	46.63	12.92	68240.00	0.41	14
90.00	94.60	64.73	40.01	5000.54	50477.30	46.63	10.09	68240.00	0.41	14
100.00	94.60	63.88	38.55	4870.52	49716.29	46.63	7.47	68240.00	0.41	14
110.00	94.60	61.36	34.23	4521.64	47455.45	46.63	5.05	68240.00	0.41	14
120.00	94.60	57.15	27.08	4043.30	43764.53	46.63	3.23	68240.00	0.40	14
130.00	94.60	51.27	17.18	3525.97	38754.54	46.63	1.82	68240.00	0.39	15
140.00	94.60	43.77	4.62	3033.87	32604.60	46.63	0.81	68240.00	0.37	15
150.00	94.60	34.69	-10.54	2596.16	25524.02	46.63	0.20	68240.00	0.35	15
160.00	94.60	24.10	-28.31	2220.97	17737.91	46.63	0.0	68240.00	0.34	15
170.00	94.60	12.50	-48.01	1914.16	9777.42	46.63	0.0	68240.00	0.32	16
172.93	94.60	10.10	-52.13	1860.41	8202.75	46.63	0.0	68240.00	0.32	16
180.00	94.60	-3.04	-75.07	1609.00	0.0	46.63	0.0	68240.00	0.30	16
187.07	94.60	10.10	-52.13	1860.41	8202.74	46.63	0.0	68240.00	0.32	16
190.00	94.60	12.50	-48.01	1914.16	9777.42	46.63	0.0	68240.00	0.32	16
200.00	94.60	24.10	-28.31	2220.97	17737.91	46.63	0.0	68240.00	0.34	15
210.00	94.60	34.69	-10.54	2596.16	25524.02	46.63	0.20	68240.00	0.35	15
220.00	94.60	43.77	4.62	3033.87	32604.60	46.63	0.81	68240.00	0.37	15
230.00	94.60	51.27	17.18	3525.97	38754.54	46.63	1.82	68240.00	0.39	15
240.00	94.60	57.15	27.08	4043.30	43764.53	46.63	3.23	68240.00	0.40	14
250.00	94.60	61.36	34.23	4521.64	47455.45	46.63	5.05	68240.00	0.41	14
260.00	94.60	63.88	38.55	4870.52	49716.29	46.63	7.47	68240.00	0.41	14
270.00	94.60	64.73	40.01	5000.54	50477.30	46.63	10.09	68240.00	0.41	14
280.00	94.60	63.89	38.56	4870.82	49716.29	46.63	12.92	68240.00	0.41	14
290.00	94.60	61.37	34.25	4523.81	47455.45	46.63	15.95	68240.00	0.41	14
300.00	94.60	57.17	27.12	4045.42	43764.53	46.63	18.77	68240.00	0.40	14
310.00	94.60	51.30	17.22	3528.00	38754.54	46.63	21.80	68240.00	0.39	14
320.00	94.60	43.80	4.67	3035.39	32604.60	46.63	24.83	68240.00	0.37	15
330.00	94.60	34.73	-10.48	2597.71	25524.02	46.63	27.25	68240.00	0.35	15
340.00	94.60	24.14	-28.23	2222.31	17737.91	46.63	29.47	68240.00	0.34	15
350.00	94.60	12.54	-47.93	1915.28	9777.42	46.63	30.89	68240.00	0.32	15
360.00	94.60	4.19	-62.36	1739.13	4398.02	46.63	31.29	68240.00	0.31	16

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G E O S Y N C H R O N O U S   S P A C E   S T A T I O N   R A D I A T O R   P R O G R A M .

ALTITUDE (N.MI.) =   19370.0

ORBIT INCLINATION BETA ANGLE (DEGREES) =   5.00

DISSIPATION (KW.), LOWEST =    20  HIGHEST =    40  INCREMENT =    20

BREAK POINT FROM PLATE TO CYLINDRICAL RADIATORS (KW.) =   20.00

MONTHS DEGRADATION FOR FLAT PLATE RADIATOR  =    60  INCREMENT =    10
MONTHS DEGRADATION FOR CYLINDRICAL RADIATOR =    60  INCREMENT =    10

ORBIT PRINT INTERVAL FOR FLAT PLATE RADIATOR (DEGREES) =    10 ,INTERVAL FOR CYLINDRICAL RADIATOR =    10

AREA FRACTION FOR FLAT PLATE RADIATOR =      1.500 , FOR CYLINDRICAL RADIATOR =      1.500

PLATE, SHAPE FACTOR TO SPACE =   0.900000  FLUID CP =     0.2500  BTU/LBM-R.
CYL. , SHAPE FACTOR TO SPACE =   0.950000  FLUID CP =     0.2500  BTU/LBM-R.

RADIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE =    0.15000  EMITTANCE =    0.88000  MONTHLY CHANGE IN ABSORPTANCE =    0.00350
CYL. , ABSORPTANCE =    0.07000  EMITTANCE =    0.76000  MONTHLY CHANGE IN ABSORPTANCE =    0.00500

EXTERNAL HEAT INPUT TABLES.

    1     SOLAR FS, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.
               0.0        0.596190
              10.00       0.981060
              20.00       0.936120
              30.00       0.862730
              40.00       0.763130
              50.00       0.640340
              60.00       0.498100
              70.00       0.340720
              80.00       0.172990
              90.00       0.0
             100.00       0.172990
             110.00       0.340720
             120.00       0.498100
             130.00       0.640340
             140.00       0.763130
             150.00       0.862730
             160.00       0.936120
             170.00       0.981060
             180.00       0.596190
             190.00       0.981060
             200.00       0.936120
             210.00       0.862730
             220.00       0.763130
             230.00       0.640340
             240.00       0.498100
             250.00       0.340720
             260.00       0.172990
             270.00       0.0
             280.00       0.172990
             290.00       0.340720
             300.00       0.498100
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	310.00	0.640340
	320.00	0.763130
	330.00	0.862730
	340.00	0.936120
	350.00	0.981060
	360.00	0.996190
2	EARTHSHINE FE, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.	
	0.0	0.011360
	360.00	0.011360
3	ALBEDO FA, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.	
	0.0	0.008350
	10.00	0.008220
	20.00	0.007850
	30.00	0.007270
	40.00	0.006530
	50.00	0.005670
	60.00	0.004750
	70.00	0.003840
	80.00	0.002970
	90.00	0.002190
	100.00	0.001520
	110.00	0.000980
	120.00	0.000580
	130.00	0.000300
	140.00	0.000130
	150.00	0.000040
	160.00	0.0
	200.00	0.0
	210.00	0.000040
	220.00	0.000130
	230.00	0.000300
	240.00	0.000580
	250.00	0.000980
	260.00	0.001520
	270.00	0.002190
	280.00	0.002970
	290.00	0.003840
	300.00	0.004750
	310.00	0.005670
	320.00	0.006530
	330.00	0.007270
	340.00	0.007850
	350.00	0.008220
	360.00	0.008350
4	SOLAR FS, B=5, CYL. RADIATOR END ON TOWARD EARTH.	
	0.0	0.027740
	10.00	0.061670
	20.00	0.111880
	30.00	0.160990
	40.00	0.205650
	50.00	0.244440
	60.00	0.276040
	70.00	0.299320
	80.00	0.313580
	90.00	0.318380
	100.00	0.313580
	110.00	0.299320
	120.00	0.276040
	130.00	0.244440
	140.00	0.205650
	150.00	0.160990

	160.00	0.111880
	170.00	0.061670
	180.00	0.027740
	190.00	0.061670
	200.00	0.111880
	210.00	0.160990
	220.00	0.205650
	230.00	0.244440
	240.00	0.276040
	250.00	0.299320
	260.00	0.313580
	270.00	0.318380
	280.00	0.313580
	290.00	0.299320
	300.00	0.276040
	310.00	0.244440
	320.00	0.205650
	330.00	0.160990
	340.00	0.111880
	350.00	0.061670
	360.00	0.027740
5	EARTHSHINE FE, B=5, CYL. RADIATOR END ON TOWARD EARTH.	
	0.0	0.002310
	360.00	0.002310
6	ALBEDO FA, B=5, CYL. RADIATOR END ON TOWARD EARTH.	
	0.0	0.001550
	10.00	0.001530
	20.00	0.001460
	30.00	0.001350
	40.00	0.001230
	50.00	0.001080
	60.00	0.000930
	70.00	0.000790
	80.00	0.000640
	90.00	0.000500
	100.00	0.000370
	110.00	0.000250
	120.00	0.000160
	130.00	0.000090
	140.00	0.000040
	150.00	0.000010
	160.00	0.0
	200.00	0.0
	210.00	0.000010
	220.00	0.000040
	230.00	0.000090
	240.00	0.000160
	250.00	0.000250
	260.00	0.000370
	270.00	0.000500
	280.00	0.000640
	290.00	0.000790
	300.00	0.000930
	310.00	0.001080
	320.00	0.001230
	330.00	0.001350
	340.00	0.001460
	350.00	0.001530
	360.00	0.001550

C-5

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2837.42 , MINIMUM AREA FRACTION ACCEPTABLE = 0.257

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.38202

MAXIMUM ABSORPTANCE VALUE = 0.36000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00350 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 0 , SOLAR ABSORPTANCE VALUE = 0.15000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	-31.70	-61.84	1745.97	187573.94	3764.62	1257.79	68239.94	0.12	15
10.00	94.60	-32.88	-63.32	1729.15	184725.13	3764.62	1238.20	68239.94	0.12	15
20.00	94.60	-36.45	-67.79	1680.99	176263.25	3764.62	1182.47	68239.94	0.12	15
30.00	94.60	-42.48	-75.41	1605.99	162444.56	3764.62	1095.10	68239.94	0.12	15
40.00	94.60	-51.09	-86.51	1508.02	143690.75	3764.62	983.63	68239.94	0.11	15
50.00	94.60	-62.53	-101.67	1390.94	120570.44	3764.62	854.09	68239.94	0.11	15
60.00	94.60	-77.13	-121.88	1261.14	93787.88	3764.62	715.51	68239.94	0.10	16
70.00	94.60	-95.51	-149.09	1120.31	64154.64	3764.62	578.43	68239.94	0.10	16
80.00	94.60	-118.76	-187.61	967.33	32572.52	3764.62	447.38	68239.94	0.09	16
90.00	94.60	-149.10	-249.87	792.43	0.0	3764.62	329.89	68239.94	0.08	17
100.00	94.60	-118.94	-187.92	966.29	32572.52	3764.62	228.96	68239.94	0.09	16
110.00	94.60	-95.80	-149.53	1118.26	64154.64	3764.62	147.62	68239.94	0.10	16
120.00	94.60	-77.49	-122.39	1258.37	93787.88	3764.62	87.37	68239.94	0.10	15
130.00	94.60	-62.94	-102.23	1387.16	120570.44	3764.62	45.19	68239.94	0.11	15
140.00	94.60	-51.55	-87.11	1502.28	143690.75	3764.62	19.58	68239.94	0.11	15
150.00	94.60	-42.96	-76.02	1601.16	162444.56	3764.62	6.03	68239.94	0.12	15
160.00	94.60	-36.95	-68.41	1675.71	176263.25	3764.62	0.0	68239.94	0.12	15
170.00	94.60	-33.40	-63.96	1721.90	184725.13	3764.62	0.0	68239.94	0.12	15
172.93	94.60	-33.05	-63.53	1726.75	185559.00	3764.62	0.0	68239.94	0.12	15
180.00	94.60	-149.46	-250.71	790.50	0.0	3764.62	0.0	68239.94	0.08	17
187.07	94.60	-33.05	-63.53	1726.75	185559.00	3764.62	0.0	68239.94	0.12	15
190.00	94.60	-33.40	-63.96	1721.90	184725.13	3764.62	0.0	68239.94	0.12	15
200.00	94.60	-36.95	-68.41	1675.71	176263.25	3764.62	0.0	68239.94	0.12	15
210.00	94.60	-42.96	-76.02	1601.16	162444.56	3764.62	6.03	68239.94	0.12	15
220.00	94.60	-51.55	-87.11	1502.28	143690.75	3764.62	19.58	68239.94	0.11	15
230.00	94.60	-62.94	-102.23	1387.16	120570.44	3764.62	45.19	68239.94	0.11	15
240.00	94.60	-77.49	-122.39	1258.37	93787.88	3764.62	87.37	68239.94	0.10	15
250.00	94.60	-95.80	-149.53	1118.26	64154.64	3764.62	147.62	68239.94	0.10	16
260.00	94.60	-118.94	-187.92	966.29	32572.52	3764.62	228.96	68239.94	0.09	16
270.00	94.60	-149.10	-249.87	792.43	0.0	3764.62	329.89	68239.94	0.08	17
280.00	94.60	-118.76	-187.61	967.33	32572.52	3764.62	447.38	68239.94	0.09	16
290.00	94.60	-95.51	-149.09	1120.31	64154.64	3764.62	578.43	68239.94	0.10	16
300.00	94.60	-77.13	-121.88	1261.14	93787.88	3764.62	715.51	68239.94	0.10	16
310.00	94.60	-62.53	-101.67	1390.94	120570.44	3764.62	854.09	68239.94	0.11	15
320.00	94.60	-51.09	-86.51	1508.02	143690.75	3764.62	983.63	68239.94	0.11	15
330.00	94.60	-42.48	-75.41	1605.99	162444.56	3764.62	1095.10	68239.94	0.12	15
340.00	94.60	-36.45	-67.79	1680.99	176263.25	3764.62	1182.47	68239.94	0.12	15
350.00	94.60	-32.88	-63.32	1729.15	184725.13	3764.62	1238.20	68239.94	0.12	15
360.00	94.60	-31.70	-61.84	1745.97	187573.94	3764.62	1257.79	68239.94	0.12	15

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2837.42 , MINIMUM AREA FRACTION ACCEPTABLE = 0.257

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.38202

MAXIMUM ABSORPTANCE VALUE = 0.36000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00350 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 10 , SOLAR ABSORPTANCE VALUE = 0.18500

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	-14.67	-41.00	2014.07	231341.13	3764.62	1551.27	68239.94	0.13	15
10.00	94.60	-15.97	-42.56	1990.67	227827.56	3764.62	1527.12	68239.94	0.13	15
20.00	94.60	-19.89	-47.32	1923.68	217391.38	3764.62	1458.38	68239.94	0.13	15
30.00	94.60	-26.52	-55.43	1819.90	200348.31	3764.62	1350.63	68239.94	0.13	15
40.00	94.60	-36.03	-67.26	1686.72	177218.56	3764.62	1213.15	68239.94	0.12	15
50.00	94.60	-48.72	-83.43	1533.89	148703.56	3764.62	1053.38	68239.94	0.11	15
60.00	94.60	-65.05	-105.08	1367.86	115671.75	3764.62	882.46	68239.94	0.11	15
70.00	94.60	-85.85	-134.50	1191.74	79124.00	3764.62	713.40	68239.94	0.10	16
80.00	94.60	-112.67	-176.96	1005.23	40172.77	3764.62	551.77	68239.94	0.09	16
90.00	94.60	-149.02	-249.67	792.91	0.0	3764.62	406.86	68239.94	0.08	17
100.00	94.60	-112.88	-177.31	1003.95	40172.77	3764.62	282.39	68239.94	0.09	16
110.00	94.60	-86.17	-134.98	1189.17	79124.00	3764.62	182.07	68239.94	0.10	16
120.00	94.60	-65.46	-105.64	1364.16	115671.75	3764.62	107.75	68239.94	0.11	15
130.00	94.60	-49.18	-84.02	1529.47	148703.56	3764.62	55.73	68239.94	0.11	15
140.00	94.60	-36.54	-67.89	1681.42	177218.56	3764.62	24.15	68239.94	0.12	15
150.00	94.60	-27.05	-56.09	1812.01	200348.31	3764.62	7.43	68239.94	0.13	15
160.00	94.60	-20.44	-47.99	1914.92	217391.38	3764.62	0.0	68239.94	0.13	15
170.00	94.60	-16.53	-43.24	1981.47	227827.56	3764.62	0.0	68239.94	0.13	15
172.93	94.60	-16.15	-42.78	1987.71	228856.13	3764.62	0.0	68239.94	0.13	15
180.00	94.60	-149.46	-250.71	790.50	0.0	3764.62	0.0	68239.94	0.08	17
187.07	94.60	-16.15	-42.78	1987.71	228856.13	3764.62	0.0	68239.94	0.13	15
190.00	94.60	-16.53	-43.24	1981.47	227827.56	3764.62	0.0	68239.94	0.13	15
200.00	94.60	-20.44	-47.99	1914.92	217391.38	3764.62	0.0	68239.94	0.13	15
210.00	94.60	-27.05	-56.09	1812.01	200348.31	3764.62	7.43	68239.94	0.13	15
220.00	94.60	-36.54	-67.89	1681.42	177218.56	3764.62	24.15	68239.94	0.12	15
230.00	94.60	-49.18	-84.02	1529.47	148703.56	3764.62	55.73	68239.94	0.11	15
240.00	94.60	-65.46	-105.64	1364.16	115671.75	3764.62	107.75	68239.94	0.11	15
250.00	94.60	-86.17	-134.98	1189.17	79124.00	3764.62	182.07	68239.94	0.10	16
260.00	94.60	-112.88	-177.31	1003.95	40172.77	3764.62	282.39	68239.94	0.09	16
270.00	94.60	-149.02	-249.67	792.91	0.0	3764.62	406.86	68239.94	0.08	17
280.00	94.60	-112.67	-176.96	1005.23	40172.77	3764.62	551.77	68239.94	0.09	16
290.00	94.60	-85.85	-134.50	1191.74	79124.00	3764.62	713.40	68239.94	0.10	16
300.00	94.60	-65.05	-105.08	1367.86	115671.75	3764.62	882.46	68239.94	0.11	15
310.00	94.60	-48.72	-83.43	1533.89	148703.56	3764.62	1053.38	68239.94	0.11	15
320.00	94.60	-36.03	-67.26	1686.72	177218.56	3764.62	1213.15	68239.94	0.12	15
330.00	94.60	-26.52	-55.43	1819.90	200348.31	3764.62	1350.63	68239.94	0.13	15
340.00	94.60	-19.89	-47.32	1923.68	217391.38	3764.62	1458.38	68239.94	0.13	15
350.00	94.60	-15.97	-42.56	1990.67	227827.56	3764.62	1527.12	68239.94	0.13	15
360.00	94.60	-14.67	-41.00	2014.07	231341.13	3764.62	1551.27	68239.94	0.13	15

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2837.42 , MINIMUM AREA FRACTION ACCEPTABLE = 0.257

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.38202

MAXIMUM ABSORPTANCE VALUE = 0.36000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00350 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 20 , SOLAR ABSORPTANCE VALUE = 0.22000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	0.60	-22.79	2325.45	275108.38	3764.62	1844.75	68239.94	0.15	14
10.00	94.60	-0.80	-24.44	2294.01	270930.06	3764.62	1816.03	68239.94	0.14	14
20.00	94.60	-5.01	-29.43	2201.81	258519.44	3764.62	1734.29	68239.94	0.14	14
30.00	94.60	-12.15	-37.96	2062.60	238252.00	3764.62	1606.15	68239.94	0.14	14
40.00	94.60	-22.43	-50.41	1883.91	210746.38	3764.62	1442.66	68239.94	0.13	15
50.00	94.60	-36.18	-67.44	1684.77	176836.63	3764.62	1252.66	68239.94	0.12	15
60.00	94.60	-53.99	-90.30	1477.32	137555.56	3764.62	1049.41	68239.94	0.11	15
70.00	94.60	-76.88	-121.52	1263.55	94093.38	3764.62	848.36	68239.94	0.10	15
80.00	94.60	-106.89	-167.24	1042.66	47772.99	3764.62	656.16	68239.94	0.09	16
90.00	94.60	-148.94	-249.47	793.33	0.0	3764.62	483.83	68239.94	0.08	17
100.00	94.60	-107.12	-167.63	1041.07	47772.99	3764.62	335.81	68239.94	0.09	16
110.00	94.60	-77.24	-122.04	1260.33	94093.38	3764.62	216.51	68239.94	0.10	16
120.00	94.60	-54.43	-90.89	1471.80	137555.56	3764.62	128.14	68239.94	0.11	15
130.00	94.60	-36.68	-68.07	1679.42	176836.63	3764.62	66.28	68239.94	0.12	15
140.00	94.60	-22.97	-51.07	1875.62	210746.38	3764.62	28.72	68239.94	0.13	15
150.00	94.60	-12.73	-38.66	2048.90	238252.00	3764.62	8.84	68239.94	0.13	14
160.00	94.60	-5.60	-30.13	2190.77	258519.44	3764.62	0.0	68239.94	0.14	14
170.00	94.60	-1.40	-25.15	2282.20	270930.06	3764.62	0.0	68239.94	0.14	14
172.93	94.60	-0.99	-24.67	2290.05	272153.13	3764.62	0.0	68239.94	0.14	14
180.00	94.60	-149.46	-250.71	790.50	0.0	3764.62	0.0	68239.94	0.08	17
187.07	94.60	-0.99	-24.67	2290.05	272153.13	3764.62	0.0	68239.94	0.14	14
190.00	94.60	-1.40	-25.15	2282.20	270930.06	3764.62	0.0	68239.94	0.14	14
200.00	94.60	-5.60	-30.13	2190.77	258519.44	3764.62	0.0	68239.94	0.14	14
210.00	94.60	-12.73	-38.66	2048.90	238252.00	3764.62	8.84	68239.94	0.13	14
220.00	94.60	-22.97	-51.07	1875.62	210746.38	3764.62	28.72	68239.94	0.13	15
230.00	94.60	-36.68	-68.07	1679.42	176836.63	3764.62	66.28	68239.94	0.12	15
240.00	94.60	-54.43	-90.89	1471.80	137555.56	3764.62	128.14	68239.94	0.11	15
250.00	94.60	-77.24	-122.04	1260.33	94093.38	3764.62	216.51	68239.94	0.10	16
260.00	94.60	-107.12	-167.63	1041.07	47772.99	3764.62	335.81	68239.94	0.09	16
270.00	94.60	-148.94	-249.47	793.33	0.0	3764.62	483.83	68239.94	0.08	17
280.00	94.60	-106.89	-167.24	1042.66	47772.99	3764.62	656.16	68239.94	0.09	16
290.00	94.60	-76.88	-121.52	1263.55	94093.38	3764.62	848.36	68239.94	0.10	15
300.00	94.60	-53.99	-90.30	1477.32	137555.56	3764.62	1049.41	68239.94	0.11	15
310.00	94.60	-36.18	-67.44	1684.77	176836.63	3764.62	1252.66	68239.94	0.12	15
320.00	94.60	-22.43	-50.41	1883.91	210746.38	3764.62	1442.66	68239.94	0.13	15
330.00	94.60	-12.15	-37.96	2062.60	238252.00	3764.62	1606.15	68239.94	0.14	14
340.00	94.60	-5.01	-29.43	2201.81	258519.44	3764.62	1734.29	68239.94	0.14	14
350.00	94.60	-0.80	-24.44	2294.01	270930.06	3764.62	1816.03	68239.94	0.14	14
360.00	94.60	0.60	-22.79	2325.45	275108.38	3764.62	1844.75	68239.94	0.15	14

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2837.42 , MINIMUM AREA FRACTION ACCEPTABLE = 0.257

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.38202

MAXIMUM ABSORPTANCE VALUE = C.36000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00350 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 30 , SOLAR ABSORPTANCE VALUE = 0.25500

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	14.49	-6.52	2701.24	318875.69	3764.62	2138.24	68239.94	0.16	14
10.00	94.60	13.01	-8.24	2657.94	314032.63	3764.62	2104.95	68239.94	0.16	14
20.00	94.60	8.54	-13.46	2527.87	299647.56	3764.62	2010.20	68239.94	0.15	14
30.00	94.60	0.95	-22.37	2336.41	276155.75	3764.62	1861.67	68239.94	0.15	14
40.00	94.60	-9.98	-35.35	2104.10	244274.25	3764.62	1672.18	68239.94	0.14	14
50.00	94.60	-24.66	-53.15	1847.84	204969.75	3764.62	1451.95	68239.94	0.13	15
60.00	94.60	-43.76	-77.05	1590.58	159439.38	3764.62	1216.36	68239.94	0.12	15
70.00	94.60	-68.50	-109.81	1336.00	109062.81	3764.62	983.33	68239.94	0.11	15
80.00	94.60	-101.38	-158.30	1079.33	55373.24	3764.62	760.55	68239.94	0.10	16
90.00	94.60	-148.86	-249.27	793.80	0.0	3764.62	560.81	68239.94	0.08	17
100.00	94.60	-101.64	-158.72	1077.68	55373.24	3764.62	389.24	68239.94	0.10	16
110.00	94.60	-68.89	-110.35	1332.44	109062.81	3764.62	250.95	68239.94	0.11	15
120.00	94.60	-44.24	-77.66	1585.92	159439.38	3764.62	148.52	68239.94	0.12	15
130.00	94.60	-25.20	-53.81	1839.66	204969.75	3764.62	76.82	68239.94	0.13	15
140.00	94.60	-10.57	-36.06	2089.89	244274.25	3764.62	33.29	68239.94	0.14	14
150.00	94.60	0.34	-23.10	2320.30	276155.75	3764.62	10.24	68239.94	0.15	14
160.00	94.60	7.91	-14.20	2510.00	299647.56	3764.62	0.0	68239.94	0.15	14
170.00	94.60	12.37	-9.00	2634.94	314032.63	3764.62	0.0	68239.94	0.16	14
172.93	94.60	12.80	-8.49	2649.03	315450.25	3764.62	0.0	68239.94	0.16	14
180.00	94.60	-149.46	-250.71	790.50	0.0	3764.62	0.0	68239.94	0.08	17
187.07	94.60	12.80	-8.49	2649.03	315450.25	3764.62	0.0	68239.94	0.16	14
190.00	94.60	12.37	-9.00	2634.94	314032.63	3764.62	0.0	68239.94	0.16	14
200.00	94.60	7.91	-14.20	2510.00	299647.56	3764.62	0.0	68239.94	0.15	14
210.00	94.60	0.34	-23.10	2320.30	276155.75	3764.62	10.24	68239.94	0.15	14
220.00	94.60	-10.57	-36.06	2089.89	244274.25	3764.62	33.29	68239.94	0.14	14
230.00	94.60	-25.20	-53.81	1839.66	204969.75	3764.62	76.82	68239.94	0.13	15
240.00	94.60	-44.24	-77.66	1585.92	159439.38	3764.62	148.52	68239.94	0.12	15
250.00	94.60	-68.89	-110.35	1332.44	109062.81	3764.62	250.95	68239.94	0.11	15
260.00	94.60	-101.64	-158.72	1077.68	55373.24	3764.62	389.24	68239.94	0.10	16
270.00	94.60	-148.86	-249.27	793.80	0.0	3764.62	560.81	68239.94	0.08	17
280.00	94.60	-101.38	-158.30	1079.33	55373.24	3764.62	760.55	68239.94	0.10	16
290.00	94.60	-68.50	-109.81	1336.00	109062.81	3764.62	983.33	68239.94	0.11	15
300.00	94.60	-43.76	-77.05	1590.58	159439.38	3764.62	1216.36	68239.94	0.12	15
310.00	94.60	-24.66	-53.15	1847.84	204969.75	3764.62	1451.95	68239.94	0.13	15
320.00	94.60	-9.98	-35.35	2104.10	244274.25	3764.62	1672.18	68239.94	0.14	14
330.00	94.60	0.95	-22.37	2336.41	276155.75	3764.62	1861.67	68239.94	0.15	14
340.00	94.60	8.54	-13.46	2527.87	299647.56	3764.62	2010.20	68239.94	0.15	14
350.00	94.60	13.01	-8.24	2657.94	314032.63	3764.62	2104.95	68239.94	0.16	14
360.00	94.60	14.49	-6.52	2701.24	318875.69	3764.62	2138.24	68239.94	0.16	14

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 9.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2837.42 , MINIMUM AREA FRACTION ACCEPTABLE = 0.257

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.38202

MAXIMUM ABSORPTANCE VALUE = 0.36000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00350 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 40 , SOLAR ABSORPTANCE VALUE = 0.29000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	27.25	8.26	3163.38	362642.88	3764.62	2431.72	68239.94	0.18	14
10.00	94.60	25.70	6.47	3098.71	357135.13	3764.62	2393.86	68239.94	0.18	14
20.00	94.60	21.00	1.03	2917.72	340775.63	3764.62	2286.11	68239.94	0.17	14
30.00	94.60	13.02	-8.22	2658.15	314059.44	3764.62	2117.20	68239.94	0.16	14
40.00	94.60	1.50	-21.72	2347.61	277802.06	3764.62	1901.69	68239.94	0.15	14
50.00	94.60	-14.00	-40.18	2025.49	233102.88	3764.62	1651.24	68239.94	0.13	15
60.00	94.60	-34.24	-65.00	1711.83	181323.25	3764.62	1383.31	68239.94	0.12	15
70.00	94.60	-60.63	-99.11	1410.21	124032.19	3764.62	1118.30	68239.94	0.11	15
80.00	94.60	-96.11	-150.01	1115.94	62973.49	3764.62	864.93	68239.94	0.10	16
90.00	94.60	-148.77	-249.08	794.27	0.0	3764.62	637.78	68239.94	0.08	17
100.00	94.60	-96.39	-150.45	1113.93	62973.49	3764.62	442.66	68239.94	0.10	16
110.00	94.60	-61.05	-99.69	1405.07	124032.19	3764.62	285.40	68239.94	0.11	15
120.00	94.60	-34.75	-65.64	1704.64	181323.25	3764.62	168.91	68239.94	0.12	15
130.00	94.60	-14.57	-40.87	2015.89	233102.88	3764.62	87.37	68239.94	0.13	15
140.00	94.60	0.89	-22.44	2335.26	277802.06	3764.62	37.86	68239.94	0.15	14
150.00	94.60	12.38	-8.98	2635.27	314059.44	3764.62	11.65	68239.94	0.16	14
160.00	94.60	20.34	0.27	2896.09	340775.63	3764.62	0.0	68239.94	0.17	14
170.00	94.60	25.02	5.69	3071.60	357135.13	3764.62	0.0	68239.94	0.17	14
172.93	94.60	25.48	6.21	3088.64	358747.38	3764.62	0.0	68239.94	0.18	14
180.00	94.60	-149.46	-250.71	790.50	0.0	3764.62	0.0	68239.94	0.08	17
187.07	94.60	25.48	6.21	3088.64	358747.38	3764.62	0.0	68239.94	0.18	14
190.00	94.60	25.02	5.69	3071.60	357135.13	3764.62	0.0	68239.94	0.17	14
200.00	94.60	20.34	0.27	2896.09	340775.63	3764.62	0.0	68239.94	0.17	14
210.00	94.60	12.38	-8.98	2635.27	314059.44	3764.62	11.65	68239.94	0.16	14
220.00	94.60	0.89	-22.44	2335.26	277807.06	3764.62	37.86	68239.94	0.15	14
230.00	94.60	-14.57	-40.87	2015.89	233102.88	3764.62	87.37	68239.94	0.13	15
240.00	94.60	-34.75	-65.64	1704.64	181323.25	3764.62	168.91	68239.94	0.12	15
250.00	94.60	-61.05	-99.69	1405.07	124032.19	3764.62	285.40	68239.94	0.11	15
260.00	94.60	-96.39	-150.45	1113.93	62973.49	3764.62	442.66	68239.94	0.10	16
270.00	94.60	-148.77	-249.08	794.27	0.0	3764.62	637.78	68239.94	0.08	17
280.00	94.60	-96.11	-150.01	1115.94	62973.49	3764.62	864.93	68239.94	0.10	16
290.00	94.60	-60.63	-99.11	1410.21	124032.19	3764.62	1118.30	68239.94	0.11	15
300.00	94.60	-34.24	-65.00	1711.83	181323.25	3764.62	1383.31	68239.94	0.12	15
310.00	94.60	-14.00	-40.18	2025.49	233102.88	3764.62	1651.24	68239.94	0.13	15
320.00	94.60	1.50	-21.72	2347.61	277802.06	3764.62	1901.69	68239.94	0.15	14
330.00	94.60	13.02	-8.22	2658.15	314059.44	3764.62	2117.20	68239.94	0.16	14
340.00	94.60	21.00	1.03	2917.72	340775.63	3764.62	2286.11	68239.94	0.17	14
350.00	94.60	25.70	6.47	3098.71	357135.13	3764.62	2393.86	68239.94	0.18	14
360.00	94.60	27.25	8.26	3163.38	362642.88	3764.62	2431.72	68239.94	0.18	14

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2837.42 , MINIMUM AREA FRACTION ACCEPTABLE = 0.257

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.38202

MAXIMUM ABSORPTANCE VALUE = 0.36000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00350 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 50 , SOLAR ABSORPTANCE VALUE = 0.32500

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	39.08	21.92	3760.25	406410.06	3764.62	2725.20	68239.94	0.20	13
10.00	94.60	37.47	20.05	3664.81	400237.63	3764.62	2682.77	68239.94	0.20	13
20.00	94.60	32.56	14.39	3404.71	381903.69	3764.62	2562.02	68239.94	0.19	14
30.00	94.60	24.23	4.78	3041.37	351963.13	3764.62	2372.72	68239.94	0.17	14
40.00	94.60	12.19	-9.20	2630.85	311329.88	3764.62	2131.21	68239.94	0.16	14
50.00	94.60	-4.04	-28.28	2223.67	261235.94	3764.62	1850.53	68239.94	0.14	14
60.00	94.60	-25.32	-53.95	1837.91	203207.06	3764.62	1550.26	68239.94	0.13	15
70.00	94.60	-53.19	-89.26	1485.79	139001.63	3764.62	1253.27	68239.94	0.11	15
80.00	94.60	-91.06	-142.28	1152.43	70573.69	3764.62	969.32	68239.94	0.10	16
90.00	94.60	-148.69	-248.88	794.68	0.0	3764.62	714.75	68239.94	0.08	17
100.00	94.60	-91.36	-142.74	1150.35	70573.69	3764.62	496.08	68239.94	0.10	16
110.00	94.60	-53.64	-89.85	1480.27	139001.63	3764.62	319.84	68239.94	0.11	15
120.00	94.60	-25.85	-54.61	1829.91	203207.06	3764.62	189.30	68239.94	0.13	15
130.00	94.60	-4.64	-29.00	2208.66	261235.94	3764.62	97.91	68239.94	0.14	14
140.00	94.60	11.55	-9.94	2611.95	311329.88	3764.62	42.43	68239.94	0.16	14
150.00	94.60	23.56	4.00	3014.87	351963.13	3764.62	13.05	68239.94	0.17	14
160.00	94.60	31.87	13.59	3370.95	381903.69	3764.62	0.0	68239.94	0.19	14
170.00	94.60	36.76	19.24	3625.25	400237.63	3764.62	0.0	68239.94	0.19	13
172.93	94.60	37.24	19.78	3649.67	402044.44	3764.62	0.0	68239.94	0.20	13
180.00	94.60	-149.46	-250.71	790.50	0.0	3764.62	0.0	68239.94	0.08	17
187.07	94.60	37.24	19.78	3649.67	402044.44	3764.62	0.0	68239.94	0.20	13
190.00	94.60	36.76	19.24	3625.25	400237.63	3764.62	0.0	68239.94	0.19	13
200.00	94.60	31.87	13.59	3370.95	381903.69	3764.62	0.0	68239.94	0.19	14
210.00	94.60	23.56	4.00	3014.87	351963.13	3764.62	13.05	68239.94	0.17	14
220.00	94.60	11.55	-9.94	2611.95	311329.88	3764.62	42.43	68239.94	0.16	14
230.00	94.60	-4.64	-29.00	2208.66	261235.94	3764.62	97.91	68239.94	0.14	14
240.00	94.60	-25.85	-54.61	1829.91	203207.06	3764.62	189.30	68239.94	0.13	15
250.00	94.60	-53.64	-89.85	1480.27	139001.63	3764.62	319.84	68239.94	0.11	15
260.00	94.60	-91.36	-142.74	1150.35	70573.69	3764.62	496.08	68239.94	0.10	16
270.00	94.60	-148.69	-248.88	794.68	0.0	3764.62	714.75	68239.94	0.08	17
280.00	94.60	-91.06	-142.28	1152.43	70573.69	3764.62	969.32	68239.94	0.10	16
290.00	94.60	-53.19	-89.26	1485.79	139001.63	3764.62	1253.27	68239.94	0.11	15
300.00	94.60	-25.32	-53.95	1837.91	203207.06	3764.62	1550.26	68239.94	0.13	15
310.00	94.60	-4.04	-28.28	2223.67	261235.94	3764.62	1850.53	68239.94	0.14	14
320.00	94.60	12.19	-9.20	2630.85	311329.88	3764.62	2131.21	68239.94	0.16	14
330.00	94.60	24.23	4.78	3041.37	351963.13	3764.62	2372.72	68239.94	0.17	14
340.00	94.60	32.56	14.39	3404.71	381903.69	3764.62	2562.02	68239.94	0.19	14
350.00	94.60	37.47	20.05	3664.81	400237.63	3764.62	2682.77	68239.94	0.20	13
360.00	94.60	39.08	21.92	3760.25	406410.06	3764.62	2725.20	68239.94	0.20	13

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2037.42 , MINIMUM AREA FRACTION ACCEPTABLE = 0.257

COCLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.38202

MAXIMUM ABSORPTANCE VALUE = 0.36000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00350 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 60 , SOLAR ABSORPTANCE VALUE = 0.36000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	50.13	34.70	4560.39	450177.31	3764.62	3018.69	68239.94	0.23	13
10.00	94.60	48.45	32.74	4414.15	443340.13	3764.62	2971.69	68239.94	0.22	13
20.00	94.60	43.36	26.86	4033.96	423031.75	3764.62	2837.93	68239.94	0.21	13
30.00	94.60	34.71	16.87	3513.57	389866.88	3764.62	2628.24	68239.94	0.19	14
40.00	94.60	22.20	2.42	2961.77	344857.75	3764.62	2360.72	68239.94	0.17	14
50.00	94.60	5.30	-17.26	2441.81	289369.00	3764.62	2049.81	68239.94	0.15	14
60.00	94.60	-16.91	-43.70	1975.39	225090.88	3764.62	1717.22	68239.94	0.13	15
70.00	94.60	-46.15	-80.11	1562.50	153971.00	3764.62	1388.23	68239.94	0.12	15
80.00	94.60	-86.21	-135.04	1188.75	78173.94	3764.62	1073.71	68239.94	0.10	16
90.00	94.60	-148.61	-248.69	795.15	0.0	3764.62	791.73	68239.94	0.08	17
100.00	94.60	-86.54	-135.52	1186.19	78173.94	3764.62	549.51	68239.94	0.10	16
110.00	94.60	-46.62	-80.71	1557.91	153971.00	3764.62	354.29	68239.94	0.12	15
120.00	94.60	-17.47	-44.38	1964.29	225090.88	3764.62	209.68	68239.94	0.13	15
130.00	94.60	4.67	-18.00	2424.77	289369.00	3764.62	108.46	68239.94	0.15	14
140.00	94.60	21.53	1.66	2939.56	344857.75	3764.62	47.00	68239.94	0.17	14
150.00	94.60	34.02	16.07	3478.87	389866.88	3764.62	14.46	68239.94	0.19	14
160.00	94.60	42.65	26.03	3983.94	423031.75	3764.62	0.0	68239.94	0.21	13
170.00	94.60	47.72	31.90	4353.75	443340.13	3764.62	0.0	68239.94	0.22	13
172.93	94.60	48.21	32.47	4396.23	445341.50	3764.62	0.0	68239.94	0.22	13
180.00	94.60	-149.46	-250.71	790.50	0.0	3764.62	0.0	68239.94	0.08	17
187.07	94.60	48.21	32.47	4396.23	445341.50	3764.62	0.0	68239.94	0.22	13
190.00	94.60	47.72	31.90	4353.75	443340.13	3764.62	0.0	68239.94	0.22	13
200.00	94.60	42.65	26.03	3983.94	423031.75	3764.62	0.0	68239.94	0.21	13
210.00	94.60	34.02	16.07	3478.87	389866.88	3764.62	14.46	68239.94	0.19	14
220.00	94.60	21.53	1.66	2939.56	344857.75	3764.62	47.00	68239.94	0.17	14
230.00	94.60	4.67	-18.00	2424.77	289369.00	3764.62	108.46	68239.94	0.15	14
240.00	94.60	-17.47	-44.38	1964.29	225090.88	3764.62	209.68	68239.94	0.13	15
250.00	94.60	-46.62	-80.71	1557.91	153971.00	3764.62	354.29	68239.94	0.12	15
260.00	94.60	-86.54	-135.52	1186.19	78173.94	3764.62	549.51	68239.94	0.10	16
270.00	94.60	-148.61	-248.69	795.15	0.0	3764.62	791.73	68239.94	0.08	17
280.00	94.60	-86.21	-135.04	1188.75	78173.94	3764.62	1073.71	68239.94	0.10	16
290.00	94.60	-46.15	-80.11	1562.50	153971.00	3764.62	1388.23	68239.94	0.12	15
300.00	94.60	-16.91	-43.70	1975.39	225090.88	3764.62	1717.22	68239.94	0.13	15
310.00	94.60	5.30	-17.26	2441.81	289369.00	3764.62	2049.81	68239.94	0.15	14
320.00	94.60	22.20	2.42	2961.77	344857.75	3764.62	2360.72	68239.94	0.17	14
330.00	94.60	34.71	16.87	3513.57	389866.88	3764.62	2628.24	68239.94	0.19	14
340.00	94.60	43.36	26.86	4033.96	423031.75	3764.62	2837.93	68239.94	0.21	13
350.00	94.60	48.45	32.74	4414.15	443340.13	3764.62	2971.69	68239.94	0.22	13
360.00	94.60	50.13	34.70	4560.39	450177.31	3764.62	3018.69	68239.94	0.23	13

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2460.20 , MINIMUM AREA FRACTION ACCEPTABLE = 0.487

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.55241

MAXIMUM ABSORPTANCE VALUE = 0.37000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 0 , SOLAR ABSORPTANCE VALUE = 0.07000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	-70.54	-165.55	1049.24	2113.44	91.23	15.04	68240.00	0.18	17
10.00	94.60	-67.02	-158.81	1077.20	4698.47	91.23	14.84	68240.00	0.18	16
20.00	94.60	-61.98	-149.40	1118.69	8523.83	91.23	14.16	68240.00	0.19	16
30.00	94.60	-57.22	-140.77	1159.76	12265.39	91.23	13.10	68240.00	0.19	16
40.00	94.60	-53.04	-133.34	1197.56	15667.92	91.23	11.93	68240.00	0.19	16
50.00	94.60	-49.52	-127.20	1230.67	18623.22	91.23	10.48	68240.00	0.20	16
60.00	94.60	-46.71	-122.38	1258.04	21030.75	91.23	9.02	68240.00	0.20	16
70.00	94.60	-44.68	-118.93	1278.40	22804.39	91.23	7.66	68240.00	0.20	16
80.00	94.60	-43.45	-116.85	1290.95	23890.82	91.23	6.21	68240.00	0.20	16
90.00	94.60	-43.04	-116.16	1295.16	24256.52	91.23	4.85	68240.00	0.20	16
100.00	94.60	-43.45	-116.86	1290.90	23890.82	91.23	3.59	68240.00	0.20	16
110.00	94.60	-44.68	-118.94	1278.29	22804.39	91.23	2.43	68240.00	0.20	16
120.00	94.60	-46.72	-122.39	1257.97	21030.75	91.23	1.55	68240.00	0.20	16
130.00	94.60	-49.53	-127.22	1230.55	18623.22	91.23	0.87	68240.00	0.20	16
140.00	94.60	-53.06	-133.37	1197.36	15667.92	91.23	0.39	68240.00	0.19	16
150.00	94.60	-57.24	-140.79	1159.67	12265.39	91.23	0.10	68240.00	0.19	16
160.00	94.60	-61.99	-149.43	1118.56	8523.83	91.23	0.0	68240.00	0.19	16
170.00	94.60	-67.04	-158.85	1076.98	4698.47	91.23	0.0	68240.00	0.18	16
172.93	94.60	-69.06	-160.78	1068.89	3941.77	91.23	0.0	68240.00	0.18	16
180.00	94.60	-73.51	-171.35	1026.38	0.0	91.23	0.0	68240.00	0.18	17
187.07	94.60	-68.06	-160.78	1068.89	3941.77	91.23	0.0	68240.00	0.18	16
190.00	94.60	-67.04	-158.85	1076.98	4698.47	91.23	0.0	68240.00	0.18	16
200.00	94.60	-61.99	-149.43	1118.56	8523.83	91.23	0.0	68240.00	0.19	16
210.00	94.60	-57.24	-140.79	1159.67	12265.39	91.23	0.10	68240.00	0.19	16
220.00	94.60	-53.06	-133.37	1197.36	15667.92	91.23	0.39	68240.00	0.19	16
230.00	94.60	-49.53	-127.22	1230.55	18623.22	91.23	0.87	68240.00	0.20	16
240.00	94.60	-46.72	-122.39	1257.97	21030.75	91.23	1.55	68240.00	0.20	16
250.00	94.60	-44.68	-118.94	1278.29	22804.39	91.23	2.43	68240.00	0.20	16
260.00	94.60	-43.45	-116.86	1290.90	23890.82	91.23	3.59	68240.00	0.20	16
270.00	94.60	-43.04	-116.16	1295.16	24256.52	91.23	4.85	68240.00	0.20	16
280.00	94.60	-43.45	-116.85	1290.95	23890.82	91.23	6.21	68240.00	0.20	16
290.00	94.60	-44.68	-118.93	1278.40	22804.39	91.23	7.66	68240.00	0.20	16
300.00	94.60	-46.71	-122.38	1258.04	21030.75	91.23	9.02	68240.00	0.20	16
310.00	94.60	-49.52	-127.20	1230.67	18623.22	91.23	10.48	68240.00	0.20	16
320.00	94.60	-53.04	-133.34	1197.56	15667.92	91.23	11.93	68240.00	0.19	16
330.00	94.60	-57.22	-140.77	1159.76	12265.39	91.23	13.10	68240.00	0.19	16
340.00	94.60	-61.98	-149.40	1118.69	8523.83	91.23	14.16	68240.00	0.19	16
350.00	94.60	-67.02	-158.81	1077.20	4698.47	91.23	14.84	68240.00	0.18	16
360.00	94.60	-70.54	-165.55	1049.24	2113.44	91.23	15.04	68240.00	0.18	17

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2460.20 , MINIMUM AREA FRACTION ACCEPTABLE = 0.487

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.55241

MAXIMUM ABSORPTANCE VALUE = 0.37000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 10 , SOLAR ABSORPTANCE VALUE = 0.12000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	-68.46	-161.55	1065.64	3623.03	91.23	25.78	68240.00	0.18	16
10.00	94.60	-62.57	-150.49	1113.74	8054.52	91.23	25.44	68240.00	0.18	16
20.00	94.60	-54.31	-135.58	1185.94	14612.28	91.23	24.28	68240.00	0.19	16
30.00	94.60	-46.70	-122.36	1258.13	21026.38	91.23	22.45	68240.00	0.20	16
40.00	94.60	-40.12	-111.30	1325.75	26859.28	91.23	20.45	68240.00	0.20	16
50.00	94.60	-34.65	-102.32	1386.31	31925.51	91.23	17.96	68240.00	0.21	15
60.00	94.60	-30.34	-95.40	1436.70	36052.69	91.23	15.47	68240.00	0.21	15
70.00	94.60	-27.26	-90.47	1475.03	39093.22	91.23	13.14	68240.00	0.22	15
80.00	94.60	-25.40	-87.54	1498.73	40955.64	91.23	10.64	68240.00	0.22	15
90.00	94.60	-24.78	-86.57	1506.84	41582.55	91.23	8.31	68240.00	0.22	15
100.00	94.60	-25.40	-87.55	1498.66	40955.64	91.23	6.15	68240.00	0.22	15
110.00	94.60	-27.26	-90.49	1474.87	39093.22	91.23	4.16	68240.00	0.22	15
120.00	94.60	-30.36	-95.41	1436.73	36052.69	91.23	2.66	68240.00	0.21	15
130.00	94.60	-34.67	-102.35	1386.00	31925.51	91.23	1.50	68240.00	0.21	15
140.00	94.60	-40.14	-111.34	1325.47	26859.28	91.23	0.67	68240.00	0.20	16
150.00	94.60	-46.72	-122.40	1257.95	21026.38	91.23	0.17	68240.00	0.20	16
160.00	94.60	-54.34	-135.64	1185.58	14612.28	91.23	0.0	68240.00	0.19	16
170.00	94.60	-62.60	-150.56	1113.45	8054.52	91.23	0.0	68240.00	0.18	16
172.93	94.60	-64.30	-153.71	1099.30	6757.32	91.23	0.0	68240.00	0.18	16
180.00	94.60	-73.51	-171.35	1026.38	0.0	91.23	0.0	68240.00	0.18	17
187.07	94.60	-64.30	-153.71	1099.30	6757.32	91.23	0.0	68240.00	0.18	16
190.00	94.60	-62.60	-150.56	1113.45	8054.52	91.23	0.0	68240.00	0.18	16
200.00	94.60	-54.34	-135.64	1185.58	14612.28	91.23	0.0	68240.00	0.19	16
210.00	94.60	-46.72	-122.40	1257.95	21026.38	91.23	0.17	68240.00	0.20	16
220.00	94.60	-40.14	-111.34	1325.47	26859.28	91.23	0.67	68240.00	0.20	16
230.00	94.60	-34.67	-102.35	1386.00	31925.51	91.23	1.50	68240.00	0.21	15
240.00	94.60	-30.36	-95.41	1436.73	36052.69	91.23	2.66	68240.00	0.21	15
250.00	94.60	-27.26	-90.49	1474.87	39093.22	91.23	4.16	68240.00	0.22	15
260.00	94.60	-25.40	-87.55	1498.66	40955.64	91.23	6.15	68240.00	0.22	15
270.00	94.60	-24.78	-86.57	1506.84	41582.55	91.23	8.31	68240.00	0.22	15
280.00	94.60	-25.40	-87.54	1498.73	40955.64	91.23	10.64	68240.00	0.22	15
290.00	94.60	-27.26	-90.47	1475.03	39093.22	91.23	13.14	68240.00	0.22	15
300.00	94.60	-30.34	-95.40	1436.70	36052.69	91.23	15.47	68240.00	0.21	15
310.00	94.60	-34.65	-102.32	1386.31	31925.51	91.23	17.96	68240.00	0.21	15
320.00	94.60	-40.12	-111.30	1325.75	26859.28	91.23	20.45	68240.00	0.20	16
330.00	94.60	-46.70	-122.36	1258.13	21026.38	91.23	22.45	68240.00	0.20	16
340.00	94.60	-54.31	-135.58	1185.94	14612.28	91.23	24.28	68240.00	0.19	16
350.00	94.60	-62.57	-150.49	1113.74	8054.52	91.23	25.44	68240.00	0.18	16
360.00	94.60	-68.46	-161.55	1065.64	3623.03	91.23	25.78	68240.00	0.18	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2460.20 , MINIMUM AREA FRACTION ACCEPTABLE = 0.487

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.55241

MAXIMUM ABSORPTANCE VALUE = 0.37000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 20 , SOLAR ABSORPTANCE VALUE = 0.17000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	-66.41	-157.66	1082.11	5132.63	91.23	36.52	68240.00	0.18	16
10.00	94.60	-58.27	-142.64	1150.57	11410.57	91.23	36.04	68240.00	0.19	16
20.00	94.60	-47.06	-122.98	1254.61	20700.73	91.23	34.40	68240.00	0.20	16
30.00	94.60	-36.92	-106.02	1360.60	29787.38	91.23	31.80	68240.00	0.21	16
40.00	94.60	-28.29	-92.12	1462.04	38050.64	91.23	28.98	68240.00	0.22	15
50.00	94.60	-21.20	-81.00	1554.56	45227.80	91.23	25.44	68240.00	0.22	15
60.00	94.60	-15.67	-72.48	1633.90	51074.64	91.23	21.91	68240.00	0.23	15
70.00	94.60	-11.72	-66.49	1694.51	55382.04	91.23	18.61	68240.00	0.23	15
80.00	94.60	-9.35	-62.92	1732.97	58020.52	91.23	15.08	68240.00	0.23	15
90.00	94.60	-8.57	-61.74	1746.12	58908.63	91.23	11.78	68240.00	0.24	15
100.00	94.60	-9.36	-62.93	1732.87	58020.52	91.23	8.72	68240.00	0.23	15
110.00	94.60	-11.73	-66.51	1694.32	55382.04	91.23	5.89	68240.00	0.23	15
120.00	94.60	-15.68	-72.50	1633.60	51074.64	91.23	3.77	68240.00	0.23	15
130.00	94.60	-21.22	-81.03	1554.17	45227.80	91.23	2.12	68240.00	0.22	15
140.00	94.60	-28.32	-92.17	1461.56	38050.64	91.23	0.94	68240.00	0.22	15
150.00	94.60	-36.95	-106.08	1360.24	29787.38	91.23	0.24	68240.00	0.21	16
160.00	94.60	-47.10	-123.05	1254.17	20700.73	91.23	0.0	68240.00	0.20	16
170.00	94.60	-58.31	-142.72	1150.25	11410.57	91.23	0.0	68240.00	0.19	16
172.93	94.60	-60.64	-146.96	1130.00	9572.87	91.23	0.0	68240.00	0.19	16
180.00	94.60	-73.51	-171.35	1026.38	0.0	91.23	0.0	68240.00	0.18	17
187.07	94.60	-60.64	-146.96	1130.00	9572.87	91.23	0.0	68240.00	0.19	16
190.00	94.60	-58.31	-142.72	1150.25	11410.57	91.23	0.0	68240.00	0.19	16
200.00	94.60	-47.10	-123.05	1254.17	20700.73	91.23	0.0	68240.00	0.20	16
210.00	94.60	-36.95	-106.08	1360.24	29787.38	91.23	0.24	68240.00	0.21	16
220.00	94.60	-28.32	-92.17	1461.56	38050.64	91.23	0.94	68240.00	0.22	15
230.00	94.60	-21.22	-81.03	1554.17	45227.80	91.23	2.12	68240.00	0.22	15
240.00	94.60	-15.68	-72.50	1633.60	51074.64	91.23	3.77	68240.00	0.23	15
250.00	94.60	-11.73	-66.51	1694.32	55382.04	91.23	5.89	68240.00	0.23	15
260.00	94.60	-9.36	-62.93	1732.87	58020.52	91.23	8.72	68240.00	0.23	15
270.00	94.60	-8.57	-61.74	1746.12	58908.63	91.23	11.78	68240.00	0.24	15
280.00	94.60	-9.35	-62.92	1732.97	58020.52	91.23	15.08	68240.00	0.23	15
290.00	94.60	-11.72	-66.49	1694.51	55382.04	91.23	18.61	68240.00	0.23	15
300.00	94.60	-15.67	-72.48	1633.90	51074.64	91.23	21.91	68240.00	0.23	15
310.00	94.60	-21.20	-81.00	1554.56	45227.80	91.23	25.44	68240.00	0.22	15
320.00	94.60	-28.29	-92.12	1462.04	38050.64	91.23	28.98	68240.00	0.22	15
330.00	94.60	-36.92	-106.02	1360.60	29787.38	91.23	31.80	68240.00	0.21	16
340.00	94.60	-47.06	-122.98	1254.61	20700.73	91.23	34.40	68240.00	0.20	16
350.00	94.60	-58.27	-142.64	1150.57	11410.57	91.23	36.04	68240.00	0.19	16
360.00	94.60	-66.41	-157.66	1082.11	5132.63	91.23	36.52	68240.00	0.18	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2460.20 , MINIMUM AREA FRACTION ACCEPTABLE = 0.487

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.55241

MAXIMUM ABSORPTANCE VALUE = 0.37000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 30 , SOLAR ABSORPTANCE VALUE = 0.22000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	-64.39	-153.87	1098.61	6642.22	91.23	47.26	68240.00	0.18	16
10.00	94.60	-54.10	-135.19	1187.91	14766.62	91.23	46.65	68240.00	0.19	16
20.00	94.60	-40.17	-111.39	1325.19	26789.18	91.23	44.51	68240.00	0.20	16
30.00	94.60	-27.78	-91.30	1468.49	38548.37	91.23	41.16	68240.00	0.22	15
40.00	94.60	-17.36	-75.07	1608.88	49241.99	91.23	37.50	68240.00	0.23	15
50.00	94.60	-8.88	-62.21	1740.87	58530.08	91.23	32.93	68240.00	0.24	15
60.00	94.60	-2.31	-52.43	1856.63	66096.56	91.23	28.35	68240.00	0.24	15
70.00	94.60	2.35	-45.57	1947.44	71670.88	91.23	24.08	68240.00	0.25	15
80.00	94.60	5.14	-41.50	2005.58	75085.38	91.23	19.51	68240.00	0.25	15
90.00	94.60	6.06	-40.15	2025.73	76234.69	91.23	15.24	68240.00	0.25	15
100.00	94.60	5.13	-41.51	2005.45	75085.38	91.23	11.28	68240.00	0.25	15
110.00	94.60	2.34	-45.59	1947.19	71670.88	91.23	7.62	68240.00	0.25	15
120.00	94.60	-2.33	-52.46	1856.27	66096.56	91.23	4.88	68240.00	0.24	15
130.00	94.60	-8.91	-62.25	1740.40	58530.08	91.23	2.74	68240.00	0.24	15
140.00	94.60	-17.40	-75.13	1608.31	49241.99	91.23	1.22	68240.00	0.23	15
150.00	94.60	-27.82	-91.37	1467.80	38548.37	91.23	0.30	68240.00	0.22	15
160.00	94.60	-40.22	-111.47	1324.65	26789.18	91.23	0.0	68240.00	0.20	16
170.00	94.60	-54.15	-135.30	1187.38	14766.62	91.23	0.0	68240.00	0.19	16
172.93	94.60	-57.09	-140.52	1161.01	12388.42	91.23	0.0	68240.00	0.19	16
180.00	94.60	-73.51	-171.35	1026.38	0.0	91.23	0.0	68240.00	0.18	17
187.07	94.60	-57.09	-140.52	1161.01	12388.42	91.23	0.0	68240.00	0.19	16
190.00	94.60	-54.15	-135.30	1187.38	14766.62	91.23	0.0	68240.00	0.19	16
200.00	94.60	-40.22	-111.47	1324.65	26789.18	91.23	0.0	68240.00	0.20	16
210.00	94.60	-27.82	-91.37	1467.80	38548.37	91.23	0.30	68240.00	0.22	15
220.00	94.60	-17.40	-75.13	1608.31	49241.99	91.23	1.22	68240.00	0.23	15
230.00	94.60	-8.91	-62.25	1740.40	58530.08	91.23	2.74	68240.00	0.24	15
240.00	94.60	-2.33	-52.46	1856.27	66096.56	91.23	4.88	68240.00	0.24	15
250.00	94.60	2.34	-45.59	1947.19	71670.88	91.23	7.62	68240.00	0.25	15
260.00	94.60	5.13	-41.51	2005.45	75085.38	91.23	11.28	68240.00	0.25	15
270.00	94.60	6.06	-40.15	2025.73	76234.69	91.23	15.24	68240.00	0.25	15
280.00	94.60	5.14	-41.50	2005.58	75085.38	91.23	19.51	68240.00	0.25	15
290.00	94.60	2.35	-45.57	1947.44	71670.88	91.23	24.08	68240.00	0.25	15
300.00	94.60	-2.31	-52.43	1856.63	66096.56	91.23	28.35	68240.00	0.24	15
310.00	94.60	-8.88	-62.21	1740.87	58530.08	91.23	32.93	68240.00	0.24	15
320.00	94.60	-17.36	-75.07	1608.88	49241.99	91.23	37.50	68240.00	0.23	15
330.00	94.60	-27.78	-91.30	1468.49	38548.37	91.23	41.16	68240.00	0.22	15
340.00	94.60	-40.17	-111.39	1325.19	26789.18	91.23	44.51	68240.00	0.20	16
350.00	94.60	-54.10	-135.19	1187.91	14766.62	91.23	46.65	68240.00	0.19	16
360.00	94.60	-64.39	-153.87	1098.61	6642.22	91.23	47.26	68240.00	0.18	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2460.20 , MINIMUM AREA FRACTION ACCEPTABLE = 0.487

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.55241

MAXIMUM ABSORPTANCE VALUE = 0.37000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 40 , SOLAR ABSORPTANCE VALUE = 0.27000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	-62.40	-150.18	1115.19	8151.82	91.23	57.99	68240.00	0.18	16
10.00	94.60	-50.05	-128.12	1225.61	18122.66	91.23	57.25	68240.00	0.20	16
20.00	94.60	-33.61	-100.63	1398.30	32877.62	91.23	54.63	68240.00	0.21	15
30.00	94.60	-19.18	-77.87	1582.74	47309.34	91.23	50.51	68240.00	0.22	15
40.00	94.60	-7.19	-59.68	1769.39	60433.34	91.23	46.02	68240.00	0.24	15
50.00	94.60	2.50	-45.35	1950.52	71832.38	91.23	40.41	68240.00	0.25	15
60.00	94.60	9.96	-34.50	2114.40	81118.50	91.23	34.80	68240.00	0.26	15
70.00	94.60	15.24	-26.89	2246.83	87959.69	91.23	29.56	68240.00	0.27	15
80.00	94.60	18.39	-22.37	2334.14	92150.19	91.23	23.95	68240.00	0.27	14
90.00	94.60	19.43	-20.88	2363.94	93560.75	91.23	18.71	68240.00	0.27	14
100.00	94.60	18.38	-22.39	2333.25	92150.19	91.23	13.84	68240.00	0.27	14
110.00	94.60	15.23	-26.91	2246.50	87959.69	91.23	9.35	68240.00	0.27	15
120.00	94.60	9.94	-34.53	2113.93	81118.50	91.23	5.99	68240.00	0.26	15
130.00	94.60	2.47	-45.40	1949.95	71832.38	91.23	3.37	68240.00	0.25	15
140.00	94.60	-7.23	-59.74	1768.69	60433.34	91.23	1.50	68240.00	0.24	15
150.00	94.60	-19.23	-77.94	1582.22	47309.34	91.23	0.37	68240.00	0.22	15
160.00	94.60	-33.66	-100.73	1397.56	32877.62	91.23	0.0	68240.00	0.21	15
170.00	94.60	-50.12	-128.24	1224.98	18122.66	91.23	0.0	68240.00	0.20	16
172.93	94.60	-53.62	-134.36	1192.23	15203.97	91.23	0.0	68240.00	0.19	16
180.00	94.60	-73.51	-171.35	1026.38	0.0	91.23	0.0	68240.00	0.18	17
187.07	94.60	-53.62	-134.36	1192.23	15203.97	91.23	0.0	68240.00	0.19	16
190.00	94.60	-50.12	-128.24	1224.98	18122.66	91.23	0.0	68240.00	0.20	16
200.00	94.60	-33.66	-100.73	1397.56	32877.62	91.23	0.0	68240.00	0.21	15
210.00	94.60	-19.23	-77.94	1582.22	47309.34	91.23	0.37	68240.00	0.22	15
220.00	94.60	-7.23	-59.74	1768.69	60433.34	91.23	1.50	68240.00	0.24	15
230.00	94.60	2.47	-45.40	1949.95	71832.38	91.23	3.37	68240.00	0.25	15
240.00	94.60	9.94	-34.53	2113.93	81118.50	91.23	5.99	68240.00	0.26	15
250.00	94.60	15.23	-26.91	2246.50	87959.69	91.23	9.35	68240.00	0.27	15
260.00	94.60	18.38	-22.39	2333.25	92150.19	91.23	13.84	68240.00	0.27	14
270.00	94.60	19.43	-20.88	2363.94	93560.75	91.23	18.71	68240.00	0.27	14
280.00	94.60	18.39	-22.37	2334.14	92150.19	91.23	23.95	68240.00	0.27	14
290.00	94.60	15.24	-26.89	2246.83	87959.69	91.23	29.56	68240.00	0.27	15
300.00	94.60	9.96	-34.50	2114.40	81118.50	91.23	34.80	68240.00	0.26	15
310.00	94.60	2.50	-45.35	1950.52	71832.38	91.23	40.41	68240.00	0.25	15
320.00	94.60	-7.19	-59.68	1769.39	60433.34	91.23	46.02	68240.00	0.24	15
330.00	94.60	-19.18	-77.87	1582.74	47309.34	91.23	50.51	68240.00	0.22	15
340.00	94.60	-33.61	-100.63	1398.30	32877.62	91.23	54.63	68240.00	0.21	15
350.00	94.60	-50.05	-128.12	1225.61	18122.66	91.23	57.25	68240.00	0.20	16
360.00	94.60	-62.40	-150.18	1115.19	8151.82	91.23	57.99	68240.00	0.18	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2460.20 , MINIMUM AREA FRACTION ACCEPTABLE = 0.487

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.55241

MAXIMUM ABSORPTANCE VALUE = C.37000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 50 , SOLAR ABSORPTANCE VALUE = 0.32000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	-60.44	-146.59	1131.76	9661.41	91.23	68.73	68240.00	0.19	16
10.00	94.60	-46.12	-121.38	1263.88	21478.71	91.23	67.85	68240.00	0.20	16
20.00	94.60	-27.33	-90.60	1473.99	38966.07	91.23	64.74	68240.00	0.22	15
30.00	94.60	-11.06	-65.49	1705.05	56070.33	91.23	59.87	68240.00	0.23	15
40.00	94.60	2.34	-45.59	1947.21	71624.69	91.23	54.54	68240.00	0.25	15
50.00	94.60	13.10	-29.98	2191.16	85134.63	91.23	47.89	68240.00	0.26	15
60.00	94.60	21.35	-18.14	2421.42	96140.44	91.23	41.24	68240.00	0.28	14
70.00	94.60	27.16	-9.85	2613.55	104248.56	91.23	35.03	68240.00	0.29	14
80.00	94.60	30.62	-4.92	2743.14	109215.06	91.23	28.38	68240.00	0.29	14
90.00	94.60	31.77	-3.30	2788.40	110886.88	91.23	22.17	68240.00	0.29	14
100.00	94.60	30.62	-4.95	2742.13	109215.06	91.23	16.41	68240.00	0.29	14
110.00	94.60	27.15	-9.87	2613.13	104248.56	91.23	11.09	68240.00	0.29	14
120.00	94.60	21.32	-18.17	2420.85	96140.44	91.23	7.10	68240.00	0.28	14
130.00	94.60	13.06	-30.02	2190.45	85134.63	91.23	3.99	68240.00	0.26	15
140.00	94.60	2.30	-45.65	1946.39	71624.69	91.23	1.77	68240.00	0.25	15
150.00	94.60	-11.11	-65.57	1704.42	56070.33	91.23	0.44	68240.00	0.23	15
160.00	94.60	-27.40	-90.70	1473.14	38966.07	91.23	0.0	68240.00	0.22	15
170.00	94.60	-46.20	-121.52	1263.05	21478.71	91.23	0.0	68240.00	0.20	16
172.93	94.60	-50.24	-128.46	1223.77	18019.52	91.23	0.0	68240.00	0.20	16
180.00	94.60	-73.51	-171.35	1026.38	0.0	91.23	0.0	68240.00	0.18	17
187.07	94.60	-50.24	-128.46	1223.77	18019.52	91.23	0.0	68240.00	0.20	16
190.00	94.60	-46.20	-121.52	1263.05	21478.71	91.23	0.0	68240.00	0.20	16
200.00	94.60	-27.40	-90.70	1473.14	38966.07	91.23	0.0	68240.00	0.22	15
210.00	94.60	-11.11	-65.57	1704.42	56070.33	91.23	0.44	68240.00	0.23	15
220.00	94.60	2.30	-45.65	1946.39	71624.69	91.23	1.77	68240.00	0.25	15
230.00	94.60	13.06	-30.02	2190.45	85134.63	91.23	3.99	68240.00	0.26	15
240.00	94.60	21.32	-18.17	2420.85	96140.44	91.23	7.10	68240.00	0.28	14
250.00	94.60	27.15	-9.87	2613.13	104248.56	91.23	11.09	68240.00	0.29	14
260.00	94.60	30.62	-4.95	2742.13	109215.06	91.23	16.41	68240.00	0.29	14
270.00	94.60	31.77	-3.30	2788.40	110886.88	91.23	22.17	68240.00	0.29	14
280.00	94.60	30.62	-4.92	2743.14	109215.06	91.23	28.38	68240.00	0.29	14
290.00	94.60	27.16	-9.85	2613.55	104248.56	91.23	35.03	68240.00	0.29	14
300.00	94.60	21.35	-18.14	2421.42	96140.44	91.23	41.24	68240.00	0.28	14
310.00	94.60	13.10	-29.98	2191.16	85134.63	91.23	47.89	68240.00	0.26	15
320.00	94.60	2.34	-45.59	1947.21	71624.69	91.23	54.54	68240.00	0.25	15
330.00	94.60	-11.06	-65.49	1705.05	56070.33	91.23	59.87	68240.00	0.23	15
340.00	94.60	-27.33	-90.60	1473.99	38966.07	91.23	64.74	68240.00	0.22	15
350.00	94.60	-46.12	-121.38	1263.88	21478.71	91.23	67.85	68240.00	0.20	16
360.00	94.60	-60.44	-146.59	1131.76	9661.41	91.23	68.73	68240.00	0.19	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 2460.20 , MINIMUM AREA FRACTION ACCEPTABLE = 0.487

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.55241

MAXIMUM ABSORPTANCE VALUE = 0.37000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 60 , SOLAR ABSORPTANCE VALUE = 0.37000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	-58.51	-143.09	1148.44	11171.01	91.23	79.47	68240.00	0.19	16
10.00	94.60	-42.30	-114.94	1302.74	24834.76	91.23	78.45	68240.00	0.20	16
20.00	94.60	-21.32	-81.17	1553.08	45054.48	91.23	74.86	68240.00	0.22	15
30.00	94.60	-3.36	-53.99	1837.12	64831.33	91.23	69.22	68240.00	0.24	15
40.00	94.60	11.31	-32.55	2146.82	82816.06	91.23	63.07	68240.00	0.26	15
50.00	94.60	23.03	-15.75	2474.00	98436.94	91.23	55.38	68240.00	0.28	14
60.00	94.60	31.98	-3.02	2796.40	111162.38	91.23	47.68	68240.00	0.29	14
70.00	94.60	38.27	5.94	3079.38	120537.38	91.23	40.51	68240.00	0.31	14
80.00	94.60	42.00	11.27	3276.31	126279.88	91.23	32.82	68240.00	0.31	14
90.00	94.60	43.24	13.04	3347.02	128212.88	91.23	25.64	68240.00	0.32	14
100.00	94.60	42.00	11.25	3275.08	126279.88	91.23	18.97	68240.00	0.31	14
110.00	94.60	38.25	5.91	3077.92	120537.38	91.23	12.82	68240.00	0.31	14
120.00	94.60	31.95	-3.05	2795.68	111162.38	91.23	8.20	68240.00	0.29	14
130.00	94.60	22.99	-15.79	2473.15	98436.94	91.23	4.61	68240.00	0.28	14
140.00	94.60	11.27	-32.61	2145.86	82816.06	91.23	2.05	68240.00	0.26	15
150.00	94.60	-3.42	-54.07	1836.05	64831.33	91.23	0.51	68240.00	0.24	15
160.00	94.60	-21.39	-81.28	1552.11	45054.48	91.23	0.0	68240.00	0.22	15
170.00	94.60	-42.39	-115.09	1301.80	24834.76	91.23	0.0	68240.00	0.20	16
172.93	94.60	-46.95	-122.78	1255.76	20835.07	91.23	0.0	68240.00	0.20	16
180.00	94.60	-73.51	-171.35	1026.38	0.0	91.23	0.0	68240.00	0.18	17
187.07	94.60	-46.95	-122.78	1255.76	20835.07	91.23	0.0	68240.00	0.20	16
190.00	94.60	-42.39	-115.09	1301.80	24834.76	91.23	0.0	68240.00	0.20	16
200.00	94.60	-21.39	-81.28	1552.11	45054.48	91.23	0.0	68240.00	0.22	15
210.00	94.60	-3.42	-54.07	1836.05	64831.33	91.23	0.51	68240.00	0.24	15
220.00	94.60	11.27	-32.61	2145.86	82816.06	91.23	2.05	68240.00	0.26	15
230.00	94.60	22.99	-15.79	2473.15	98436.94	91.23	4.61	68240.00	0.28	14
240.00	94.60	31.95	-3.05	2795.68	111162.38	91.23	8.20	68240.00	0.29	14
250.00	94.60	38.25	5.91	3077.92	120537.38	91.23	12.82	68240.00	0.31	14
260.00	94.60	42.00	11.25	3275.08	126279.88	91.23	18.97	68240.00	0.31	14
270.00	94.60	43.24	13.04	3347.02	128212.88	91.23	25.64	68240.00	0.32	14
280.00	94.60	42.00	11.27	3276.31	126279.88	91.23	32.82	68240.00	0.31	14
290.00	94.60	38.27	5.94	3079.38	120537.38	91.23	40.51	68240.00	0.31	14
300.00	94.60	31.98	-3.02	2796.40	111162.38	91.23	47.68	68240.00	0.29	14
310.00	94.60	23.03	-15.75	2474.00	98436.94	91.23	55.38	68240.00	0.28	14
320.00	94.60	11.31	-32.55	2146.82	82816.06	91.23	63.07	68240.00	0.26	15
330.00	94.60	-3.36	-53.99	1837.12	64831.33	91.23	69.22	68240.00	0.24	15
340.00	94.60	-21.32	-81.17	1553.08	45054.48	91.23	74.86	68240.00	0.22	15
350.00	94.60	-42.30	-114.94	1302.74	24834.76	91.23	78.45	68240.00	0.20	16
360.00	94.60	-58.51	-143.09	1148.44	11171.01	91.23	79.47	68240.00	0.19	16

G E O S Y N C H R O N O U S   S P A C E   S T A T I O N   R A D I A T O R   P R O G R A M .

ALTITUDE (N.MI.) = 19370.0

ORBIT INCLINATION BETA ANGLE (DEGREES) = 5.00

DISSIPATION (KW.), LOWEST = 20 HIGHEST = 40 INCREMENT = 20

BREAK POINT FROM PLATE TO CYLINDRICAL RADIATORS (KW.) = 20.00

MONTHS DEGRADATION FOR FLAT PLATE RADIATOR = 60 INCREMENT = 10
MONTHS DEGRADATION FOR CYLINDRICAL RADIATOR = 60 INCREMENT = 10

ORBIT PRINT INTERVAL FOR FLAT PLATE RADIATOR (DEGREES) = 10 ,INTERVAL FOR CYLINDRICAL RADIATOR = 10

AREA FRACTION FOR FLAT PLATE RADIATOR = 0.300 , FOR CYLINDRICAL RADIATOR = 0.550

PLATE, SHAPE FACTOR TO SPACE = 0.900000 FLUID CP = 0.2500 BTU/LBM-R.
CYL. , SHAPE FACTOR TO SPACE = 0.950000 FLUID CP = 0.2500 BTU/LBM-R.

RADIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE = 0.07000 EMITTANCE = 0.76000 MONTHLY CHANGE IN ABSORPTANCE = 0.00400
CYL. , ABSORPTANCE = 0.15000 EMITTANCE = 0.88000 MONTHLY CHANGE IN ABSORPTANCE = 0.00500

EXTERNAL HEAT INPUT TABLES.

1 SOLAR FS, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.

0.0	0.596190
10.00	0.581060
20.00	0.536120
30.00	0.862730
40.00	0.763130
50.00	0.640340
60.00	0.498100
70.00	0.340720
80.00	0.172990
90.00	0.0
100.00	0.172990
110.00	0.340720
120.00	0.498100
130.00	0.640340
140.00	0.763130
150.00	0.862730
160.00	0.936120
170.00	0.981060
180.00	0.996190
190.00	0.981060
200.00	0.936120
210.00	0.862730
220.00	0.763130
230.00	0.640340
240.00	0.498100
250.00	0.340720
260.00	0.172990
270.00	0.0
280.00	0.172990
290.00	0.340720
300.00	0.498100

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          310.00        0.640340
          320.00        0.763130
          330.00        0.862730
          340.00        0.936120
          350.00        0.981060
          360.00        0.996190
  2    EARTHSHINE FE, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.
            0.0         0.011360
          360.00        0.011360
  3    ALBEDO FA, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.
            0.0         0.008350
           10.00        0.008220
           20.00        0.007850
           30.00        0.007270
           40.00        0.006530
           50.00        0.005670
           60.00        0.004750
           70.00        0.003840
           80.00        0.002970
           90.00        0.002190
          100.00        0.001520
          110.00        0.000980
          120.00        0.000580
          130.00        0.000300
          140.00        0.000130
          150.00        0.000040
          160.00        0.0
          200.00        0.0
          210.00        0.000040
          220.00        0.000130
          230.00        0.000300
          240.00        0.000580
          250.00        0.000980
          260.00        0.001520
          270.00        0.002190
          280.00        0.002970
          290.00        0.003840
          300.00        0.004750
          310.00        0.005670
          320.00        0.006530
          330.00        0.007270
          340.00        0.007850
          350.00        0.008220
          360.00        0.008350
  4    SOLAR FS, B=5, CYL. RADIATOR END ON TOWARD EARTH.
            0.0         0.027740
           10.00        0.061670
           20.00        0.111880
           30.00        0.160990
           40.00        0.205650
           50.00        0.244440
           60.00        0.276040
           70.00        0.299320
           80.00        0.313580
           90.00        0.318380
          100.00        0.313580
          110.00        0.299320
          120.00        0.276040
          130.00        0.244440
          140.00        0.205650
          150.00        0.160990
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	160.00	0.111880
	170.00	0.061670
	180.00	0.027740
	190.00	0.061670
	200.00	0.111880
	210.00	0.160990
	220.00	0.205650
	230.00	0.244440
	240.00	0.276040
	250.00	0.299320
	260.00	0.313580
	270.00	0.318380
	280.00	0.313580
	290.00	0.299320
	300.00	0.276040
	310.00	0.244440
	320.00	0.205650
	330.00	0.160990
	340.00	0.111880
	350.00	0.061870
	360.00	0.027740
5	EARTHSHINE FE, B=5, CYL. RADIATOR END ON TOWARD EARTH.	
	0.0	0.002310
	360.00	0.002310
6	ALBEDO FA, B=5, CYL. RADIATOR END ON TOWARD EARTH.	
	0.0	0.001550
	10.00	0.001530
	20.00	0.001460
	30.00	0.001350
	40.00	0.001230
	50.00	0.001060
	60.00	0.000930
	70.00	0.000790
	80.00	0.000640
	90.00	0.000500
	100.00	0.000370
	110.00	0.000250
	120.00	0.000160
	130.00	0.000090
	140.00	0.000040
	150.00	0.000010
	160.00	0.0
	200.00	0.0
	210.00	0.000010
	220.00	0.000040
	230.00	0.000090
	240.00	0.000160
	250.00	0.000250
	260.00	0.000370
	270.00	0.000500
	280.00	0.000640
	290.00	0.000790
	300.00	0.000930
	310.00	0.001080
	320.00	0.001230
	330.00	0.001350
	340.00	0.001460
	350.00	0.001530
	360.00	0.001550

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 644.51 , MINIMUM AREA FRACTION ACCEPTABLE = 0.214

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.31000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00400 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 0 , SOLAR ABSORPTANCE VALUE = 0.07000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	31.80	-15.85	2471.40	19883.05	738.51	133.33	68239.94	0.35	15
10.00	94.60	31.38	-16.56	2455.79	19581.07	738.51	131.25	68239.94	0.35	15
20.00	94.60	30.13	-18.67	2410.04	18684.11	738.51	125.34	68239.94	0.35	15
30.00	94.60	28.06	-22.17	2337.81	17219.30	738.51	116.08	68239.94	0.35	15
40.00	94.60	25.21	-26.99	2245.10	15231.38	738.51	104.27	68239.94	0.34	15
50.00	94.60	21.63	-33.07	2138.14	12780.61	738.51	90.53	68239.94	0.34	15
60.00	94.60	17.38	-40.32	2023.16	9941.63	738.51	75.84	68239.94	0.33	15
70.00	94.60	12.54	-48.64	1905.75	6800.46	738.51	61.31	68239.94	0.32	16
80.00	94.60	7.22	-57.87	1790.35	3452.72	738.51	47.42	68239.94	0.31	16
90.00	94.60	1.53	-67.85	1680.36	0.0	738.51	34.97	68239.94	0.31	16
100.00	94.60	7.18	-57.94	1789.55	3452.72	738.51	24.27	68239.94	0.31	16
110.00	94.60	12.47	-48.76	1904.02	6800.46	738.51	15.65	68239.94	0.32	16
120.00	94.60	17.28	-40.49	2020.75	9941.63	738.51	9.26	68239.94	0.33	15
130.00	94.60	21.50	-33.29	2134.42	12780.61	738.51	4.79	68239.94	0.34	15
140.00	94.60	25.06	-27.24	2240.47	15231.38	738.51	2.08	68239.94	0.34	15
150.00	94.60	27.90	-22.44	2332.34	17219.30	738.51	0.64	68239.94	0.35	15
160.00	94.60	29.95	-18.96	2403.80	18684.11	738.51	0.0	68239.94	0.35	15
170.00	94.60	31.20	-16.87	2448.94	19581.07	738.51	0.0	68239.94	0.35	15
172.93	94.60	31.33	-16.66	2453.42	19669.47	738.51	0.0	68239.94	0.35	15
180.00	94.60	1.48	-67.95	1679.37	0.0	738.51	0.0	68239.94	0.31	16
187.07	94.60	31.33	-16.66	2453.42	19669.47	738.51	0.0	68239.94	0.35	15
190.00	94.60	31.20	-16.87	2448.94	19581.07	738.51	0.0	68239.94	0.35	15
200.00	94.60	29.95	-18.96	2403.80	18684.11	738.51	0.0	68239.94	0.35	15
210.00	94.60	27.90	-22.44	2332.34	17219.30	738.51	0.64	68239.94	0.35	15
220.00	94.60	25.06	-27.24	2240.47	15231.38	738.51	2.08	68239.94	0.34	15
230.00	94.60	21.50	-33.29	2134.42	12780.61	738.51	4.79	68239.94	0.34	15
240.00	94.60	17.28	-40.49	2020.75	9941.63	738.51	9.26	68239.94	0.33	15
250.00	94.60	12.47	-48.76	1904.02	6800.46	738.51	15.65	68239.94	0.32	16
260.00	94.60	7.18	-57.94	1789.55	3452.72	738.51	24.27	68239.94	0.31	16
270.00	94.60	1.53	-67.85	1680.36	0.0	738.51	34.97	68239.94	0.31	16
280.00	94.60	7.22	-57.87	1790.35	3452.72	738.51	47.42	68239.94	0.31	16
290.00	94.60	12.54	-48.64	1905.75	6800.46	738.51	61.31	68239.94	0.32	16
300.00	94.60	17.38	-40.32	2023.16	9941.63	738.51	75.84	68239.94	0.33	15
310.00	94.60	21.63	-33.07	2138.14	12780.61	738.51	90.53	68239.94	0.34	15
320.00	94.60	25.21	-26.99	2245.10	15231.38	738.51	104.27	68239.94	0.34	15
330.00	94.60	28.06	-22.17	2337.81	17219.30	738.51	116.08	68239.94	0.35	15
340.00	94.60	30.13	-18.67	2410.04	18684.11	738.51	125.34	68239.94	0.35	15
350.00	94.60	31.38	-16.56	2455.79	19581.07	738.51	131.25	68239.94	0.35	15
360.00	94.60	31.80	-15.85	2471.40	19883.05	738.51	133.33	68239.94	0.35	15

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 644.51 , MINIMUM AREA FRACTION ACCEPTABLE = 0.214

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.31000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00400 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 10 , SOLAR ABSORPTANCE VALUE = 0.11000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	46.89	9.51	3208.10	31244.78	738.51	209.51	68239.94	0.38	15
10.00	94.60	46.28	8.50	3170.29	30770.24	738.51	206.25	68239.94	0.38	15
20.00	94.60	44.48	5.46	3062.20	29360.73	738.51	196.97	68239.94	0.37	15
30.00	94.60	41.49	0.44	2898.96	27058.90	738.51	182.41	68239.94	0.37	15
40.00	94.60	37.35	-6.53	2699.19	23935.02	738.51	163.85	68239.94	0.36	15
50.00	94.60	32.09	-15.37	2482.25	20083.80	738.51	142.27	68239.94	0.35	15
60.00	94.60	25.79	-26.00	2263.37	15622.54	738.51	119.18	68239.94	0.34	15
70.00	94.60	18.53	-38.35	2053.19	10686.44	738.51	96.35	68239.94	0.33	15
80.00	94.60	10.41	-52.33	1857.82	5425.70	738.51	74.52	68239.94	0.32	16
90.00	94.60	1.57	-67.78	1681.07	0.0	738.51	54.95	68239.94	0.31	16
100.00	94.60	10.35	-52.43	1856.60	5425.70	738.51	38.14	68239.94	0.32	16
110.00	94.60	18.42	-38.54	2050.26	10686.44	738.51	24.59	68239.94	0.33	15
120.00	94.60	25.64	-26.26	2258.67	15622.54	738.51	14.55	68239.94	0.34	15
130.00	94.60	31.91	-15.68	2475.25	20083.80	738.51	7.53	68239.94	0.35	15
140.00	94.60	37.13	-6.89	2689.75	23935.02	738.51	3.26	68239.94	0.36	15
150.00	94.60	41.25	0.03	2886.51	27058.90	738.51	1.00	68239.94	0.37	15
160.00	94.60	44.23	5.03	3047.72	29360.73	738.51	0.0	68239.94	0.37	15
170.00	94.60	46.02	8.05	3154.02	30770.24	738.51	0.0	68239.94	0.38	15
172.93	94.60	46.20	8.35	3165.09	30909.15	738.51	0.0	68239.94	0.38	15
180.00	94.60	1.48	-67.95	1679.37	0.0	738.51	0.0	68239.94	0.31	16
187.07	94.60	46.20	8.35	3165.09	30909.15	738.51	0.0	68239.94	0.38	15
190.00	94.60	46.02	8.05	3154.02	30770.24	738.51	0.0	68239.94	0.38	15
200.00	94.60	44.23	5.03	3047.72	29360.73	738.51	0.0	68239.94	0.37	15
210.00	94.60	41.25	0.03	2886.51	27058.90	738.51	1.00	68239.94	0.37	15
220.00	94.60	37.13	-6.89	2689.75	23935.02	738.51	3.26	68239.94	0.36	15
230.00	94.60	31.91	-15.68	2475.25	20083.80	738.51	7.53	68239.94	0.35	15
240.00	94.60	25.64	-26.26	2258.67	15622.54	738.51	14.55	68239.94	0.34	15
250.00	94.60	18.42	-38.54	2050.26	10686.44	738.51	24.59	68239.94	0.33	15
260.00	94.60	10.35	-52.43	1856.60	5425.70	738.51	38.14	68239.94	0.32	16
270.00	94.60	1.57	-67.78	1681.07	0.0	738.51	54.95	68239.94	0.31	16
280.00	94.60	10.41	-52.33	1857.82	5425.70	738.51	74.52	68239.94	0.32	16
290.00	94.60	18.53	-38.35	2053.19	10686.44	738.51	96.35	68239.94	0.33	15
300.00	94.60	25.79	-26.00	2263.37	15622.54	738.51	119.18	68239.94	0.34	15
310.00	94.60	32.09	-15.37	2482.25	20083.80	738.51	142.27	68239.94	0.35	15
320.00	94.60	37.35	-6.53	2699.19	23935.02	738.51	163.85	68239.94	0.36	15
330.00	94.60	41.49	0.44	2898.96	27058.90	738.51	182.41	68239.94	0.37	15
340.00	94.60	44.48	5.46	3062.20	29360.73	738.51	196.97	68239.94	0.37	15
350.00	94.60	46.28	8.50	3170.29	30770.24	738.51	206.25	68239.94	0.38	15
360.00	94.60	46.89	9.51	3208.10	31244.78	738.51	209.51	68239.94	0.38	15

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MTX = 40.00

PLATFORM AREA IN FT2 = 644.51 , MINIMUM AREA FRACTION ACCEPTABLE = 0.214

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.31000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00400 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 20 , SOLAR ABSORPTANCE VALUE = 0.15000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	60.73	32.97	4429.06	42606.52	738.51	285.70	68239.94	0.41	14
10.00	94.60	59.97	31.67	4337.98	41959.42	738.51	281.25	68239.94	0.41	14
20.00	94.60	57.70	27.81	4087.19	40037.37	738.51	268.59	68239.94	0.40	14
30.00	94.60	53.92	21.38	3728.32	36898.51	738.51	248.75	68239.94	0.39	14
40.00	94.60	48.65	12.49	3324.36	32638.67	738.51	223.43	68239.94	0.38	15
50.00	94.60	41.93	1.18	2921.92	27387.01	738.51	194.00	68239.94	0.37	15
60.00	94.60	33.79	-12.50	2548.75	21303.47	738.51	162.52	68239.94	0.35	15
70.00	94.60	24.30	-28.53	2216.98	14572.41	738.51	131.39	68239.94	0.34	15
80.00	94.60	13.53	-46.93	1928.72	7398.69	738.51	101.62	68239.94	0.32	16
90.00	94.60	1.60	-67.72	1681.68	0.0	738.51	74.93	68239.94	0.31	16
100.00	94.60	13.45	-47.06	1926.87	7398.69	738.51	52.01	68239.94	0.32	16
110.00	94.60	24.16	-28.78	2212.50	14572.41	738.51	33.53	68239.94	0.34	15
120.00	94.60	33.60	-12.83	2541.02	21303.47	738.51	19.85	68239.94	0.35	15
130.00	94.60	41.69	0.77	2909.35	27387.01	738.51	10.26	68239.94	0.37	15
140.00	94.60	48.38	12.03	3305.89	32638.67	738.51	4.45	68239.94	0.38	15
150.00	94.60	53.62	20.87	3702.34	36898.51	738.51	1.37	68239.94	0.39	15
160.00	94.60	57.38	27.26	4053.61	40037.37	738.51	0.0	68239.94	0.40	14
170.00	94.60	59.64	31.12	4300.09	41959.42	738.51	0.0	68239.94	0.40	14
172.93	94.60	59.86	31.49	4325.42	42148.84	738.51	0.0	68239.94	0.41	14
180.00	94.60	1.48	-67.95	1679.37	0.0	738.51	0.0	68239.94	0.31	16
187.07	94.60	59.86	31.49	4325.42	42148.84	738.51	0.0	68239.94	0.41	14
190.00	94.60	59.64	31.12	4300.09	41959.42	738.51	0.0	68239.94	0.40	14
200.00	94.60	57.38	27.26	4053.61	40037.37	738.51	0.0	68239.94	0.40	14
210.00	94.60	53.62	20.87	3702.34	36898.51	738.51	1.37	68239.94	0.39	15
220.00	94.60	48.38	12.03	3305.89	32638.67	738.51	4.45	68239.94	0.38	15
230.00	94.60	41.69	0.77	2909.35	27387.01	738.51	10.26	68239.94	0.37	15
240.00	94.60	33.60	-12.83	2541.02	21303.47	738.51	19.85	68239.94	0.35	15
250.00	94.60	24.16	-28.78	2212.50	14572.41	738.51	33.53	68239.94	0.34	15
260.00	94.60	13.45	-47.06	1926.87	7398.69	738.51	52.01	68239.94	0.32	16
270.00	94.60	1.60	-67.72	1681.68	0.0	738.51	74.93	68239.94	0.31	16
280.00	94.60	13.53	-46.93	1928.72	7398.69	738.51	101.62	68239.94	0.32	16
290.00	94.60	24.30	-28.53	2216.98	14572.41	738.51	131.39	68239.94	0.34	15
300.00	94.60	33.79	-12.50	2548.75	21303.47	738.51	162.52	68239.94	0.35	15
310.00	94.60	41.93	1.18	2921.92	27387.01	738.51	194.00	68239.94	0.37	15
320.00	94.60	48.65	12.49	3324.36	32638.67	738.51	223.43	68239.94	0.38	15
330.00	94.60	53.92	21.38	3728.32	36898.51	738.51	248.75	68239.94	0.39	14
340.00	94.60	57.70	27.81	4087.19	40037.37	738.51	268.59	68239.94	0.40	14
350.00	94.60	59.97	31.67	4337.98	41959.42	738.51	281.25	68239.94	0.41	14
360.00	94.60	60.73	32.97	4429.06	42606.52	738.51	285.70	68239.94	0.41	14

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 644.51 , MINIMUM AREA FRACTION ACCEPTABLE = 0.214

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.31000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00400 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 30 , SOLAR ABSORPTANCE VALUE = 0.19000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	64.83	40.00	4422.58	53968.26	738.51	361.89	60368.05	0.42	1
10.00	94.60	64.83	40.00	4483.04	53148.61	738.51	356.25	61193.34	0.42	1
20.00	94.60	64.83	40.00	4662.57	50713.99	738.51	340.22	63644.00	0.42	1
30.00	94.60	64.83	40.00	4955.69	46738.12	738.51	315.08	67645.00	0.42	1
40.00	94.60	59.25	30.45	4255.26	41342.31	738.51	283.01	68239.94	0.40	14
50.00	94.60	51.22	16.82	3509.52	34690.20	738.51	245.74	68239.94	0.39	15
60.00	94.60	41.42	0.33	2895.71	26984.39	738.51	205.86	68239.94	0.37	15
70.00	94.60	29.87	-19.11	2400.65	18458.39	738.51	166.42	68239.94	0.35	15
80.00	94.60	16.59	-41.66	2003.42	9371.67	738.51	128.72	68239.94	0.33	15
90.00	94.60	1.63	-67.67	1682.23	0.0	738.51	94.91	68239.94	0.31	16
100.00	94.60	16.50	-41.83	2000.80	9371.67	738.51	65.88	68239.94	0.33	15
110.00	94.60	29.70	-19.40	2394.48	18458.39	738.51	42.47	68239.94	0.35	15
120.00	94.60	41.19	-0.07	2883.30	26984.39	738.51	25.14	68239.94	0.37	15
130.00	94.60	50.93	16.34	3487.88	34690.20	738.51	13.00	68239.94	0.39	15
140.00	94.60	58.93	29.89	4218.34	41342.31	738.51	5.63	68239.94	0.40	14
150.00	94.60	64.83	40.00	4978.64	46738.12	738.51	1.73	67958.31	0.42	1
160.00	94.60	64.83	40.00	4687.50	50713.99	738.51	0.0	63984.21	0.42	1
170.00	94.60	64.83	40.00	4509.14	53148.61	738.51	0.0	61549.59	0.42	1
172.93	94.60	64.83	40.00	4491.56	53388.54	738.51	0.0	61309.66	0.42	1
180.00	94.60	1.48	-67.95	1679.37	0.0	738.51	0.0	68239.94	0.31	16
187.07	94.60	64.83	40.00	4491.56	53388.54	738.51	0.0	61309.66	0.42	1
190.00	94.60	64.83	40.00	4509.14	53148.61	738.51	0.0	61549.59	0.42	1
200.00	94.60	64.83	40.00	4687.50	50713.99	738.51	0.0	63984.21	0.42	1
210.00	94.60	64.83	40.00	4978.64	46738.12	738.51	1.73	67958.31	0.42	1
220.00	94.60	58.93	29.89	4218.34	41342.31	738.51	5.63	68239.94	0.40	14
230.00	94.60	50.93	16.34	3487.88	34690.20	738.51	13.00	68239.94	0.39	15
240.00	94.60	41.19	-0.07	2883.30	26984.39	738.51	25.14	68239.94	0.37	15
250.00	94.60	29.70	-19.40	2394.48	18458.39	738.51	42.47	68239.94	0.35	15
260.00	94.60	16.50	-41.83	2000.80	9371.67	738.51	65.88	68239.94	0.33	15
270.00	94.60	1.63	-67.67	1682.23	0.0	738.51	94.91	68239.94	0.31	16
280.00	94.60	16.59	-41.66	2003.42	9371.67	738.51	128.72	68239.94	0.33	15
290.00	94.60	29.87	-19.11	2400.65	18458.39	738.51	166.42	68239.94	0.35	15
300.00	94.60	41.42	0.33	2895.71	26984.39	738.51	205.86	68239.94	0.37	15
310.00	94.60	51.22	16.82	3509.52	34690.20	738.51	245.74	68239.94	0.39	15
320.00	94.60	59.25	30.45	4255.26	41342.31	738.51	283.01	68239.94	0.40	14
330.00	94.60	64.83	40.00	4955.69	46738.12	738.51	315.08	67645.00	0.42	1
340.00	94.60	64.83	40.00	4662.57	50713.99	738.51	340.22	63644.00	0.42	1
350.00	94.60	64.83	40.00	4483.04	53148.61	738.51	356.25	61193.34	0.42	1
360.00	94.60	64.83	40.00	4422.58	53968.26	738.51	361.89	60368.05	0.42	1

FLAT PLATE RADIATOR FOR CASE OF 66239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.6C , MIX = 40.00

PLATFORM AREA IN FT2 = 644.51 , MINIMUM AREA FRACTION ACCEPTABLE = 0.214

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = C.31000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00400 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 40 , SOLAR ABSORPTANCE VALUE = 0.23000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	64.83	40.00	3584.64	65330.00	738.51	438.07	48930.14	0.42	1
10.00	94.60	64.83	40.00	3657.82	64337.78	738.51	431.25	49929.17	0.42	1
20.00	94.60	64.83	40.00	3875.16	61390.61	738.51	411.84	52895.75	0.42	1
30.00	94.60	64.83	40.00	4229.98	56577.70	738.51	381.41	57739.09	0.42	1
40.00	94.60	64.83	40.00	4711.34	50045.95	738.51	342.59	64309.67	0.42	1
50.00	94.60	60.03	31.78	4345.26	41993.40	738.51	297.47	68239.94	0.41	14
60.00	94.60	48.72	12.60	3329.03	32665.32	738.51	249.20	68239.94	0.38	15
70.00	94.60	35.26	-10.04	2608.70	22344.37	738.51	201.46	68239.94	0.36	15
80.00	94.60	19.60	-36.52	2081.83	11344.65	738.51	155.82	68239.94	0.33	15
90.00	94.60	1.67	-67.61	1682.88	0.0	738.51	114.90	68239.94	0.31	16
100.00	94.60	19.49	-36.72	2078.78	11344.65	738.51	79.75	68239.94	0.33	15
110.00	94.60	35.06	-10.38	2600.20	22344.37	738.51	51.41	68239.94	0.36	15
120.00	94.60	48.45	12.13	3309.99	32665.32	738.51	30.43	68239.94	0.38	15
130.00	94.60	59.70	31.22	4307.28	41993.40	738.51	15.74	68239.94	0.40	14
140.00	94.60	64.83	40.00	4735.94	50045.95	738.51	6.82	64645.43	0.42	1
150.00	94.60	64.83	40.00	4257.77	56577.70	738.51	2.10	58118.40	0.42	1
160.00	94.60	64.83	40.00	3905.33	61390.61	738.51	0.0	53307.59	0.42	1
170.00	94.60	64.83	40.00	3689.42	64337.78	738.51	0.0	50360.42	0.42	1
172.93	94.60	64.83	40.00	3668.14	64628.21	738.51	0.0	50069.98	0.42	1
180.00	94.60	1.48	-67.95	1679.37	0.0	738.51	0.0	68239.94	0.31	16
187.07	94.60	64.83	40.00	3668.14	64628.21	738.51	0.0	50069.98	0.42	1
190.00	94.60	64.83	40.00	3689.42	64337.78	738.51	0.0	50360.42	0.42	1
200.00	94.60	64.83	40.00	3905.33	61390.61	738.51	0.0	53307.59	0.42	1
210.00	94.60	64.83	40.00	4257.77	56577.70	738.51	2.10	58118.40	0.42	1
220.00	94.60	64.83	40.00	4735.94	50045.95	738.51	6.82	64645.43	0.42	1
230.00	94.60	59.70	31.22	4307.28	41993.40	738.51	15.74	68239.94	0.40	14
240.00	94.60	48.45	12.13	3309.99	32665.32	738.51	30.43	68239.94	0.38	15
250.00	94.60	35.06	-10.38	2600.20	22344.37	738.51	51.41	68239.94	0.36	15
260.00	94.60	19.49	-36.72	2078.78	11344.65	738.51	79.75	68239.94	0.33	15
270.00	94.60	1.67	-67.61	1682.88	0.0	738.51	114.90	68239.94	0.31	16
280.00	94.60	19.60	-36.52	2081.83	11344.65	738.51	155.82	68239.94	0.33	15
290.00	94.60	35.26	-10.04	2608.70	22344.37	738.51	201.46	68239.94	0.36	15
300.00	94.60	48.72	12.60	3329.03	32665.32	738.51	249.20	68239.94	0.38	15
310.00	94.60	60.03	31.78	4345.26	41993.40	738.51	297.47	68239.94	0.41	14
320.00	94.60	64.83	40.00	4711.34	50045.95	738.51	342.59	64309.67	0.42	1
330.00	94.60	64.83	40.00	4229.98	56577.70	738.51	381.41	57739.09	0.42	1
340.00	94.60	64.83	40.00	3875.16	61390.61	738.51	411.84	52895.75	0.42	1
350.00	94.60	64.83	40.00	3657.82	64337.78	738.51	431.25	49929.17	0.42	1
360.00	94.60	64.83	40.00	3584.64	65330.00	738.51	438.07	48930.14	0.42	1

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 644.51 , MINIMUM AREA FRACTION ACCEPTABLE = 0.214

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.31000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00400 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 50 , SOLAR ABSORPTANCE VALUE = 0.27000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	64.83	40.00	2746.69	76691.69	738.51	514.26	37492.27	0.42	1
10.00	94.60	64.83	40.00	2832.61	75526.94	738.51	506.25	38665.02	0.42	1
20.00	94.60	64.83	40.00	3087.74	72067.19	738.51	483.47	42147.52	0.42	1
30.00	94.60	64.83	40.00	3504.27	66417.31	738.51	447.74	47833.20	0.42	1
40.00	94.60	64.83	40.00	4069.35	58749.60	738.51	402.17	55546.43	0.42	1
50.00	94.60	64.83	40.00	4765.75	49296.61	738.51	349.20	65052.39	0.42	1
60.00	94.60	55.71	24.42	3889.44	38346.25	738.51	292.54	68239.94	0.40	14
70.00	94.60	40.46	-1.26	2847.57	26230.34	738.51	236.50	68239.94	0.37	15
80.00	94.60	22.55	-31.50	2164.66	13317.63	738.51	182.92	68239.94	0.34	15
90.00	94.60	1.70	-67.55	1683.44	0.0	738.51	134.88	68239.94	0.31	16
100.00	94.60	22.42	-31.73	2160.83	13317.63	738.51	93.61	68239.94	0.34	15
110.00	94.60	40.25	-1.66	2835.91	26230.34	738.51	60.36	68239.94	0.37	15
120.00	94.60	55.41	23.89	3860.65	38346.25	738.51	35.72	68239.94	0.40	14
130.00	94.60	64.83	40.00	4789.98	49296.61	738.51	18.48	65383.13	0.42	1
140.00	94.60	64.83	40.00	4098.22	58749.60	738.51	8.01	55940.59	0.42	1
150.00	94.60	64.83	40.00	3536.89	66417.31	738.51	2.46	48278.45	0.42	1
160.00	94.60	64.83	40.00	3123.16	72067.19	738.51	0.0	42630.95	0.42	1
170.00	94.60	64.83	40.00	2869.70	75526.94	738.51	0.0	39171.27	0.42	1
172.93	94.60	64.83	40.00	2844.72	75867.88	738.51	0.0	38830.33	0.42	1
180.00	94.60	1.48	-67.95	1679.37	0.0	738.51	0.0	68239.94	0.31	16
187.07	94.60	64.83	40.00	2844.72	75867.88	738.51	0.0	38830.33	0.42	1
190.00	94.60	64.83	40.00	2869.70	75526.94	738.51	0.0	39171.27	0.42	1
200.00	94.60	64.83	40.00	3123.16	72067.19	738.51	0.0	42630.95	0.42	1
210.00	94.60	64.83	40.00	3536.89	66417.31	738.51	2.46	48278.45	0.42	1
220.00	94.60	64.83	40.00	4098.22	58749.60	738.51	8.01	55940.59	0.42	1
230.00	94.60	64.83	40.00	4789.98	49296.61	738.51	18.48	65383.13	0.42	1
240.00	94.60	55.41	23.89	3860.65	38346.25	738.51	35.72	68239.94	0.40	14
250.00	94.60	40.25	-1.66	2835.91	26230.34	738.51	60.36	68239.94	0.37	15
260.00	94.60	22.42	-31.73	2160.83	13317.63	738.51	93.61	68239.94	0.34	15
270.00	94.60	1.70	-67.55	1683.44	0.0	738.51	134.88	68239.94	0.31	16
280.00	94.60	22.55	-31.50	2164.66	13317.63	738.51	182.92	68239.94	0.34	15
290.00	94.60	40.48	-1.26	2847.57	26230.34	738.51	236.50	68239.94	0.37	15
300.00	94.60	55.71	24.42	3889.44	38346.25	738.51	292.54	68239.94	0.40	14
310.00	94.60	64.83	40.00	4765.75	49296.61	738.51	349.20	65052.39	0.42	1
320.00	94.60	64.83	40.00	4069.35	58749.60	738.51	402.17	55546.43	0.42	1
330.00	94.60	64.83	40.00	3504.27	66417.31	738.51	447.74	47833.20	0.42	1
340.00	94.60	64.83	40.00	3087.74	72067.19	738.51	483.47	42147.52	0.42	1
350.00	94.60	64.83	40.00	2832.61	75526.94	738.51	506.25	38665.02	0.42	1
360.00	94.60	64.83	40.00	2746.69	76691.69	738.51	514.26	37492.27	0.42	1

FLAT PLATE RADIATOR FOR CASE OF 68239.9 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 644.51 , MINIMUM AREA FRACTION ACCEPTABLE = 0.214

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.27

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.32993

MAXIMUM ABSORPTANCE VALUE = 0.31000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00400 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 60 , SOLAR ABSORPTANCE VALUE = 0.31000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	64.83	40.00	1908.75	88053.44	738.51	590.45	26054.33	0.42	1
10.00	94.60	64.83	40.00	2007.39	86716.13	738.51	581.25	27400.83	0.42	1
20.00	94.60	64.83	40.00	2300.32	82743.88	738.51	555.09	31399.27	0.42	1
30.00	94.60	64.83	40.00	2778.56	76256.88	738.51	514.08	37927.27	0.42	1
40.00	94.60	64.83	40.00	3427.35	67453.19	738.51	461.75	46783.27	0.42	1
50.00	94.60	64.83	40.00	4226.93	56599.81	738.51	400.94	57697.46	0.42	1
60.00	94.60	62.43	35.89	4650.05	44027.18	738.51	335.88	68239.94	0.41	14
70.00	94.60	45.54	7.24	3124.59	30116.32	738.51	271.53	68239.94	0.38	15
80.00	94.60	25.45	-26.59	2252.41	15290.62	738.51	210.02	68239.94	0.34	15
90.00	94.60	1.73	-67.49	1684.11	0.0	738.51	154.86	68239.94	0.31	16
100.00	94.60	25.30	-26.84	2247.78	15290.62	738.51	107.48	68239.94	0.34	15
110.00	94.60	45.28	6.80	3109.17	30116.32	738.51	69.30	68239.94	0.38	15
120.00	94.60	62.09	35.30	4603.56	44027.18	738.51	41.01	68239.94	0.41	14
130.00	94.60	64.83	40.00	4254.75	56599.81	738.51	21.21	58077.18	0.42	1
140.00	94.60	64.83	40.00	3460.50	67453.19	738.51	9.19	47235.77	0.42	1
150.00	94.60	64.83	40.00	2816.02	76256.88	738.51	2.83	38438.52	0.42	1
160.00	94.60	64.83	40.00	2340.98	82743.88	738.51	0.0	31954.33	0.42	1
170.00	94.60	64.83	40.00	2049.97	86716.13	738.51	0.0	27982.08	0.42	1
172.93	94.60	64.83	40.00	2021.30	87107.56	738.51	0.0	27590.64	0.42	1
180.00	94.60	1.48	-67.95	1679.37	0.0	738.51	0.0	68239.94	0.31	16
187.07	94.60	64.83	40.00	2021.30	87107.56	738.51	0.0	27590.64	0.42	1
190.00	94.60	64.83	40.00	2049.97	86716.13	738.51	0.0	27982.08	0.42	1
200.00	94.60	64.83	40.00	2340.98	82743.88	738.51	0.0	31954.33	0.42	1
210.00	94.60	64.83	40.00	2816.02	76256.88	738.51	2.83	38438.52	0.42	1
220.00	94.60	64.83	40.00	3460.50	67453.19	738.51	9.19	47235.77	0.42	1
230.00	94.60	64.83	40.00	4254.75	56599.81	738.51	21.21	58077.18	0.42	1
240.00	94.60	62.09	35.30	4603.56	44027.18	738.51	41.01	68239.94	0.41	14
250.00	94.60	45.28	6.80	3109.17	30116.32	738.51	69.30	68239.94	0.38	15
260.00	94.60	25.30	-26.84	2247.78	15290.62	738.51	107.48	68239.94	0.34	15
270.00	94.60	1.73	-67.49	1684.11	0.0	738.51	154.86	68239.94	0.31	16
280.00	94.60	25.45	-26.59	2252.41	15290.62	738.51	210.02	68239.94	0.34	15
290.00	94.60	45.54	7.24	3124.59	30116.32	738.51	271.53	68239.94	0.38	15
300.00	94.60	62.43	35.89	4650.05	44027.18	738.51	335.88	68239.94	0.41	14
310.00	94.60	64.83	40.00	4226.93	56599.81	738.51	400.94	57697.46	0.42	1
320.00	94.60	64.83	40.00	3427.35	67453.19	738.51	461.75	46783.27	0.42	1
330.00	94.60	64.83	40.00	2778.56	76256.88	738.51	514.08	37927.27	0.42	1
340.00	94.60	64.83	40.00	2300.32	82743.88	738.51	555.09	31399.27	0.42	1
350.00	94.60	64.83	40.00	2007.39	86716.13	738.51	581.25	27400.83	0.42	1
360.00	94.60	64.83	40.00	1908.75	88053.44	738.51	590.45	26054.33	0.42	1

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 836.04 , MINIMUM AREA FRACTION ACCEPTABLE = 0.504

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.45000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 0 , SOLAR ABSORPTANCE VALUE = 0.15000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	30.54	-21.72	2346.73	1539.01	35.90	10.95	68240.00	0.36	16
10.00	94.60	33.81	-15.94	2469.46	3421.44	35.90	10.81	68240.00	0.37	16
20.00	94.60	38.54	-7.60	2670.98	6207.08	35.90	10.31	68240.00	0.38	15
30.00	94.60	43.03	0.30	2894.82	8931.70	35.90	9.54	68240.00	0.38	15
40.00	94.60	47.01	7.31	3127.37	11409.43	35.90	8.69	68240.00	0.39	15
50.00	94.60	50.40	13.28	3356.78	13561.48	35.90	7.63	68240.00	0.40	15
60.00	94.60	53.11	18.05	3565.98	15314.64	35.90	6.57	68240.00	0.40	15
70.00	94.60	55.07	21.53	3735.91	16606.21	35.90	5.58	68240.00	0.41	15
80.00	94.60	56.27	23.64	3846.66	17397.35	35.90	4.52	68240.00	0.41	15
90.00	94.60	56.67	24.34	3885.50	17663.67	35.90	3.53	68240.00	0.41	15
100.00	94.60	56.26	23.63	3846.51	17397.35	35.90	2.61	68240.00	0.41	15
110.00	94.60	55.07	21.51	3734.80	16606.21	35.90	1.77	68240.00	0.41	15
120.00	94.60	53.10	18.04	3565.56	15314.64	35.90	1.13	68240.00	0.40	15
130.00	94.60	50.39	13.26	3356.22	13561.48	35.90	0.64	68240.00	0.40	15
140.00	94.60	47.00	7.29	3126.65	11409.43	35.90	0.28	68240.00	0.39	15
150.00	94.60	43.01	0.27	2893.95	8931.70	35.90	0.07	68240.00	0.38	15
160.00	94.60	39.52	-7.64	2669.91	6207.08	35.90	0.0	68240.00	0.38	15
170.00	94.60	33.79	-15.97	2468.73	3421.44	35.90	0.0	68240.00	0.37	16
172.93	94.60	32.84	-17.65	2431.88	2870.41	35.90	0.0	68240.00	0.37	16
180.00	94.60	27.80	-26.62	2252.02	0.0	35.90	0.0	68240.00	0.36	16
187.07	94.60	32.84	-17.65	2431.88	2870.41	35.90	0.0	68240.00	0.37	16
190.00	94.60	33.79	-15.97	2468.73	3421.44	35.90	0.0	68240.00	0.37	16
200.00	94.60	39.52	-7.64	2669.91	6207.08	35.90	0.0	68240.00	0.38	15
210.00	94.60	43.01	0.27	2893.95	8931.70	35.90	0.07	68240.00	0.38	15
220.00	94.60	47.00	7.29	3126.65	11409.43	35.90	0.28	68240.00	0.39	15
230.00	94.60	50.39	13.26	3356.22	13561.48	35.90	0.64	68240.00	0.40	15
240.00	94.60	53.10	18.04	3565.56	15314.64	35.90	1.13	68240.00	0.40	15
250.00	94.60	55.07	21.51	3734.80	16606.21	35.90	1.77	68240.00	0.41	15
260.00	94.60	56.26	23.63	3846.51	17397.35	35.90	2.61	68240.00	0.41	15
270.00	94.60	56.67	24.34	3885.50	17663.67	35.90	3.53	68240.00	0.41	15
280.00	94.60	56.27	23.64	3846.66	17397.35	35.90	4.52	68240.00	0.41	15
290.00	94.60	55.07	21.53	3735.91	16606.21	35.90	5.58	68240.00	0.41	15
300.00	94.60	53.11	18.05	3565.98	15314.64	35.90	6.57	68240.00	0.40	15
310.00	94.60	50.40	13.28	3356.78	13561.48	35.90	7.63	68240.00	0.40	15
320.00	94.60	47.01	7.31	3127.37	11409.43	35.90	8.69	68240.00	0.39	15
330.00	94.60	43.03	0.30	2894.82	8931.70	35.90	9.54	68240.00	0.38	15
340.00	94.60	38.54	-7.60	2670.98	6207.08	35.90	10.31	68240.00	0.38	15
350.00	94.60	33.81	-15.94	2469.46	3421.44	35.90	10.81	68240.00	0.37	16
360.00	94.60	30.54	-21.72	2346.73	1539.01	35.90	10.95	68240.00	0.36	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 826.04 ; MINIMUM AREA FRACTION ACCEPTABLE = 0.504

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.45000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 10 , SOLAR ABSORPTANCE VALUE = 0.20000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	31.45	-20.12	2379.52	2052.01	35.90	14.60	68240.00	0.37	16
10.00	94.60	35.77	-12.48	2549.24	4561.92	35.90	14.41	68240.00	0.37	16
20.00	94.60	41.97	-1.57	2838.33	8276.10	35.90	13.75	68240.00	0.38	15
30.00	94.60	47.81	8.73	3178.92	11908.93	35.90	12.72	68240.00	0.39	15
40.00	94.60	52.96	17.78	3553.64	15212.56	35.90	11.58	68240.00	0.40	15
50.00	94.60	57.30	25.47	3948.63	18081.97	35.90	10.17	68240.00	0.41	15
60.00	94.60	60.76	31.61	4333.81	20419.53	35.90	8.76	68240.00	0.42	15
70.00	94.60	63.27	36.08	4664.40	22141.62	35.90	7.44	68240.00	0.42	15
80.00	94.60	64.79	38.79	4891.20	23196.47	35.90	6.03	68240.00	0.43	15
90.00	94.60	65.29	39.69	4971.43	23551.54	35.90	4.71	68240.00	0.43	15
100.00	94.60	64.78	38.77	4889.84	23196.47	35.90	3.48	68240.00	0.43	15
110.00	94.60	63.26	36.06	4662.90	22141.62	35.90	2.35	68240.00	0.42	15
120.00	94.60	60.75	31.59	4332.27	20419.53	35.90	1.51	68240.00	0.42	15
130.00	94.60	57.29	25.44	3947.00	18081.97	35.90	0.85	68240.00	0.41	15
140.00	94.60	52.94	17.76	3552.74	15212.56	35.90	0.38	68240.00	0.40	15
150.00	94.60	47.79	8.68	3177.23	11908.93	35.90	0.09	68240.00	0.39	15
160.00	94.60	41.94	-1.60	2837.62	8276.10	35.90	0.0	68240.00	0.38	15
170.00	94.60	35.74	-12.53	2548.02	4561.92	35.90	0.0	68240.00	0.37	16
172.93	94.60	34.49	-14.74	2496.39	3827.21	35.90	0.0	68240.00	0.37	16
180.00	94.60	27.80	-26.62	2252.02	0.0	35.90	0.0	68240.00	0.36	16
187.07	94.60	34.49	-14.74	2496.39	3827.21	35.90	0.0	68240.00	0.37	16
190.00	94.60	35.74	-12.53	2548.02	4561.92	35.90	0.0	68240.00	0.37	16
200.00	94.60	41.94	-1.60	2837.62	8276.10	35.90	0.0	68240.00	0.38	15
210.00	94.60	47.79	8.68	3177.23	11908.93	35.90	0.09	68240.00	0.39	15
220.00	94.60	52.94	17.76	3552.74	15212.56	35.90	0.38	68240.00	0.40	15
230.00	94.60	57.29	25.44	3947.00	18081.97	35.90	0.85	68240.00	0.41	15
240.00	94.60	60.75	31.59	4332.27	20419.53	35.90	1.51	68240.00	0.42	15
250.00	94.60	63.26	36.06	4662.90	22141.62	35.90	2.35	68240.00	0.42	15
260.00	94.60	64.78	38.77	4889.84	23196.47	35.90	3.48	68240.00	0.43	15
270.00	94.60	65.29	39.69	4971.43	23551.54	35.90	4.71	68240.00	0.43	15
280.00	94.60	64.79	38.79	4891.20	23196.47	35.90	6.03	68240.00	0.43	15
290.00	94.60	63.27	36.08	4664.40	22141.62	35.90	7.44	68240.00	0.42	15
300.00	94.60	60.76	31.61	4333.81	20419.53	35.90	8.76	68240.00	0.42	15
310.00	94.60	57.30	25.47	3948.63	18081.97	35.90	10.17	68240.00	0.41	15
320.00	94.60	52.96	17.78	3553.64	15212.56	35.90	11.58	68240.00	0.40	15
330.00	94.60	47.81	8.73	3178.92	11908.93	35.90	12.72	68240.00	0.39	15
340.00	94.60	41.97	-1.57	2838.33	8276.10	35.90	13.75	68240.00	0.38	15
350.00	94.60	35.77	-12.48	2549.24	4561.92	35.90	14.41	68240.00	0.37	16
360.00	94.60	31.45	-20.12	2379.52	2052.01	35.90	14.60	68240.00	0.37	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 836.04 , MINIMUM AREA FRACTION ACCEPTABLE = 0.504

COOLANT MASS FLOW RATE (LBM/HR.) = 4959.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.45000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 20 , SOLAR ABSORPTANCE VALUE = 0.25000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFP(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	32.34	-18.53	2412.93	2565.02	35.90	18.25	68240.00	0.37	16
10.00	94.60	37.70	-9.08	2632.91	5702.40	35.90	18.01	66240.00	0.38	15
20.00	94.60	45.32	4.35	3024.75	10345.13	35.90	17.19	68240.00	0.39	15
30.00	94.60	52.46	16.92	3514.17	14886.14	35.90	15.89	68240.00	0.40	15
40.00	94.60	58.70	27.95	4095.55	19015.69	35.90	14.48	68240.00	0.41	15
50.00	94.60	63.94	37.28	4762.45	22602.47	35.90	12.72	68240.00	0.42	15
60.00	94.60	65.47	40.00	4863.21	25524.40	35.90	10.95	66382.63	0.43	1
70.00	94.60	65.47	40.00	4705.63	27677.02	35.90	9.30	64231.67	0.43	1
80.00	94.60	65.47	40.00	4609.16	28995.59	35.90	7.53	62914.86	0.43	1
90.00	94.60	65.47	40.00	4576.76	29439.44	35.90	5.89	62472.67	0.43	1
100.00	94.60	65.47	40.00	4609.39	28995.59	35.90	4.36	62918.04	0.43	1
110.00	94.60	65.47	40.00	4706.09	27677.02	35.90	2.94	64238.04	0.43	1
120.00	94.60	65.47	40.00	4863.87	25524.40	35.90	1.88	66391.69	0.43	1
130.00	94.60	63.93	37.24	4759.27	22602.47	35.90	1.06	68240.00	0.42	15
140.00	94.60	58.68	27.91	4093.50	19015.69	35.90	0.47	68240.00	0.41	15
150.00	94.60	52.44	16.88	3512.18	14886.14	35.90	0.12	68240.00	0.40	15
160.00	94.60	45.30	4.31	3023.26	10345.13	35.90	0.0	68240.00	0.39	15
170.00	94.60	37.67	-9.13	2631.50	5702.40	35.90	0.0	68240.00	0.38	15
172.93	94.60	36.12	-11.86	2564.05	4784.01	35.90	0.0	68240.00	0.37	16
180.00	94.60	27.60	-26.62	2252.02	0.0	35.90	0.0	68240.00	0.36	16
187.07	94.60	36.12	-11.86	2564.05	4784.01	35.90	0.0	68240.00	0.37	16
190.00	94.60	37.67	-9.13	2631.50	5702.40	35.90	0.0	68240.00	0.38	15
200.00	94.60	45.30	4.31	3023.26	10345.13	35.90	0.0	68240.00	0.39	15
210.00	94.60	52.44	16.88	3512.18	14886.14	35.90	0.12	68240.00	0.40	15
220.00	94.60	58.68	27.91	4093.50	19015.69	35.90	0.47	68240.00	0.41	15
230.00	94.60	63.93	37.24	4759.27	22602.47	35.90	1.06	68240.00	0.42	15
240.00	94.60	65.47	40.00	4863.87	25524.40	35.90	1.88	66391.69	0.43	1
250.00	94.60	65.47	40.00	4706.09	27677.02	35.90	2.94	64238.04	0.43	1
260.00	94.60	65.47	40.00	4609.39	28995.59	35.90	4.36	62918.04	0.43	1
270.00	94.60	65.47	40.00	4576.76	29439.44	35.90	5.89	62472.67	0.43	1
280.00	94.60	65.47	40.00	4609.16	28995.59	35.90	7.53	62914.86	0.43	1
290.00	94.60	65.47	40.00	4705.63	27677.02	35.90	9.30	64231.67	0.43	1
300.00	94.60	65.47	40.00	4863.21	25524.40	35.90	10.95	66382.63	0.43	1
310.00	94.60	63.94	37.28	4762.45	22602.47	35.90	12.72	68240.00	0.42	15
320.00	94.60	58.70	27.95	4095.55	19015.69	35.90	14.48	68240.00	0.41	15
330.00	94.60	52.46	16.92	3514.17	14886.14	35.90	15.89	68240.00	0.40	15
340.00	94.60	45.32	4.35	3024.75	10345.13	35.90	17.19	68240.00	0.39	15
350.00	94.60	37.70	-9.08	2632.91	5702.40	35.90	18.01	68240.00	0.38	15
360.00	94.60	32.34	-18.53	2412.93	2565.02	35.90	18.25	68240.00	0.37	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 836.04 , MINIMUM AREA FRACTION ACCEPTABLE = 0.504

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.45000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 30 , SOLAR ABSORPTANCE VALUE = 0.30000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	33.24	-16.95	2447.01	3078.02	35.90	21.90	68240.00	0.37	16
10.00	94.60	39.61	-5.70	2721.69	6842.88	35.90	21.62	68240.00	0.38	15
20.00	94.60	48.62	10.15	3232.40	12414.16	35.90	20.63	68240.00	0.39	15
30.00	94.60	56.99	24.91	3917.22	17863.38	35.90	19.07	68240.00	0.41	15
40.00	94.60	64.26	37.85	4810.13	22818.84	35.90	17.38	68240.00	0.43	15
50.00	94.60	65.47	40.00	4745.78	27122.95	35.90	15.26	64779.77	0.43	1
60.00	94.60	65.47	40.00	4489.06	30629.29	35.90	13.14	61275.57	0.43	1
70.00	94.60	65.47	40.00	4299.96	33212.43	35.90	11.16	58694.41	0.43	1
80.00	94.60	65.47	40.00	4184.20	34794.70	35.90	9.04	57114.25	0.43	1
90.00	94.60	65.47	40.00	4145.33	35327.32	35.90	7.06	56583.61	0.43	1
100.00	94.60	65.47	40.00	4184.48	34794.70	35.90	5.23	57118.06	0.43	1
110.00	94.60	65.47	40.00	4300.52	33212.43	35.90	3.53	58702.04	0.43	1
120.00	94.60	65.47	40.00	4489.86	30629.29	35.90	2.26	61286.44	0.43	1
130.00	94.60	65.47	40.00	4746.81	27122.95	35.90	1.27	64793.77	0.43	1
140.00	94.60	64.24	37.80	4806.45	22818.84	35.90	0.57	68240.00	0.43	15
150.00	94.60	56.96	24.87	3914.85	17863.38	35.90	0.14	68240.00	0.41	15
160.00	94.60	48.59	10.09	3230.00	12414.16	35.90	0.0	68240.00	0.39	15
170.00	94.60	39.58	-5.76	2720.05	6842.88	35.90	0.0	68240.00	0.38	15
172.93	94.60	37.74	-9.01	2634.57	5740.82	35.90	0.0	68240.00	0.38	15
180.00	94.60	27.80	-26.62	2252.02	0.0	35.90	0.0	68240.00	0.36	16
187.07	94.60	37.74	-9.01	2634.57	5740.82	35.90	0.0	68240.00	0.38	15
190.00	94.60	39.58	-5.76	2720.05	6842.88	35.90	0.0	68240.00	0.38	15
200.00	94.60	48.59	10.09	3230.00	12414.16	35.90	0.0	68240.00	0.39	15
210.00	94.60	56.96	24.87	3914.85	17863.38	35.90	0.14	68240.00	0.41	15
220.00	94.60	64.24	37.80	4806.45	22818.84	35.90	0.57	68240.00	0.43	15
230.00	94.60	65.47	40.00	4746.81	27122.95	35.90	1.27	64793.77	0.43	1
240.00	94.60	65.47	40.00	4489.86	30629.29	35.90	2.26	61286.44	0.43	1
250.00	94.60	65.47	40.00	4300.52	33212.43	35.90	3.53	58702.04	0.43	1
260.00	94.60	65.47	40.00	4184.48	34794.70	35.90	5.23	57118.06	0.43	1
270.00	94.60	65.47	40.00	4145.33	35327.32	35.90	7.06	56583.61	0.43	1
280.00	94.60	65.47	40.00	4184.20	34794.70	35.90	9.04	57114.25	0.43	1
290.00	94.60	65.47	40.00	4299.96	33212.43	35.90	11.16	58694.41	0.43	1
300.00	94.60	65.47	40.00	4489.06	30629.29	35.90	13.14	61275.57	0.43	1
310.00	94.60	65.47	40.00	4745.78	27122.95	35.90	15.26	64779.77	0.43	1
320.00	94.60	64.26	37.85	4810.13	22818.84	35.90	17.38	68240.00	0.43	15
330.00	94.60	56.99	24.91	3917.22	17863.38	35.90	19.07	68240.00	0.41	15
340.00	94.60	48.62	10.15	3232.40	12414.16	35.90	20.63	68240.00	0.39	15
350.00	94.60	39.61	-5.70	2721.69	6842.88	35.90	21.62	68240.00	0.38	15
360.00	94.60	33.24	-16.95	2447.01	3078.02	35.90	21.90	68240.00	0.37	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 836.04 , MINIMUM AREA FRACTION ACCEPTABLE = 0.504

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.45000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 40 , SOLAR ABSORPTANCE VALUE = 0.35000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	34.13	-15.38	2482.05	3591.02	35.90	25.55	68240.00	0.37	16
10.00	94.60	41.50	-2.38	2814.82	7983.36	35.90	25.22	68240.00	0.38	15
20.00	94.60	51.85	15.84	3466.05	14483.18	35.90	24.06	68240.00	0.40	15
30.00	94.60	61.40	32.74	4412.76	20840.61	35.90	22.25	68240.00	0.42	15
40.00	94.60	65.47	40.00	4782.12	26621.97	35.90	20.27	65275.74	0.43	1
50.00	94.60	65.47	40.00	4414.42	31643.45	35.90	17.80	60256.73	0.43	1
60.00	94.60	65.47	40.00	4114.92	35734.16	35.90	15.33	56168.51	0.43	1
70.00	94.60	65.47	40.00	3894.31	38747.82	35.90	13.02	53157.15	0.43	1
80.00	94.60	65.47	40.00	3759.25	40593.82	35.90	10.55	51313.62	0.43	1
90.00	94.60	65.47	40.00	3713.90	41215.21	35.90	8.24	50694.54	0.43	1
100.00	94.60	65.47	40.00	3759.57	40593.82	35.90	6.10	51318.06	0.43	1
110.00	94.60	65.47	40.00	3894.96	38747.82	35.90	4.12	53166.04	0.43	1
120.00	94.60	65.47	40.00	4115.85	35734.16	35.90	2.64	56181.20	0.43	1
130.00	94.60	65.47	40.00	4415.62	31643.45	35.90	1.48	60273.05	0.43	1
140.00	94.60	65.47	40.00	4783.55	26621.97	35.90	0.66	65295.36	0.43	1
150.00	94.60	61.37	32.69	4408.95	20840.61	35.90	0.16	68240.00	0.42	15
160.00	94.60	51.82	15.78	3463.39	14483.18	35.90	0.0	68240.00	0.40	15
170.00	94.60	41.46	-2.44	2813.02	7983.36	35.90	0.0	68240.00	0.38	15
172.93	94.60	39.34	-6.20	2708.20	6697.62	35.90	0.0	68240.00	0.38	15
180.00	94.60	27.80	-26.62	2252.02	0.0	35.90	0.0	68240.00	0.36	16
187.07	94.60	39.34	-6.20	2708.20	6697.62	35.90	0.0	68240.00	0.38	15
190.00	94.60	41.46	-2.44	2813.02	7983.36	35.90	0.0	68240.00	0.38	15
200.00	94.60	51.82	15.78	3463.39	14483.18	35.90	0.0	68240.00	0.40	15
210.00	94.60	61.37	32.69	4408.95	20840.61	35.90	0.16	68240.00	0.42	15
220.00	94.60	65.47	40.00	4783.55	26621.97	35.90	0.66	65295.36	0.43	1
230.00	94.60	65.47	40.00	4415.62	31643.45	35.90	1.48	60273.05	0.43	1
240.00	94.60	65.47	40.00	4115.85	35734.16	35.90	2.64	56181.20	0.43	1
250.00	94.60	65.47	40.00	3894.96	38747.82	35.90	4.12	53166.04	0.43	1
260.00	94.60	65.47	40.00	3759.57	40593.82	35.90	6.10	51318.06	0.43	1
270.00	94.60	65.47	40.00	3713.90	41215.21	35.90	8.24	50694.54	0.43	1
280.00	94.60	65.47	40.00	3759.25	40593.82	35.90	10.55	51313.62	0.43	1
290.00	94.60	65.47	40.00	3894.31	38747.82	35.90	13.02	53157.15	0.43	1
300.00	94.60	65.47	40.00	4114.92	35734.16	35.90	15.33	56168.51	0.43	1
310.00	94.60	65.47	40.00	4414.42	31643.45	35.90	17.80	60256.73	0.43	1
320.00	94.60	65.47	40.00	4782.12	26621.97	35.90	20.27	65275.74	0.43	1
330.00	94.60	61.40	32.74	4412.76	20840.61	35.90	22.25	68240.00	0.42	15
340.00	94.60	51.85	15.84	3466.05	14483.18	35.90	24.06	68240.00	0.40	15
350.00	94.60	41.50	-2.38	2814.82	7983.36	35.90	25.22	68240.00	0.38	15
360.00	94.60	34.13	-15.38	2482.05	3591.02	35.90	25.55	68240.00	0.37	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES; ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 ; MIX = 40.00

PLATFORM AREA IN FT2 = 836.04 , MINIMUM AREA FRACTION ACCEPTABLE = 0.504

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.45000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 50 , SOLAR ABSORPTANCE VALUE = 0.40000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	35.01	-13.82	2517.80	4104.02	35.90	29.20	68240.00	0.37	16
10.00	94.60	43.37	0.92	2913.98	9123.84	35.90	28.82	68240.00	0.39	15
20.00	94.60	55.02	21.45	3731.72	16552.20	35.90	27.50	68240.00	0.41	15
30.00	94.60	65.47	40.00	4987.17	23817.84	35.90	25.43	68074.69	0.43	1
40.00	94.60	65.47	40.00	4503.29	30425.12	35.90	23.17	61469.70	0.43	1
50.00	94.60	65.47	40.00	4083.07	36163.94	35.90	20.34	55733.71	0.43	1
60.00	94.60	65.47	40.00	3740.77	40839.04	35.90	17.52	51061.43	0.43	1
70.00	94.60	65.47	40.00	3488.65	44283.23	35.90	14.88	47619.88	0.43	1
80.00	94.60	65.47	40.00	3334.29	46392.95	35.90	12.06	45512.98	0.43	1
90.00	94.60	65.47	40.00	3282.46	47103.09	35.90	9.42	44805.48	0.43	1
100.00	94.60	65.47	40.00	3334.67	46392.95	35.90	6.97	45518.07	0.43	1
110.00	94.60	65.47	40.00	3489.39	44283.23	35.90	4.71	47630.05	0.43	1
120.00	94.60	65.47	40.00	3741.84	40839.04	35.90	3.01	51075.93	0.43	1
130.00	94.60	65.47	40.00	4084.43	36163.94	35.90	1.70	55752.36	0.43	1
140.00	94.60	65.47	40.00	4504.93	30425.12	35.90	0.75	61492.11	0.43	1
150.00	94.60	65.47	40.00	4989.02	23817.84	35.90	0.19	68099.94	0.43	1
160.00	94.60	54.98	21.37	3727.90	16552.20	35.90	0.0	68240.00	0.41	15
170.00	94.60	43.33	0.84	2911.37	9123.84	35.90	0.0	68240.00	0.39	15
172.93	94.60	40.92	-3.40	2785.65	7654.42	35.90	0.0	68240.00	0.38	15
180.00	94.60	27.80	-26.62	2252.02	0.0	35.90	0.0	68240.00	0.36	16
187.07	94.60	40.92	-3.40	2785.65	7654.42	35.90	0.0	68240.00	0.38	15
190.00	94.60	43.33	0.84	2911.37	9123.84	35.90	0.0	68240.00	0.39	15
200.00	94.60	54.98	21.37	3727.90	16552.20	35.90	0.0	68240.00	0.41	15
210.00	94.60	65.47	40.00	4989.02	23817.84	35.90	0.19	68099.94	0.43	1
220.00	94.60	65.47	40.00	4504.93	30425.12	35.90	0.75	61492.11	0.43	1
230.00	94.60	65.47	40.00	4084.43	36163.94	35.90	1.70	55752.36	0.43	1
240.00	94.60	65.47	40.00	3741.84	40839.04	35.90	3.01	51075.93	0.43	1
250.00	94.60	65.47	40.00	3489.39	44283.23	35.90	4.71	47630.05	0.43	1
260.00	94.60	65.47	40.00	3334.67	46392.95	35.90	6.97	45518.07	0.43	1
270.00	94.60	65.47	40.00	3282.46	47103.09	35.90	9.42	44805.48	0.43	1
280.00	94.60	65.47	40.00	3334.29	46392.95	35.90	12.06	45512.98	0.43	1
290.00	94.60	65.47	40.00	3488.65	44283.23	35.90	14.88	47619.88	0.43	1
300.00	94.60	65.47	40.00	3740.77	40839.04	35.90	17.52	51061.43	0.43	1
310.00	94.60	65.47	40.00	4083.07	36163.94	35.90	20.34	55733.71	0.43	1
320.00	94.60	65.47	40.00	4503.29	30425.12	35.90	23.17	61469.70	0.43	1
330.00	94.60	65.47	40.00	4987.17	23817.84	35.90	25.43	68074.69	0.43	1
340.00	94.60	55.02	21.45	3731.72	16552.20	35.90	27.50	68240.00	0.41	15
350.00	94.60	43.37	0.92	2913.98	9123.84	35.90	28.82	68240.00	0.39	15
360.00	94.60	35.01	-13.82	2517.80	4104.02	35.90	29.20	68240.00	0.37	16

CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATION = 20.0 KW.

ORBIT BETA ANGLE = 5.00 DEGREES, ALTITUDE = 19370.0 NAUTICAL MILES.

TEMPERATURES, INLET = 94.60 , MIX = 40.00

PLATFORM AREA IN FT2 = 836.04 , MINIMUM AREA FRACTION ACCEPTABLE = 0.504

COOLANT MASS FLOW RATE (LBM/HR.) = 4999.28

SOLAR ABSORPTANCE VALUE FOR UPPER LIMIT OF EXTERNAL LOADS FOR SIZING RADIATOR AREA = 0.63963

MAXIMUM ABSORPTANCE VALUE = 0.45000 FOR A PERIOD OF 60 MONTHS AT A DEGRADATION RATE OF 0.00500 DELTA ABSORPTANCE PER MONTH

ORBIT POSITION ENTERING ECLIPSE = 172.93 , ORBIT POSITION EXITING ECLIPSE = 187.07

TIME AFTER LAUNCH IN MONTHS = 60 , SOLAR ABSORPTANCE VALUE = 0.45000

ORBITAL SOLUTION

DEGREES	INLET (F)	RAD (F)	OUTLET (F)	MFR(LBM/HR)	SOL(BTU/HR)	ES(BTU/HR)	AL(BTU/HR)	DISSIP(BTU/HR)	ETA	ITN
0.0	94.60	35.89	-12.27	2554.30	4617.03	35.90	32.85	68240.00	0.37	16
10.00	94.60	45.22	4.16	3018.41	10264.32	35.90	32.42	68240.00	0.39	15
20.00	94.60	58.14	26.96	4035.57	18621.22	35.90	30.94	68240.00	0.41	15
30.00	94.60	65.47	40.00	4768.82	26795.07	35.90	28.61	65094.31	0.43	1
40.00	94.60	65.47	40.00	4224.45	34228.25	35.90	26.07	57663.67	0.43	1
50.00	94.60	65.47	40.00	3751.71	40684.44	35.90	22.89	51210.66	0.43	1
60.00	94.60	65.47	40.00	3366.63	45943.93	35.90	19.71	45954.36	0.43	1
70.00	94.60	65.47	40.00	3082.98	49818.64	35.90	16.74	42082.61	0.43	1
80.00	94.60	65.47	40.00	2909.34	52192.07	35.90	13.56	39712.36	0.43	1
90.00	94.60	65.47	40.00	2851.03	52990.98	35.90	10.60	38916.42	0.43	1
100.00	94.60	65.47	40.00	2909.76	52192.07	35.90	7.84	39718.08	0.43	1
110.00	94.60	65.47	40.00	3083.82	49818.64	35.90	5.30	42094.05	0.43	1
120.00	94.60	65.47	40.00	3367.82	45943.93	35.90	3.39	45970.68	0.43	1
130.00	94.60	65.47	40.00	3753.24	40684.44	35.90	1.91	51231.64	0.43	1
140.00	94.60	65.47	40.00	4226.30	34228.25	35.90	0.85	57688.89	0.43	1
150.00	94.60	65.47	40.00	4770.91	26795.07	35.90	0.21	65122.71	0.43	1
160.00	94.60	58.09	26.87	4030.43	18621.22	35.90	0.0	68240.00	0.41	15
170.00	94.60	45.17	4.08	3015.59	10264.32	35.90	0.0	68240.00	0.39	15
172.93	94.60	42.49	-0.64	2866.39	8611.23	35.90	0.0	68240.00	0.38	15
180.00	94.60	27.80	-26.62	2252.02	0.0	35.90	0.0	68240.00	0.36	16
187.07	94.60	42.49	-0.64	2866.39	8611.22	35.90	0.0	68240.00	0.38	15
190.00	94.60	45.17	4.08	3015.59	10264.32	35.90	0.0	68240.00	0.39	15
200.00	94.60	58.09	26.87	4030.43	18621.22	35.90	0.0	68240.00	0.41	15
210.00	94.60	65.47	40.00	4770.91	26795.07	35.90	0.21	65122.71	0.43	1
220.00	94.60	65.47	40.00	4226.30	34228.25	35.90	0.85	57688.89	0.43	1
230.00	94.60	65.47	40.00	3753.24	40684.44	35.90	1.91	51231.64	0.43	1
240.00	94.60	65.47	40.00	3367.82	45943.93	35.90	3.39	45970.68	0.43	1
250.00	94.60	65.47	40.00	3083.82	49818.64	35.90	5.30	42094.05	0.43	1
260.00	94.60	65.47	40.00	2909.76	52192.07	35.90	7.84	39718.08	0.43	1
270.00	94.60	65.47	40.00	2851.03	52990.98	35.90	10.60	38916.42	0.43	1
280.00	94.60	65.47	40.00	2909.34	52192.07	35.90	13.56	39712.36	0.43	1
290.00	94.60	65.47	40.00	3082.98	49818.64	35.90	16.74	42082.61	0.43	1
300.00	94.60	65.47	40.00	3366.63	45943.93	35.90	19.71	45954.36	0.43	1
310.00	94.60	65.47	40.00	3751.71	40684.44	35.90	22.89	51210.66	0.43	1
320.00	94.60	65.47	40.00	4224.45	34228.25	35.90	26.07	57663.67	0.43	1
330.00	94.60	65.47	40.00	4768.82	26795.07	35.90	28.61	65094.31	0.43	1
340.00	94.60	58.14	26.96	4035.57	18621.22	35.90	30.94	68240.00	0.41	15
350.00	94.60	45.22	4.16	3018.41	10264.32	35.90	32.42	68240.00	0.39	15
360.00	94.60	35.89	-12.27	2554.30	4617.03	35.90	32.85	68240.00	0.37	16

G E O S Y N C H R O N O U S   S P A C E   S T A T I O N   R A D I A T O R   P R O G R A M .

ALTITUDE (N.MI.) = 19370.0

ORBIT INCLINATION BETA ANGLE (DEGREES) = 5.00

DISSIPATION (KW.), LOWEST = 20 HIGHEST = 40 INCREMENT = 20

BREAK POINT FROM PLATE TO CYLINDRICAL RADIATORS (KW.) = 20.00

MONTHS DEGRADATION FOR FLAT PLATE RADIATOR = 60 INCREMENT = 10
MONTHS DEGRADATION FOR CYLINDRICAL RADIATOR = 60 INCREMENT = 10

ORBIT PRINT INTERVAL FOR FLAT PLATE RADIATOR (DEGREES) = 10 ,INTERVAL FOR CYLINDRICAL RADIATOR = 10

AREA FRACTION FOR FLAT PLATE RADIATOR = 0.100 , FOR CYLINDRICAL RADIATOR = 1.000

PLATE, SHAPE FACTOR TO SPACE = 0.900000 FLUID CP = 0.2500 BTU/LBM-R.
CYL. , SHAPE FACTOR TO SPACE = 0.950000 FLUID CP = 0.2500 BTU/LBM-R.

RADIATOR MATERIAL PROPERTIES
PLATE, ABSORPTANCE = 0.15000 EMITTANCE = 0.88000 MONTHLY CHANGE IN ABSORPTANCE = 0.00350
CYL. , ABSORPTANCE = 0.07000 EMITTANCE = 0.88000 MONTHLY CHANGE IN ABSORPTANCE = 0.01500

EXTERNAL HEAT INPUT TABLES.

1 SOLAR FS, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.

0.0	0.996190
10.00	0.981060
20.00	0.936120
30.00	0.862730
40.00	0.763130
50.00	0.640340
60.00	0.498100
70.00	0.340720
80.00	0.172990
90.00	0.0
100.00	0.172990
110.00	0.340720
120.00	0.498100
130.00	0.640340
140.00	0.763130
150.00	0.862730
160.00	0.936120
170.00	0.981060
180.00	0.996190
190.00	0.981060
200.00	0.936120
210.00	0.862730
220.00	0.763130
230.00	0.640340
240.00	0.498100
250.00	0.340720
260.00	0.172990
270.00	0.0
280.00	0.172990
290.00	0.340720
300.00	0.498100

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         310.00       0.640340
         320.00       0.763130
         330.00       0.862730
         340.00       0.936120
         350.00       0.981060
         360.00       0.996190
2     EARTHSHINE FE, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.
           0.0        0.011360
         360.00       0.011360
3     ALBEDO FA, B=5, PLATE RADIATOR NORMAL TO ORBIT PLANE.
           0.0        0.008350
          10.00       0.008220
          20.00       0.007850
          30.00       0.007270
          40.00       0.006530
          50.00       0.005670
          60.00       0.004750
          70.00       0.003840
          80.00       0.002970
          90.00       0.002190
         100.00       0.001520
         110.00       0.000980
         120.00       0.000580
         130.00       0.000300
         140.00       0.000130
         150.00       0.000040
         160.00       0.0
         200.00       0.0
         210.00       0.000040
         220.00       0.000130
         230.00       0.000300
         240.00       0.000580
         250.00       0.000980
         260.00       0.001520
         270.00       0.002190
         280.00       0.002970
         290.00       0.003840
         300.00       0.004750
         310.00       0.005670
         320.00       0.006530
         330.00       0.007270
         340.00       0.007850
         350.00       0.008220
         360.00       0.008350
4     SOLAR FS, B=5, CYL. RADIATOR END ON TOWARD EARTH.
           0.0        0.027740
          10.00       0.061670
          20.00       0.111880
          30.00       0.160950
          40.00       0.205650
          50.00       0.244440
          60.00       0.276040
          70.00       0.299320
          80.00       0.313580
          90.00       0.318380
         100.00       0.313580
         110.00       0.299320
         120.00       0.276040
         130.00       0.244440
         140.00       0.205650
         150.00       0.160990
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          160.00        0.111880
          170.00        0.061670
          180.00        0.027740
          190.00        0.061670
          200.00        0.111880
          210.00        0.160990
          220.00        0.205650
          230.00        0.244440
          240.00        0.276040
          250.00        0.299320
          260.00        0.313580
          270.00        0.318380
          280.00        0.313580
          290.00        0.299320
          300.00        0.276040
          310.00        0.244440
          320.00        0.205650
          330.00        0.160990
          340.00        0.111880
          350.00        0.061670
          360.00        0.027740
  5   EARTHSHINE FE, B=5, CYL. RADIATOR END ON TOWARD EARTH.
            0.0         0.002310
          360.00        0.002310
  6   ALBEDO FA, B=5, CYL. RADIATOR END ON TOWARD EARTH.
            0.0         0.001550
           10.00        0.001530
           20.00        0.001460
           30.00        0.001350
           40.00        0.001230
           50.00        0.001080
           60.00        0.000930
           70.00        0.000790
           80.00        0.000640
           90.00        0.000500
          100.00        0.000370
          110.00        0.000250
          120.00        0.000160
          130.00        0.000090
          140.00        0.000040
          150.00        0.000010
          160.00        0.0
          200.00        0.0
          210.00        0.000010
          220.00        0.000040
          230.00        0.000090
          240.00        0.000160
          250.00        0.000250
          260.00        0.000370
          270.00        0.000500
          280.00        0.000640
          290.00        0.000790
          300.00        0.000930
          310.00        0.001080
          320.00        0.001230
          330.00        0.001350
          340.00        0.001460
          350.00        0.001530
          360.00        0.001550

 AREA FRACTION FOR FLAT PLATE RADIATOR IS BELOW MINIMUM ACCEPTABLE VALUE OF 0.257 , SOLUTION TERMINATED.
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CYLINDRICAL RADIATOR FOR CASE OF 68240.0 BTU/HR. DISSIPATICN = 20.0 KW.

MAXIMUM SOLAR ABSORPTANCE VALUE OVER INTERVAL EXCEEDS 0.63963 WHICH IS UPPER LIMIT REQUIRING INFINITE RADIATOR AREA

Appendix F

INDUSTRY SEARCH RESULTS

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NASA/GSFC*

Goddard Space Center has expressed an interest in the general area of thermal-control surfaces for large space structures. They feel studies should be initiated in the following areas:

- Reapplication of coatings in space (paints, polymers)
- Development of techniques to liquify helium in space
- Development of techniques to clean radiators in space
- Development of an $80^{\circ}K$-5 watt cryoradiator
- Development of electrostatic methods to attract contamination to noncritical surfaces
- Development of a 75 to $100^{\circ}K$ mechanical cooler
- Ionization of waste disposal - collection somewhere else
- Development of space-stable conductive coatings for geosynchronous orbits
- Development of accelerated testing philosophy to predict 30-year lifetimes
- Development of techniques to coat large structures with thin films in orbit

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*Participating individuals and organization

- Mr. Jack Triolo - Thermal Design Branch
- Dr. Alan Sherman - Thermal Design Branch
- Mr. James Heaney - Optics Branch

NASA/JSC*

Johnson Space Center has an active interest in general areas of thermal-control surfaces for long-term missions. They have submitted a RTOP on the subject of repair and replacement of radiators in space. They are soliciting information from government agencies and industry on state-of-the-art synchronous altitude space simulation facilities. They feel studies should be initiated in the following areas:

- Develop techniques to coat structures with thin films in orbit; e.g., SPS
- Develop structural composites [(polymides, polyesters, graphite epoxies) (1-5 mil)] useful as thermal-control surfaces
- Develop techniques to monitor optical properties/mechanical properties
- Develop techniques to maintain pointing accuracy of reflectors as a function of changes in optical/radiative properties
- Develop accelerated testing philosophy to predict 30-year lifetime
- Develop ultra-low outgassing materials
- Develop docking techniques to prevent thruster plume impingement

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*Participating individuals and organization

- Mr. Stephen Jacobs - Materials Technology Branch
- Dr. Lubert Leger - Materials Technology Branch

NASA/LaRC*

Langley Research Center is extremely interested in this subject. They are deeply involved in the large-area space-structures program and feel studies should be performed in the following disciplines:

- Develop techniques to monitor the optical/mechanical properties of materials in space
- Develop testing philosophies to predict 30-year lifetimes on materials
- Develop low outgassing materials
- Develop techniques to repair or replace materials in space

*Participating individuals and organization

- Mr. Wayne Slemp - Materials Application Branch

NASA/LeRC*

Lewis Research Center offered the following suggestions:

- Develop techniques to monitor the optical/radiative/ mechanical properties of thermal surfaces in orbit
- Develop charge-control materials (e.g., thermal coatings, etc.)
- Develop an accelerated testing philosophy for predicting 30-year lifetimes
- Develop lightweight, high-temperature MLI
- Determine effects of ion engines on materials

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*Participating individuals and organization

- Mr. Frank Berkopec - Electrical Systems Branch
- Mr. George Smolak - Flight Project Branch

AFML/WPAFB*

The Air Force Materials Laboratory has initiated programs in the development of extended-life satellite materials. They are of the opinion that programs of this nature must be undertaken for long-term future missions to be successful.

- Develop low outgassing conductive adhesives
- Develop charge-control materials (i.e., thermal coatings, insulation, solar cell coverslides)
- Investigate mass transport properties and effects of contaminants

*Participating individuals and organizations

- Dr. William Lehn - Materials and Elastomers Branch

IIT Research Institute*

IITRI feels NASA should initiate studies in the following areas:

- Develop techniques to clean radiators in space
- Develop methods to monitor optical properties and contamination on optical surfaces
- Develop techniques to refurbish surfaces in orbit
- Develop techniques to reapply coatings in space (paints, etc.)
- Develop new low outgassing conductive adhesives
- Develop new low outgassing materials

*Participating individuals and organizations

- o Mr. Jack Gilligan - Polymer Chemistry Research
- o Mr. Yoshiro Harada - Mechanics of Materials Division