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Nuclear Engine System Simulation (NESS): Version 2.0 Program User's Guide

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CONTENTS

Section	n
1.0 INTRODUCTION	Page
	1-1
2.0 ENGINE SYSTEM MODEL	
 2.1 Overall Analysis Method	2-1
2.2 Major Code Components	2-1 2-4
2.2.1 Engine Performance 2.2.2 Nozzle Cooling	2-4 2-4
2.2.2 Nozzle Cooling. 2.2.3 Nozzle Modeling Options	2-9
2.2.3 Nozzle Modeling Options.2.2.4 Reactor	2-10
2.2.5 Auxiliary Components	2-11
 2.2.5 Auxiliary Components 2.2.6 Materials of Construction 2.2.7 Tankage 	2-15
2.2.7 Tankage	2-16
2.2.8 Propellant Pressure/Temperature/Flowrate Schedules 2.2.9 Propellant Properties	2-17
2.2.9 Propellant Properties	2-20
2.2.10 Turbopump Assembly	2-25
2.2.11 Weight Multipliers 2.3 Additional Features	2-33
2.3.1 Pump-Out Option	2-34
2.3.2 User-Defined Engine Burn Time	2-34
2.3.3 User-Defined Turbomachinery 2.3.4 Weight Margin	2-36
2.3.4 Weight Margin2.3.5 Bleed Cycle Component Models	2-30 2-30
 2.3.5 Bleed Cycle Component Models. 2.4 Code Setup and Execution. 	2-39
	2-43
3.0 REACTOR SYSTEM	
3.1 Reactor System Description 3.1.1 Reactor Assembly	3-1
3.1.1 Reactor Assembly 3.1.2 Fuel and Support Elements	3-1
3.1.2 Fuel and Support Elements 3.1.3 Radiation Shield	3-1 3-1
3.1.3 Radiation Shield 3.2 Baseline Reactor Design	3-1
 3.2 Baseline Reactor Design	3-7
3.4 Reactor Weight Model	3-9
3.5 Design Variable Options 3	-11
3.6 Key Assumptions	-16
4.0 SAMPLE NTRENCINE SYSTEM PROPERTY 3	-16
4.0 SAMPLE NTP ENGINE SYSTEM DESIGN CASES	1_1
5.0 MODEL VERIFICATION/COMPADISON	4 -1
5.0 MODEL VERIFICATION/COMPARISON	5-1
6.0 CONCLUDING REMARKS	
7.0 REFERENCES	5-1
	7 1
Appendix A NESS INDUT WORKSHIPPER	'-1
Appendix A NESS INPUT WORKSHEETS A	-1

CONTENTS (Cont.)

List of Figures

Figures

	NESS Program Overview	2-2
2-1	NESS Program Overview	2-3
2-2	NESS Program Flow Logic	
2-3	Dependentative NTD Expander ()as (jenerator, and Bicco Englic	2-5
	System Cycle Flow Paths	
2-4	and the second Key Input Variables	2-12
2-5		
2-6		
2-7	Axial Pump Head Coerticient as a Function of Specific Speed	2-28
2-8	Axial Pump Head Coefficiency as a Function of Specific Speed Axial Main Pump Efficiency as a Function of Specific Speed	2-30
2-9		
2-10	T I T T T T T T T T T T T T T T T T T T	2-42
2-11		
3-1	TATA DI ED Class (NEDVA Type) Nuclear I nemital Rocket Lighte Reader	3-3
3-2	The second Elements and SUDDOUS	
3-3	Propellant Flow Circuits Through the Reactor	
3-4	The second she will Reactor	
3-5	R-Z Model of the Regions in the R-1 Reactor	5-14

List of Tables

Table

2-1	Key NESS Input Flags and Variables	2-6 2-19
2-2		
2-3		
2-4		
2-5		
3-1	The second Close and Close	
3-2		
3-3	- w i z i z i z z i wiła ot o Dione 64 inches PORVAIII () LIIC CUIC CONVINI	
3-3 3-4	\sim $117 \cdot 14$ Model Regions	
5-4 4-1		
4-1 4-2		
• =		
4-3	Sample Case No. 2 Sample Case No. 3	. 4-94
4-4	Sample Case No. 3 Sample Case No. 4	.4-118
4-5	Sample Case No. 4 Sample Case No. 5	.4-141
4-6	Sample Case No. 5 Sample Case No. 6	.4-164
4-7	Sample Case No. 6 Sample Case No. 7	. 4-191
4-8	Sample Case No. 7 Sample Case No. 8	. 4-215
4-9	Sample Case No. 8 Engine Cycle Parameter Comparison	
5-1	Engine Cycle Parameter Comparison Engine Component Weight Comparison	. 5-2
5-2	Engine Component Weight Comparison Effect of Wall Temperature on Performance	. 5-3
5-3	Effect of Wall Temperature on Ferrormance	

Page

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FOREWORD

This Program User's Guide discusses the Nuclear Thermal Propulsion (NTP) engine system design features and capabilities modeled in the Nuclear Engine System Simulation (NESS): Version 2.0 program (referred to as NESS throughout the remainder of this document), as well as its operation. NESS has been upgraded to include many new modeling capabilities not available in the original version delivered to the NASA Lewis Research Center in December 1991, see Ref. 1-0. NESS's new features include:

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- An improved input format
- An advanced solid-core NERVA-type reactor system model (ENABLER II)
- A bleed-cycle engine system option
- An axial-turbopump design option
- An automated pump-out turbopump assembly sizing option
- An off-design gas generator engine cycle design option
- Updated hydrogen properties
- An improved output format
- Personal computer operation capability

Sample design cases are presented in this user's guide that demonstrate many of the new features associated with this upgraded version of NESS, as well as design modeling features associated with the original version of NESS, discussed in Ref. 1-0.

CONSULTATION

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1.0 INTRODUCTION

An accurate, standalone, preliminary Nuclear Thermal Propulsion (NTP) engine system design analysis tool is required to support current and future Space Exploration Initiative (SEI) propulsion and vehicle design studies. Currently available NTP engine design models are those developed during the NERVA program in the 1960s and early 1970s and are highly unique to that design (see Ref. 1-1) or are modifications of current liquid propulsion system design models. To date, NTP engine-based liquid design models lack integrated design of key NTP engine design features, such as in the areas of reactor, shielding, multipropellant capability, and multiredundant pump feed fuel systems. Additionally, since the SEI effort is in the initial development stage, a robust, verified NTP analysis design tool could be of great use to the community.

This effort developed an accurate, versatile NTP engine system design analysis program (tool), known as the Nuclear Engine System Simulation (NESS) program, to support ongoing and future engine system and stage design study efforts. In this effort, Science Applications International Corporation's (SAIC) NTP version of the Expanded Liquid Engine Simulation (ELES) program was modified extensively to include Westinghouse Electric Corporation's near-term and next generation solid-core reactor design models, ENABLER I and ENABLER II reactor designs, respectively. The ELES program has extensive capability to conduct preliminary system design analysis of liquid rocket systems and vehicles. The program is modular in nature and is versatile in terms of modeling state-of-the-art component and system options as discussed in Refs. 1-2 and 1-3. The Westinghouse reactor design model, which were integrated in the NESS program, are based on the near-term and upgraded version of the solid-core ENABLER NTP reactor design concept, see Ref. 1-4.

This program is now capable of accurately modeling (characterizing) a complete near-term or next generation solid-core NTP engine system in great detail, for a number of design options, in an efficient manner. The following discussion summarizes the overall analysis methodology, key assumptions, and capabilities associated with the NESS, presents example problems, and compares the results to a related NTP engine system design.

2.0 ENGINE SYSTEM MODEL

This section discusses the overall NTP engine system design and performance prediction methodology and the unique model input options associated with NESS. To better understand the operation of NESS, it is important that the operator be familiar with the ELES program which is discussed in detail in Refs. 1-2 and 2-1.

2.1 Overall Analysis Method

The NESS flow logic is essentially the same as the ELES logic detailed in the ELES Programmer's Manual, Ref. 1-3. A simple summary of the analysis procedure is shown in Figure 2-1, and a detailed flow chart is given in Figure 2-2. Many portions of the code are iterated two or more times to improve accuracy. The key inputs include the thrust level, FVAC, reactor type, IREACTR, and engine cycle type, KCYCLE=1 for gas generator (GG), =3 for expander, or =7 for bleed cycle. Also important are the chamber pressure and temperature, PC and TCHAMBER, respectively, flow paths (bypass fractions NFF and BYPTUR), nozzle configuration, NOZTYP and KOOLNZ, turbopump type, IPTYPE, reactor scaling factor, FALPHA, and the number of propellant feed legs, NTPA.

Once an input file has been formulated and read in by NESS, the first step is to initialize propellant properties from the libraries of propellant data stored in the code. These properties will be recalculated at many different code locations and for many different conditions throughout code execution. The ideal performance is initially estimated based on known chamber pressure and temperature, and nozzle area ratio; the boundary layer and divergence efficiencies are calculated at this time and an estimated delivered specific impulse (Isp) is found. This estimate is used to calculate a reactor flowrate. The nozzle heat load is estimated as 1% of total reactor power, and this heat load, Isp, and flowrate are passed to the reactor design portion of the code, ENABLER, for calculation of reactor fuel and overall operating characteristics. The generic NESS ENABLER reactor design module can be configured to represent either an ENABLER I or ENABLER II NTP reactor design, see Section 3.0.

The reactor inlet pressure and temperature are now used to calculate the cycle pressure schedule. During the pressure calculations, the nozzle barrier cooling requirement is also calculated along with the regen cooling requirements. Now that all engine efficiencies are known, the actual delivered Isp and flowrate are calculated. The actual nozzle heat load is compared with the original estimate and if they are not within 10%, the code loops back to the reactor design

portion of the code and repeats all steps up to the point this comparison is made. If the nozzle heat loads are reasonably matched but the reactor design has only been performed once, the code loops back to the reactor design with the newly calculated Isp and flowrate to improve accuracy.

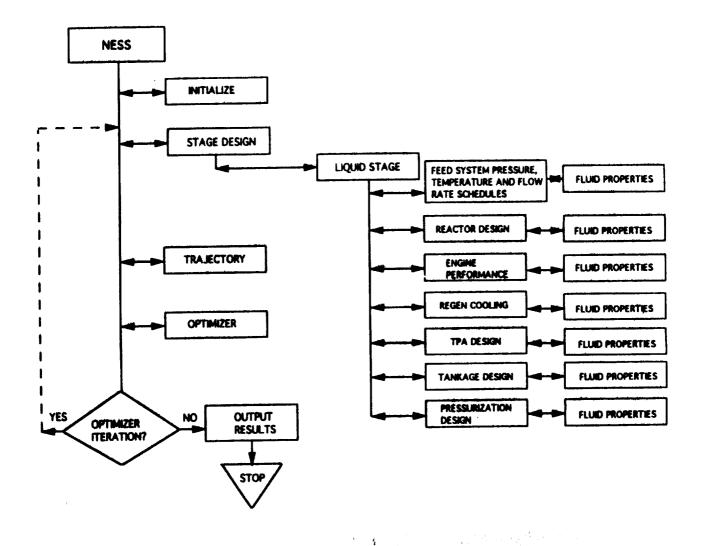
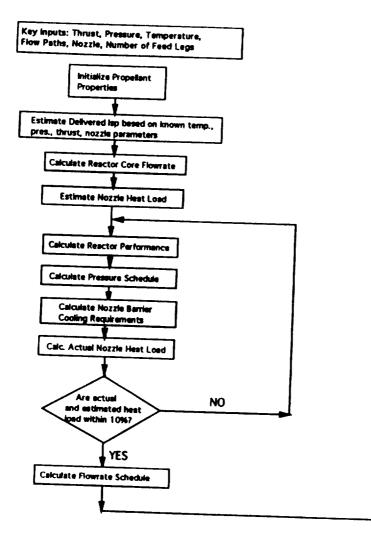


Figure 2-1. NESS Program Overview



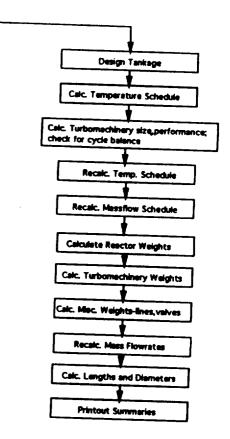


Figure 2-2. NESS Program Flow Logic

After the reactor design, performance, and pressure schedule have been completed satisfactorily, the code now calculates all cycle flowrates. Tankage volumes, pressures, temperatures, and pressurization requirements are calculated next. The temperature schedule is determined, and the turbomachinery can now be analyzed. The turbopump assembly (TPA) portion of the code calculates the size and performance of the pumps and turbines, and checks for cycle balance by comparing pump required horsepower to the turbine delivered horsepower; if not balanced, a new turbine pressure ratio is calculated and the TPA design process is repeated.

Once the TPA design has been completed, the flowrate and temperature schedules are recalculated to improve accuracy. Next, component weight calculations for the reactor, turbomachinery, nozzle, and all miscellaneous parts (lines, valves, etc) are performed. Mass flowrates are calculated one more time, overall engine dimensions are found, and finally, output summaries are printed out. When the pump-out (double run) option is selected (see Section 2.3.1), the entire design process is completed for an engine at reduced thrust level and then a second iteration of the entire design at full thrust level is performed beginning with the reactor module using some of the values calculated in the first pass (TPA parameters and some weights).

Flow path schematics of the representative NTP expander, gas generator, and bleed engine cycle systems are shown in Figure 2-3. The representative NTP engine systems shown in Figure 2-3, incorporate dual propellant feed systems in all cases, and boost pumps for the expander and bleed cycles only. The representative GG system does not include boost pumps.

2.2 Major Code Components

Table 2-1 lists the major code modules along with key flags and input variables. Each of these modules is discussed in further detail in the sections following, including both overall discussion of the module and how to determine the inputs required.

2.2.1 Engine Performance

Engine performance calculations begin with an ideal one-dimensional equilibrium (ODE) performance value that is later degraded with loss multipliers. The ideal values for specific impulse (Isp) and C star (C*) are calculated by the ODE module of the Two-Dimensional Kinetic Reference Program (TDK), Ref. 2-1, as a function of chamber pressure, temperature, and nozzle area ratio. Tables of hydrogen performance data are stored in the subroutine HYDROGEN along with the curve-fit equations used to calculate ideal C*, which is a function of temperature and pressure

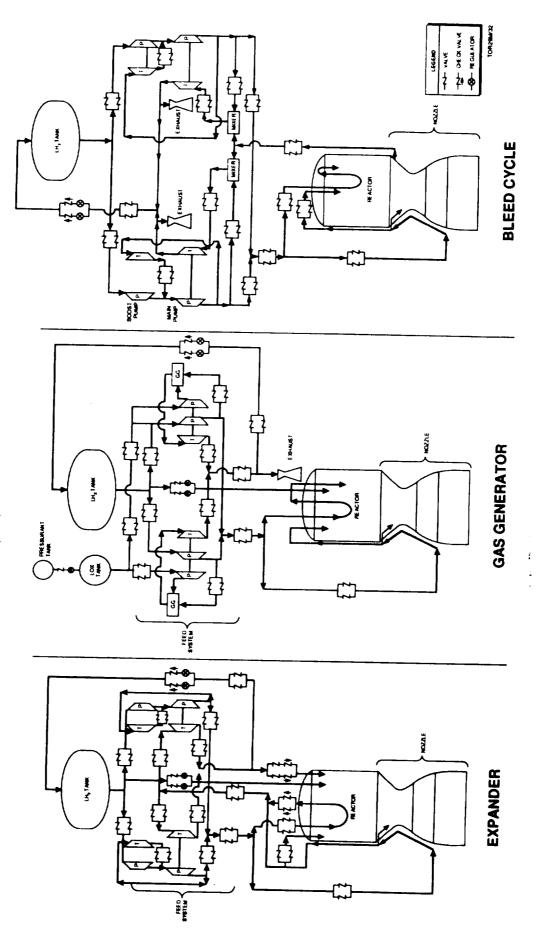


Figure 2-3. Representative NTP Expander, Gas Generator, and Bleed Engine System Cycle Flow Paths

2-5

Module	Variable	Value	Result
General Input:			
Cycle Type	KCYCLE	= 1	Gas Generator Cycle
-778		= 3	Expander Cycle
		= 7	Bleed Cycle
Thrust Level	FVAC		Set thrust level
Chamber Pressure	PC		Set pressure
	TCHAMBER		Set temperature
Chamber Temperature			Use ENABLER 1
Reactor Type	IREACTR	= 1	
		= 2	Use ENABLER II
Choose double-run?	IDBLRUN	0,1	If =1, double-run used
Iterate pump design?	ITRATE	0,1	If=1, iterate pump design
Bleed cycle solver	ISOLVE	= 0	Input bleed flow fractions
		= 1	Input turbine inlet temp.
Input burn time?	IUSRBRN	0.1	If =1, input burn time
User-defined TPA?	ISTSET	0.1	If =1, input TPA values
Use-delined IFAI	101021		
Nozzle:			
Exit area ratio	EPS		Set exit area ratio
Use extension?	KEXNOZ	0.1	If =1, use extension
	NOZTYP	0.1	If $=1$, use 3-portion nozzle
Use 3-portion nozzle?		0,1	Set ext. attach area ratio
Attach area ratio 1	EPSATT		
Attach area ratio 2	EPSAT2		Set 2nd ext attach area ratio
Nozzle cooling	KOOLNZ	= 2	Regen cooling of nozzle ext.
•••••••		= 3	Trans-regen cooling
		= 4	Radiation cooling
		= 5	Film cooling (GG cycle only)
		_	
Regen Cooling:			
Turbine Bypass Ratio	BYPTUR		Set turbine bypass flow
Tablie Dypart Hand		= 1.0	Tie tube flow drives turbine
Barrier Temp. Fraction	DIFTBF		Set barrier temperature
Barner Temp. Fraction			
Reactor:			
Reactor flow paths	CONFIG	= 1	Original flow paths
Reactor now pairs		= 2	Tie tube flow drives turbine
En al Tama	FTYPE	= 1	Graphite fuel
Fuel Type	Inne	= 2	Composite fuel
		-	
		= 3	Carbide fuel
Support Pattern	SPAT	= 2:1	Set support pattern
		= 3:1	
		= 6:1	
Nozzle Flow Percent	NFF		Set nozzle/tie tube flows
Fuel Scaling Factor	FALPHA		Set fuel scaling factor
Lact Scatting Lacou			
Tankage:			
Tank Type	NCTNK	= 0	Tandem tankage
	1	= 1	Non-conventional tankage
Pressurization Method	KGASFL	= 0	Cold helium or solid GG
LIGDULIZAGUNI MIGUNA		= 1	Autogenous
			Ĭ
Turbopump Assembly:			
Pump Configuration	JCNFIG	= 1	Gearbox
		= 2	Single shaft TPA
		= 3	Twin TPA in series
		= 4	Twin TPA in parallel
	1	=4 =5	Multiple feed leg TPA
_		-	
Turbopump Type	IPTYPE	= 0	Centrifugal Pumps
	1	= 1	Axial Pumps
Use Boost Pumps?	JBPFL NTPA	0,1	If =1, use fuel boost pump Set number of TPA feed legs

Table 2-1. Key NESS Input Flags and Variables

only. An ideal Isp at desired conditions is interpolated from these tables. To run the code with a propellant other than hydrogen, ODE (or a similar code) must be run to generate the tables of Isp data and the C* equations. This data would be put into a new subroutine that is called by the rest of the code when appropriate.

The loss multipliers used to degrade the ideal performance are calculated using standard JANNAF procedures, Ref. 2-2, or Aerojet-derived methods, Ref. 1-2. It is assumed that the reactor itself has no losses, and therefore engine efficiency is determined by nozzle-related factors. The efficiencies (or losses) calculated by NESS are the nozzle boundary layer efficiency, divergence efficiency, and nozzle barrier cooling efficiency. The gas generator bleed efficiency is calculated when applicable. A thorough explanation of these efficiencies is given in the ELES Technical Information Manual, Ref. 1-2, and the key equations are summarized below.

The boundary layer loss equation was developed by Aerojet as a result of their experience in defining this loss. The equation is as follows:

$$ETABL = 0.997 - (ln(EPS)/100)*[1.-0.065*ln(0.01*Pc*Fvac)+ 0.001*(ln(0.01*Pc*Fvac))^2]$$

where

EPS = Nozzle Exit Area Ratio Pc = Chamber Pressure (psia) Fvac = Vacuum Delivered Thrust (lbf)

This equation is accurate for engines with a radiation or film cooled nozzle, but does not take into account the energy returned to the core flow by a regen-cooled nozzle. In this case, the energy lost by the nozzle is retained by the regen coolant flow and fed back into the engine, and therefore should not be considered a true loss. A nozzle that is completely regen cooled should have a boundary layer efficiency of 1.0, while a partially regen-cooled nozzle, as is typically used, should have an ETABL less than 1.0, but higher than that predicted by the above equation. To provide accurate modeling of the regen-cooled nozzle option, an input adjustment factor, ADJBL, is applied to the efficiency calculated by the above equation. The adjustment factor is applied as:

$$ETABL = 1.0 - (1.0 - ETABL)*ADJBL$$

The current value used for ADJBL of 0.2 (code default = 1.0) was determined by comparison with Rocketdyne performance values, see Ref. 2-3, which were calculated in much greater detail than is possible with NESS.

The divergence loss is a function of nozzle shape and was derived as curve-fits of the information presented in Appendix A of the CPIA document No. 178, see Ref. 2-4. The equations are as follows:

For conical nozzles:

$$ETADIV = 0.5 + \cos(alpha)/2.$$

alpha = half angle in deg.

For RAO nozzles:

ETADIV = 1.0-(1.-C)*[(1.75-RATMLR)/0.75)]^{1.7} for RATMLR <= 1.75 ETADIV = 1.0 for RATMLR > 1.75

where

or

C = constant = 0.945 + 0.01*ln(EPS) for EPS <= 20= 0.958 + 0.00566*ln(EPS) for EPS > 20

EPS = Nozzle Area Ratio

RATMLR = ratio of nozzle length to the length of a minimum length RAO nozzle; an input

The divergence efficiency can also be adjusted, if desired, with the input factor ADJDIV used as:

ETADIV = 1.0 - (1.0 - ETADIV)*ADJDIV

The barrier cooling loss is a function of the amount of coolant fluid needed to maintain the nozzle wall temperature below the maximum allowable for the material used. Aerojet chose a simplified barrier cooling loss routine consisting of a stream tube analysis which flow-averages the performance of the core stream tube with that of the barrier stream tube. The procedure for calculating stream tube flow areas and flow rates is detailed in the ELES Technical Manual, Ref. 1-2. The maximum barrier temperature is input as described in section 2.2.2, and is used to

calculate barrier Isp and C*, and ultimately barrier mass flux. The fraction of fuel used for barrier film cooling (FFFC) is calculated as:

FFFC = barrier flowrate/(barrier flowrate + core flowrate)

The barrier loss (ETABAR) is set at 0.95 and is put into the comprehensive barrier cooling loss equation:

where all Isps are ideal.

This efficiency can be adjusted by the input ADJMRD in the same form as that used for the boundary layer and divergence losses. Note that the "barrier cooling loss" is referred to as the "mixture ratio maldistribution loss" in the ELES manuals.

For gas generator cycles, the gas generator bleed efficiency is calculated as a function of the bleed nozzle flowrate, pressure, and area ratio. It can be adjusted with ADJGGB in the form: ETAGGB = ETAGGB * ADJGGB

All other efficiencies described in the ELES Technical Manual, Ref. 1-2, were set equal to 1.0 because of their inapplicability to the nuclear engine; for example, injector or fuel and ox mixing efficiencies.

2.2.2 Nozzle Cooling

The nozzle can be cooled by a number of methods. The converging portion of the nozzle, including the throat, is automatically regen cooled. It is of milled slot construction to upstream area ratio of 4 with an adapter of regen tubes connecting the nozzle to the reactor. The remainder of the nozzle is cooled by regen tubes, radiation, a cold film of turbine exhaust (GG cycles only), or by a combination of these. A detailed explanation of regen cooling calculations is given in the ELES Technical Information Manual, Ref. 1-2, and Section 2.2.3 of this report gives nozzle modeling options.

The nozzle regen cooling requirements are based on the nozzle wall material properties, chamber temperature, regen coolant flowrate, regen inlet temperature and pressure, and regen channel size. The maximum wall material temperature in input as TGWNOM and is the

temperature above which the material will begin to degrade. For copper, a common converging nozzle material, this max temperature is 1460°R. The 1460°R temperature limit is typical of that used for the maximum design nozzle wall temperature for the Space Shuttle Main Engine (SSME) which is made of NARLOY-Z, a copper alloy, Ref. 2-5. For the high chamber temperatures typical of nuclear reactors, the regen coolant is unable to maintain this maximum wall temperature if the fluid on the other side of the wall is at chamber temperature. Therefore, a small amount of cool fluid from the regen outlet is dumped into the chamber at the top of the converging nozzle and is used to form a cool barrier between the wall and the hot core fluid. The loss in efficiency due to this barrier cooling is detailed in Section 2.2.1 of this report and in the ELES Technical Manual, Ref. 1-2. The greater the temperature mismatch between the barrier fluid and the core fluid, the larger the cooling loss, and therefore the highest possible barrier fluid temperature should be chosen that can still maintain the required material wall temperature. The barrier temperature is input as a relation between the core temperature and max wall temperature, TGWNOM. The input variable DIFTBF is used as follows:

 $T_{barrier} = TGWNOM + DIFTBF*(T_{core} - TGWNOM)$

Ideally, DIFTBF = 1.0 and the barrier temperature equals the core temperature to minimize flow losses. If DIFTBF = 0.0, the barrier temperature is set equal to the max wall temperature. For a copper wall with max temperature 1460°R and a core temperature of 4860°R (2700°K), the maximum barrier temperature that could still maintain the required wall temperature is 1630_R, which means the input DIFTBF = 0.05. A good value for DIFTBF can really only be determined by past experience and trial and error; the larger the difference between the maximum wall temperature and the core temperature, the lower the value for DIFTBF will have to be.

Other key regen cooling inputs include the gas wall material thermal conductivity and minimum gauge. The land width (WLTHR) and channel width (WTHR) of the regen cooling channels at the throat are also important inputs because they will strongly affect the regen pressure drop, i.e., small channels => high velocity => large delta P. There is also an option for user-input regen pressure and temperature drops, initiated with the flag INDPDT set equal to 1 and DELTAT and DELTAP input.

2.2.3 Nozzle Modeling Options

The user has a number of different nozzle modeling options. The most basic option is to set the nozzle extension flag KEXNOZ to zero and have regen slots all the way out to the exit area ratio EPS. This type of nozzle is almost never used in practice because of excess weight, and

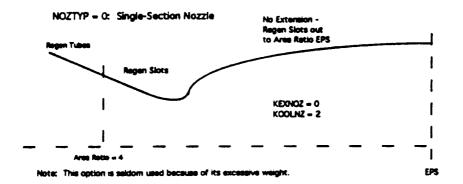
therefore a nozzle extension option is allowed. If the nozzle type flag NOZTYP is set to zero and KEXNOZ = 1, an extension will be added to the regen slots. This section extends from area ratio EPSATT to EPS, and can be regen, radiation, or film cooled (GG cycles only), with cooling option selected with the variable KOOLNZ. The new and final option is for NOZTYP=1, which models a three-section nozzle made up of regen slots, regen tubes, and a radiation cooled extension. The user must set KEXNOZ = 1, KOOLNZ = 2 (regen tubes in portion 2), and area ratios EPS, EPSATT (attach point of second section) and EPSAT2 (attach point of third section). Figure 2-4 shows the three nozzle modeling options and key input variables.

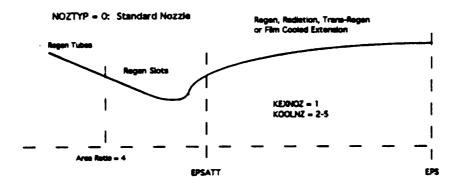
The regen slot portion of the nozzle extends out to an upstream area ratio of 4 where it attaches to a nozzle/reactor adapter that is made of aluminum regen tubes covered by a load-bearing casing of aluminum. The weight of this assembly is calculated in the reactor weight subroutine, and is included in the reactor pressure vessel weight.

Material density and strength are input for the converging nozzle, first nozzle extension, and second nozzle extension with RHCSTR, RHONZE, RHONZ2 and SIGCHM, SIGNZE, SIGNZ2, respectively. The minimum thicknesses of the two possible extensions are input as TNZMIN and TNZMN2. The volume of material used for the regen slots is calculated and the total converging nozzle weight is a function of this volume, the density of the material used for each region of the slots, and total surface area. The weight of the regen tubes is a function of the maximum pressure in the tubes, surface area, and material density, strength, and minimum gauge. The radiation-cooled extension weight is simply a function of surface area and material density and thickness.

2.2.4 Reactor

A solid core, ENABLER-type reactor design module was developed by Westinghouse Electric Corporation and integrated with ELES to form NESS. The reactor design is made up of two segments: the first calculates fuel requirements and reactor operating conditions, the second calculates approximately 30 reactor component weights along with key reactor dimensions. NESS provides hydrogen data, Isp, core flowrate, and nozzle heat load to the reactor module (ENABLER) for its calculations. In return, ENABLER provides the reactor inlet and tie tube outlet conditions needed for pressure and temperature schedule analysis. A detailed discussion of the reactor model can be found in Section 3.0.





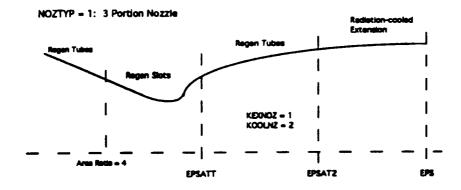


Figure 2-4. Nozzle Modeling Options and Key Input Variables

The ENABLER reactor design module consists of two distinct reactor modeling options. The first is ENABLER I, a near-term solid core reactor design based on the NERVA reactor. The second option, ENABLER II, provides a more advanced reactor design, with different flow paths and scaled fuel, reflecting state-of-the-art technology. This option yields reactor designs with higher power densities and lower weights. By properly utilizing the inputs to the NESS reactor design module (ENABLER), these NTP reactor options can be represented.

One key reactor input is the nozzle flow fraction, NFF, which determines the percentage of flow going to the tie tubes and to regen cooling. The user also selects the fuel type as either graphite, composite, or carbide using the variable FTYPE. The reactor temperature is input as TCHAMBER, and is used extensively in the reactor design process, along with determining the overall engine performance.

The input variable SPAT is used to select the ratio of fuel to support elements in the reactor, and may be input as a support pattern of 2:1, 3:1, or 6:1. The support pattern will affect the reactor weight, overall engine cycle performance, and reactor criticality. The support pattern should always be set as high as possible (6:1) to reduce weight. However, for small engines and scaled fuel engines, this ratio will often need to be reduced in order to achieve reactor criticality. Also, for some high pressure expander cycles, the tie tube flow will not contain enough energy to drive the turbines and the support pattern can be reduced to increase the tie tube outlet temperature and thus add more energy to the flow.

Two reactor flow path options are currently available for the expander cycle. Standard operation utilizes tie tube flow plus some input percentage of reflector outflow to drive the turbines. This reflector flow percentage is input as turbine bypass ratio, BYPTUR, (see Section 2.2.10 for a detailed explanation), and is used to determine what fraction of the reflector outflow bypasses the turbine. The second flow path option is always used with the ENABLER II reactor design option and results in the turbines being driven by the tie tube flow only, with all reflector flow being dumped directly into the core. This flow option can be set in one of two ways: either set BYPTUR = 1.0 or set CONFIG = 2; either choice automatically sets the other variable, i.e., if BYPTUR = 1.0 in the input file, CONFIG is automatically set to 2 by the code and vice versa. This option yields reduced reflector pressures, and therefore a lighter-weight pressure vessel. This cycle can be difficult to power balance, especially for high chamber pressures, and the typical reactor support pattern of 6:1 must occasionally be reduced to 3:1 in order to increase the tie tube outlet temperature and add enough energy to the turbine drive fluid for successful cycle balance.

This support ratio reduction yields a much higher support mass that often outweighs the reduction in pressure vessel mass.

An important reactor input is the fuel scaling factor, FALPHA. It provides a means of including state-of-the-art technology in the reactor design. If FALPHA is equal to 1.0, the resulting reactor design represents an ENABLER I NTP reactor configuration which is typical of NERVA technology. A value for FALPHA less than 1.0 simulates the advances made in fuel element design and corresponds to an ENABLER II NTP reactor system design. This multiplier is applied to all fuel element cross-sectional dimensions. To scale the fuel element length as well, the variable LEL must be set to a value other than zero so that it overrides the input core length LC. This length scaling is used in the form:

if
$$LEL > 0$$
: $LC = FALPHA * LEL$

The power per fuel element is input with PMW, and is actually the power per a 52 inch length that is reduced based on the scaled element length. The minimum value physically possible for FALPHA is 0.5; in practice, however, the recommended minimum value is 0.67.

The flag IREACTR is used to determine the reactor option to be used for the run, i.e., ENABLER I or ENABLER II. If IREACTR = 1, the ENABLER I method is used, and the fuel scaling factor (FALPHA) is automatically set to 1.0. The variables CONFIG and BYPTUR are input by the user to set the flow paths. For IREACTR = 2, the user inputs FALPHA (default = 0.67) and the flow paths are automatically set to the second option, CONFIG = 2 and BYPTUR = 1.0, so that only the tie tube flow drives the turbines.

During reactor design, a criticality check involving the number of ZrH loaded tie tubes is made, and a warning printed out if criticality cannot be achieved. For small engines (< approximately 35,000 lbf) this warning will typically be issued, but the user should further evaluate the design. The criticality determination is based on a comparison of the minimum fuel volume required for each support pattern with the actual calculated volumes. Some small engines may not pass this fuel volume check, but could actually achieve criticality if other parts of the reactor, such as the reflector, were designed differently. The detailed design analysis that would be required for an alternate reflector design, for example, is not available in ENABLER.

An estimate of fuel life is calculated based on the allowable mass loss rate. For scaled fuel, the support to fuel element ratio (SPAT) will often need to be reduced in order to achieve

criticality. This ratio reduction will yield a smaller minimum fuel volume requirement that can be now be met with the scaled fuel volume.

As can be seen in the worksheet, the user can input a number of variables related to heat pickup in various sections of the reactor, as well as several fuel element characteristics. The channel coating thickness at various locations may be input with the variables ZRCI, ZRCO, and ZRCH. The pressure vessel material properties such as specific gravity and allowable stress may also be input.

The fraction of possible ZrH loading in the tie tubes is input with the variable FZRH and varies with engine size. This fraction has not been studied extensively, and therefore the values presented in this section are merely suggested values. For small engines with a diameter less than approximately 25 inches, FZRH will typically be equal to 1.0. For large engines with unscaled fuel (diameter > approximately 34 in.), FZRH should be 0.0. For scaled fuel engines, compare the core volume with the standard NERVA 35 in. x 52 in. length reactor core, for which FZRH=0.0, and scale FZRH accordingly. A core diameter of 31 in. uses an FZRH of approximately 0.4.

The weight of the control safety rods required by the reactor during launch is calculated by ENABLER, but is not added into the nominal reactor weight. During standard operation, these safety rods are placed in the reactor during launch and are then discarded upon achieving a safe orbit. In both the reactor summary and final engine summary, the safety rod weight is listed after the reactor or engine weights, and a total launch weight is then calculated.

2.2.5 Auxiliary Components

The category "auxiliary components" consists of instrumentation, a pneumatic supply system, thrust structure, gimbal, and reactor cooldown assembly. Previously in ELES, some of these component weights were calculated as a percentage of the total engine weight, some were a function of thrust only, and some were not calculated at all. Also, these weights were originally calculated assuming a standard liquid rocket engine rather than a nuclear rocket engine.

A report issued by TRW, Ref. 1-1, includes equations for various nuclear rocket engine auxiliary component weights. These correlations relating component weight to reactor power were developed as curve fits of NERVA-type reactor data. The TRW equations applicable to the ENABLER-type rocket engine design have been programmed into NESS and which are:

Instrumentation:	weight = $166.9 + 0.00743 * P - 1.64 E - 7 * P^2$
Pneumatic Supply System:	weight = $751.6 - 0.00208 * P + 2.35E - 6 * P^2$
Reactor Cooldown Assembly:	weight = $238.1 + 0.0254*P - 8.04E-7*P^2$
Upper Thrust Structure:	weight = $786.25 - 0.1868 + 5.2E - 5 + P^2$
Lower Thrust Structure:	weight = $492.9 + 0.0911*P + 1.463E-6*P^2$

where P = power in MW

The upper and lower thrust structures are combined into the "thrust mount" weight. The other three weights make up the "support hardware weight".

Although these equations provide a useful starting point for auxiliary component weight calculations, they represent NERVA-era technology rather than state-of-the-art designs. To account for advances in technology, weight multipliers are input that decrease these weights to values more in line with current engine designs. The instrumentation multiplier, CXWINST, is left at 1.0. The pneumatic supply system weight was compared with similar system weights on current engines, such as the SSME, and was found to be extremely high, see Refs. 2-5, and 2-6. It should be noted that the TRW pneumatic supply system weight correlations assume that the complete pneumatic supply is part of the NTP engine system, while for the SSME the main supply is located in the Space Shuttle. This is one major contributor to the weight difference as well as the higher pressure and lighter weight components associated with today's systems. Therefore, the pneumatic system weight multiplier, CXWPNEU, is input as 0.25. The reactor cooldown assembly multiplier, CXWTNKAS, is input as 0.9 to account for technology advances. The thrust structure multiplier, CXWTHM, is set to 0.9 to allow for lighter weight materials and improved technology. If NERVA-era technology is desired, all above multipliers should be input as 1.0.

2.2.6 Materials of Construction

The NESS user is allowed to select the material of construction of all major subsystem components. Standard library tank materials include 6061-T6 aluminum and 6Al-4V titanium, or the user may input density, strength, and minimum gauge for a previously undefined material. A discussion/comparison of candidate cryogenic tank materials is given in the ELES Technical Information Manual, Ref. 1-2. The input worksheet includes a table of the most common engine materials along with their densities and strengths. This data is typically used for valves, nozzles, lines, and regen channels, and the user may input data for any unlisted material desired. The

nozzle designs also require input of minimum material thicknesses. The turbine blade strength and density, as well as an overall TPA density that is used in pump and turbine weight calculations, can also be input.

2.2.7 Tankage

The main tankage options in NESS are either tandem tankage, in which fuel and oxidizer are stacked on top of each other to fit within a common shroud, or non-conventional tankage, where the user selects the number of tanks as well as their shapes and placement on the stage. The tandem tanks option should probably not be used for nuclear thermal rockets because they use only hydrogen as propellant, and may carry only a very small amount of oxidizer for use with a gas generator. The tandem tank model automatically calculates an oxidizer tank weight even if the amount of oxidizer carried is very small or zero, and this tank is sized to fit in the tank shroud with a diameter based on the size of the large fuel tank. The non-conventional tankage design option should give a better estimate of actual tank sizes.

The tank sizes for both tank geometries are dependent on amount of burned propellant, ullage fractions, acquisition system design, residual propellant, propellant boiloff, and autogenous pressurization. The approach taken in sizing the propellant tanks is as follows:

- a. Amount of fuel burned is input; calculate amount of oxidizer burned in GG if necessary.
- b. Add weight of autogenous pressurization requirements to each propellant
- c. Calculate the tank free volumes using the propellant densities and ullage fractions
- d. Calculate propellant residuals and acquisition device volumetric displacement based on tank free volume estimate
- e. Calculate tank surface area as needed for heat transfer calculations to determine propellant boiloff
- f. Total tank volume is now calculated as the sum of the above volumes: burnt propellant, ullage, residuals, boiloff, autogenous pressurant, and acquisition devices

These tank volumes are now used to determine pressurization requirements and update initial estimates.

The large variety of possible tandem tank configurations is shown in the ELES Technical Information Manual, Ref. 1-2, along with the equations used to calculate many of the tank dimensions and volumes. All tanks can be cylindrical, spherical, or elliptical (CSE tanks), and the non-conventional tankage option allows toroidal tanks as well. Non-conventional tank weights are calculated from an ideal tank weight through the use of a tank non-optimum factor, which is defined as the ratio of actual tank mass to ideal tank mass. The ideal tank mass is based on tank wall thickness and size. The actual mass includes any additional material required for weld lands and fittings. For conventional tanks that require feedlines, supports, pressurization, and a propellant management device, a tank non-optimum factor of 1.7 is suggested. Different factors are recommended for different tank types, and these factors are listed in Table 7.3.1.1 in the ELES Technical Manual, Ref. 1-2. The tank nonoptimum factor is input as the variable CXWTNK.

When preparing inputs for tankage design, the user must first set the variable NCTNK equal to either 0 for tandem tanks or 1 for non-conventional tanks. If tandem tanks are chosen, the user now determines such factors as arrangement of propellant (fuel forward or aft, etc), common or separate dome tanks, monocoque or suspended arrangement, tank head ellipse ratio, tank dome orientation, safety factor (SFFLTK, SFOXTK, SFPRTK), and tank material (MTNKFL, MTNKOX, MATPT).

To use the non-conventional tank option, the user should first sketch the arrangement of tanks and engines on the stage. The total number of non-conventional tanks is input with NTANKS (includes ox, fuel, and pressurant), up to the maximum of 15 tanks. The type of fluid contained within each tank is input with the variable INTNK1, where an input of 1 is for ox tanks, 2 is fuel, 3 is pressurant. For example, if two ox and two fuel tanks are desired, input INTNK1 = 1,2,1,2. This indicates that tanks 1 and 3 are ox tanks, and tanks 2 and 4 are fuel tanks; retain this same numbering scheme when defining the remaining tank parameters. Input the tank ellipse ratio for each tank with ELTNK1. The tank type is selected as either CSE or torus with the variable KTANK1. The angular location of each tank gives its relative position on the stage and is input as TANGL1. Tank radial location indicates the tank distance from the center of the stage, RADLO1 = 4*1.0 places all four tanks at the edge of the stage and RADLO1 = 0 places a tank at the center of the stage. Engine angular and radial locations are input similarly with the variables ENGAN1 and ENGRD1, with a maximum of five engines allowed. The material for each tank is selected with the variable MATNK1. Tank safety factors are input with SFTNK1, and tank weight multipliers are input with CXNCT1. More input variables for each tank geometry are contained in the worksheet, see Appendix A.

The forward and aft skirt length inputs are actually input as fractions of tank lengths. For tandem tankage, both aft and forward skirt lengths should be input as 1.0 to form a skirt fully covering both tanks. To shroud non-conventional tankage, the forward skirt should be set to 0.0

and the aft skirt length should be 1.0. This will yield a skirt that covers all tankage and is as long as the tallest non-conventional tank. DMOTOR is used to input the stage diameter.

2.2.7.1 Tank Heat Transfer. For the long duration missions proposed for nuclear rockets, tank heat transfer and insulation are important aspects of vehicle design. A detailed discussion of this area is provided in the ELES Technical Information Manual, Ref. 1-2, and includes information on optimizing insulation thicknesses.

NESS offers four possible tank heat transfer scenarios: ignore tank heat transfer, external boundary exposed to conductive source, worst case solar radiation, and ground hold ice formation. The desired option is selected with the variable KHXOPT. The most common options are either to ignore heat transfer (when tank design is not important) or worst case solar radiation. The solar radiation option requires input of insulation characteristics, space hold time, flight time, average orbital distance from earth, and earth and solar heat flux parameters. The insulation is typically composed of a layer of spray-on foam insulation (SOFI) plus a multi-layer insulation (MLI) blanket. The density, thermal conductivity, and thickness of each type can be input. Table 2-2 lists these values for a variety of types of MLI.

MLI Configuration	No. (cm)	No. (in)	K g (m ³)	Lbm (ft ³)	Watts (m-K)	BTU (hrft°R)
DAM/DBL silk net	19.7	50.0	45.2	2.82	4.5x10-5	2.5x10-5
DAM/Tissue glass	39.4	100.0	51.9	3.24	2.5x10-5	1.4x10-5
SAM Crinkled	15.7	40.0	14.6	0.91	4.7x10-5	2.6x10 ⁻⁵
DAM/SGL Nylon Net	31.5	80.0	53.8	3.36	3.0x10-5	1.7x10 ⁻⁵
DAM/Dexiglass	23.6	60.0	58.8	3.67	5.0x10-5	2.8x10 ⁻⁵
DAM Crinkled/Tissue glass	23.6	60.0	31.1	1.94	7.0x10-5	2.0x10 3.9x10 ⁻⁵
Superfloc	11.8	30.0	13.8	0.86	4.5x10-5	2.5x10 ⁻⁵

Table 2-2. Multi-Layer Insulation Data Comparison

2.2.7.2 Propellant Tank Pressurization. Propellant tanks can be pressurized by cold helium gas, a solid gas generator, or autogenously. The method of pressurization is selected with the variables KGAS, KGASFL, and KGASOX as shown in the worksheet. The selection of a propellant acquisition device, either some sort of bladder or surface tension device, has a strong effect on the pressurization calculations. An extremely detailed discussion of tank pressurization is presented in the ELES Technical Information Manual, Ref. 1-2.

When cold gas pressurization is selected, KGASFL,KGASOX = 0 and KGAS = 2, the user also inputs the cold helium storage pressure as PICG and the helium tank final pressure fraction, FPULCG, where a value less than 1.0 indicates a blowdown tank. If KGAS is set equal to 1 instead of 2, a solid gas generator will be used which requires fairly extensive user inputs regarding solid fuel characteristics and burn rates (see worksheet). If KGASFL, KGASOX are set to 1, the tanks will be pressurized autogenously. This option has an advantage over helium pressurization when the additional weight of the evaporated propellants is less than that of the helium storage vessel, as occurs in pump fed stages with low NPSH requirements. The propellant used in autogenous pressurization of the hydrogen tank will be bled off from the turbine exhaust for all engine cycles. Because only a small amount of oxidizer is used in the GG cycle, the oxidizer tank is assumed to be pressurized with cold gas to reduce cycle complexity. If autogenous pressurization is selected, the pressurized with cold gas to reduce cycle complexity. If autogenous pressurization is selected, the pressurizing oxygen flow will be bled off from the oxidizer pump outlet flow.

2.2.8 Propellant Pressure/Temperature/Flowrate Schedules

The propellant pressure, temperature, and flowrate are calculated at key points within each engine cycle. The pressure schedule is calculated "backwards", beginning with the chamber pressure and working back up through the cycle using input and calculated pressure changes. The temperature and flowrate schedules begin at the tank outlet and flow down through the cycle to the reactor inlet conditions. NESS can handle expander, gas generator and bleed cycles.

For all engine cycles, the tank outflow is divided into the tube and regen/reflector flow based on the input flow fraction, NFF. The regen flow is used to cool both the nozzle and reflector, with a small amount bled off to form a cool barrier inside the nozzle.

As can be seen in the expander cycle flow paths shown in the schematic in Figure 2-3, the reflector outflow can be either dumped directly into the core or used to run the turbine. Reflector outflow going to the turbine is mixed with the tie tube flow, and turbine inlet temperature is calculated by an energy balance of tie tube and reflector flows, i.e.

T_{turbine inlet} = [(T*mdot*Cp)_{reflector} + (T*mdot*Cp)_{tie tube}]/ (Cp*mdot)_{turbine inlet} where

T = temperature mdot = mass flow rate Cp = specific heat coefficient for constant pressure

Turbine outflow is dumped into the reactor core, with a small amount bled off for autogenous pressurization if needed.

The key pressure assignments for the expander cycle are the turbine and reflector outlet pressures. The reactor inlet pressure and temperature are calculated by the reactor model, and are therefore known. The tie tube pressure drop is fixed at 250 psid, and the reflector pressure drop is 25 psid. These pressure drops are typical of solid-core reactor systems, based on past Westinghouse NTP reactor design experience. Pressure drops could be higher for large, high-heat-load NTP reactor designs. The reflector, turbine, and reactor pressures are related by the following list which includes the key pressure variable names and descriptions, along with some key pressure cycle assumptions:

PTURBI, PTURBO = turbine inlet and outlet pressure, respectively PREFI, PREFO = reflector inlet and outlet pressure, respectively PTTI, PTTO = tie tube inlet and outlet pressures, respectively PREGI, PREGO = regen inlet and outlet pressures, respectively PCI = core inlet pressure PVLVFO = main valve outlet pressure TURBPR = turbine pressure ratio DELTAP = regen pressure drop

PTURBO = PTURBI/TURBPR PREFO = PREFI - 25 PTTO = PTTI-250

For the expander cycle with partial or no turbine bypass (some or all reflector flow goes to the turbine), the reflector (PREFO) and tie tube outlet (PTTO) pressures are set equal to the turbine inlet pressure, PTURBI. The turbine outlet pressure is set equal to the reactor inlet pressure, PTURBO=PCI.

Once the reflector outlet pressure is known, the reflector inlet pressure, which equals the regen outlet pressure, can be calculated so that the regen cooling analysis can be performed and all other pressures in the cycle can be calculated. For multiple feed leg TPA designs, the individual turbine flow rates are multiplied by the number of legs to accurately calculate the pressures.

For all cycles, the main valve outlet pressure is normally calculated as the reflector outlet pressure plus the pressure drop across the regen and reflector, but the valve pressure must be high enough to allow for all pressure drops across the tie tubes and turbine. Therefore, the valve outlet pressure is set equal to the maximum of the required tie tube inlet pressure and the reflector outlet pressure plus regen and reflector pressure drops, i.e.,

PVLVFO=MAXIMUM((PTTO+250),(PREGO+DELTAP))

Another option for the expander cycle is to set the input variable BYPTUR equal to 1, which sends all reflector flow directly into the reactor so that the turbines are driven by the tie tube flow only. The user must exercise caution when choosing this flow option as the tie tube flow will occasionally not have enough energy to power the turbines, especially at high chamber pressures and when the reactor support pattern is set at 6:1. A support ratio of 3:1 or 2:1 will yield higher tie tube temperatures, and therefore more energy to drive the turbine, but the turbine inlet temperature will also be increased, and may exceed the accepted temperature limits of approximately 1400°R. A lower support ratio will also substantially increase the weight of the reactor.

When this option is selected, the reflector (PREFO) and turbine outlet (PTURBO) pressures are set equal to the previously determined reactor inlet pressure (PCI). The tie tube outlet pressure is set equal to the required turbine inlet pressure, and the tie tube inlet pressure allows for the fixed 250 psi pressure drop across the tie tubes. The valve outlet pressure is calculated as shown above, and once the valve outlet pressure is set, the pump discharge pressure can be determined.

The gas generator bleed cycle flow schematic shown in Figure 2-3 uses small amounts of oxidizer and fuel to feed the gas generator that drives the turbine. The turbine exhaust is either dumped overboard through a small bleed nozzle or is dumped into the main nozzle for film cooling. Although this exhaust dump results in a performance loss, the GG cycle has the advantages of relatively simple cycle design (TPA and regen design are not coupled) and lower pump discharge pressures. Since the turbine is powered by the GG, the reflector and tie tube flows are dumped directly into the reactor core. PREFO and PTTO are set equal to PCI, and the

remaining calculations proceed as usual. The tie tube inlet pressure, PTTI, is now calculated and compared with the valve outlet pressure, PVLVFO, and if PTTI is greater than the valve outlet, PVLVFO is set equal to PTTI. This adjustment will occur whenever the regen pressure drop (delta P) is less than the fixed tie tube pressure drop of 250 psid. As in the expander case, once the reflector outlet pressure is known, the regen cooling analysis can then be performed and all other pressures calculated.

The bleed cycle is analyzed using the same pressure assignments as those used for the GG cycle. For the bleed cycle, a small amount of flow from the cold, high pressure propellant pump outlet flow is tapped off to combine with the hot, lower pressure flow bled off from the reactor chamber exit region to drive the turbine. This cycle is analyzed using the same pressure assignments as those used for the GG cycle. The chamber bleed flow undergoes a pressure drop as it travels through the line to the mixer. The cold bleed line pressure at the mixer inlet is set equal to the chamber bleed line pressure at the mixer inlet to prevent flow backup. The cold bleed flow also undergoes a pressure drop as it travels through the lines. These line pressure drops are determined by the inputs CPLINH, CPLINC. The remaining pressure drop in the cold bleed flow required to match the hot bleed pressure occurs in the cold bleed valve and is calculated automatically. After the two flows are mixed, further pressure drops occur across the turbine inlet line and turbine throttling valve; these drops are determined by the fractional inputs CPLINT, CPVLVT. The remaining pressure schedule for the bleed cycle is calculated by the same methods used for the GG cycle. The temperature at the mixer outlet is calculated using an energy balance:

(Cp*T*mdot)_{mixer outlet}=(Cp*T*mdot)_{hot bleed}+(Cp*T*mdot)_{cold bleed}

To evaluate the bleed cycle, the user must select from the two solver options using the input variable ISOLVE. If ISOLVE equals 1, the user inputs the turbine inlet temperature with TURBTIN and the code determines the mass flow fractions of hot and cold bleed flow required to provide that temperature. The other option is for the user to set ISOLVE equal to zero, input the hot and cold mass flow fractions FRACHB and FRACCB, and have the code determine the turbine inlet temperature. In practice, the first method will be selected most often because it eliminates the extra step required by the second method, namely evaluation of the output to determine whether the calculated turbine inlet temperature falls within acceptable limits, and if not, another run must be made with mass flow fractions adjusted appropriately.

For all engine cycles, tank outflow is equal to the core flowrate plus the nozzle barrier flowrate, autogenous pressurant flowrate, and gas generator or bleed flow.

2.2.9 Propellant Properties

Propellant properties are required over a very wide range for the variety of models used in NESS, including both gas and liquid phases. The approach used to obtain these values is to begin with a known value of the propellant property at some reference point, and then scale that value to some other condition based on empirical or theoretical correlations. The exceptions to this method include hydrogen and helium, which require separate, extensive data bases from which desired values are interpolated. A detailed discussion of the methods used to determine property data can be found in the ELES Technical Information Manual, Ref. 1-2. Hydrogen data is stored in the routine H2DATA.

A computer program was recently developed at NASA Lewis Research Center to provide parahydrogen thermal and transport properties that match the National Bureau of Standards (NBS) parahydrogen data, see Ref. 2-7. The NBS data represents the most recent compilation of hydrogen properties available in the nation. The program NBSPH2 has been incorporated in the NESS program. The routine PH2 was developed to match NBS data exactly across the pressure range 29 to 2320 psia (0.2 to 16 MPa) and temperature range 24.8 to 54,000°R (13.8 to 3,000°K). The routine includes data tables for density, thermal conductivity, viscosity, Prandtl number, speed of sound, enthalpy, and specific heat. All data is stored in SI units and a routine was written to convert the data into the English engineering units required by NESS.

NESS will occasionally require hydrogen data outside of the pressure or temperature range available in NBSPH2. In this case, the original hydrogen data routine, H2DATA, will be called instead. For pressures in the range from 2320 psia to 2600 psia, the old routine H2DATA will be called with a pressure of 2600 psia and the new routine, NBSPH2, is called with a pressure of 2320 psia. A linear interpolation using the actual pressure is then performed to find average property values. This interpolation was added to prevent fluid property discontinuities in the above pressure range. The original (non-NBS) hydrogen data is also used for fluid at the high temperatures associated with carbide fuel reactors. If more extensive NBS hydrogen data becomes available, that data could be incorporated into the NESS properties at a later date.

An option exists in ELES that allows for user-defined propellants, which requires that the user input certain propellant properties and then select a propellant from the existing ELES library that the new propellant is most similar to. The code next evaluates this new propellant performance based on comparison with the chosen similar propellant. This option is set up for use by non-nuclear, chemical bipropellant propulsion systems, and therefore cannot be used for reactor

designs without major code modification. Hydrogen is currently the only propellant with full performance data tables programmed into the code, and the current method of determining Isp is different than that used for bipropellants and may not be compatible with the ELES user-defined propellant evaluation method.

2.2.10 Turbopump Assembly

The purpose of the turbopump assembly (TPA) model is to determine the size, weight, and performance of all pumps and turbines for expander, gas generator, and bleed cycles. The code can evaluate both centrifugal and axial turbopumps. NESS offers the following turbomachinery configurations:

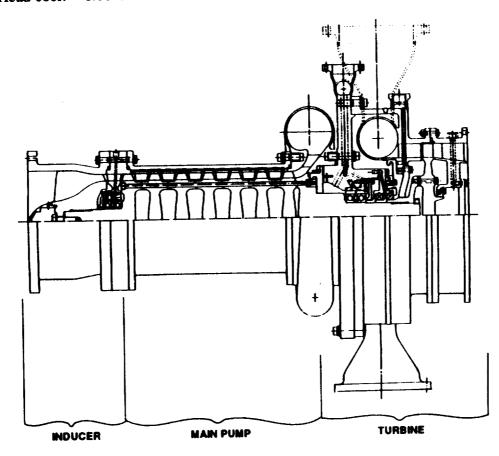
- 1. Single turbine driving a gearbox which powers an oxidizer and fuel pump on a common shaft.
- 2. Single turbine driving ox and fuel pumps on a common shaft.
- 3. Twin TPAs, series drive fluid flow.
- 4. Twin TPAs, parallel drive fluid flow.
- 5. Multiple propellant feed leg TPA each leg is identical and sees 1/NTPA of the flow

The desired option is indicated with the input variable JCNFIG. If the multiple feed leg option is chosen (JCNFIG=5), the number of feed legs is input as NTPA. Boost pumps may be included in the propellant circuit by setting JBPFL, JBPOX=1, with the boost pump fraction of total propellant head rise input as BPFRFL, BPFROX.

NESS checks the necessity for pump or turbine staging, allowing up to four stages for centrifugal pumps, twenty stages for axial pumps, and two stage turbines. To avoid unrealistic designs, the code checks the maximum allowable tip speeds and the turbine blade root stresses. Pump head coefficients and pump and turbine efficiencies are calculated from tables included in the program. A partial admission turbine is designed if blade height falls below 0.3 in. The equations used to design the centrifugal pumps and turbines are given in the ELES Technical Information Manual, Ref. 1-2.

For high flow rates, the low fluid density of hydrogen leads to a high volumetric flow rate, a regime for which the multi-stage axial pump is well suited. The axial pump is attractive for such applications compared to the centrifugal pump in terms of weight, construction, and performance. For this reason, an axial pump option has been added to NESS. A typical axial turbopump schematic is shown in Figure 2-5. Axial pump design is selected with the input variable IPTYPE=1. Code modifications assumed that an axial pump will not be used for oxygen flow (very poor design selection due to the high density of oxygen) and will therefore not be used for the gas generator cycle. The logic embedded in NESS to design an axial pump is displayed in Figure 2-6.

The performance calculation methods for the axial pumps are essentially the same as those for the centrifugal pumps. Key axial pump design modeling considerations are that the maximum number of stages allowed is twenty, and the specific speed (SS) at which the pump will stage is 3200 (vs. 800 for centrifugal pumps). The pump head coefficient is interpolated from data tables containing values based on existing axial pump designs (see Figure 2-7 and Ref. 2-8). The best-fit equation used to calculate the head coefficient as a function of main pump specific speed is:



Head coef. = $0.88237 - 2.3145E-4*SS + 2.3161E-8*SS^2 - 7.7028E-13*SS^3$

Figure 2-5. Typical Axial Turbopump Design

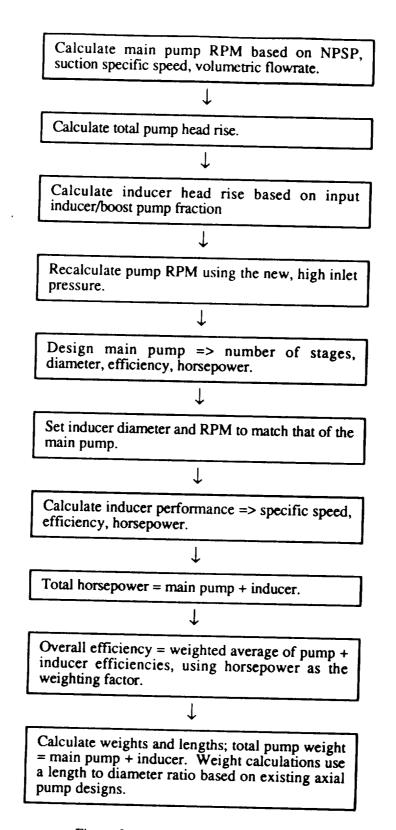


Figure 2-6. Axial Pump Design Logic

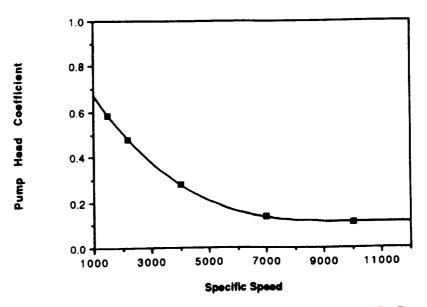


Figure 2-7. Axial Pump Head Coefficient as a Function of Specific Speed

The maximum allowable tip speed is 1500 ft/sec for hydrogen, above which the pump will stage. The axial pump inducer is modeled as a single stage boost pump, with the boost pump flag, JBPFL, initialized automatically within the code when the axial pump option is selected. The inducer is forced to operate at the same speed (RPMs) and have the same diameter as the main pump. Its pressure-head is determined by the input fraction BPFRFL.

The inducer efficiency is calculated from the existing boost pump efficiency curves in ELES, and the main pump efficiency is interpolated from the data shown in Figure 2-8, which is also based on existing axial pump design data, see Ref. 2-8. The best-fit equation used to calculate main pump efficiency as a function of main pump specific speed is:

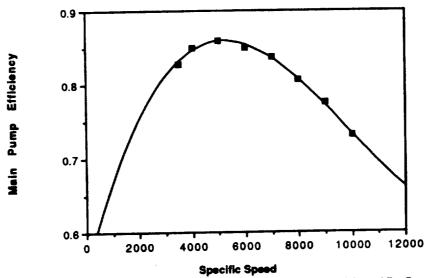


Figure 2-8. Axial Main Pump Efficiency as a Function of Specific Speed

Main Pump Efficiency = $0.54854 + 1.3501E-4*SS - 1.7544E-8*SS^2 + 5.901E-13*SS^3$ The overall axial pump efficiency is calculated as a weighted average of the inducer and main pump efficiencies, using pump horsepower as the weighting quantity, shown as:

Overall Efficiency =
$$[(HP*eff)_{inducer} + (HP*eff)_{pump}]/total HP$$

Inducer weight is calculated using the standard boost pump method. The axial main pump differs only slightly from the centrifugal main pump weight and is as follows:

Main Pump Weight =
$$rho^{*}(pi/4)^{*}D^{3*}(L/D)^{*}N^{*}f_{m}$$

where:

rho	= pump material density (lb/in ³)
D	= pump tip diameter (in.)
(L/D)	= pump length to diameter ratio per stage
N	= number of pump stages
f _m	= pump material fraction = $(0.12*D + 0.9)/D$

The length to diameter ratios (L/D) per stage for both the main pump and inducer are calculated by correlations of the data on length to diameter ratios of existing axial pump designs, see Ref. 2-8, is shown in Figures 2-9 and 2-10, respectively. The points on the graph indicate existing design values, while the curve defines the correlation used in the L/D calculation as given by:

$$(L/D)_{inducer} = 1.992 - 0.23348*D + 0.0106*D^2$$

 $(L/D)_{main pump} = (0.52415 - 0.02714*D + 0.0011387*D^2)*N$

Total axial pump weight combines the main pump and inducer weights. Comparison with existing axial pump weights, as shown in Section 2.2.11, indicates that a multiplying factor may be necessary to bring the pump weight to within the accepted range.

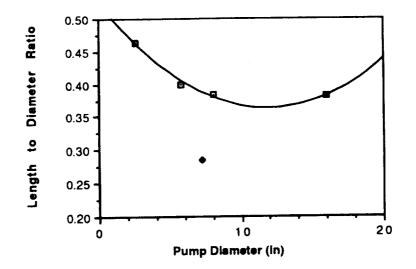


Figure 2-9. Axial Main Pump Length to Diameter Ratio (Per Stage)

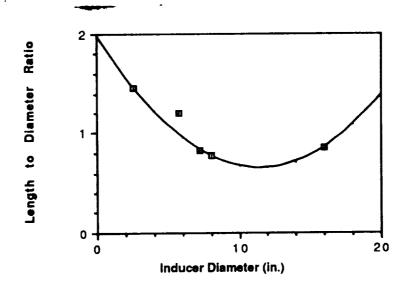


Figure 2-10. Inducer Length to Diameter Ratio (Per Stage)

Turbopump lengths are determined so that a feed system mounting length can be calculated. This mount length is the distance between the bottom of the propellant tank and the gimbal attach point at the top of the reactor where the turbomachinery, lines, and valves are located. If a value other than 0.0 is input for the mount length, XMOUNT, that value will be used in finding the total engine length. If XMOUNT = 0.0, it is calculated by the program as:

XMOUNT = 0.5*Reactor length + Total pump length

where,

Total axial pump length		Nstages*((L/D)*Dia) _{main pump} + ((L/D)*Dia) _{inducer} + ((L/D)*Dia) _{turbine}
Total centrifical pump length	=	((L/D)*Dia) _{main pump} + ((L/D)*Dia) _{boost pump} + ((L/D)*Dia) _{turbine}

L/D = length to diameter ratio (per stage for axial pumps)

Dia = diameter

An expander engine cycle is considered balanced when the ratio of required pump horsepower to delivered turbine horsepower is approximately equal to 1.0. If the cycle is not balanced, a new value for turbine pressure ratio is calculated and the entire design process is repeated. For the gas generator and bleed cycles, the turbine mass flowrate is calculated based on the horsepower required by the pump and boost pump/inducer, and a balance is achieved in this manner rather than through pressure ratio adjustment.

Some important, yet easily overlooked inputs are fluid specific heat ratio, GAMGPB, and heat capacity, CPGGPB. Despite the misleading variable names that seem to refer only to the GG cycle, these values are used for all cycles in various locations, such as the turbine enthalpy calculation. In general, the code calculates the heat capacity at each point where it is needed based on conditions at that point, but CPGGPB is used often enough to require a reasonable value be input, and it can be the factor that causes an expander cycle to either balance or fail. Default values for these variables are for a mixture of hydrogen and oxygen at a ratio of 0.75. However, for code operation using an expander or bleed cycle, these values should be set to values appropriate for hydrogen at similar conditions as those experienced at the turbine inlet during the cycle of interest. Some sample values for hydrogen at 1400°R and 1000 psi are GAMGPB=1.46 and CPGGPB=3.51; these values were obtained from the new hydrogen properties data (see Ref. 2-7).

An important input for expander cycle TPA design is the turbine bypass ratio, BYPTUR; it is the ratio of reflector outflow that goes directly to the core divided by the total reflector outflow. The tie tube flow goes directly to the turbine and is therefore not affected by this bypass. As the bypass ratio acts only on the reflector flow, the user must be careful when determining this value. For example, if an overall turbine bypass of 50% is desired and the nozzle flow fraction is 0.70 (30% of flow goes to tie tubes, 70% to nozzle), the turbine bypass ratio BYPTUR is calculated and input as 0.5/0.7 = 0.71. Setting BYPTUR equal to 1.0 will cause all reflector flow to be dumped directly into the core so that the turbines are driven by tie tube flow only.

The gas generator cycle requires input of the GG mixture ratio, OFGGPB, the ratio of specific heats, GAMGPB, the specific heat, CPGGPB, and the molecular weight, WMGGPB. The default values for these variables are for LOX/H₂ at approximately 1400 psia. The ratio of specific heats, specific heat, and molecular weight were determined by a run of the ODE module of the TDK computer code using the desired pressure and mixture ratio. The user also inputs the turbine outlet pressure, PTURBO, and the pressure ratio across the gas generator/pre-burner, PBPFR, PBPRO. For the bleed cycle, the user selects the analysis method and then inputs either the turbine inlet temperature, TURBTIN, or the bleed mass flow fractions, FRACHB, FRACCB, along with turbine outlet pressure, PTURBO.

The multiple propellant feed leg TPA option (JCNFIG=5) was added to ELES to allow for the redundancy usually desired with NTP engines. Typically, two feed legs will be desired, with one half of the total flow running through each pump and turbine during normal operation, as can be seen in the cycle schematics in Figure 2-3. This option is normally used with the pump-out (double run) option as described in Section 2.3.1. If three feed legs are desired, the initial pumpout design run is made assuming one pump is out and two are operational. These two remaining pumps are typically designed to handle the full thrust level (FFRAC = 1.0). When multiple feed legs are used, the TPA output lists the weight for each pump and turbine in their corresponding output sections, while the final engine system TPA summary section lists weights for the total turbopump feed system.

Another new code option is the evaluation of a user-defined TPA, which is described in detail in Section 2.3.3. This option allows evaluation of off-design pump and turbine performance. It is used automatically with the double run option in which turbomachinery is

designed at a pump-out thrust level and then multiple pumps and turbines possessing the previously determined characteristics are evaluated at full thrust level. The flag to initiate the userdefined TPA design option is ISTSET = 1, and INPTPA = 1 indicates that TPA-related weights will be input.

2.2.11 Weight Multipliers

Due to the wide range of possible design strategies available for most engine components, weight multipliers are provided for all major components. These multipliers are useful when trying to match existing designs or design methods. They are also used to account for excess component weight not specifically calculated in the code; for example, the standard tank weight multiplier is 1.7 to allow for the extra material required for weld lands and fittings, see Ref. 1-2. Some of these weight multipliers have been discussed in detail elsewhere in this report; all will be summarized here.

The weight multipliers are listed in the worksheet, see Appendix A, along with their default values. All tank-related multipliers are set to 1.0 as NESS will primarily be used for engine design; the user must input any desired value other than this default. The total nozzle and hardware multiplier, CXWENG, is set to 1.0 as it is more likely that the multipliers for individual components will be used to account for extra weight rather than adjusting the entire engine weight. The valve multiplier, CXVALV, is set to 2.8 to account for dual valves (for redundancy) and a factor of 1.4 to include some extra valve weights (other than the main valve) not explicitly calculated in NESS. The convergent nozzle multiplier, CXWCHM, is set to 1.0. CXWNZE is the nozzle extension multiplier and is used on all portions of the nozzle extension (tubes + radiation-cooled portion when used); its value of 1.1 allows for flanges and fittings.

Hot gas ducting weight is adjusted with CXWDUC that is set to a value of 3.5 to account for the weight of flanges, bolts, bellows, bosses, insulation, etc. The gimbal system (excluding the power supply) is multiplied by a factor of 1.4 as set by the variable CXWGIM. The thrust mount multiplier CXWTHM is set to 0.9 to allow for technology advances not included in the NERVA-era weight correlation between thrust structure and reactor power. The gas generator injector weight is multiplied by 1.4 as input by CXWIGG. The turbine weight is multiplied by a factor of 1.3 using CXWTPA, and all pump weights are multiplied by CXWPMP, a factor of either 1.3 (centrifugal pumps) as was deemed necessary after comparison with other engine designs. The multiplier for axial pump weights depends on the thrust level, with a value of 4.93 recommended for thrust levels below 50,000 lbf, a value of 5.75 used over the range 50,000100,000 lbf, and a value of 6.0 used for thrust greater than 100,000 lbf. A comparison with the few existing design weights, and the multiplier used to achieve these weights is displayed in Table 2-3.

	Single	Leg	Dual		
Thrust Level (lbf)	Design Wt. (lbm)	NESS Wt. (lbm)	Design Wt. (lbm)	NESS Wt. (lbm)	Multiplier Used
25,000	90*	87.8	130*	141.7	4.93
50,000	200*	172.7	270*	274.0	5.75
75,000			400*	396.9	5.75
104,000	1030**	1037.5			6.0

Table 2-3.	Axial Pump	Weight	Comparison	and Multipliers
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*Ref. 2-9

****Ref. 2-10**

Comparison with existing designs gives an ignition system multiplier CXWIGN with a value of 1.3. Engine bay lines are multiplied by 2.5 to allow for flanges, bolts, bellows, etc. The TPA components, valves, and engine bay lines are all multiplied automatically by the number of propellant feed legs, NTPA, when appropriate.

The support hardware multipliers, CXWPNEU, CXWINST, and CXWTNKAS, are discussed in the support hardware section of this report, and reflect the technology advances made since the correlations used to calculate the component weights were developed.

2.3 Additional Features

A number of features have been added to the original ELES to more accurately model a nuclear thermal propulsion system.

2.3.1 Pump-Out Option

A typical nuclear propulsion system will include multiple propellant feed legs for redundancy. Each feed leg will be designed to a desired pump-out thrust level that is less than the nominal operating value. To accurately model this feature, a computer run would have to be made at this reduced thrust level to design/size a single pump and turbine for these conditions, and then these values would be used for a second run at full thrust level with multiple pumps to determine nominal operating conditions. To simplify this process, a pump-out (double-run) option is available for all engine cycles. The first pass through the code designs a single shaft turbopump that operates at a reduced thrust level and corresponding reduced chamber pressure (pump-out conditions) specified by the user. The second pass automatically assigns the pump and turbine parameters calculated by the first run to be inputs for the user-defined TPA option. The valve and engine bay line weights from the first run are also retained to be output with the total engine summary. The second pass will design a system using an input number of identical propellant feed legs, each with characteristics as calculated in the first pass.

If the number of feed legs is greater than two, the first pass through the code, the pump-out run, will be made assuming NTPA-1 feed legs. For example, if the desired number of feed legs is 3, the first run will be made assuming a single pump failure and will perform the cycle analysis with 2 pumps. The individual pump, turbine, valve, and line weights will be retained from the first run and later multiplied by the total number of feed legs as usual.

To utilize this option, the input file must contain IDBLRUN = 1 and a corresponding thrust level fraction FFRAC (default = 0.8, or 80% thrust level), based on a dual propellant feed system. The user must set the pump configuration flag to the single shaft option, or JCNFIG = 2; the code automatically sets JCNFIG = 5 and assigns the pump and turbine parameters calculated in the first pass to the appropriate user-defined TPA variables for the second pass. In the input file, the user specifies the number of identical feed legs to be used for the second pass as NTPA.

Upon completion of a double run, the user must examine the turbopump output for the offdesign run to determine whether the design is feasible for operation in both thrust regimes. An option has been added to NESS to be used with the double run option that will perform this evaluation automatically, and if the design fails either of the tests used, the thrust fraction FFRAC set for the initial pump design run will be reduced by 5% and the entire process repeated until either an acceptable design is achieved or the thrust fraction becomes less than the fraction of flow through each pump at full thrust level (i.e., FFRAC < 1/NTPA). To select this option, set TTRATE=1. The tests used to determine adequate off-design performance include a check for axial pump specific speed above 800. Also, the axial pumps cannot be throttled below 60% and therefore a test is made to determine whether the axial pump volumetric flow is at least 60% of the volumetric flow handled by the pump in the initial low-thrust design run. This same test is performed for the centrifugal pumps, with the throttling limit set to 40% instead of the 60% limit used for the axial pumps.

For all runs made using the pump-out option, whether iterative or not, the speed (RPMs) of the pumps calculated during off-design (full thrust) operation is compared with the calculated blade root stress speed limit. This speed limit is based on turbine size and blade material properties. If the calculated pump RPMs are more than 3% higher than the speed limit, a warning is printed out in the warning section of the output indicating that pump RPMs are too high and pump design is nominal. This speed limit problem can often be overcome by using a higher pump-out design thrust fraction (FFRAC).

2.3.2 User-Defined Engine Burn Time

An option has been added which allows the user to input the engine burn time rather than have the code calculate the burn time based on flowrates and input amount of propellant. This option is useful when the amount of propellant to be used is unknown or the tankage design is not important. This burn time is used mainly to size the gimbal power supply, whose weight is timedependent. To use this option, set the flag IUSRBRN equal to 1 and then input burn time in seconds as TUSRBRN.

2.3.3 User-Defined Turbomachinery

The user-defined turbomachinery option of NESS allows evaluation of pump and turbine performance at off-design operating characteristics and with a variety of propellants. The parameters input to define the TPA for off-design evaluation are detailed in the worksheets following, and include number of stages for all pumps and turbines, pump and turbine diameters, turbine annulus area, turbine admission fraction, and various gas generator/mixer parameters.

NESS calculates pump head rise and volumetric flowrate, and turbine horsepower, mass flowrate, and pressure ratio based on cycle balance requirements. For the centrifugal pumps, these values are used to calculate the pump rpm as a function of input pump diameter. To perform this calculation, a correlation had to be developed for pump head coefficient as a function of specific speed (standard cases interpolate this coefficient from a data table), and is of the form:

$$HC = const * SS^{x}$$

where

HC = head coefficient SS = pump specific speed

For example, the main pump correlation is:

$$HC = 3.7852 * SS - 0.28786$$

This correlation is different for main pumps and boost pumps. The specific speed is a function of pump rpm, head rise, and volumetric flowrate, as is shown below:

SS = RPM * SQRT(volumetric flowrate)/(pump head rise^{0.75})

The pump diameter is calculated as:

Dia = (720/pi*RPM) * SQRT(32.2*pump head rise/head coefficient)

Substituting the head coefficient and specific speed equations into the equation for pump diameter and rearranging gives an equation for pump rpms as a function of input pump diameter only. Once the rpms are known, the specific speed, efficiency, and horsepower are easily found from the standard ELES equations.

The axial pump user-defined TPA method is slightly different from that used for the centrifugal pumps. Using the equations listed above for specific speed (SS) and pump diameter, along with the best-fit equation determined for pump head coefficient as a function of specific speed, the following equation is found:

52525*32.2*QFL/(Dia²*sqrt(HFL))=SS²(0.88237-2.3145E-4*SS+ 2.3161E-8*SS²-7.7028E-13*SS³)

where:

QFL = volumetric flowrate (gpm) HFL = pump pressure-head rise (ft) Dia = pump diameter (in.)

This equation is a function of specific speed only, and is of the form of a fifth-order polynomial that can now be solved by the iterative secant method. Once the specific speed is known, the pump

rpms can be found and the rest of the calculation proceeds the same as for the centrifugal pumps. The inducer is again modeled as a boost pump with its speed (rpm) and diameter fixed to that of the main pump. The inducer head rise is determined by the input fraction BPFRFL, and the specific speed, efficiency, and horsepower are now easily calculated by the standard equations.

The user-defined TPA option of NESS calculates the required turbine mass flowrate and horsepower and then evaluates the user input turbine to see how well it performs in meeting these requirements. The first step is to calculate the isentropic spouting velocity (Co) based on the number of turbine stages. Now calculate the ratio of turbine blade tangential velocity to Co based on input turbine diameter (U/Co) and check whether this ratio is within the accepted range of 0.2 - 0.6; if not, print a warning. Next, calculate the turbine inlet mach number and check whether it is below the accepted maximum value of 1.7; issue a warning if not. Finally, calculate turbine specific speed, efficiency, and horsepower provided. Compare the horsepower provided with the horsepower required and if not within 3%, calculate a new turbine pressure ratio and repeat the entire process.

To use this option, first set the variables ISTSET = 1 and INPTPA=1 to indicate that the TPA is user-defined and the TPA-related weights will be input. The number of pump stages are input with PDIAFL and PDIAOX. Turbine stages are input with either TSTGES for a single shaft turbine, or TSTAGF and TSTAGO for fuel and ox turbines (can be used only for GG cycles). Diameters are input in inches with PDIAFL and PDIAOX, and either TDIAM or TDIAFL and TDIAOX. Boost pump diameters can be input with BPDIAF and BPDIAO. Turbines also need to have admission fraction and annulus area input using the variables listed in the worksheet. TPA-related weights will not be calculated for the user-defined TPA option and therefore the user may input these weights for total TPA, TPAWT, start system, WSTART, ignition system, WIGNIT, hot gas manifolding, WHGMF, autogenous heat exchanger, WTHTX, and gas generator/preburner, WGGPB. If not input, the weight summaries will list these weights as zero unless a double run is being made, in which case the weights calculated in the first pass are retained and printed out in the output summaries.

The user-defined gas generator cycle requires many more inputs than are required for the expander cycle. First set the flag IUSRGG equal to 1 to indicate a user-defined GG and input all pump and turbine parameters as described above. In order to insure that the GG and turbine are modeled correctly, the turbine inlet and outlet pressures, PUSRTI and PTURBO, respectively, must be set to the values calculated/input for the NESS-calculated case. For example, if a NESS-calculated GG cycle using LO2/H2 is designed at 80% thrust level and is next to be evaluated at

50% thrust level, the turbine inlet and outlet pressures calculated by NESS in the first run must be used as inputs for the user-defined run. The turbine inlet temperature, TUSRGG, should be set to the actual value found for the propellant combination at given mixture ratio and pressure; normally this temperature will simply be the same as that found in the 80% run. If a different propellant is to be evaluated or the GG is being input based on an existing design (not NESS-generated), this temperature can be found most easily by an initial NESS run where the user-defined option is not used and the GG is at conditions similar to those to be used for the actual user-defined run. The turbine flowrate, although listed as an input, is actually calculated by NESS as the correct amount of fluid flow required for the given operating conditions. The GG bleed flowrate, Isp, and efficiency can be set to any reasonable values. The drive fluid parameters must be input to any value other than zero.

Inputs required for the user-defined bleed cycle include IUSRGG=1 and a matched turbine outlet pressure PTURBO and inlet temperature TUSRGG. The standard pump and turbine parameters, such as diameters and number of stages, are retained or input as usual.

2.3.4 Weight Margin

The user may now input a fraction of the total non-nuclear weight to be added in as a margin weight. Inside the code, non-nuclear weight is the sum of nozzle weight, total TPA weight, lines, valves, thrust mount, support hardware, and total gimbal system. The percent (fraction) of this weight to be used as margin is input with FMARG, whose default is 0.02 (2% margin). In the output summary, the "non-nuclear weight" includes the weight margin.

2.3.5 Bleed Cycle Component Models

The bleed cycle requires a number of extra lines and valves which differ from those required by the other engine cycles. The hot bleed flow is tapped off the reactor chamber flow at the exit region. NESS assumes that a single line is used for all hot bleed flow regardless of the number of TPA propellant feed legs. If required, the hot bleed flow is split into the necessary number of feed lines prior to entering the mixers. Cold bleed flow is tapped off from the pump outlet flow, and one line is needed for each feed leg. Each cold bleed line includes a valve that steps the pressure down as needed to meet the required mixer inlet pressure. One mixer is used for each propellant feed leg, and consists of a hot bleed line wrapped by a cold flow line. The flows are merged at the mixer outlet and then sent to the turbine. Each turbine has its own inlet line containing a throttling valve for flow regulation. Pressure drops across all lines and the turbine

throttling valve are input as fractions of the line/valve inlet pressure using the variables CPLINH, CPLINC, CPLINT, CPVLVT. The cold bleed valve pressure drop is calculated automatically based on the mixer pressure requirement. The hydrogen velocity was assumed to be 200 ft/sec, a typical value used elsewhere in NESS for line calculations. For pump-out (double-run) cases, the bleed components are designed on the second pass (the full thrust run).

Table 2-4. Bleed Line Component Design Characteristics

Component	Equivalent Length
Flange	0.2*Line diameter
Bellows	1.0*Line diameter
Elbow	5.5*Line diameter
1	

Table 2-5. Bleed Cycle Line Characteristics

ſ <u> </u>	Number		Number		
Component	of items	Flanges	Bellows	Elbows	Line Length
Cold bleed line	NTPA	2	2	2	1.5*Reactor Pressure Vessel Diameter
Hot bleed line	1	2	1	2	1.5*Reactor Pressure Vessel Length
Turbine inlet line	NTPA	2	2	3	0.7*Reactor Pressure Vessel Diameter
Mixer	NTPA	2	1	0	3.5*Turbine Line Diameter

Each flow line consists of the line itself plus a number of flanges, bellows, and elbows. Using a method described in the TRW report, see Ref. 1-1, each line length was calculated as a series of equivalent lengths, most of which are functions of the line diameter. It was assumed that each flange would add a length that was 20% of the line diameter, a bellows adds 100% of the line diameter in length, and an elbow has a length 5.5 times the line diameter (see Figure 2-4). The lengths of the lines themselves are functions of the reactor diameter and length. A summary of bleed line component design characteristics is shown in Figure 2-5. Total assumed line lengths are as follows:

Cold bleed line = $1.5*D_{reactor} + 2$ bellows + 2 elbows + 2 flanges

Hot bleed line = $1.5*L_{reactor} + 1$ bellows + 2 elbows + 2 flanges

Turbine inlet line = $0.7*D_{reactor} + 2$ bellows + 3 elbows + 2 flanges

Line diameters are calculated as a function of mass flowrate, and fluid density and velocity. Line thickness is a function of pressure, line diameter, and line material strength, see Ref. 2-1. Once the line length, diameter, and thickness are known, the volume of material can be found and finally the weight of each line is determined. Hot bleed line weight assumes all hot bleed flow travels through a single line, while each cold bleed and turbine inlet line are sized assuming (1/NTPA)*flowrate.

The cold bleed and turbine throttling values are sized using the standard NESS/ELES value weight procedure. Value weights are a function of value material density, mass flowrate, pressure drop across the value, and fluid density in the form:

Valve Weight = 1.476*rho_{vlv}*mdot/sqrt(rho_{H2}*delta-P)

where:

rho _{vlv} =	valve material density (lb/in ³)
mdot =	fluid mass flowrate (lb/sec)
$rho_{H_2} =$	fluid density (lb/in ³)
delta-P =	pressure drop across the valve (psi)

The typical valve multiplying factor, CXVALV, of 2.8 (=2*1.4) is applied to the bleed line valves along with all other valves in the cycle. The factor of 2 doubles the number of required valves to provide redundancy. For example, a typical bleed cycle has two feed legs and therefore requires one cold bleed and turbine valve for each leg; application of the valve multiplier will instead allow for two valves of each sort for each feed leg to satisfy the usual redundancy requirements. The 1.4 factor accounts for valve weight not specifically calculated by NESS, see Ref. 2-1.

The mixer design is shown in Figure 2-11. It consists of diverging and cylindrical cold flow portions plus a hot flow line. The overall mixer length is assumed to be:

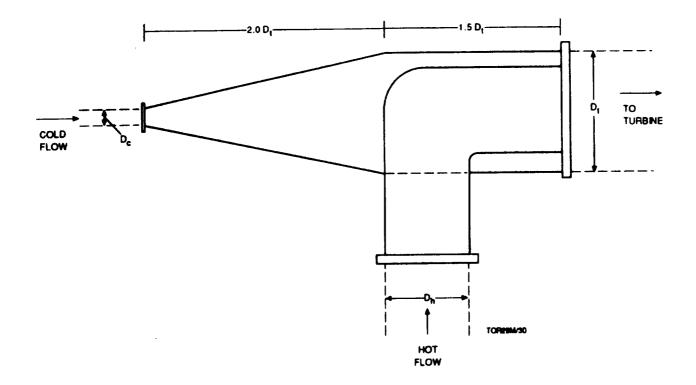


Figure 2-11. Bleed Cycle Mixer Design

Mixer Length = 3.5*D_{turbine inlet} + 1 flange (cold side)+1 flange (mixer outlet) + 1 bellows (mixer outlet)

where:

D_{turbine inlet} = Turbine inlet line diameter

The hot flow line length within the mixer is assumed to be:

Hot Line Length = $2.5 \text{*}D_{\text{turbine inlet}} + 1$ flange + 1 bellows

The length of the diverging section of the cold flow portion of the mixer is set to:

Divergent Length= 2*D_{turbine inlet} + 1 flange

The volume of material needed for each portion of the mixer is now calculated individually so that the weight for each portion, and finally the entire mixer weight, is determined.

2.4 Code Setup and Execution

NESS is written in FORTRAN 77 and currently resides on a VAX mainframe computer system. It has recently been modified for use on a personal computer (PC) as well. Allowing a much larger range of potential users. The major NESS modification required for transport to a PC was a reformatting of the input file from a VAX-specific namelist file to an unformatted read file that contains all possible input variables along with a brief description of each variable's function, see Appendix A.

The entire NESS code is made up of four parts: the source code, the executable, the library of subroutine object files, and a library of propellant performance data. The NESS executable takes up approximately 4700 blocks of storage space on the VAX and about 1.6 MB on a PC. The source code for NESS is made up of approximately 220 subroutines that have been separated into individual files for easier editing. The subroutines take up approximately 4800 blocks of storage space on the VAX, and 1.9 MB on a PC. The object library ELES_LIB.OLB takes up about 6,000 block of storage space, or about 2 MB on the PC. The propellant performance library is included with the code, but may not be needed as all hydrogen performance data has been entered elsewhere in the code; this data uses 72 blocks of storage. If storage space is a problem, the executable alone could be loaded onto the computer while the rest of the code is left on disk to be loaded as needed.

The standard NESS operation requires creation of a structured series of directories whenever the code is loaded onto a new computer system. The executable and propellant data file must be put into a directory called [account name.ELES]. The input files reside in the directory [account name.ELES.INPUT], and the output appears in the directory [account name.ELES.OUTPUT]. The source code and object file library are loaded into [account name.TEMP.CURRENT]. If the code will be run in debug mode, a directory [account name.TEST] must be set up that includes the propellant library file PROPLIB.DAT and an input file with the name ELES.INP. This directory structure is especially suited for VAX operation.

To simplify the code structure, PC users may wish to edit the governing .COM (or batch) files - ELES_SETUP.COM and RUN.COM - to allow placement of all code parts (executable, source, input, output, etc.) into a single directory. The code itself can be easily edited to operate off a single input file (always the same name), if desired. NESS has been successfully tested on a PC using Lahey FORTRAN 77/EM-32 with the entire code contained in a single directory. The

code was edited to always open a certain input file and can be run by simply typing the word NESS (or whatever the code file is called); .COM files are not required at all.

For standard (VAX) code operation, a number of *.COM files are necessary/useful for code execution. The file ELES_SETUP.COM must be run at some point before the code is run to insure proper directory and file initialization; this is most simply achieved by adding this file to the LOGIN.COM file and having it execute automatically with each login. In the [..CURRENT] directory, the file FL.COM is used to compile an individual subroutine and add/replace it in the object library; it is used as "@FL filename". FALL.COM will recompile all subroutines and replace their previous versions in the object library. To link the governing routine with the object library, type "@LD" to execute LD.COM and a new NESS executable will be created.

If the code has been edited to always open the same input file, all input files must have the name assigned by the programmer (NESS.INP, for example), otherwise, the filename must have the extension inp and must contain 10 characters or less, excluding the extension. To run the code (standard operation, unmodified code) type "MODEC filename" without the filename extension of .inp; for example, typing "MODEC NTPREGEN" will run NESS with the input file NTPREGEN.INP and place the output in a file called NTPREGEN.OUT in the output directory. A file called NTPREGEN_ELES.OUT is also created in the output directory that is essentially a printout of the input file. If the computer has a debug mode, enter the [account name.TEST] directory and type "RUN ELES:MODEC" and the code will execute using the input file ELES.INP. For PC operation, the programmer/user may compile and link all source code into an executable, called NESS for example, and edit the code to open a single input file, such as NESS.INP. If this is done, the user need only type "NESS" to run the code, and the output will appear in the same directory as the code with a name assigned by the programmer.

2-44

3.0 REACTOR SYSTEM

This section describes the Westinghouse ENABLER NTP reactor system series models (ENABLER I and ENABLER II) including their internal shield, modeling assumptions, and scaling relations.

3.1 Reactor System Description

An engineering description of the reactor's major subassemblies for both the ENABLER I and II reactor systems are given in the following sections.

3.1.1 Reactor Assembly

For both reactor types, their assembly consists of a nuclear reactor and an actuation system for reactivity control devices with associated instrumentation and controls are shown in Figure 3-1. The reactor consists of fuel elements, support elements, a core periphery, support plates and plena, an internal shield, a reflector assembly, and control drum drive assemblies. Reflector coolant is provided from the nozzle coolant channel exhausts. The support stem coolant exhaust is used as drive power for the engine turbopump. Additional turbopump flow may also be obtained by routing the reflector coolant exhaust to the turbopump. The turbine exhaust gas flows through the dome flow baffle, internal shield, plena between the core support plate and the internal shield and reactor core, and through the reactor core. This gas is heated by the reactor assembly to operating temperatures and exhausted out the nozzle.

3.1.2 Fuel and Support Elements

The fuel elements in Figure 3-2 for the ENABLER class reactor serve the combined function of providing the energy for heating both the hydrogen propellant and the required heat exchanger surfaces. The energy is provided through the fission of ²³⁵U contained in the fuel element. Table 3-1 lists the characteristics of the three fuel materials defined in the NESS code. Multiple coolant channels coated with ZrC (for graphite and composite) form flow passages through the elements. The exterior surfaces of the hexagonal fuel elements (except carbide) are also coated with ZrC. This coating protects the carbon from reaction with the hydrogen propellant. The fuel element dimensions were established by the NERVA program, i.e., a nominal 0.75 inch hexagonal with 19 holes 0.100 to 0.110 inches in diameter. Other basic fuel dimensions such as coating thicknesses are setup in NESS as default values for user variables. The NESS code permits the user to specify scaled fuel, see Refs. 3-1 and 3-2, that allows an increase in the allowable fuel power density.



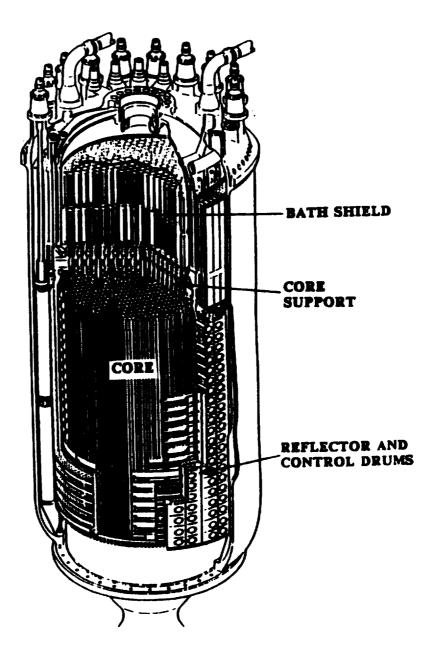


Figure 3-1. ENABLER Class (NERVA Type) Nuclear Thermal Rocket Engine Reactor

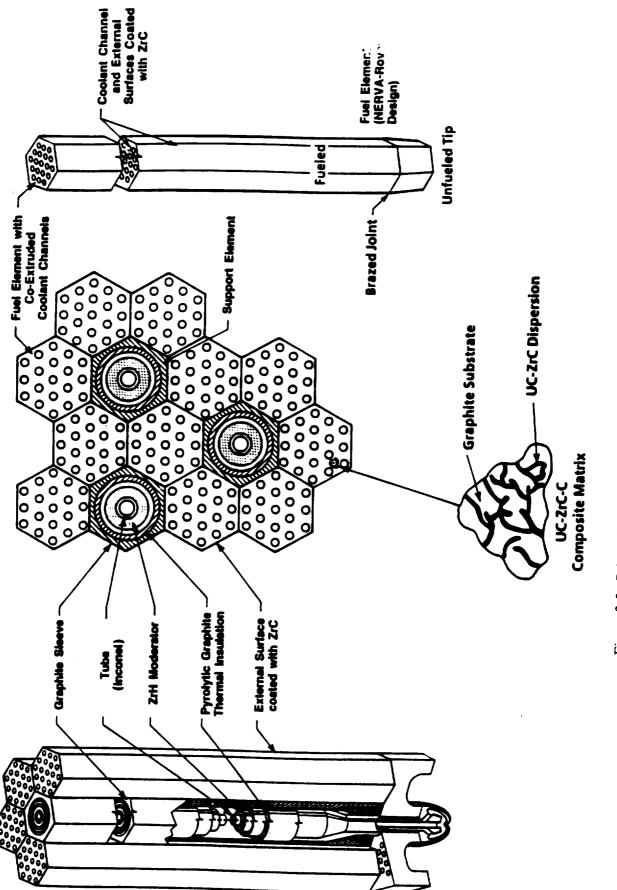


Figure 3-2. Prismatic Fuel Elements and Supports

Fuel Element Composition	Graphite	Composite	Carbide	
Temperature Range (°K)	2200-2500	2500-2900	2900-3300	
Fuel	Coated Particle	UC . ZrC Solid Solution and Carbon	(U,Zr) C Solid Solution	
Coating	ZrC	ZrC		
Unfueled Support Element Composition	Graphite	ZrC-Graphite Composite	ZrC	
Unfucied Element Coating	ZrC	ZrC		

Table 3-1. Fuel and Support Element Parameters

The reactor core is supported in the longitudinal direction by tie-tubes anchored in the core support plate above (inlet end) the core. The tie-tubes run the full length of the reactor core and connect to fuel support blocks below (exhaust end) the core. These tie-tubes are located inside unfueled support elements, which have the same length and external dimensions as the fuel elements. The support elements have a single, large longitudinal hole with a porous ZrC insulating liner. Within the hole is located the tie tube assembly, which may incorporate ZrH_2 moderator as required. The support element composition is given in Table 3-1.

The reactor core is sized based on an average fuel element power of 1.2 MW per element and one support element per six fuel elements in Table 3-2 at thrust levels greater than 50,000 pounds. The 1.2 MW per fuel element was demonstrated in the Pewee reactor (402 fuel elements with a power level of 503 MW) and was the design level for the Phoebus-2A reactor (4068 fuel elements with a 5000 MW design power level). For the smaller reactors, sufficient reactivity is obtained by increasing the relative number of support elements to fuel elements (Table 3-2) which increases the amount of zirconium hydride moderator to the desired level. Also to keep a reasonable core length to diameter ratio (<2) for the smaller reactors (15000-25000 lbf. thrust) the element length was set at 35 inches. At the 25000 thrust level (Pewee size core volume) the relative power density of the fuel element is the same as the larger reactors (1.2 MW/52 inch). However, at the lowest thrust level (15,000 lbf.) the fuel element power density had to be reduced in order to obtain a core large enough for criticality. Fuel volume, zirconium hydride loading, and reflector thickness all act to increase core reactivity. Neutronic analysis to determine the exact combination of these parameters that achieves criticality is not part of the NESS code at this time. The NESS code does provide a warning message if the selected combination of parameters is questionable.

Thrust (lbf)	15,000	25,000	>50,000
Reactor Power Range	275-400	460-670	920-6700
Fuel and Support Element Length (inch)	35	35	52
Pressure Vessel Length (inch)	82.6	84	101.6
Fuel Element Power (MW)	0.629	0.808	1.20
Relative Fuel Element Power Density	0.778	1.0	1.0
Ratio of Fuel Elements (N) to Support Elements	2:1	3:1	6:1

Table 3-2. Reactor Parameters as a Function of Thrust Level

3.1.3 Radiation Shield

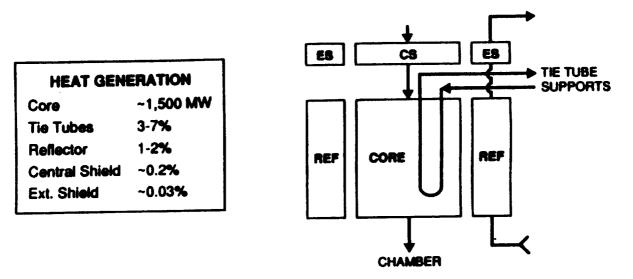
A radiation shield internal to the pressure vessel is used to reduce the gamma and neutron flux levels in the engine components forward of the reactor. This internal shield limits radiation leakage through a plane 63 inches forward of the core center, perpendicular to the engine axis, to the levels given in Table 3-3. The shield is located immediately upstream of the core support plate, see Figure 3-1. The reactor internal shields for the thrust levels over 50,000 lbf. have about 12.5 inches of Borated Aluminum Titanium Hydride (BATH) and about 1.3 inches of lead. At the lower thrust levels the thickness of the BATH and lead is slightly reduced due to lower core power density.

Table 3-3. Radiation Leakage Limits at a Plane 63 Inches Forward of the Core Center

Type of Radiation	Radiation Leakage Limits Within Pressure Vessel Outside Radius
Gamma Carbon KERMA Rate	1.8 x 10 ⁷ Rad(c)/hr
Fast Neutron Flux	2.0 x 10 ¹² n/cm ² -sec
Intermediate Neutron Flux	$3.0 \times 10^{12} \text{ n/cm}^2\text{-sec},$ $0.4 \text{ eV} \le \text{En} \le 1.0 \text{ MeV}$
Thermal Neutron Flux	$6.0 \times 10^{11} \text{ n/cm}^2\text{-sec}$ En < 0.4 ev

3.1.4 Reactor Propellant/Coolant Circuits

In an NTP system, a nuclear reactor supplies the energy to heat the propellant flowing through the engine. The hot propellant flows into a nozzle that functions in the same manner as a chemical engine. The reactor in an ENABLER reactor-based NTP engine system generally has three propellant (coolant) circuits as shown in Figure 3-3. The primary circuit is through the central shield and core into the chamber. This circuit provides more than 90% of the heat to the propellant. All the components surrounding the core require cooling due to the radiation induced heating and heat transfer from the primary stream. The propellant cooling of the ex-core components is divided into two additional circuits: the tie tube (core support) circuit and the peripheral component circuit that includes the core reflector and extension shield. These circuits along with the nozzle regenerative cooling circuit provide the first pass through the reactor system for the propellant, which acts as component coolant. The heat supplied by these secondary circuits provides the energy to power the turbopump. After passing through the turbine, all the propellant passes through the primary core circuit and into the nozzle to provide the engine thrust.



COMPONENT BLOCK DIAGRAM

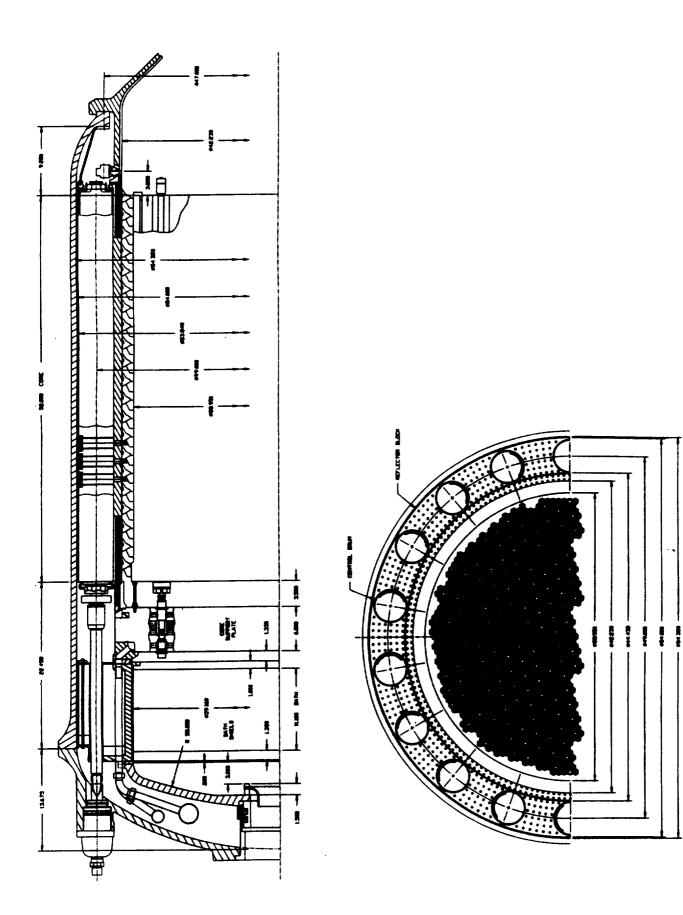
Figure 3-3. Propellant Flow Circuits Through the Reactor

The NESS code allows the user to choose one of two propellant circuit connection options. The first option routes the outlet of both the tie tube circuit and the peripheral component circuit to the turbopump. This arrangement was selected for the NERVA flight engine, the R-1, and it provides sufficient energy to the turbopump to allow operation of the engine at high chamber pressures (approximately 2000 psia) for small engine systems (\leq 40,000 lbf thrust). The second option routes only the tie tube circuit outlet to the turbopump, while the outlet of the peripheral component circuit is routed directly to the core inlet. This configuration saves weight by eliminating a massive flow baffle at the top of the core and by reducing the pressure vessel design pressure, thus decreasing its thickness. With this configuration, the energy available to drive the turbopump is reduced and therefore engine operation at high chamber pressures (>1000 psia) may not be possible in engines with a 6:1 fuel to support ratio. The second configuration is generally preferable if a cycle balance can be achieved.

3.2 Baseline Reactor Design

The Rover/NERVA database provides numerous reference designs for reactors and engines in the size range of 15,000 lbf to greater than 250,000 lbf thrust range. The engine modeled in the NESS program is the ENABLER reactor class of NTP engine systems, which is discussed in Ref. 1-4, that is derived from the nuclear rocket technology developed in the Rover/NERVA programs. The ENABLER designs incorporates NERVA type fuel elements which are 0.75 inch (19 mm) hexagonal extrusions of graphite based fuel with a 19 coolant channel array within the element. The code allows the user to select from one of the three fuel materials developed during the Rover/NERVA program: Graphitic, Composite, or Carbide. The ENABLER engine is generally specified with fuel elements fabricated from the (U,Zr)C-Graphite composite material developed late in the Rover/NERVA program, which exhibits improved corrosion resistance and allows higher operating temperatures and power densities, see Refs. 3-3 and 3-4. Zirconium-hydride moderator is placed in the core support elements (demonstrated in the Pewee reactor) to increase the neutronic reactivity and thereby decrease the required uranium fuel loading.

Detailed data is available on the breakdown of actual reactor system component masses. In the NESS model the core size is based on the number of fuel elements needed to meet the required power level. The design of the reactor peripheral regions follows the R-1 engine design shown in Figure 3-4, but the peripheral components are sized according to the core dimensions. For the R-1 reactor shown in Figure 3-4, the nominal core dimensions are 38 inch (96 cm) diameter by 52 inch (132 cm) long. The components surrounding the core are sized to satisfy structural and neutronic requirements. The major components are the core barrel, reflector, pressure vessel, core support plate, flow baffles, and top shields.





3.3 Reactor Core Design and Thermal-Hydraulic Model

The required core power level is determined from the specified engine flow and chamber temperature. The core power level and the average allowable heat generation of a fuel element determines the total number of fuel elements and support elements in the core. Based on the core peaking factor, a single channel analysis is performed to calculate the thermal and pressure profile for the peak channel of the peak element in the core. The calculation uses finite increments along the channel length beginning at the core exit where the chamber conditions are specified. The governing equations are given below.

The convective heat transfer between the fluid and channel wall is defined by:

$$q = h_c A_s (T_w - T_r)$$

where T_w is the channel wall temperature and T_r is the coolant gas stagnation recovery temperature. For small Mach numbers (<<1.0) the difference between the recovery temperature (T_r) and the fluid free stream bulk temperature (T_b) is not significant, so that the equation may be written as:

$$q = h_c A_s (T_w - T_h)$$

The heat transfer (q) must match the heat generation in the fuel material. The heat generation in the fuel is determined by the fuel loading, fuel volume, and neutron fluence. For the purposes of the thermal hydraulic calculations it is sufficient to specify a power profile and the total power produced by the element. The NESS code uses a cosine power profile typical of that observed in the NERVA reactors:

 $P = P_n \cos(0.891\pi (x/L - 0.452))$

where P_n is the normalized element power factor and x/L is the normalized axial location in the core measured from the inlet. The peak temperature in the fuel (T_f) is determined from the following correlations for a heat generating solid with a hexagon array of coolant channels of diameter D and pitch S:

$$\varepsilon = \frac{\pi D^2}{3.4641 \text{ S}^2}$$

$$K = \frac{D}{4} \left(\frac{1}{\epsilon} - 1\right)$$
$$\Psi = \left(\frac{S}{2}\right)^2 \left(0.55133 \ln\left(\frac{S}{D}\right) + 0.25 \left(\frac{D}{S}\right)^2 - 0.23446\right)$$
$$T_f - T_w = \frac{q_i \Psi}{K k_s}$$

where k_s is the thermal conductivity of the solid.

The convective heat transfer coefficient, h_c , is determined by the McCarthy-Wolf, see Ref. 3-5, correlation:

$$h_{e} = 0.025 \frac{k_{b}}{D} \operatorname{Re}_{b}^{0.8} \operatorname{Pr}_{b}^{0.4} \left(\frac{T_{b}}{T_{w}}\right)^{0.55} \left(1 + 0.3 \left(\frac{x}{D}\right)^{-0.7}\right)$$

where the fluid properties are evaluated at the fluid bulk temperature. The entrance effect term $(1 + 0.3 (x/D)^{-0.7})$ is limited to 1.1 for small x.

As the coolant flows along the channel, it experiences a pressure loss due to wall friction and fluid acceleration. The momentum equation for one dimensional flow in finite increment form is:

$$P_{i} - P_{i+1} = \frac{G_{n}^{2}}{g} \left(v_{i+1} - v_{i} \right) + f_{i} \frac{G_{n}^{2} \Delta x}{g D_{h}} \left(v_{i+1} + v_{i} \right)$$

where P_i is the coolant pressure at station i, G_n is the mass flow per unit area, v_i is the specific volume of the coolant, D_h is the hydraulic diameter of the channel, f_i is the Fanning friction factor, and Dx is the length increment along the channel. The friction factor is obtained from the Taylor, see Ref. 3-6, correlation for gaseous flow through a smooth tube:

$$f = \left(0.0014 + \frac{0.125}{Re_{w}^{0.32}}\right) \left(\frac{T_{b}}{T_{w}}\right)^{0.5}$$

where Re_w is a modified surface Reynolds number in which the gas density is evaluated at the fluid bulk temperature, but the viscosity is evaluated at the channel wall temperature:

$$\operatorname{Re}_{w} = \left(\frac{\operatorname{G}_{n} \operatorname{D}}{\mu_{w}}\right) \left(\frac{\operatorname{T}_{h}}{\operatorname{T}_{w}}\right)$$

The evaluation of these equations for the peak channel in the core determines the required core pressure drop.

After the calculation of the core profile and pressure drop, the heat generation rates for the core peripheral regions are calculated. Because NESS does not have neutronics analysis capabilities, the heat generation in the peripheral regions is defined as a fraction of the total core power. After completion of the thermal hydraulics, code control returns to the NESS engine code for determination of the cycle balances.

In addition to the basic thermal-hydraulic parameters of the core, NESS calculates the estimated life of the fuel based on the hot end corrosion correlations obtained from the Nuclear Furnace 1 and electrical testing, see Ref. 3-3. Fuel life is given by:

$$rh = 30.5 \exp\left(-\frac{35114}{T_w}\right)$$
$$t_1 = m_{limit} A_f / rh$$

where T_w is the peak wall temperature of the fuel channel at the hot end in degrees Kelvin, is the fuel mass loss rate in g/sec per cm of fuel element length, A_f is the fuel area, m_{limit} is the allowable mass loss in g/cm³, and t_l is the fuel life in seconds. NESS contains the necessary corrections for calculating the life of scaled fuel. The fuel life estimate is not valid for the carbide fuel type.

3.4 Reactor Weight Model

The reactor mass model divides the reactor system into 53 regions for both types in an R-Z model as shown in Figure 3-5 and Table 3-4. Each region contains one, or at most a few, components. The masses of all the components and their constituent parts within a region have been tallied and converted into a pseudodensity for each region, see Ref. 3-7. The dimensions of the regions are based on the core size determined above, with appropriate dimensional dependency algorithms.

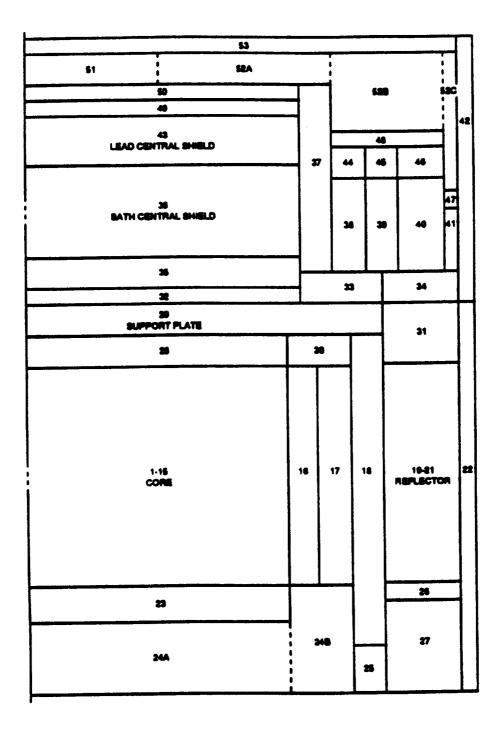


Figure 3-5. R-Z Model of the Regions in the R-1 Reactor

	REGION DESCRIPTION	MATERIAL	
1 - 15	Core	Fueled Element Unfueled Element Pyro Sleeve A-286 SS-304 Hydrogen	
16	Core Periphery	Graphitite-G Pyrofoil ZrC (60% Dense) TZM Moly Hydrogen	
17	Lateral Support	P03 Graphite ZTA Graphite Pyrofoil Hydrogen	
18	Ai-60 A-280	P03 Graphite Al-6061 A-286 Hydrogen	
19 - 21	Reflector	P03 Graphite Pyrofoil Beryllium Al-6061 A-286 Control Vane Hydrogen Al-7039 Hydrogen	
22	Pressure Vessel Side A		
23	CHESH	Pyrographite Pyrofoil NbC/C Comp. W-ThO A-286 SS-304 SS-316 Hydrogen	
24	Nozzle Chamber	Hydrogen	
25	Nozzle Barrel	SS-347	
26	Aft Reflector Hardware	Al-6061 A-286 SS-440C Hydrogen	
27	Aft Reflector Plenum	Hydrogen	

Table 3-4.	Reactor	Weight	Model	Regions
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TOR29K/14a

EGION NUMBER	REGION DESCRIPTION	MATERIAL
28	Core Plenum	TZM Moly Copper-Boron A-286 SS-302 SS-304 Hydrogen
29	Support Plate	Pyrofoil Al-6061 A-286 SS-302 SS-304 Hydrogen
30	Lateral Support-Forward	Al-6061 A-286 Hydrogen
31	Forward Reflector Hardware I	AI-6061 A-286 SS-304 SS-440C Hydrogen
32	Support Plate Plenum	A-286 SS-304 Hydrogen
33	Instrumentation Ring	Al-6061 SS-304 Hydrogen
34	Forward Reflector Hardware II	Al-6061 A-286 SS-304 Hydrogen
35	Aft Central Shield Plate	Al-6061 Hydrogen
36	BATH Central Shield	BATH Al-6061 Hydro ge n
37	Flow Baffle I	Al-6061 SS-304 Hydrogen
38	BATH Peripheral Shield 1	BATH Al-6061 Hydrogen
39	BATH Peripheral Shield II	BATH Hydrogen
40	BATH Peripheral Shield III	BATH AI-6061 A-286 SS-304 Hydrogen

Table 3-4. Reactor Weight Model Regions (Cont.)

TOR29K/14b

	REGION DESCRIPTION	MATERIAL
41	BATH Peripheral Shield IV	BATH Al-6061 Hydrogen
42	Pressure Vessel Side B	Al-7039 Hydrogen
43	Lead Central Shield	Lead Alloy Al-6061 Hydrogen
44	Lead Peripheral Shield I	Lead Alloy Al-6061 Hydrogen
45	Lead Peripheral Shield II	Load Alloy Hydrogen
46	Lead Peripheral Shield III	Lead Alloy Hydrogen Al-6061 A-286 SS-304 Hydrogen
47	Lead Peripheral Shield IV	Lead Alloy Al-6061 Hydrogen
48	Peripheral Shield Plate	A-6061 A-286 SS-304 Hydrogen
49	Shield Plenum	Al-6061 SS-304 Hydrogen
50	Flow Battle II	AI-6061
51	Central Dome Plenum	Hydrogen
52	Peripheral Dome Plenum	Al-6061 A-286 SS-304 Hydrogen
53	Pressure Vessel Dome	Al-7039
	NERVA Nuclear Subsystem	

Table 3-4. Reactor Weight Model Regions (Cont.)

TOR29K/14c

The pseudodensity is applied to each region to yield the mass schedule of the reactor for everything out to and including the pressure vessel. The weight algorithms automatically delete the flow baffles if they are not required based on the choice of flow circuits, see Section 3.1.4. Thrust structure, turbopumps, and nozzle masses are not calculated in this module; the NESS code determines the balance of engine masses, which is discussed in Section 2.0.

3.5 Design Variable Options

User inputs can be divided into three categories: engine parameters, reactor parameters, and fuel element parameters. The primary engine parameters are thrust level, chamber temperature, chamber pressure, and nozzle expansion ratio. These primary variables are used by the code to define the engine specific impulse, propellant flow rate, and required reactor power. The reactor parameters include reactor pressure vessel material, power fractions in the peripheral components, and tie tube power levels.

The user supplies the governing parameters for the fuel elements. These include mean fuel element power, element dimensions, fuel scaling, and material. The code modules provides for a choice from three fuel materials: graphitic (UC₂ beads in graphite), composite ((U,Zr)C-Graphite), or carbide ((U,Zr)C). Each fuel type exhibits different properties with regard to mass density, power density, and temperature limits. The fuel to support ratio within the core may be set to one of three patterns: 2:1, 3:1, or 6:1. The fuel parameters are strictly user defined in that the code does not attempt to judge the validity of the inputs. For guidance, Tables 3-1 and 3-2 provide information on typical parameters based on the Rover/NERVA technology. The reflector thickness and zirconium hydride loading of the tie tubes are also user selected based on the user's estimate of criticality requirements.

3.6 Key Assumptions

The code assumes that the same basic design will be used at every size level within the specified code domain. This provides the basis for calculating the size of the core periphery.

The code assumes that the user has specified a viable combination of input criteria. For example, the code does not verify core criticality and control span. This cannot be accomplished until core neutronics is integrated into the code. In particular, engine weights are strongly influenced (upward) by criticality considerations for engines with thrust ratings below 50000 lb.

Many of the input variables are based on NERVA test experience and should not be altered. This includes such things as the limiting fuel element power density and the power distribution in the peripheral regions, which are based on external data sources such as test measurements.

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4.0 SAMPLE NTP ENGINE SYSTEM DESIGN CASES

Eight NESS NTP engine design problems are presented in this section. These sample design cases demonstrate many of the design capabilities associated with NESS. Key engine system design parameters associated with these sample cases are presented in Table 4-1. For each sample design case, the NESS VAX mainframe computer input file and engine design output file are given (see Tables 4-2 through 4-9). For Sample Case No. 2, initialized NESS program input sheets are shown. A clean set of input worksheet forms is given in Appendix A.

Summary
Case
Design
Sample
4-1.
Table

		Table	4-1. Sample	Table 4-1. Sample Design Case Summary	Summary			
Case No./ Parameter	1	3	3	4	S	Q	4	~
Cycle Type	Expander	Expander	Bleed	Cas Generator	Expander	Bleed	Gas Generator	Expander
Thrust Level (lbf/N)	75,000/ 333,600	75,000/ 333,600	75,000/ 333,600	75,000/ 333,600	75,000/ 333,600	35,000/ 155,700	250,000/ 1,112,000	75,000/ 333,600
Reactor Type	ENABLER I	ENABLER II	ENABLER II	ENABLER II	ENABLER II	ENABLER I	ENABLER I	ENABLER I
Reactor Fuel Type	Composite	Composite	Composite	Composite	Carbide	Composite	Composite	Composite
Chamber Pressure (psia/KPa)	1,000/ 6,895	500/ 3,348	500/ 3,348	500/ 3,348	1,000/ 6,895	500/ 3,348	500/ 3,348	1,000/ 6,895
Chamber Temperature ("R/"K)	4,860/ 2,700	4,860/ 2,700	4,860/ 2,700	4,860/ 2,700	5,580/ 3,100	4,860/ 2,700	4,860/ 2,700	4,860/ 2,700
Nozzle Area Ratio	500:1	200:1	200:1	200:1	500:1	200:1	200:1	500:1
No. of Propellant Feed Legs	2	2	2	2	2	-	e	2
Turbopump Type	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Axial	Centrifugal	Axial	Axial
Reactor Fuel Scaling Factor	1.00	0.67	0.67	0.67	0.67	0.67	1.00	1.00

Table 4-2. Sample Case No. 1

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Input Listing

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WEXYOLE VCYCLE VCYCLE VCYCLE IPTYP		WPAYLD	Vehicle payload wt.
CVCLE SCYCLE		WEXPND	
ISOLVE ISOLVE		KCYCLE	Cycle type (1mGG.3mErnonder 7mm1.2.4)
ISOLVE ISOLVE FRACHB FRACHB FRACHB FRACHB FRACHB FRACHB FRACHB FRACHB FRACHB FRACHB FRACHB FRACHB FRACHB COLUNT COLUBIERUN UBPOX <td></td> <td>JCNFIG</td> <td>configu</td>		JCNFIG	configu
TURBTIN FRACEB FRACEB CPLINC C			type (0-centr.,
FRACHBHot bleed fractionCPLINTCold bleed fractionCPLINTCold bleed fractionCPLINTCold bleed fractionJBPFLUse fuel boost pump?JBPLUse fuel boost pump?JBBLDouble run flagJUSSBRNDouble run flag <td></td> <td>TURBTIN</td> <td>\sim</td>		TURBTIN	\sim
FRACCBCold bleed fractionCPLINHCold bleed fine losCPLINHCold bleed fine losUBPFLUse or boost pumpUBPCXUse or boost pumpUBPCXUse or boost pumpUBPCXUse or boost pumpUSRBRNDouble run fing filIUSRBRNDouble run fing filIUSRBRNDouble run fing filIUSRBRNDouble run filIIINOZZIIIINOZZIIIINOZZIIIINOZZIIIINOZZIIIINOZZIIIINOZZIIIIINOZZIIIIINOZZIIIIINOZZII		FRACHB	bleed fraction ?
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OUTPUT FOR MULTIPLE PUMPS AT FULL THRUST LEVEL

PROPELLANTS LIQUID OXYGEN - LIQUID HYDROGEN ASSUMPTIONS:

TEMP ENTHALPY Lox 90.18 K -- 3003. CAL/MOL LH2 20.27 K -- 2154. CAL/MOL

ODK VALUES CORRESPOND TO THROAT RADIUS=2.289 IN. C-STAR & CHAMBER TEMP DATA EVALUATED AT ODE PC & ODE MR VAL TURBINE PRESSURE RATIO- 1.569545879986624 TURBINE PRESSURE RATIO- 1.569545879986624 TURBINE PRESSURE RATIO- 1.720100935248108 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO- 1.761992772871283 SUCCESSFUL CYCLE POWER BALANCE

KEY INPUTS

4-13

THRUST LEVEL75000. (1bf)CYCLE TYPEEXPANDER CYCLEREACTOR TYPEEXPANDER CYCLEFUEL TYPEENABLER IFUEL TYPEENABLER IFUEL TYPECOMPOSITE FUELPROPELLANT USED1000. (peid)CHAMBER TEMPERATURE1000. (peid)CHAMBER OF PROPELLANT FEED LECS4860. (deg R)

TANKAGE SUMMARY FOR STAGE #1 EXPANDER CYCLE (FUEL SIDE) AFT TANK CONTAINS OXIDIZER ... FORWARD TANK CONTAINS FUEL FUEL TANK IS PRESSURIZED WITH COLD GAS TANK MATERIALS (OX - USER DEF) (FUEL ~ diuminum)

··· DIMENSIONS (INCHES) ···

78.43 2317.37 4540.87 4855.67 16.52 424.27 TANK CONSTRUCTION WEIGHT ···· WEIGHTS (POUNDS) ... STRUCTURAL WALL AFT SKIRT AFT TANK FORWARD TANK PRESSURE TANK 100.00 1012.55 541.46 328.85 12.00 78.24 STAGE DIAMETER TOTAL STAGE LENGTH TOTAL TANK LENGTH NOZZLE LENGTH CONVERGENT NOZZLE LENGTH MOUNT LENGTH

107.30 0.00	0.00 255.96 407.04	217.00 11.30	8696.89 8696.89	99.9 9.9 9.9 9.9 9.9 9.9 9.9 9.9 9.9 9.	323.76 0.00 754.19		1.25 1.25 1.25
FORWARD SKIRT TANK MOUNT	PRESSURE TANK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION	REVERSE HEAD STIFFENER FUEL ACQUISITION SYSTEM	PRESSURANT CONTROL HARDWARE TANK LINES BURNED FUEL	BURNED OXIDIZER Fuel Residual Oxidizer Residual Oxidizer Autogemous Pressurant	STORED PRESSURANT HOLD TIME FUEL BOILOFF HOLD TIME OX BOILOFF FLIGHT FUEL BOILOFF	MISC EXPENDED FUEL MISC EXPENDED OXIDIZER MISCELLANEOUS WEIGHT INTERSTAGE WEIGHT	INPUT MINIMUM SAFETY FACTORS Structural Wall Lines Oxidizer Tank Fuel Tank Pressure Tank
1.38	55.04 56.04 76.26 76.26	e.ee 464.10 6.80	0.00 4.03 454.42 36.04	8.888 8.938 8.23	6.63 6.63 4.65 4.65 7.55 7.55	6.52 6.53 6.56 6.56	0.07 0.09 0.090 0.000
<u> </u>	TANK END	AFT TANK CYLINDRICAL LENGTH Forward Tank Cylindrical Length Pressure Tank Cylindrical Lngth	AFT LINE DIAMETER FORWARD LINE DIAMETER AFT SKIRT LENGTH FORWARD SKIRT LENGTH	STRUCTURAL WALL THICKNESS Aft tank Wall Thickness comment tank Wall thickness		FUEL TAME MLI THICKNESS FUEL TAME SOFI THICKNESS OXIDIZER TANE MLI THICKNESS OXIDIZER TANE SOFI THICKNESS PRESSURE TANE INSULATION THICK	FUEL TWK HEAT FLUX(BTU/HR IN++2) OX TANK HEAT FLUX(BTU/HR IN++2) FUEL BOILOFF RATE (LB/SEC) OX BOILOFF RATE (LB/SEC)

PROPELLANT SUMMARY FOR STAGE #1 PROPELLANT IS LH2

NOWINAL PROPELLANT BULK DENSITY(LB/IN++3)= 0.0025

	(PSIA) 56.3	#P(DEGR) 38.5 ••3) 0.0025 E(PSIA) 20.0	EGR) 40.0 4++3) 0.0025 RE(PSIA) 25.0	EGR) 38.5
FUEL	NOMINAL TANK PRESSURE(PSIA)	NOMINAL PROPELLANT TEMP(DEGR) NOMINAL DENSITY(LB/IN++3) NOMINAL VAPOR PRESSURE(PSIA)	MAX PROPELLANT TEMP(DEGR) MAX TEMP DENSITY(LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA)	MIN PROPELLANT TEMP(DEGR)
	Ð. Ð	0.0 0.0000 0.0000	0.0 0.0000 0.0	9 .0
OXIDIZER	NOMINAL TANK PRESSURE(PSIA)	NOMINAL PROPELLANT TEMP(DEGR) NOMINAL DENSITY(LB/IN++) NOMINAL VAPOR PRESSURE(PSIA)	MAX PROPELLANT TEMP(DEGR) MAX TEMP DENSITY(LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA)	MIN PROPELLANT TEMP (DEGR)

MIN TEMP DENSITY(LB/IN++3) MIN TEMP VAPOR PRESSURE(PSIA)

0.0000 0.0

WIN TEMP DENSITY(LB/IN++3) WIN TEMP VAPOR PRESSURE(PSIA)

0.0025 20.0

.

ENGINE SIZE, WEIGHT, & PERFORMANCE SUMMARY FOR STAGE #1 EXPANDER CYCLE CONVERGENT NOZZLE IS REGEN COOLED (MILLED SLOT CONSTRUCTION) NOZZLE IS REGEN COOLED (TUBE CONSTRUCTION) PROPELLANT IS LH2

Ì FLO THE :

·	912.78 933.79	16491. 16789.	1888. 75888. 75888. 3688.	.977		6.60 82.17 82.17
··· PERFORMANCE	DELIVERED ISP(VAC),SEC Ideal ISP(ODE),SEC	DELIVERED CSTAR,FT/SEC Ideal Cstar,Ft/Sec	CHAMBER PRESSURE, PSIA Thrust Per Engine(VAC), LBF Total Vac Thrust, LBF Burn Time, Sec	OVERALL EFFICIENCY	KINETIC EFFICIENCY BARRIER COOLING EFFICIENCY BOUNDARY LAYER EFFICIENCY DIVERGENCE EFFICIENCY	FOR 1 ENGINE OXIDIZER FLOWRATE, LB/SEC FUEL FLOWRATE, LB/SEC TOTAL FLOWRATE, LB/SEC
7.43	35.81 49.83 166.06	18.19 12.00 1.220	6.248 6.918 6.198 588.88	15.13 6.00 20	138.85 328.85 78.24 52.00	
· EWGINE DIMENSIONS (INCHES) THROAT DIAMETER REACTOR SUPPORT DIAMETER	0.D. HETER	CONVERGENT MOZZLE LENGTH CONV. MOZZLE STRUCTURAL THICK. GAS SIDE WALL THICKNESS	THICKNESS TENSION THICKNESS RATIO	CH AREA RATIO TACH AREA RATIO		

THE FOLLOWING IS THE REGENERATIVE COOLING SUMMARY FOR STAGE 1

0.00 0.00 4860. 1630.

CORE TEMPERATURE, DEG R BARRIER TEMPERATURE, DEG R ENGINE MIXTURE RATIO FUEL FILM COOLING FRACTION

THE ENGINE IS A FUEL COOLED CONVENTIONAL EXPANSION MOZZLE

16.706 INCH LONG WOZZLE SECTIONS 3.220 INCH LONG CONVERGENT CHAMBER SECTIONS 0.000 INCH LONG CYLINDRICAL CHAMBER SECTIONS GAS WALL THICKNESS = 0.248 GAS WALL THERMAL CONDUCTIVITY =.00039000 (BTU/IN SEC DEGR) GAS WALL MAXIMUM OPERATING TEMPERATURE= 1460. (DEG R) ເບັນ STATIONS 1 THROUGH 6 ARE BOUNDS TO THE STATIONS 6 THROUGH 11 ARE BOUNDS TO THE STATIONS 11 THROUGH 11 ARE BOUNDS TO THE

.1596+03 1006+03 5026+02 3026+02 .3026+02 .1006+01 2496+01 2456+01 .7476+01 .7476+01 .1516+02 .1975-93 .2775-93 .7255-93 .7255-93 .1555-93 .1555-93 .1555-93 .1815-91 .1815-91 .5795-92 .5795-92 .1855-92 .1855-93 .3395-93 ¥ .3166-04 .5706-04 .1256-04 .1256-03 .4016-03 .5916-02 .2806-02 .1056-02 .1056-03 .555E-03 Ŧ 197 .1186+03 .1266+03 .1266+03 .1816+05 .3286+04 .1336+04 .1356+04 .1166+04 .1066+03 .09066+03 .09066+03 2 . 1225+03 . 1335+03 . 1555+03 . 21655+03 . 2165+03 . 2675+03 . 3355+03 . 3355+03 . 4295+03 . 4295+03 . 5416+03 .116E+03 1CM COOLANT PRESSURE (PSIA) COOLANT BULK TEMPERATURE (DEGR) COOLANT CHANNEL WIDTH (IN) COOLANT VELOCITY (IN/SEC) HEAT FLUX (BTU/IN++2 SEC) HEAT FLUX (BTU/IN++2 SEC) TEMPERATURE OF COOLANT WALL (DEGR) GAS SIDE HEAT TRANSFER COEFF (BTU/IN++2 SEC DEGR) COOLANT SIDE HEAT TRANSFER COEFF (BTU/IN++2 SEC DEGR) .630E-02 .141E-01 .399E-01 .177E+00 .131E+01 .954E+00 .713E+00 .549E+00 .434E+00 324E-02 σ 1986+82 3006+82 5886+82 1846+83 321646+83 5546+84 18866+84 18856+84 35256+83 35256+83 35256+83 2486+83 > NOZZLE DELTA T = 10.7 NOZZLE DELTA P = -218.1 NOZZLE DELTA P = -218.1 ADAPTER DELTA P = -0.1 TOTAL HEAT TRANSFER = 1852.7 (BTU/SEC) .1286+91 .9866+99 .5986+99 .3956+99 .1966+99 .1766+99 .1766+99 .2526+99 .2526+99 .2526+99 158E+01 .9996+02 .9996+03 .1002+03 .1092+03 .1102+03 .1102+03 .1116+03 .1116+03 .1116+03 81 50.01 .2246+04 .2246+04 .2246+04 .2246+04 .2246+04 .2026+04 .2026+04 .2026+04 .2026+04 -218. 2 ۵ Ļ 4 11 ŧ 1 1 ~~~~~~~~~~ STATION DELTA

28365493 32866493 59966493 59966493 59966493 76966494 1636494 1636494 1636494

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PRESSURE AND TEMPERATURE SCHEDULES FOR STAGE #1 EXPANDER CYCLE LOCAL AREA RATIO (-) COMBUSTION CAS TEMPERATURE (DEGR)

	ON TEMP OF PR		
G R) Idizer	0.0 (SATURATION TEMP OF PR		
TEMPERATURE (DEG R) FUEL OXIDIZER		4 4 6 6 6 0 0 0	633.9
FUEL	NT 550.0	NT 38.5 399.2 924.2 11.7 201.7 2	
<i>6</i> 7	PRESSURANT	PROPELLANT	
PSIA) Oxidizer			8
PRESSURE (PSIA) FUEL	4365.0 62.0 56.3	56.3 45.0 45.0 2324.1 2244.8 1294.8 1994.8 1132.1 1000.0	1994.8
	MAX STORAGE VENT ULLAGE	TANK PROPELLANT MAIN PUMP INLET MAIN VALVE INLET MAIN VALVE OUTLET TIE TUBE OUTLET REGEN OUTLET (REFL I REGEN OUTLET (REFL I REACTOR INLET REACTOR INLET	TURBINE INLET

ROPELLANT)

TGAS

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1132.1

527.5

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(DEG R)		
ES E CHANGES	8 8 8 8 8 8	•
PRESSURE/TEMPERATURE CHANGES TEMPERATURE CHANGES	0.0 60.7 80.7	
COMPONENT (PSID) 0.0	6 6 6 6 6 6	
CHANGES		862.7
PRESSURE 0.0	11.3 2267.7 79.2 250.0	218.2 25.0
ACQUISITION DEVICE	TEEU LINE MAIN PUMP MAIN VALVE TIE TUBES	REGEN JACKET REFLECTOR TURBINE

FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 EXPANDER CYCLE

OXIDIZER	0.000	9.000	0.000						000 0	8 888		
FUEL	82.167	41.880	82.167	23.947	58.219	2.342	39.673	28 876	-	9999	69.0	79.825
		MAIN PUMP - EACH	MAIN VALVE	TIE TUB	REGEN JACKET INFLOW	BARRIE	REGEN/REFL OUTLET TO CORE	L N N	TURBINE TO CORE	×	STORED PRESSURANT (AVE)	CORE

REACTOR OPERATING CHARACTERISTICS AND MASSES

	LB/SEC	Ĩ	1N2	1 R / 1 N 2					DEG R	PSIA	BTU/LB	DEGR	PSIA	BTU/LB	MW/TUBE	BTU/S		RTIL/S		BTU/S
	79.82	61	.34	4			3	8	88	88.	.53	.97	£1.	.02	0.31	. 70	00	69	0.01 01	5
	79	1587.01	198.34	•	•		1277.54	248	4860.08	1000	18764	348.97	1132.1	1102.02	0	73153.70	0	1852.69	6	18354.71
REACTOR OPERATING CHARACTERISTICS						(FE		S			-					•	NOZZLE		REFLECTOR	-
REACTOR OPERATI	TOTAL COOLANT FLOW	REACTOR POWER	CORE FLOW AREA	CORE MASS FLOW RATE	FUEL ELEMENT POWER	FUEL ELEMENT OPERATING LIFE	NUMBER OF FUEL ELEMENTS	NUMBER OF SUPPORT ELEMENTS	CHAMBER TEMPERATURE	CHAMBER PRESSURE	CHAMBER ENTHALPY	INLET	INLET		HEAT PICKUP PER TIE TUBE	HEAL PICKUP IN TIE TUBES	FRACTIONAL HEAT PICKUP IN	HEAT PICKUP IN NOZZLE	FRACTIONAL HEAT PICKUP IN	HEAT PICKUP IN REFLECTOR

FRACTIONAL CENTRAL SHIELD HEAT PICKUP	0.00 2602 78	BTIL/S
FRACTIONAL EXTENSION SHIELD HEAT PICKUP	•	
PICKUP	n	S
PEAK CHANNEL WALL TEMPERATURE PEAK FUEL TEMPERATURE	5077.55	DEG R
REACTOR DIMENSIONS		
CORE LENGTH	52.00	Z]
ELEMENT CHANNEL	0.11	Ľ
FRACTION OF	0.32	
TO AVERAGE CHANNER	•	NI.
LATERAL SUPPORT DIAMETER	35.81	
STRUCTURE OD	•	N
REFLECTOR OD	47.58	N
PRESSURE VESSEL ID	•	Z 7
OF BAT	• •	12
THICKNESS OF LEAD SHIELD	ņ	Ż
PRESSURE VESSEL LENGTH FUEL VOLUME	101.54 22307.26	N I
SJSSTM GULJTJG		
S	3878.48	6
	640.33	8
æ –	40.400	99
	•	3
STRUCTURE MASS	091.00 7744 61	<u>n</u> a
	• •	99
LECTOR MAS	•	9
E INLET PLE	•	9
ATE MASS	545.93	99
E TURRAR MASS	41.85	3 9
ATION RIN		8
FORWARD REFLECTOR HARDWARE MASS		9 9
SUBIUTAL CURE A FIDE BAFFIF MASS	•	9 9
	195.02	9
TOTAL CORE SUBSYSTEM MASS		99
SEL SEL	1068.34	39
SEL	• •	99
OR ADAPTER	· •	9
RE VESSEL	1766.21	9!
CENTRAL SHIELD MAS	•	99
PERIPHERAL SHIFLU	757.78	9 9
CENTRAL SHIELD MASS	• •	9 9
AL SHIELD		9
AL SHIELD 2	-	9
IELO PLATE N	40.52	99
	2444.13 18555 48	<u> </u>
	ŧ.	9 ª
SAFETY RODS-FOR LAUNCH ONLY	5	39

____ ...

99 11176.08 13620.21 REACTOR MASS W/O SHIELD-LAUNCH WT. REACTOR MASS W/ SHIELD-LAUNCH WT.

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TPA SUMMARY FOR STAGE #1 ••• EXPANDER CYCLE 2 PROPELLANT FEED LEGS CENTRIFUGAL PUMPS TPA SIZE/WT/PERFORMANCE IS USER DEFINED •

... PROPELLANT PUMP ...

45566. 6586. 28869. 29969. 25.88 25.88 2324.86 4297.86 4297.81 8867.81	101.29
PUMP SPEED (RPM) SPECIFIC SPEED SUCTION SPECIFIC SPEED SUCTION SPECIFIC SPEED NUMBER OF PUMP STAGES NET POS SUCTION PRESSURE(PSIA) ACCELERATION HEAD(PSIA) PUMP OUTLET PRESSURE(PSIA) VOLUMETRIC FLOMRATE(GPM) MASS FLOWRATE(LBM/SEC) PUMP FORSEPOWER(HP) PUMP DIAMFTED(TH)	PUMP WT. (LB) - EACH PUMP

4-19

... TURBINE ...

1.900 1.900 1.762 1.762 2.06 6.00 6.00 16.905 16.905 0.36 0.36 0.36	
ADWISSIOM FRACTION EFFICIENCY PRESSURE RATIO MASS FLOWRATE(LB/SEC) DIAMETER(IN) NUMBER OF TURBINE STAGES BLADE ROOT STRESS LIMIT(PSI) ROOT STRESS SPEED LIMIT(PSI) ROOT STRESS SPEED LIMIT(RPM) SPECIFIC SPEED TURBINE RONULUS AREA(IN2) U OVER C INLET MACH NUMBER	TPA

:

0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	->->>->->-
TPA START SYSTEM WT. GAS GENERATOR/PREBURNER WTEAC IGNITION SYSTEM WTTOTAL HOT GAS MANIFOLD WTTOTAL GEARBOX WTTOTAL BOOST PUMP WT EACH MAIN TURBOPUMP WT EACH	

277.63 3 99.8 7	78.43 2317.37 4546.87 4855.67 25.81	424.27 187.38 0.08 16.52 8.08 255.96 255.96	11.36 0.99 60.79	16568.40 2444.13 1179.25 1669.35 201.80 201.21 615.38 215.38 215.38 215.38	32.24 9.99 9.69 9.69 9.80 9.60 9.90	93.94 17803.41	754.19 8.86 8.86 8.88 8.98 8.98	32266.61
TOTAL TURBOPUMP WT. TOTAL TPA WT.	STAGE #1 WEIGHTS (POUNDS) AFT TANK FORWARD TANK PRESSURE TANK TANK CONSTRUCTION WEIGHT TANK LINES	AFT SKIRT FORWARD SKIRT TAMK MOUNT STRUCTURAL WALL PRESSURE TAMK INSULATION FUEL TAMK INSULATION OXIDIZER TAMK INSULATION	FUEL ACQUISITION SYSTEM OXIDIZER ACQUISITION SYSTEM PRESSURANT CONTROL HARDWARE	ENGINE WEIGHTS: 1 REACTOR INTERNAL SHIELD 1 REACTOR INTERNAL SHIELD 1 NOZZLE 1 NOZZLE MOUNT(S) 1 THRUST MOUNT(S) 1 GIMBAL SYSTEM(S) 2 ENGINE BAY LINE(S) 2 MAIN VALVE(S) 1 GIMBAL POWER SUPPLY	2 IGNITION SYSTEM(S) 2 HOT GAS MANIFOLD(S) 2 GAS GENERATOR/PREBURNER 2 TPA ASSY(S) 1 GEARBOX(S) 2 TPA START SYSTEM(S) 1 GAS GENERATOR/PREBURNER(S)	NON-NUCLEAR WEIGHT MARGIN Total Engine Weight	FLIGHT FUEL BOILOFF FLIGHT OXIDIZER BOILOFF Expendable Weight Miscellameous Weight User Defined Weight Reactor Safety Rod Wt.	TOTAL INERT WEIGHT

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PRESSURE AND TEMPERATURE SCHEDULES FOR STAGE #1 FOR ONE PUMP AT REDUCED THRUST LEVEL 60000. EXPANDER CYCLE
: STAG 6000
FOR
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ж П Т
CYCE ATL
MPE REC
ID TEMPE
PP S
PRESSURE AND TEMPERATURE SCHEDULES FOR ONE PUMP AT REDUCED THRUST LEV EXPANDER CYCLE
ESSI A OI
R O

OUTPUT FOR SINGLE PUMP AT REDUCED THRUST

Lox/LH2 75000.0 1000.0 500.00 3600.00 3600.00 312.8 812.8 82.17 79.82

PROPELLANT THRUST, VACUUM DELIVERED, LBF PC, PSIA NOZZLE AREA RATIO BURN TIME, SEC ISP, VACUUM DELIVERED, SEC ISP EFFICIENCY TOTAL PROP. FLOWRATE, LB/SEC CORE PROP. FLOWRATE, LB/SEC

. . PERFORMANCE . .

STAGE DIAMETER NOZZLE EXIT DIAMETER NUMBER OF NOZZLES STAGE LENGTH PAYLOAD LENGTH

TOTAL VEH LENGTH

. . DIMENSIONS, IN. .

100.00 166.06 1012.55 9.99 1012.55

STAGE #1

**** VEHICLE SUMMARY ****

Nuclear Thermal Vehicle

8000,000 0,000 0,000 0,000 0,000 0,000 0,000 0,000 0,000 0,000 0,000 0,000 0,000 0,000

INTERSTAGE WEIGHT BURNED FUEL BURNED OXIDIZER FUEL RESIDUAL OXIDIZER RESIDUAL OXIDIZER AUTOGENOUS PRESSURANT STORED PRESSURANT MISC ON-BOARD FUEL MISC ON-BOARD OXIDIZER

40597.27 31225.40

8.88 6.00

HOLD TIME FUEL BOILOFF HOLD TIME OX BOILOFF

GROSS IGNITION WEIGHT GROSS BURNOUT WEIGHT

PROPELLANT 38.5 38.5 78.4 78.4 937.7 92.5 181.3 569.4 569.4	SSURE (PSIA) OXIDIZER PRESSURANT 550.0 0.0 0.0 0.0 PROPELLANT 18 5
---	--

(DEG R)
CHANGES CHANGES
COMPONENT PRESSURE/TEMPERATURE CHANGES (PSID) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
COMPONENT PR (PSID) 0.0 0.0 0.0 0.0
HANGES
PRESSURE 0.0 1641.0 159.0 139.9 250.0 25.0
ACQUISITION DEVICE FEED LINE MAIN PUMP MAIN VALVE TIE TUBES REGEN JACKET REFLECTOR TURBINE

STAGE	
FOR	
(LB/SEC)	
SCHEDULE	CYCLE
FLOWRATE	EXPANDER

Ę,

بعا		
R CYCLE		
EXPANDER		
ŭ		

0XIDIZER 8.808 6.808 8.888		000	000
		32. 887	0.08
FUEL 65.663 65.663 65.663	19.138 46.525	31.705 37 087	63.792
TANK OUTFLOW MAIN PUMP MAIN PUMP	JACKE	ي بي لا	TURBINE TO CORE AUTOGENOUS PRESSURANT STORED PRESSURANT (AVE) CORE

●●●● TPA SUMMARY FOR STAGE #1 ●●● SUMMARY FOR TPA AT THRUST LEVEL FRACTION 0.80 EXPANDER CYCLE SINGLE SHAFT TPA CENTRIFUGAL PUMPS

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--- PROPELLANT PUMP

40583. 932. 2000. 25.00	1695.63 1695.63 6571.14 652.66 9329.16 0.798 10.29
PUMP SPEED (RPM) SPECIFIC SPEED SUCTION SPECIFIC SPEED NUMBER OF PUMP STAGES NET POS SUCTION PRESSURE(PSIA) ACCELERATION HEAD(PSIA)	PUMP OUTLET PRESSURE(FSIA) VOLUMETRIC FLOWRATE(GPM) MASS FLOWRATE(LBM/SEC) PUMP HORSEPOWER(HP) PUMP DIAMETER(H) PUMP DIAMETER(IN) PUMP WT.(LB)

··· TURBINE ...

	333600.0 N 333600.0 N 2605.0 kpg 2700.0 deg K 500.0 deg K 37.3 kg/s	
900 900 900 900 900 900 900 900 900 900	ibf psia deg R ibm/s	EQ
1.00 1.00 1.43 3.2.00 3.2.00 4.82.00 4.82.00 4.85.00 1.43	75868.8 1888.8 4869.8 568.8 568.8 568.8 568.8	10568.4 2444.1 49.8
4-5-7 ADMISSION FRACTION EFFICIENCY PRESSURE RATIO MASS FLOWRATE(LB/SEC) MASS FLOWRATE(LB/SEC) MABER OF TURBINE STAGES BLADE ROOT STRESS LIMIT(PSI) NUMBER OF TURBINE STAGES BLADE ROOT STRESS LIMIT(PSI) SPECIFIC SPEED TURBINE SPEED LIMIT(RPM) TURBINE SPEED LIMIT(RPM)	EXPANDER CYCLE ENABLER I CENTRIFUGAL PUMPS THRUST LEVEL CHAMBER PRESSURE = CHAMBER PRESSURE = NOZZLE EXIT AREA RATIO = NUMBER OF FEED LEGS = TOTAL PROPELLANT FLOWRATE =	REACTOR COMPOSITE FUEL REACTOR WEIGHT SHIELD WEIGHT PRESSURE VESSEL DIA.

257.9 cm 36.2 kg/aec	82.6 kg 181.0 kg 271.3 kg 534.8 kg 580.0 kg 18.9 cm 421.8 cm 421.8 cm 835.3 cm 835.3 cm 333600.0 N	125.9 K9 8.8 K9 8.8 K9 14.6 K9 9.8 K9	757.1 kg 279.2 kg 91.6 kg 189.7 kg 137.3 kg 2172.7 kg	8074.1 kg 695.7 kg 6965.7 kg 41.3 N/kg 47.9 N/kg 275.6 kg 7241.3 kg 7241.3 kg 5516.0 kPa 8954.8 N-sec/kg 2700.0 deg K	
in Ibm/sec				1 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	
101.5 79.8	182.1 399.6 598.1 1179.3 566.1 7.4 328.8 328.8 328.8 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4	FEED LEGS) 277.6 0.0 32.2 32.2	1669.3 615.6 201.9 418.2 302.8 93.9 4790.9	17863.4 15559.3 4.2 4.2 4.2 6664.9 15967.7 15967.6 918.8 918.8 918.8 918.8 918.8	
PRESSURE VESSEL LENGTH CORE PROPELLANT MASS FLOW	NOZZLE CONVERGING NOZZLE WEIGHT NOZZLE EXTENSION WEIGHT SECOND NOZZLE EXTENSION WEIGHT TOTAL NOZZLE WEIGHT AREA RATIO THROAT DIAMETER EXIT DIAMETER EXIT DIAMETER NOZZLE LENGTH DELIVERED VACUUM ISP DELIVERED THRUST	TURBOPUMP ASSEMBLY (TOTAL FOR ALL FEED MAIN PROP. TURBOPUMP WT PROPELLANT BOOST PUMP WT PROPELLANT BOOST PUMP WT MAIN OX PUMP WEIGHT TPA IGNITION WEIGHT BLEED LINE/VALVE WEIGHT	MISC. HARDWARE WEIGHTS THRUST MOUNT Support Hardware Support Hardware Engine Limes Main Valve Cimbal + Power Supply Margin (2.0%) Total Monnuclear Weight	TOTAL ENGINE SYSTEM TOTAL ENGINE WEIGHT TOTAL ENGINE WEIGHT TOTAL ENGINE WEIGHT WITHOUT SHIELD THRUST/WEIGHT RATIO WITHOUT SHIELD THRUST/WEIGHT RATIO WITHOUT SHIELD THRUST/WEIGHT RATIO WITHOUT SHIELD REACTOR SAFETY ROD WIT-LAUNCH ONLY TOTAL ENGINE LAUNCH WI. W/O SHIELD PUMP-OUT CONDITIONS PUMP-OUT CONDITIONS PUMP-OUT THRUST PUMP-OUT THRUST PUMP-OUT TAMBER PRESSURE PUMP-OUT ISP	OVERALL DIMENSIONS OVERALL ENGINE LENGTH OVERALL ENGINE DIAMETER

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4-24

THE FOLLOWING WARNINGS OCCUR FOR STAGE 1

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TWO PHASE FLUID ENCOUNTERED IN REGEN

RECOMMENDED RANGE = 1.5 TO 4 CR = 15.130

STAGE DIAM = 100.0 NOZZLE EXIT DIAM = 166.1

AXIAL BUCKLING DESIGNS STRUCTURAL WALL THICKNESS MINIMUM GAUGE DESIGNS AFT TANK WALL THICKNESS

HOOP STRESS DESIGNS FORWARD TANK WALL THICKNESS AFT TANK ULLAGE INCREASED BY GEOMETRY CONSTRAINT

THE FUEL PUMP TIP SPEED EXCEEDS 2000 FPS AND HAS THE MAXIMUM OF 4 STAGES Gas phase encountered in regen Jacket TPA calculations terminated by Achieving desired Accuracy

END NOMINAL STAGE DESIGN

_____ ----- Table 4-3. Sample Case No. 2

-

Input Worksheet Forms

-

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TITLE: NUCLEAR Thennel Vehicle	Vehicle	VARIABLE	NAMELIST	UNITS	DEFAULT
Vacuum Thrust (Ibf)	75000	FVAC	ridnin	141	75000
Chamber Pressure		Я	INFGEN	1) S † R	500
Propellant: 5) L112		IPROP	DULU		Ś
Note: GG cycle will use LO2 as needed					
Vehicle Payload wt. (Ibm)	/	WPAYLD	INPGEN	lbm	0
Miscellancous Stage wt. (Ibm)		WMISC	INPGEN	lbm	Ð
Expendable Stage wt. (Ibm)		WEXPND	INPGEN	l b m	0
Cycle Type: <u> 1) Gas</u> Generator <u> 7) Bleed</u>		кстал	LFLAG		£
Pump Configuration: 1) Gearbox 2) Single Shaft TPA 3) Twin TPA in series 4) Twin TPA in parallel 5) Multiple feed leg TPA		JCNFIQ	PUMP		2
Note: If a double run is being made, choose JCNF1(3=2 in the input file; the code auto- matically sets JCNF1G=5 for the second pass.					

	VARL	VARIABLE	NAMELIST	UNITS	DEFAULT
	Id	ELYPE			ο
l'unit l'ype: H'TTTE =			-		
Centrifugat Pumps					
l Axint Pumps					
Bleed Cycle solver option: ISOLVE =	ISO	ISOLVE			-
0 Input bleed flow fractions; solve for turbine infet temperature					
l Input turbine inlet temperature; sulve for bleed mass flows					
Turbine Inlet Temperature (ISOLVE=1)	I'UR	TURBTIN		deg. R	0.0
Bleed mass flow fractions (ISOLVE=0)					
Hot bleed fraction of total bleed	LIRA	FRACHB			0.0
Cold bleed fraction of total bleed	HRA	FRACCB			0.0
Bleed Cycle Line/Valve losses (fractions)					
Hot bleed line loss		CILLINI			0.07
Cold bleed line loss	Gi 	CIALINC			0.07
Turbine inlet line loss	-	CPLINT			0.07
Turbine throttling valve loss	Ċ	CrvLvr			0.08
			•		

4-29 C-Z

Boost Punips: (0 = no, 1 = yes) Oxidizer Fuct

.

Number of Identical Turbopump Propellant Feed Assemblies (Used if JCNFIG=5 or IDBLRUN=1)

Do a double run? $(0 = n_0, 1 = y_{CS})$ (If yes, first run made at reduced thrust level to size turbomachinery that will be used as part of a multiple-leg feed system used in the second run at full thrust level) Percent (fraction) of total thrust to be used for the first run (IDBLRUN=1) Input the engine burn time? (0 = no, 1 = yes) (If no, code calculates burn time based on amount of propellant and mass flow rate)

Engline burn time (sec) (IUSRBRN = 1)

Percent (fraction) of Non-nuclear weight to be added as margin

Iterate on pump design? (0=no, 1=yes) This option checks whether the off-design performance of the pumps meets certain criteria; if not, FFRAC is reduced and the entire design process is repeated.

	VARIABLE	NAMELIST	UNITS	DEFAULT	
_	Jerral Xorial	AMUA		00	
X	ATTN	PUMP		2	
-7-	IDBLRUN	LFLAG		_	
0 0	FFRAC	LFLAG		8.0	
	IUSRBRN	LIQUID			
	TUSRBRN	LIQUID	200	3600.0	
	FMARG	nindin		0.02	
0	ITRATE			0	

		VARIABLB	NAMELIST	UNITS	DEPAULT	
Engine Expansion Area Ratio	1	EPS	INPOBN		500	
Use a Nozzle Extension? (0 = no, 1 = yes)		KEXNOZ	DNajli			
Use n 3-portion Nozzie? (regen slots+tubes+extension) (0 = no, 1 = yes)		JYTZON	DVIII		-	
Nozzle Extension 1 Attach Area Ratio	و	EPSATT	INPGEN		Q	
Nozzle Extension 2 Attack Area Ratio (NOZTYP = 1)	25	EPSAT2	INPOBN		25	
Convergent Nozzle Length (In)		XIN	LIQENC	Ë.	12.	
OnTal		KNOZ	LIQENG		2	_
Conneur 0 1 Rao/Befi 0 2 Piug Cluster 1 - Annular 2 -		DNJAI	andri		0	
Ratio of Nozzie Length to Minimum Rao Nozzie Length	1.1868	RATMLR	DNBOLI		1.177	
Cas Cenerator/Pre-Burner: Mixture Ratio	<u> </u>	0100FB	PUMP		0.75	
Ratio of Specific Heats		GAMAPB	PUMP		1.378	
Specific Heat (BTU/Ib°R) 3.55		CLOCHE	PUMP	8° U/UT8	2.054	
Molecular Weight		WMOOPB	PUMP		3.53	

l

DEFAULT	_		
UNITS			
NAMELIST			
VARIABLE	IREACTR	CONFIG	

Solid Core (ENABLER) Reactor Inputs	Reactor Flow Path Option:
Reactor Model:	(CONFIG affects only the expander cycle)
1) ENABLER I: automatically scts	1) ENABLER I option: turbines driven by
CONFIG=1, FALPHA=1.0	tie tube and some reflector flow
CONFIG=1, EALPHA=1.0	2) ENABLER II option: turbines driven
CONFIG=2, BYPTUR=1.0	tie tube flow only

		VARIABLE	NAMELIST	UNITS	DEFAULT
<u>Reactor Inputs (cont'd)</u> Chamber Temperature	4860	TCIIAMBER	REACIR	ж Ж	4860
Fuel Element Channel Diameter	0.11	8	REACTR	L	0.10
Spacing between Holes	+	SC	REACTR	jn.	0.173
Peak to Average Channel Factor	Het.	PAC	REACTR		1.2
Number of Holes per Element	2	INIES	REACTR		19.0
Fuel Type 1) Graphite 2) Composite 3) Carbide		FTYPE	REACIR		7
Support Pattern 1) 2:1 2) 3:1 3) 6:1		SPAT	REACIR		œ
Core Length	2 S	ы	REACIR	L	52.
Power in each Element per 52 inches	1.2	PMW	REACTR	MW/52"	1.2
Nozzle Flow Percent (fraction) (= Regen flow)	58.0	NFF	REACTR		0.7

Peak to Average Chu

Fuel Type 1) Graphite 2) Composite 3) Carbide

	VARIABLE	NAMELIST	UNITS	DEFAULT
	QIT	REACTR	MW/tube	0.31
	HTANK	REACIR	ΒΤυ/Ιδ	-106.0
	FREF	REACIR		0.0122
	FES	REACIR		0.00031
	ß	REACIR		0.00173
	FALPHA			0.67
	XEIH		in.	0.75
	LEL	s	in.	52.
A	ZRCI		in.	0.002
7	ZRCO		in.	0.006
24	ZRCH		in.	0.0015
2	ĐSNđ			2.74
	PVSA		psi	50000.
-	TREFL		in.	4.785
0.8	FZRII			1.0
_				

Scalable fuel element length; overrides LC Fractional licat Pickup in External Shield Pressure vessel material allowable stress Fuel scaling factor; applies to fuel cross-section dimensions Pressure vessel material specific gravity Fractional Heat Pickup in Central Shield Fraction of maximum Zril loading in tic Enthalpy of Coolant Entering System Fractional lleat Pickup in Reflector Element external coating thickness Channel coating thickness at outlet Channel coating thickness at inlet Uncoated fuel hex flat dimension Thickness of beryllium reflector lleat Pickup per Tie Tube Reactor Inputs (cont'd) If LEL is not zero lubes

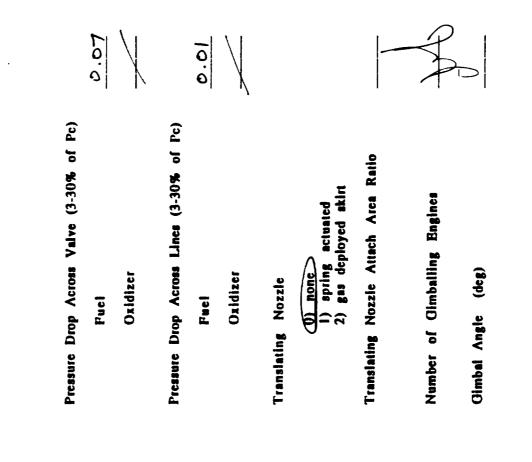
	VARIABLE	NAMBLIST	UNITS	DEFAULT
Burned Propellant wt. (Ibm)	WTLPRP	LIQUID	lbm	5000
Ullage Fractions				
Oxidizer	XOLITIN	LTANK		.02
Fuel	ULLFTL	LTANK		.02
Propellant Acquisition Device	KAQQXK	DVTIT		Ŷ
 None Itransverse collapsing AL bladder Itransverse collapsing AL bladder full bonded rolling diaphram - AL full bonded rolling diaphram - stainless steel half bonded rolling diaphram - stainless steel aurface involue diaphram - stainless steel 	KACQIL	DVTIT		Ŷ
=0	KOASOX KOASFL	DV-11 LFLAQ		
1) non-autogenous (KGAS=) 1) solid gas generator 2) cold hellum	KŪAS	LFLAQ		7
l) autogenous				
Cold Helium Storage Pressure (psia)	PICO		psia	4365
Hellum Tank Final Pressure Fraction (less than 1.0 indicates blowdown)	17ULCO	DQTDD		0.8

		VARIABLE	NAMELIST	UNITS	DEFAULT
Propellant Tank Heat Transfer		KIIXOPT	DFTAG		0
 0) ignore heat transfer 1) external boundary exposed to conductive source 2) worst case solar radiation 3) ground hold ice formation 					
Propellant Tank Insulation (in.)			,		
Fuel Tank SOFI thickness	<u>ہ</u>	:ILIOS.I.	TINKIIX.	in.	0.5
MLI thickness	0.018	TMLIF	TANKUX	in.	1.97
Oxidizer Tank SOFI thickness	0.5	0H0ST	TANKJIX	in.	0.5
MLI thickness	2.0.0	TMLIO	TANKIIX	in.	1.97
Stage Operating Temperature Range (°F)					
Minimum temperature		TMIN	LIQUID	ч	60.0
Nominal temperature		dOL	LIQUID	<u>17</u> 0	75.0
Maximum temperature		XVML	CIQUID	ند ہ	90.0

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	VARIABLE	NAMELIST	UNITS	DEFAULT
Nozzle Cooling Method (second portion) 2)Regenerative 3)Trans-Regen 4)Radiation 5)Pitim (GQ only)	KOOLVZ	LFLAQ		2
Note: When used, third portion of nozzle extension is automatically radiation cooled				
Nominal Convergent Wall material temperature (°R) 1460	MONWOL	INREON	<u>م</u>	2000.0
Regen/Trans-regen input:				
Output a regen summary $(0 = n_0, 1 = y_{cg})$	IRPRNT	INREON		-
Cas wall minimum gauge (in.) 0.01275	DNIMWD	INREGN	in.	0.025
Gas wall thermal conductivity (BTU/in sec "R) 0.2003	WALLK	INREGN	BTU/in sec	0.00039
DIFTBF = (Tburler-TOWNOM)(Tcore-TOWNOM) 0.05	DIFTBP	INREGN	2	0.05
Nominal nozzie material temperature (°R) <u>2000</u>	MONEINI	DNayl	.	2000.0

VARIABLB	NAMELIST	UNITS	DEPAULT
	riðnid		0.07
	ngund		0.07
	LIQUID		0.08
	LIQUID		0.08
	LIQENO		0
ti da ser de la companya de la comp	DNƏÒFI		150
	LIQUID		-
	LIQUID	qeß	6.0



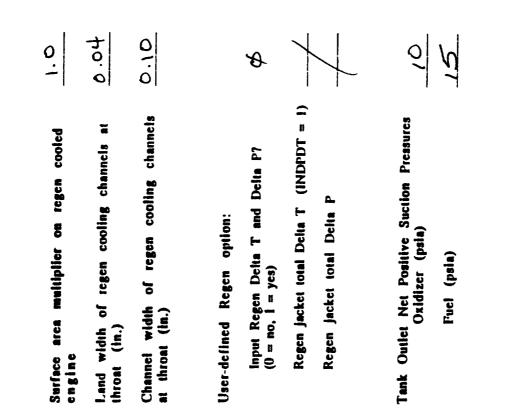
	0.322 2500	0.322 25000	6.323	0.29	27000 37000	Part -
Engine Materials of Construction (use density and strength at temperature)Aluminum0.098 lb/in3, 25000 psin Stainless Steel0.28 lb/in3, 25000 psin 25000 psin 0.32 lb/in3, 25000 psin Stainless Steel0.32 lb/in3, 25000 psin 25000 psin 25000 psin 25000 psin Copper0.32 lb/in3, 25000 psin 	Convergent Nozzle/Throat (regen slots) density strength	Regen Closeout material density strength	Regen Gas Wall Material Density	Valve Material Density	Nozzle Extension 1 (usually regen tubes) density strength minimum thickness (in)	Nozzle Extension 2 (NOZTYP=1) density strength minimum thickness

	VARIABLE	NAMELIST	UNITS	DEFAULT
Translating Nozzle Material Density (Ib/in ³)	ROIRNZ	LIQMAT	1b/in ³	0.28
Engine Weight Model:	KWIMOD	OVTIT		4866
-1) input engine weight 1) physical engine weight model				
Engine sizc/weight input (KWTMOD = -1)				
nozzie length (in)	ZONIX	LIQENO	in.	76.04
engine weight (1b)	WILTCA	ngeng	lbm	184.4
nozzle throat diameter (in)	THDUSR	DNEO	ln.	0.0
Regen Cooling:				
Turbine bypass flow fraction 1.0 (Set would	BYPTUR	INREGN		0.0
Cooling channel multiplier	CIIMULT	INREGN		1.0
Absolute surface roughness of regen channels	EPIPE	INREGN	ίπ.	0.0008
Maximum depth to width ratio in cooling channels 2.2	XVWMOII	INREGN		5.0
Number of regen segments in:		-		
Convergent chamber section	NCON	INREGN		S
Nozzle	NNZL	INREGN		S

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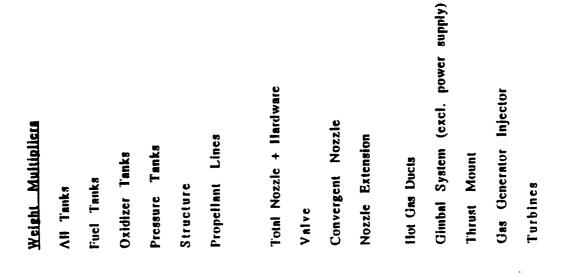
VARIABLE	NAMELIST	UNITS	DEFAULT
SAMULT	INREGN		1.0
WL'THR	INREGN	in.	0.03
WTHR	INREGN	in.	0.03
TUPDT	INREGN		0
DELTAT	INREGN	X	100.
DELTAP	INREGN	psia	.001
dSJNXO	PUMP	psia	10.
FLNPSP	PUMP	psia	10.
			,



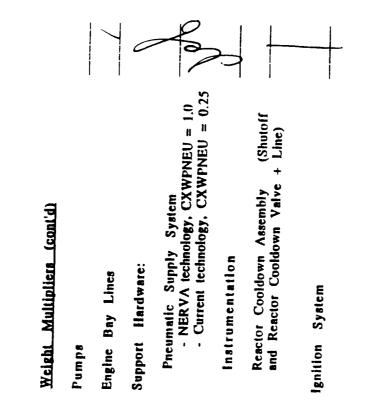
VARIABLE	NAMELIST	UNITS	DEFAULT
ADJGGB	LQPERF		1.0
ADJBL ADJDIV ADJMRU	LQITERF LQITERF LQITERF		<u>0. 0. 0.</u>
XLFL	LQPERF INJECT	ces. Ges.	0.15 0.15

0.1		0.0 1.0 .0	
Engine Efficiency Adjustment Factors: Oas Generator Bleed Efficiency Factor in the form: ETTOGB = EFFOGB*ADJOGB	The following factors are used in the form: EFF = 1 - (1 - EFF)*adjustment factor	Boundary Layer Efficiency Adjustment Divergence Efficiency Adjustment Barrier Cooling Efficiency Adjustment	Barricr liquid film length Barricr mixing angle

VARIABLE	NAMELIST	UNITS	DEFAULT
CXWINK	CXWMLT NCTINP		1.0
CXWILT	CXWMLT		1.0
CXWUXT	CXWMLT		1.0
CXWPIN	CXWMLT		1.0
CXWSTR	CXWMLT		1.0
CXWAIL CXWFIL CXWFIL	CXWMLT CXWMLT CXWMLT		0.0.
CXWENG	CXWMLT		1.0
CXVALV	CXWMLT		2.8
CXWCIM	CXWMLT		0.1
CXWNZE	CXWMLT		1.1
CXWDUC	PUMP		3.5
CXWGIM	CXWMLT		۹.4 ا
CXWIIIM	CXWMLT		0.9
CXWICO	PUMP		1.4
CXWIPA	CXWMLT		1.3



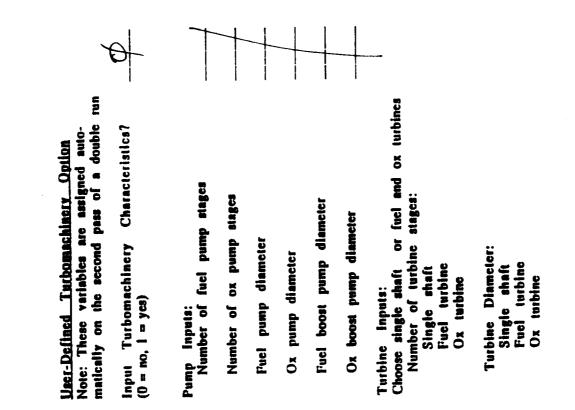
VARIABLE	NAMELIST	UNITS	DEFAULT
CXWPMP CXWLIN	PUMP		1.3 2.5
CXWPNEU	CXWMLT		0.25
CXWINST	CXWMLT CXWMLT		1.0 0.9
CXWIGN	CXWMLT		1.3



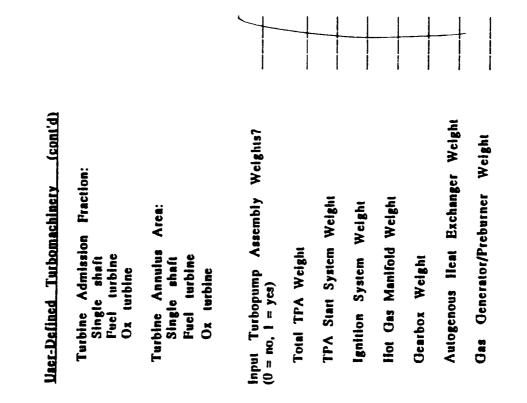
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DEFAULT	0	_	-	0.0	0.0	0.0	0.0	 		0.0
NITS				in.	hn.	łn.	'n.			
NAMBLIST	PUMP	AMUA	AMUA	PUMP						



DEFAULT	0.0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	
UNITS		in 2 in 2 in 2		р Ч	на 1 1 1 2 1	E A I	[Ф В В В В В В В В В В В В В В В В В В В	lbm	
NAMELIST	4MU4 9MU4	PUMP PUMP PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	
VARIABLE	ADMFR ADMFRP ADMFRO	ANAREA ANARFL ANAROX	NPTPA	TWAUT	WSTART WIGNIT	WIIGMP	XORDW	WOOPB	



VARIABLE	NAMELIST	UNITS	DEFAULT
IUSROO	PUMP		0
WDBLNZ	PUMP	1b/sec	0.1
ELAOOB	PUMP		0.99
TINLIMI	PUMP	я.	5000.
TUSROO	PUMP	• X	0.0
WDUSRG	PUMP	lb/sec	0.0
USRGQI	PUMP	5	0.0
PUSRTI	PUMP	psia	0.0
WPUSRQ	PUMP	lbm	10.0
WIUSRO	PUMP	lbm	10.0
ROUSRO	PUMP	lb/in ³	0.01
SYUSRO	PUMP	pei	25000.0
ROUSMT	PUMP	lb/in ³	0.098



(cont'd)	rator?								Weight	rank Weight		Tank	k Material
<u>User-Delined</u> Turbomachinery (coni [,] d)	liave User-Defined Gas Generator? (0 = no, 1 = yes)	Gas Generator Inputs: Bleed Nozzle Flowrate	OO Bleed Biliciency	Max Turbine Temp. Limit	Turbine/OO Inlet Temp.	Turbine Pilowrate	Isp of GO Bleed	Turbine Inlet Pressure	User Defined Drive Fluid Weight	User Defined Drive Fluid Tank Weight	Density of Drive Fluid	Yield Stress of Drive Fluid Tank	Density of Drive Fluid Tank Material

	VARIABLB	NAMELIST	UNITS	DEPAULT
Transpiration Cooling Inputs:				
Transpiration Cooling Criteria	IDTRAN	NDBON		•
I) use QMAXTR				7
2) input BPSTRD and BPSTRU				
Maximum heat fiux before transpiration cooling (BTU/in ² sec)	 QMAXIR	INREGN	BTU/in ² s	1.0
Upstream area ratio for transp. cooling	 EPSTRU	INREGN		0 0
Downstream area ratio for transp. cooling _	 EPSTRD	INKEGN		· ·
Transpiration section platelet dimensions	 			<u>!</u>
etched platelet thickness	 lioant	INREGN	1	
platelet fand thickness	TURNE	NDBON		0
separator platelet thickness	SCREET.		E .	0.1
flow passage widths	MURIL		: .	0.04
				0.14
Transpiration cooling insert:				
material density	 RIITRIN	LIQMAT	lb/in3	0.28
thickness	TRINST	LIOMAT		
thermal conductivity (BTU/in sec °R)	TRANKM	NDBDN		
			X, S U/OFA	0.0004

Tank Geometry	VARIABLE	BLE NAMEL IST	151	UNITS	DEF AUL T
	NCINK	K LFLAG	ĐQ	8	0
Tandem Tanks	/ Mucuv	<u>.</u>	INKGEO	£	-
raw Sketch Here) monocoque tanks (1)	/ MICOF		INKGEO	I	-
-	KDOHE		INKGEO	1	-
Pressure Tank Geometry	KPRESS		TNKGEO	I	0
0) spherical in engine bay mumber of tanks 1) suspended forward of forward tank 2) mumbrane senarate dree	¥ 	NPRB INK	INKGEO	ŧ	-
comon 1 In f					
propellant tank head ellipse ratio 1.38	EL DOHE		INPGEN	I	1.0
pressurant tank head ellipse ratio	= 	ELRP LI	LTANK	I	1.0
propellant tank dome orientation (-1 = convex formard) (1 = convex aft	KXATAH KXATAH KXFTAH KXFTAH KPRPA	•	INKGEO INKGEO INKGEO INKGEO INKGEO		
propeliant location (1 = fuel aft, not 1 = fuel not aft					

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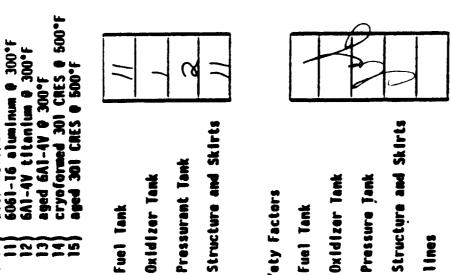
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(Drav Sketch Here)	VARIABLE	NAHEL IST	UNITS	DEFAULT
	HIAHKS	NCTINP	•	-
Tank elyipse ratios	ELTNKI	NCTINP	ı	1.0
Tank types (1 - CSE, 2 - torus)	KTAHKI	NCTINP	ł	-
fuel, 3 =	INTMKI	NCTINP	ı	-
Tank angular Vocation (deg)	1 ANGL 1	NCTINP	deg	0.0
Tank radial location	RADLO1	NCTINP	3	0.0
Kind of dimensional input				
dimensionless (0) Louive i Ruive	KALHOD	NCTINP	ı	0
major dimension (in) (1)	RDIMI	NCTINP	1	2.0
Rtank i Rhub	ICMM	MCTINP	ł	25.0
Engine angular location (deg)	ENGANT	NCTINP	dea	0.0
Engine radial location	ENGRD1	NCTINP		0.0
Stage Diamator (in)	DH010R	INPGEN	ţ	66.0
· Forward Skirt Length (in)	FFSKIL	(, Iquib	ŧ	0.3
ALL SKIFT Langth (In)	FASKIL	L I QUID	ŧ	0.067

DEFAUL	-	-	2	-	-	a 0.035 0.035	1.25	1.25	1.5	1.25	2.0	1.5	
STINU	ŧ	8	ł	Ø	•	1b/in ³ psi psi biu/1b -R in tu/in sec ⁴ in	ı	•	٠	ı	•	•	
	1												
NAHEL IST	LIGHAT	LIQHAT	LIQHAT	LIGHAT	NCTINP	LIGHT LIGHT LIGHT LIGHT LIGHT LIGHT LIGHT LIGHT	LIQMT	LIQMT	LIQHAT	LIQMT	LIQMI	MCTIMP	



Oxidizer Tank

Fuel Tank

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user defined

1-10)

1221

(fill in material (D)

Design Safety Factors

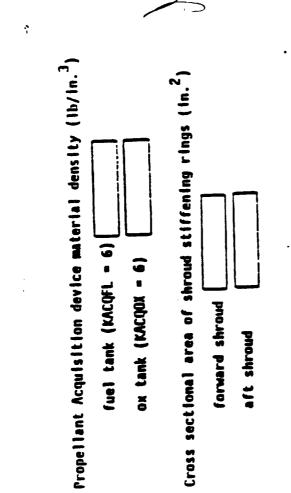
Structure and Skirts Pressure Jank Oxidizer Tank Fuel Tank

lines

		VARIABLE	NAMELIST	UNITS	DEFAULT
Engine Mounting Length Adjustment (In) To have NESS calculate a mounting length based on TPA component lengths and reactor length, input XMOUNT = 0.0	0.0	XMOUNF		Е	0.0
Propellant Expulsion Efficiency					
1) Input		INPEXF INPEXO			0 0
Fuct expulsion efficiency	-	ЕХИЛА			0.995
Oxidizer expulsion efficiency	JUD .	EXILOX			0.995
			· ·		

וולתו אהרתוופור והההר ההוציוההר

Tankage





DEFAULT	0.1 0.152 0.152 0.25
STINU	16/11. 6. 17 8. 1 8. 1 8. 1 1. 3 1. 3 1. 3 1. 3 1. 3 1. 3 1. 3 1
HAHEL IST	LIANK LIANK LIANK
VARIABLE I	DACQFL DACQOX AFSSR AFSSR

-
-
-
CON
0
-
-
-
36
-
-

General Input

Propellant temperatures input option for library

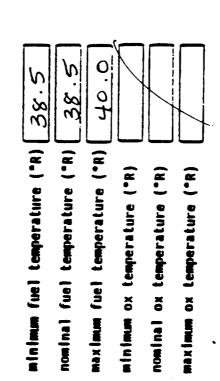
propellants (IPROP > 0)

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(Circle One)

0) use default temperatures

1) input temperatures



	DEF AUL T	0	varies	varies	varies	varies	varies	varies	
hø.i	UNITS	•	 æ •	æ.	۳.	æ.	¥.	. 2	
	NAMEL IST	LFLAG	 LFVEL	LFUEL	LFUEL	LOXID	LOXID	LOXID	· · ·
	VARIABLE	I PUTHP	TPMINF	TPROME	TPIMXF	TPHINO	TPNOHO	TPMAXO	

DEFAILT	-	0.0	-
STINU	J	<u>4</u>	- • • •
NAHEL 151	LFLAG	INPGEN INPGEN	Line

Miscellaneous on-board propellant (1bm) (remains on stage at burnout Lines full at burnout (Circle One) (0 - No. 1 - 785) fuel ž General Input

Space between suspended tank and structural vehicle wall Number of pressure bottles in engine bay Propellant feed line flag (Circle One) Figure 2.1 Contingent input Worksheet pressure tank (KPRESS = 1) forward tank (MICQF = 0) U) external feed line Pressure tank insulation density 1) internal feed line aft tank (MiCQA = 3) Tandem Tanks (NCINK = 0) (KPRESS = . 0) $(\text{NCINK} = 0)(1b/in.^3)$ 4-56

DEF AUL T	0.0	0.0	.0414	~	~	
SIIM	<u> </u>	i i	16/1n. ³		Ũ	
NAHEL IST	LTANK	LTANK	MATER	TNKGEO	TNKGEO	

ligure (cont.)

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Positive Expulsion Bladders

Space between transverse collapsing bladder and tank wall (in.)

ox tank	fuel tank

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Bond material density of bonded rolling diaphram



(16/1n.³)

Bladder thickness (for BRD only) (in.)



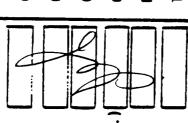
DEFAULT	10.	.04 .04 .025 .025	
UNITS	e e	1b/in. ³ 1b/in. ³ in.	
NAHEL IST	BLADER	BLADER BLADER BLADER BLADER	
VARIABLE	BLSPDX	DBMDFL DBMDFL TBLDOX TBLDFL	

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[1gun :... (cont.)

Tandem Tanks (NCTNK = 0)

Stage critical bending moment (NCINK = 0) (in./lb_f) Haximum carry moment (NCINK = 0)(in./lb_f) Space between aft and forward tank (KDONE = 0) (in.) Space between forward tank and pressure tank (KFNESS = 1-3) (in.] Density of pressure tank insulation (lb/m³) Insulation thickness for pressure tank (in.)



HANHEL IST UNITS LTANK In./1bf LTANK In./1bf LTANK In. LTANK In. LTANK In. LTANK In.

	VARIABLE NAMELIST UNITS DEFAULT		RATNKI NCTINP - 1.0			CLRINK NCTINP In. 2.0	ENGSPC NCTINP In. 2.0				KNEST NCTINP - 3			KINCKI NCTINP - 1	
r nurt (cont.)	A Committee (MCTHM = 1)	Non-conventional tank usable volume ratios	fuel tanks	ox tanks	pressure tanks	Minimum clearance between, non-conventional tanks (in.)	Hinimum clearnace between wozzles in mon-conventional model (in.)		Non-conventional models engine nexting mode (Circle One)	1) nest each engine independently	2) nest engines to highest comon plane	3) nest angine exit plane to end of tankage + XHOUNT	Mon-conventional tankage thickness option (Circle One)	0) variable wall thickness	1) constant wall thickness

4-59

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	VAR I ABLE	NANGL. 15T	STI NU	DEF AUL T	
Non-Conventional Tanks (NCTNK = 1) : Non-conventional tank feed line hydraulics					
velocity heads lost in fuel lines velocity heads lost in fuel lines elc.	FLKFCT	LTANK	J	5.0	
velocity heads lost in ox lines including valves, bends, etc.	OXKFCT	L TANK	ı	5.0	
absolute surface rownhness of fuel lines (in.)	RUFFFL	LTANK	Ē.	1000.	
absolute surface roughness of ox lines (in.)	RUFFOX	LTANK	ln.	1000.	
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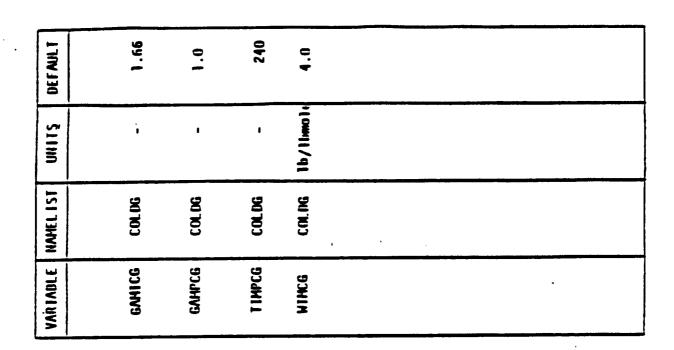
Cold Gas Pressurization

Pressurant Properties (default is Helium)

Isentropic ratio of specific heats (-)

Polytropic ratio of specific heat at time equal infinity (-)

Time at which polytropic ratio falls to 1.1 (sec.) Holecular wt. of pressurant (1b/11mole)



2011d gas generator pressurization (default is IAL-A)	VARIABLE	NAMEL IST	UNITS	DEFAULT
Minimum port to throat area ratio	APATGG	SAN INCC		
Ratio of equilibrium temperature in propellant tank to minimum operating temperature (THIN)	BIE()GG	SOLIGG	9 F	n 4 1
Burn rate coefficient of solid grain (in./sec.)	CBRGG	SOL DGG	fn./sec.	0.0
Design complexity multiplier solid g.g.	CDESGG	SOLDGG	t	
Solid grain characteristic velocity (it./sec.)	CSGB	- SOLDGG	ft./sec.	
Minimum allowable solid grain diameter (in.)	DHINSG	SOL DGG	ln.	3.0
burn rate exponent of solid grafn	EBRGG	SOL 066	1	0.64
rolar fraction of water in combustion products	FII2066	SOLDGG	ı	0.2662
Pultiplying factor on ullage pressure to calculate minimum operating g.g. pressure	FPULGG	501.DGG	ı	1.1
Combustion products ratio of specific heats	GAHGG	SOI DGG		
Temperature sensitivity of g.g. pressure (1/°R)	PIPKGG	SOL DGG	1/•R	73.1 ALON 0
Solid grain density (lb/in. ³)	BOHR	SOLAGG	1b/1n. ³	0.056

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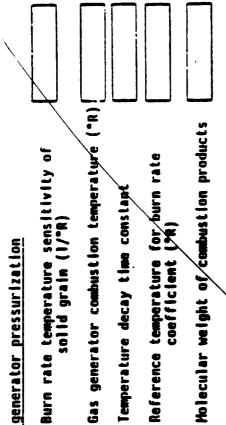
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DEFAULT	0.0013	2130	100	80	19.0	
UNITS	1/°R	.	sec.	4 •	lb/lbmole	
NAMEL ISI	SOL DGG	SOL DGG	SOL (166	501.DGG	SOLDGG	· · ·
VARIABLE	51666	TCMBGG	TINCYGG	TREFGG	WINGG	



DEFAULT .0464 0.65 .0464 1.2 1.2 20. 2 800 800 . . UNITS psia 1 1 . ł 1 **4**° <u>د</u> ł **NAMEL 1ST** PUHP PUMP PUMP PUMP PUMP PUHP dim PERP PUMP VARIABLE CVIAL TF BPFRFL BPFROX PTURB0 TULLFL TULLOX PBPRO PBPRF KPUHP Gas generator/pre-burner control valve pressure drop multiplier Boost pump fraction of total propellant head rise Turbine outlet pressure (for gas generator bleed cycle) (KCYCLE = 1) (psia) Pressure ratio across gas generator/pre-burner Number of turbo pump assemblies (Circle One) or more TPA per engine (KGASOX - 1) (KGASFL - 1) Autogenous Pressurant temperature ("R) 1) 1 TPA per stage 0 0 1.11111 fuel side ox side fuel fuel X ŏ 5 a mhi i Cum L 4-64

12. 0.3 0.3 30000 2.0 30000 2.0 0.4 20000 20000 30000 0000E DEFAULT lb/in.³ 1b/1n.³ | ps l ps t SIINN 1 1 1 1 ŧ 1 NAMEL 151 Party Pump Part Part Pup **J**E **PIP Jup** PUHP **Pap** THE Jung ROINGG ROSIAK SYBUCT **SYING** VARIABLE SSSBP0 TURBPR UOVERC EP SGGB 5558PF SSSFL SSSOX BGCR 0.298 .43 Gas generator or pre-burner injector material density (lb/m³) Gas generator or pre-burner injector yield strength (psi) Initial value of turbine pressure ratio (KCYCLE > = 2) Jurbine pitch line velocity divided by isentropic spouting velocity Gas generator or pre-burner contraction ratio Suction specific speeds of propellant pumps Hot gas duct material yield strength (psi) Not gas duct material density (1b/in.³) Area ratio of bleed mozzle (KCVCLE = 1) 20000 20000 00000 20000 fuel boost pump main fuel pump ox boost pump main ox pump fligut 2.3. (cont.) Pump

T UNLES DEFAIRE	•	- 1.0 - 1.0 10.14 1b/1bmole 28. - 1.0 1b/1n.3 0.16 1b/1n.3 0.16 1b/1n.3 0.15 1b/1n.3 0.07 psi 75000 psi 100000 psi 75000 psi 830 ************************************
NAMEL 151	Putte	anna anna anna anna anna anna anna ann
VARIABLE	ISTAR	CVACUM BURNRA GASAM NR RIOCYL RIOCYL RIOCYL RIOCYL RIOCYL RIOCYL RIOCYL RIOCYL SYBOT SYCART SYCAL SYCYL SYCH
Pump Primp	0) Lank head 1) cold gas spin 2) start tanks 3) solid cartridge	ITA Start System start valve complexity multiplier accumulator valve complexity multiplier accumulator valve complexity multiplier (ISIARI - 2) solid grain burn rate (ISIARI - 3) (in./sec.) molecular veight of pressurization gas (ISIARI - 2) mumber of engine restarts start cylinder material density (ISIARI - 2) (ib/in. ³) start sphere material density (ISIARI - 2) (ib/in. ³) start cylinder material density (ISIARI - 1) (ib/in. ³) start cartridge material density (ISIARI - 3) (ib/in. ³) start cartridge material density (ISIARI - 3) (ib/in. ³) start cartridge grain density (ISIARI - 3) (ib/in. ³) start cartridge yield strength (ISIARI - 2) (psi) start cartridge yield strength (ISIARI - 2) (psi) start cylinder yield strength (ISIARI - 2) (psi) start system sphere yield strength (ISIARI - 2) (psi) start system sphere temperature (ISIARI - 1) (°R)

4-66

figure ... (cont.)

IFA Material properties

fuel turbine blade material degsity (JCNFIG = 3 or 4) (lb/in.)

ox turbine blade material dens[ty (JCNFIG = 3 or 4) (lb/in.) turbine blade material density₃ (JCHFIG = 1 or 2) (lb/in.³)

0.305

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0 0

> JFA effective material density (lb/in.³) Turbine blade uitimate strength (ps1)

Turbine blade yield strength (psi)

20000

0.298

30000

000161

0.298

Propellant line material density (enginebay) (lb/in.³) Propellant line material yield strength (ps!) Cold gas valve material density (ISIARI = 1) Accumulator valve material density (ISIARI = 2)

DEFAULT		E.0	0.3	0.3	E.O	127000	104000	0.3	30000	0.3	0.3	
STINU	~	1b/1n."	11/11.3	1b/in. ³	1b/1ú. ³	h s d	ps l	1b/ln. ³	psi	1b/1n ³	1b/in. ³	
NAMEL IST		diffid	PUHP	anna	PUMP	JHINJ	PUMP	dHIId	unu.	MM		
VARIABLE NAMELIST		MOTEL	RHOTOX	RIOTUR	MOTPA	SN	۲S	ROL INE	SYL IN	ROSPAL	ROACM	

4-67

lank lieat Transfer

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Tank insulation conductivity flag (Circle One)

0) Input conductivity of M.I and SOFI

1) calculate conductivity of M.I and SOFI

Effective thermal conductivity of NLI (DIU/In.sec.*R) *(A.59,76-9*) Effective thermal conductivity of SOFI (BIU/In.sec.*R) <u>P.S647 E-8</u>

SOFI Thermal conductivity constants (KALCON = 1)

K = A + B + T A (Blu/in.sec. R) 3.9

A (BIU/In.sec. *R) <u>3.935 E 8</u> B (BIU/In.sec. *R²) <u>5.676 e -/0</u>

Insulation density (lb/in.³).

HI SOFT

Radiation shields per inch in M.I (1/in.) Average stage acceleration (g's) Iteration counter in heat transfer calcs



DEF AM. T		*R 4.0E-9 *8.3.5E-7	•R 3.935E-8 •R2676E-10	.002	.00127	40. 2 D	
S11N0	•	BTU/in.se .R	BTU/in.se.*R 3.935E-8 BTU/in.se.*R 6.676E-1	lb/in. ³	lb/in. ³	1/in. g's	, I 3
HAMEL IST	TANKIIX	TANKIIX	TANKIIX TANKIIX	TANKIIX	TANKIIX	TANKIIK TANKIIK	TANKIIX
VARIABLE	KALCON	CMAL I CNSOF I	SOF LA SOF IB	DIAR. 2	DNSOF 1	RADPIN	NITIX

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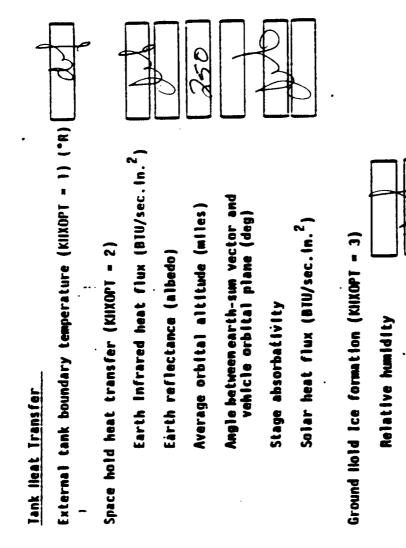
Flguri (cont.)

DEF AUL T	::	001 100	-	2.06-7
MILTS	4 1	5 e C . 5 e C .	1	e 5 £
HAHEL IST	TANKIIX	TANKUX TANKUX	TANKILX	TANKIIX
VARIABLE	FVENTF FVENTO	FLTTIM	M. IENV	PRGML
<u> </u>				

Iank ileat Iranifer Fraction of propellant tank nominal ullage pressure at which venting occurs in which venting occurs in the fraction of the sec. in the sec. Stage action time (sec.)	H.I purge gas pressure at space hold conditions (psia) deb
Tank Heat Fraction Stage ac	M.1 purg

4-69

figur. (cont.)



DEFAILT	560	ç	1. 2 C L	66.0	125	0.0	0.2	1, ² 8.20E-4	60.	· 560.	. 10.	
UNITS	æ.		BTU/sec.1	ı	mi les	deg	ı	BIU/sec.1.	ŧ	æ.	ydu	
NAMEL IST	TANKIIX		TANKIIX	TANKIIX	TANKIIX	TARKIIX	TANKIIX	TANKIIX	TANKIIX	TANKUX	TANKIIX	
VAR LABLE	TEXBOU		EARIR	EARREF	IIXALT	ORBANG	SAB 50R	SOLCON	RELINIM	TANICE	INTHUN	•

Ambient temperature (*R)

Wind velocity (HPH)

Figure (cont.)

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Positive Expuision Bladders

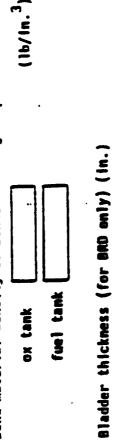
Space between transverse collapsing bladder and tank wall (in.)



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fuel tank

ox tank

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DEFAULT	10.	10.	¥0.	•0.	.025	.025	
UNITS	fa.	in.	1b/in. ³	lb/in. ³	tn.	tn.	
NAMEL IST	BLADER	BLADER	BLADER	BLADER	BLADER	BLADER	
VARIABLE	BL SPOX	BLSPFL	XOONeO	DBNDFL	TBLDOX	TBLBFL	• •

Input Listing

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	FVAC	
	PC	
	IPROP	lant flag
• •	WPAYLD	Vehicle payload wt.
		ous st
	KCYCLE	Expendable stage wt.
~	JCNFIG	Cycle type (1=66.J=Expander,7=Bleed) Pump configuration
	IPTYPE	
6	ISOLVE	I cycle solver (s
		bine inlet temp ?
. –	F KACHB	leed fro
•		i bleed fraction
•		line loss f
•••	CPLINT	s frac
•	CPVLVT	thread line toss fracti
	JBPFL	-
	JBPOX	X
	NTPA	
	IDBLRUN	run flag
	I FRAC	
	I KAI E	•
600.00	I USABAN	Input engine burn time?
	I USABAN	burn time
•		n weight i
.15	ALENTY	-
	Sd3	Faring angle
	KEXNOZ	ratio
	NOZTYP	
	EPSATT	e extension 1 attoch area area
20. 19 B	EPSAT2	• • • • • • • • • • • • • • • • • • •
	XLN	
	KNOZ I BI 110	•
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2.010 4880	WAGEPB	
	TCHAMBER	
	I KEACIR CONFIC	-
.11	DC DC	ag (1-oid.2-new)
0.173	SS	Prement chamber
	PAC	duction for the second se
Ð	HOLES	i holes per of
	FTYPE	VD0
6	SPAT	
1.2		Core length
. 25		n eac
.31	011	fraction
-105.0	HTANK	-
.0122	FREF	i i
. 00031	FES	hadt pickup in reflector
60 1 / J	FCS	

nabler1,2=enabler2) =new) ameter

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W per 52 inches)

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Uncosted fuel hex flat dimension Scalable fuel hex flat dimension Scalable fuel element (overrides LC) Channel coating thickness at inlet Channel coating thickness at outlet Fressure vessel material specific grav. Pressure vessel mat. allowable stress Baryllium reflector thickness Fraction of max ZrH loading in the tubes Burned propellant wt. Ox ullage fraction Ox acquisition device Fuel ullage fraction Ox tank pressurization Fuel acquisition device Fuel acquisition device Fuel acquisition device Fuel tank pressurization Fuel tank final pressure fuel tank final pressure fraction propellant tank hightant	tank MLI thickness ank MLI thickness ank MLI thickness and stage operati nai stage operati nai stage operati nai stage operati nai conting method to conting method vall thermal cond worksheet nai nozzle materi sure drop across sure drop across sure drop across sure drop across sure drop across sure drop across sure drop across	Generation of generating angles convergent nozzle strength Convergent nozzle strength Regen closecut material density Regen closecut material density Regen closecut material density Valve material density Nozzle extension 1 atrength Nozzle extension 2 density Nozzle extension 2 density fronslating nozzle density Engine weight model Input nozzle length Input nozzle length Input nozzle length Input nozzle throot diameter Turbine bypass fraction
HEX LEEX ZACI ZACI ZACI ZACO ZACI ZACO ZACI ZACO VILLFOX VILLFOX KGASOX KAS	TALLE TSOFIO TWLIO TMLIO TMLIO TGMNOM TGMNIA TGMNAT	RMD AND RHCSTR SIGCAM RHCSTR SIGCAM RHCCLS SIGCAM RHCCLS RHCCSTR RHCCLS RHCCLS RHCCLS RHCCLS RHCCLS RHCCLS RHCCSTR RHCCLS RHCLS RHCCLS
e. 75 e. 75 e. 6 e. 75 e. 6 e. 7 e. 6 e. 6 e. 6 e. 6 e. 6 e. 6 e. 6 e. 6 e. 7 e. 6 e. 6 e. 7 e. 6 e. 7 e. 6 e. 6 e. 7 e. 6 e. 6 e. 7 e. 6 e. 6 e. 6 e. 7 e. 6 e. 7 e.	0.01 0.02 0.03 0.01	6.8 25996 2322 23296 23296 23296 23296 23296 23296 23296 23296 23296 23296 23296 23296 23296 23296 23296 23296 23296 2329 2322 2322

Cooling channel land width Input regen delta T and width Cooling channel width Tuput regen total delta P Fuel MPSP Ox NPSP Ox Regen channel zurface roughness Max depth to width ratio Number of regen zegments in conv. zec. Number of regen zegments in nozzie zurface area multiplier fuel turbine admission fraction number of fuel turbine stages number of ox turbine stages turbine diameter ox turbine admission fraction Cooling channel multiplier ox turbine diameter turbine admission fraction fuel turbine annulus area fuel boost pump diameter ox boost pump diameter number of turbine stages number of ox pump stages ox turbine annulus area fuel turbine diameter turbine annulus area fuel pump diameter ox pump diameter CXWTNK CXWFTK CXWFTK CXWFTK CXWFTK CXWFTK CXWFTL CX CHMULT EPIPE HOMMAX NCON SAMULT WLTHR WTHR DELTAP FLNPSP OXNPSP Adjggb Adjbl Adjbl INDPDT TDIAFL TDIAOX ADMFR ANARFL **IDIAN** ADMFRF NOMFRO NAREA NNZL . 0 0.00008 5+1.0 • • • 9.22 • • 3 'n 8 a, m 66 000 000 4-75

	TPAWT WSTART WIGNIT WHGBOX WGBOX	
	WTHTX WCCPB IUSRCC	
. 1 . 99 800 . 8	ETAGGB TTLIMT	GC bleed afficiency max turbine temperature
	TUSRCC WDUSRC USRCCI	6 bleed
	PUSRT I WPUSRG WIUSRG	ed drive
. 61 5900 . 0	ROUSRG SYUSRG BOUISMT	density of drive fluid tank yisid stress of drive fluid tank dansity of drive fluid tank material
8 89 .	IDTRAN	tation coo
	EPSTRU EPSTRD TCECN	
	TGEOL	let land ator pla
	TGEOW RHTRIX TBINGT	flow passage widths transp. cooling insert density transp. cooling insert thickness
000+	TRANKN	nep. cooling insert non-conventional to
	MNCQF KDOME KPRESS	
36	NPR8 ELDONE	number of pressure bottles propellant tank head ellipse ratio
•	KXATAH KXATFH KXATFH	tank dome orientat tank dome orientat
	KXFTFH KXFTFH	propellant tank dome orientation propellant tank dome orientation
-	KPRPA NTANKS ELTINKI	propertant rocarros number of non-conventional tanks tank ellipse ratios
		types contents
5+0.0 5+1.0	TANGL1 RADL01	angular location radial location
5•2.0	KALMOD RDIM1	~
15+0.0 5+0.0	ENGAN1 ENGAN1	adius angular
5+0.0 100.0	ENGR01 DMOTOR FESKTI	engine radiat totation stage diameter forword skirt length
	FASKTL	kirt lengt

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4-76

tank materials (non-conventional tanks) user defined tank material elastic mod. user defined tank material elastic mod. user defined tank material strength user defined tank material sconductivity user defined tank material conductivity user defined tank material min gauge user defined tank material min gauge number of temp achedule iterations space between off auspended tank & wall space between for. suspended tank & wall space between pres. suspended tank & wall pressure tank insulation density ox tank adfety factor pressure tank safety factor structure safety factor lines safety factor tank safety factors - non-conv. tanks engine mounting length adjustment fuel expulsion efficiency flag ox expulsion efficiency flag space between and and forward tank space between forward and pressure tanks pressure tank insulation density insulation thickness for pressure tank non-conv. tank usable volume ratios pressurant ratio of specific heats (isen) pressurant ratio of specific heats (poly) time at which polytropic ratio is 1.1 min clearance between non-conv tanks non-conv duel engine mesting mode non-conv tank thickness mode velocity heads lost in fuel lines velocity heads lost in ox lines ox acquisition device density forward shroud cross-sect. area ox exputsion efficiency fuel acquisition device density aft shroud cross-sect, area Input propellant temperatures? pressure tank material structure and skirts material propellant feed line flag stage critical bending moment min clearance between nozzles miscellaneous fuel on-board miscellaneous ox on-board fuel line surface roughness ox line surface roughness fuel exputsion efficiency Lines full at burnout? fuel min temp fuel nominal temp fuel max temp ox tank material ox nominal temp Max carry moment ox min temp ox max temp MATNK1 MATNK1 RHO YMOD SIGMAX SPHEAT CONDCT MTNKOX SFFLTK SFOXTK SFOXTK SFOXTK SFITK SFLTK SFLTK SFLTK SFLTK INPEXF INPEXF INPEXF INPEXF INPEXF INPEXF DACOFL **TMINGS** IPMAXF IPMINO IPNOMO AFSSR LINFULL WMISFL WMISOX NTMPIT TMING **PMINF** RHOINS DXAM9 CLRTNK MATPT PNONF KTHCK1 FLKFCT RHPT IN ENGSPC KNEST OXKFCT TSPCA TSPCF TSPCP CLRAF RUFFFL RUFFOX GAMICG CLRFP **RATNK1** TINSUI TIMPCG **BAMPCG** CBM 29.0E6 112300.0 .00023 i+1.5 035 5+11 985 0.0001 . 29 12 .152 0 0.0001 1.0 240.0 25 .66 5+1 5.1 • • • •• • 4-77

serrant coat area ration p ratio ficient ity multiplier ristic velocity grain diameter duct water fra a exponent a extingiler ific heat rati	tivity of GG pressur naity ate temp sensitivit on temperature dy time constant for burn rate coef. r weight of comb. pr on of total head ris on of total head ris	ratio across fiet pressure (fo designments fuel pressurent fuel pressurent exction specific pump suction specific pump suction specific tion ratio focity ratio fion ratio tion ratio	
MTMC6 APATC6 BTCAC6 BTCAC6 CBTC6 CBTC6 CDMTMC6 FNUL60 CAMD6 CAMD6	PIPKOG RHOGG SIGGG TCMBGG TCCMBGG WTMCG BPFRFL BPFRFL CVMLTF CVMLTF	PBPRF PBPRO PBPRO PBPRO FILLEFL TULLEFL SSSSFL SSSSBPF SSSSBPF SSSSBPF SSSSBPF COCR CCCR CCCR	ROSTAR FOINGC SYLNGC SYLNGC SYLNGC SYLNGC CVACUM CVACUM CVACUM ROCARI RHOROT SYCART SY
4.0 3.6 1.5 3.95 3.95 5.6 0.265 1.1 2.65 2.65 2.65 2.65 2.65 2.65 2.65 2.65	1.2/ 6.9036 6.9036 6.9013 2130.9 190.9 190.9 190.9 190.9 190.9 190.9	2	22.8 2.2.8 2.3.8 2.3.8 2.3.8 2.3.9 2.3.9 2.3.9 2.3.9 2.3.9 2.3.9 2.3.9 2.3.9 2.3.9 2.3.9 2.3.9 2.3.9 2.4 2.4 2.5.8

turbine blade uitimate strength turbine blade vield strength engine bay line density engine bay line yield strength cold gas valve material density accumulator valve material density		tuel tank ullage pressure fraction-vent. ox tank ullage pressure fraction-vent. stage dotid time stage hold time MLI environment flag MLI environment flag MLI environment flag MLI purge gas pressure at space hold external tank boundary temperature Earth reflectance (albedo) average orbital altitude orbital angle stage absorbativity solar head flux relative humidity ablent temperature wind velocity space between fox bladder and wall space between fox bladder and wall space between fox dlaphragm density fuel bonded rolling dlaphragm density fuel bladder thickness	
US YS ROLINE SYLIN ROSPVL	CNALCON CNALL CNALLI SOFIA SOFIA SOFIA DNMLI BNMLI SACCEL SACCEL	FUENTS FUENTS FUENTS FUENT MLIENV MLIENV MLIENV FREMLI FRANC EARIR EARIR FANCE SABSOR	
134909.0 136909.0 39909.0 3998.0 4.0 9.3 9.3 9.3 9.3 9.3 9.3 9.3 9.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1	2.5917E-9 9.5647E-8 5.676E-8 6.602 40.00127 2.0 8	e f f f f f f f f f f f f f	

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Output Listing

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OUTPUT FOR MULTIPLE PUMPS AT FULL THRUST LEVEL

ODK VALUES CORRESPOND TO THROAT RADIUS=2.289 IN. C-STAR & CHAMBER TEMP DATA EVALUATED AT ODE PC & ODE MR VAL TURBINE PRESSURE RATIO= 1.394726138748292 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO= 1.394726138748292 TURBINE PRESSURE RATIO= 1.316081365426303 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO= 1.316081365426303 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO= 1.316081365426303 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO= 1.316081365426303 LIQUID OXYGEN - LIQUID HYDROGEN TEMP ENTHALPY 90.18 K -3093. CAL/MOL 20.27 K -2154. CAL/MOL KEY INPUTS ЦČ PROPELLANTS ASSUMPTIONS:

75000. (151) Expander Cycle	ENABLER	0.67 Composite fuel	200.	500. (psic)	t 1860 (deg Ŕ) S = 2	
THRUST LEVEL = CYCLE TYPE =	REACTOR TYPE = File Scaltuc Factor	FUEL TYPE =	WOZZLE EXIT AREA RATIO = PROPELLANT USED =	CHAMBER PRESSURE -	CHAMBER TEMPERATURE = NUMBER OF PROPELLANT FEED LEGS =	

4-81

TANKAGE SUMMARY FOR STAGE #1 EXPANDER CYCLE (FUEL SIDE) AFT TANK CONTAINS OXIDIZER ... FORWARD TANK CONTAINS FUEL FUEL TANK IS PRESSURIZED WITH COLD GAS TANK MATERIALS (OX - USER DEF) (FUEL - qiuminum)

: .. DIMENSIONS (INCHES)

	78.43 1524.54 3236.41 3387.56	16.52 341.40 107.30
WEIGHTS (POUNDS)	AFT TANK Forward tank Pressure tank Tank construction weight	STRUCTURAL WALL AFT SKIRT FORWARD SKIRT
	1960.96 966.21 542.64 128.51	
MENSIONS (INCHES)	STAGE DIAMETER TOTAL STAGE LENGTH TOTAL TANK LENGTH MOZZLE LENGTH CONVERGENT NOZZLE LENGTH	MOUNT LENGTH TANK HEAD ELLIPSE RATIO

6.66 6.66 256.26 497.64	184.69 11.31 0.00 56.81 26.07		7.25 1.25 1.56
TANK MOUNT PRESSURE TAMK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION	REVERSE HEAD STIFFENER FUEL ACQUISITION SYSTEM OXIDIZER ACQUISITION SYSTEM PRESSURANT CONTROL HARDWARE TANK LINES BURNED FUEL	BURNED OXIDIZER FUEL RESIDUAL OXIDIZER RESIDUAL OXIDIZER RESIDUAL OXIDIZER RUTOGENOUS PRESSURANT SORED PRESSURANT FOLD TIME FUEL BOILOFF HOLD TIME OX BOILOFF FLIGHT OXIDIZER BOILOFF MISC EXPENDED FUEL MISC EXPENDED FUEL MISC EXPENDED OXIDIZER MISC ELLANEOUS WEIGHT INTERSTAGE WEIGHT	INPUT MINIMUM SAFETY FACTORS Structural Wall Lines Oxidizer tank Fuel tank Pressure tank
1.00 35.35 35.35 55.35 55.35 55.35 55.35 55.35 55.35 55.35 55.35 55.35 55.35 55.35 55.35 55.35 55.35 55.35 55.35 55.55 5	4 6 6 7 7 8 8 8 8 7 7 8 8 8 8 8 8 8 8 8 8		
PRESSURE TANK ELLIPSE RATIO AFT TANK HEAD HEIGHT Forward Tank head height Pressure Tank head height Pressure Tank diameter AFT Tank Cytimprical i Fingth	FORWARD TANK CYLINDRICAL LENGTH PRESSURE TANK CYLINDRICAL LNGTH AFT LINE DIAMETER FORWARD LINE DIAMETER AFT SKIRT LENGTH FORWARD SKIRT LENGTH	STRUCTURAL WALL THICKNESS AFT TANK WALL THICKNESS FORWARD TANK WALL THICKNESS PRESSURE TANK WALL THICKNESS AFT TANK DOME THICKNESS FORWARD TANK DOME THICKNESS FORWARD TANK DOME THICKNESS FUEL TANK MLI THICKNESS FUEL TANK MLI THICKNESS OXIDIZER TANK MLI THICKNESS OXIDIZER TANK SOFI THICKNESS PRESSURE TANK INSULATION THICK	FUEL TWK HEAT FLUX(BTU/HR IN••2) OX TANK HEAT FLUX(BTU/HR IN••2) FUEL BOILOFF RATE (LB/SEC) OX BOILOFF RATE (LB/SEC)

PROPELLANT SUMMARY FOR STAGE #1 PROPELLANT IS LH2

MOMINAL PROPELLANT BULK DENSITY(LB/IN++3)-

0.0025

	35.0	38.5 0.0025 20.0	40.0 0.0025 25.0	38.5 0.0025
FUEL	NOMINAL TANK PRESSURE(PSIA)	NOMINAL PROPELLANT TEMP(DEGR) NOMINAL DENSITY(LB/IN++3) NOMINAL VAPOR PRESSURE(PSIA)	MAX PROPELLANT TEMP(DEGR) MAX TEMP DENSITY(LB/IN+3) MAX TEMP VAPOR PRESSURE(PSIA)	MIN PROPELLANT TEMP(DEGR) MIN TEMP DENSITY(LB/IN++3)
	0.0	0000 .0000 .0000	8 . 8 9 . 9 9 . 9 9 . 9	6.8 6. 888
OXIDIZER	NOMINAL TANK PRESSURE(PSIA)	NOMINAL PROPELLANT TEMP(DEGR) NOMINAL DENSITY(LB/IN++3) NOMINAL VAPOR PRESSURE(PSIA)	MAX PROPELLANT TEMP(DEGR) MAX TEMP DENSITY(LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA)	MIN PROPELLANT TEMP(DEGR) MIN TEMP DENSITY(LB/IN++3)

4-82

MIN TEMP VAPOR PRESSURE(PSIA)

0.0

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ENGINE SIZE, WEIGHT, & PERFORMANCE SUMMARY FOR STAGE #1 EXPANDER CYCLE CONVERGENT MOZZLE IS REGEN COOLED (MILLED SLOT CONSTRUCTION) NOZZLE IS REGEN COOLED (TUBE CONSTRUCTION) PROPELLANT IS LH2

:

	908.58 928.88	16446. 16597.	588. 75888. 75888. 3688.88	6 .978	0.999 0.999 0.996 0.996 0.995	0.00 82.55 82.55
PERFORMANCE	DELIVERED ISP(VAC).SEC IDEAL ISP(ODE).SEC	DELIVERED CSTAR,FT/SEC IDEAL CSTAR,FT/SEC 16.	CHAMBER PRESSURE, PSIA THRUST PER ENGINE (VAC), LBF 756 TOTAL VAC THRUST, LBF 756 BURN TIME, SEC 30	OVERALL EFFICIENCY	KINETIC EFFICIENCY BARRIER COOLING EFFICIENCY BOUNDARY LAYER EFFICIENCY DIVERGENCE EFFICIENCY	FOR 1 ENGINE OXIDIZER FLOWRATE, LB/SEC FUEL FLOWRATE, LB/SEC TOTAL FLOWRATE, LB/SEC
ENGINE DIMENSIONS (INCHES) In 47	DIANETER 0.D. UETED	LATTACH DIAN E LENGTH UCTURAL THICK	HICKNESS W THICKNESS XTENSION THICKNESS	CONTRACTION RATIO	ATTACH ARE RATI 2 MIN RAO LENGTH) 22 NT LENGTH 22	

4860. 1630. 8.80 8.82

CORE TEMPERATURE, DEG R BARRIER TEMPERATURE, DEG R ENGINE MIXTURE RATIO FUEL FILM COOLING FRACTION

THE FOLLOWING IS THE REGENERATIVE COOLING SUMMARY FOR STAGE #1

THE ENGINE IS A FUEL COOLED Conventional expansion Nozzle

8.375 INCH LONG NOZZLE SECTIONS 3.198 INCH LONG CONVERGENT CHAMBER SECTIONS 0.000 INCH LONG CYLINDRICAL CHAMBER SECTIONS GAS WALL THICKNESS = 0.073 GAS WALL THERMAL CONDUCTIVITY =.00039000 (BTU/IN SEC DEGR) GAS WALL MAXIMUM OPERATING TEMPERATURE 1460. (DEG R) STATIONS 1 THROUGH 6 ARE BOUNDS TO THE STATIONS 6 THROUGH 11 ARE BOUNDS TO THE STATIONS 11 THROUGH 11 ARE BOUNDS TO THE

E TGAS 256E+02 539E+03 176E+02 618E+03 516E+02 618E+03 516E+02 739E+03 536E+03 141E+04 197E+01 163E+04 197E+01 163E+04 327E+01 163E+04 684E+01 163E+04 165E+04 165E+04 165E+05		
HG 8296-04 1226-03 1956-03 3496-03 3176-03 11856-03 1856-03 1856-03 6106-03 6106-03 6106-03		
TGW .224E403 .224E403 .327E403 .436E403 .657E403 .657E403 .657E403 .837E403 .837E403 .877E403 .877E403 .877E403 .877E403		
76W 6.219565403 6.219565403 6.312555403 6.55955403 6.55955403 6.55555403 6.7555403 6.7555403 6.7555403 6.7655403 6.7655403 6.7655403		(Hereit and Hereit and H
Q 2615-01 .2615-01 .4345-01 .8045-01 .1795+00 .5735+00 .2215+01 .1345+01 .1345+01 .1345+00 .5355+00		SEC DEGR) ++2 SEC DEGR)
<pre>346492 3566492 5566492 8896492 1566492 1566493 1566493 1566493 8846493 14476493 2866493 1486493 1486493</pre>	â	URE (PSIA) TEMPERATURE (DEGR) EL WIDTH (IN) ITY (IN/SEC) U/IN++2 SEC) F COOLANT WALL (DEGR) F CAS WALL (DEGR) F CAS WALL (DEGR) F CAS WALL (DEGR) F COOLANT WALF (DEGR) F COO
 852 W 852 E+99 853 E+99 853 E+99 853 E+99 156 E+99 156 E+99 156 E+99 156 E+99 233 E+99 333 E+99 333 E+99 	7 8 .4 .4 (BTU/SEC)	(PSIA) ERATURE (DEGR) (DTH (IN) (IN/SEC) •2 SEC) •2 SEC) •2 SEC) •2 MALL (DEGR) * MALL (DEGR)
TB TB TB TB TB T775E+022 T775E+022 T895E+022 T895E+022 T955E+022 T9		COOLANT PRESSURE (PSIA) COOLANT BULK TEMPERATURE (COOLANT CHANNEL WIDTH (IN) COOLANT VELOCITY (IN/SEC) HEAT FLUX (BTU/IN+2 SEC) TEMPERATURE OF COOLANT WAL TEMPERATURE OF GOOLANT WAL TEMPERATURE OF GAS WALL (D) GAS SIDE HEAT TRANSFER COE COOLANT SIDE HEAT TRANSFER LOCAL AREA RATIO (-)
STATION 2	DELTA T= 23.1 DELTA P= -6.9 HOZZLE DELTA T = NOZZLE DELTA P = ADAPTER DELTA P = ADAPTER DELTA P = ADAPTER DELTA P = TOTAL HEAT TRANSFER	P - COOLANT PRESSURE TB - COOLANT BULK TEMP W - COOLANT BULK TEMP W - COOLANT VELOCITY V - COOLANT VELOCITY O - HEAT FLUX (BTU/IN TCW - TEMPERATURE OF GA HG - GAS SIDE HEAT TRA HG - COOLANT SIDE HEAT TRA

5
STAGE
FOR
SCHEDULES
D TEMPERATURE XPANDER CYCLE
AND
PRESSURE

RE(DEG R) OXIDIZER	0.0 (SATURATION TEMP OF PROPELLANT)	
TEMPERATURE (DEG R) FUEL OXIDIZER	ANT 550.0 43.2	ANT 38.5 40.3 40.3 76.6 76.6 78.6 539.8 324.9 539.8 659.7 659.7
(A) OXIDIZER	PRESSURANT 6.8 8.0	9.9 9.9 9.9 9.9
PRESSURE(PSIA) FUEL OXIDIZER	4385.8 385.8 35.8	35.0 116.1 106.0 1646.2 1575.7 1325.7 1007.3 1007.3 500.0 1325.7
	MAX STORAGE Vent Ullage	TANK PROPELLANT BOOST PUMP OUTLET MAIN PUMP INLET MAIN VALVE INLET MAIN VALVE OUTLET TIE TUBE OUTLET REGEN OUTLET (REFL I REACTOR INLET REACTOR INLET REACTOR CORE TURBINE INLET

TURBINE OUTLET

1007.3

596.8

•

(DEG R)
ES :: CHANGES :
T PRESSURE/TEMPERATURE CHANGES . TEMPERATURE CHANGES . 1.8 0.0 36.3 0.0 36.3 0.0 574.1 23.1 23.9 53.9
NT PRE
COMPONENT (PSID) 0.0 0.0 0.0
CHANGES
PRESSURE 81.1 15.10.1 15.40.2 25.0 25.0 25.0 25.0 25.0 25.0
DEVICE
ACOUISITION BOOST PUMP FEED LINE MAIN PUMP MAIN VALVE TIE TUBES REGEN JACKET REFLECTOR TURBINE

FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 EXPANDER CYCLE

OXIDIZER 9.999 9.999 9.999		0.00 0.00 0.00
	2 1.660 2 30.332	5
FUEL 82.546 41.273 82.546 69.665 21.881		88.887 89.887
TAMK OUTFLOW MAIN PUMP - EACH MAIN VALVE MAIN VALVE TOTAL TIE TUBES REGEN JACKET INFLOW MOZZLE BARRIFR COOLTUC	EGEN/REFL OUTLET TO CORE URBINE - EACH URBINE TO CORF	AUTOGENOUS PRESSURANT STORED PRESSURANT (AVE) CORE

REACTOR OPERATING CHARACTERISTICS AND MASSES

LB/SEC MN IN2	LB/1N2 MW/Element HR	DEG R PSIA BTU/LB DEG R PSIA	BTU/LB MW/TUBE BTU/S BTU/S
1368	6.80 6.80 1932.23 668.08	4846.00 586.00 18764.53 539.85 1867.30	1811.04 131543.91 8.88 1889.19 6.01
TOTAL COOLANT FLOW REACTOR POWER CORE FLOW CORE FLOW AREA CORE MASS FLOW RATE	FUEL ELEMENT POWER FUEL ELEMENT OPERATING LIFE NUMBER OF FUEL ELEMENTS NUMBER OF SUPPORT ELEMENTS CHANDER OF SUPPORT ELEMENTS		HEAT PICKUP PER TIE TUBE HEAT PICKUP IN TIE TUBES FRACTIONAL HEAT PICKUP IN NOZZLE HEAT PICKUP IN NOZZLE FRACTIONAL HEAT PICKUP IN REFLECTOR

UP 2637.56 B1 4948.95 19 4948.95 19 5985.42 05 5985.42 05 5985.42 05 5985.42 05 6.07 1.22 1.1.	IEAT PICKUP IN REFLECTOR Practional central shield heat pickup	ି ଭି ଭି	BTU/S
FAT PICKUP 472.561 BIU IMENSIONS 34.126 5885.422 DEG 5885.422 DEG 4948.99 5865.422 DEG 5885.422 DEG 5885.422 DEG 5985.421 DE 31.031 NI 31.031 NS 34.133 NI 31.035 NS 53.058 NI 31.035 NS 53.058 NI 32.056 NS 53.058 NI 33.0556 NS 53.058 NI 33.0556 NS 53.058 NI 33.0556 NS 53.058 NI 33.0556 NS 53.058 NI 33.0555 NS 53.058 NI 33.0555 NS 53.058 NI 33.0555 NS 53.058 NI 33.0555 NS 53.058 NI 33.05556 NS 53.058 NI	CKUP	ñ	BTU/S
IMENSIONS 34.84.99 IMENSIONS 34.84.10 28.65.42 28.65.42 28.65.42 34.13 31.93 34.13 34.13 34.13 34.13 34.13 34.13 34.13 34.13 34.13 34.13 34.13 34.13 34.13 34.13 34.13 14.56 14.66 14.55 14.66 14.55 14.66 14.55 14.66 14.55 14.66 14.55 14.66 14.55 14.66 14.55 14.66 14.55 14.66 14.55 14.66 14.55 14.66 14.55 18.65 14.66 14.55 18.65 172.56 18.65 172.56 18.65 172.56 18.65 172.56 18.65 172.56 18.65 172.56 18.65 172.56 18.65 172.56 18.65 172.56 18.65 172.56 18.65 19.65 172.56 18.65 172.56 18.65 172.56 18.65 19.65 172.56 18.65 172.56 18.65 172.56 18.65 19.65 172.56 18.65 19.65 19.65 19.65 10.85	HIELD HEAT	Š C	BTU/S
IMENSIONS 34.84 IN 34.13 9.67 1.186 31.93 31.93 10.32 31.93 1.4.53 11.18 31.93 1.4.53 11.18 31.93 1.4.53 11.13 31.93 1.4.53 11.18 31.93 1.4.53 11.18 31.93 1.4.53 11.18 31.93 1.4.53 11.18 31.93 1.4.53 11.18 31.93 1.4.53 11.18 31.93 1.4.55 1.8 31.93 1.4.55 1.8 32.93 1.4.55 1.8 33.1.23 1.8 1.8 33.1.23 1.8 1.12 33.1.23 1.8 1.12 33.1.23 1.12 1.8 33.1.23 1.26 1.12 33.1.23 1.12 1.12 33.1.23 1.12 1.12 33.1.23 1.12 1.12 33.1.23 1.12 1.12 33.13 1.12 1.12<	TENSION SHIELU HEAT FICKUT) Ø	DEGR
IMENSIONS IMENSIONS S 4.84 IN S 4.84 IN 28.65 IN 28.65 IN 28.65 IN 28.65 IN 34.15 20 34.15 IN 44.92 IN 44.92 IN 44.92 IN 14.96 39 LB 27.95 LB 27.95 LB 27.95 LB 27.95 LB 28.55 LB 28.55 LB 28.55 LB 28.55 LB 28.55 LB 28.55 LB 28.55 LB 28.55 LB 28.55 LB 5.59 LB 5.50 LB 5.5	EAK FUEL TEMPERATURE	•	DEG R
A 24.84 IN 24.84 IN 24.85 A 28.655 IN 24.45 A 34.13 27.91 IN 27.91 IN 27.91 IN 27.95 B 10 27.91 IN 27.95 B 10 27.95	ACTOR		
28.65 1.25 85 0.07 9.07 1.23 9.07 1.23 9.1.95 1.23 9.1.95 1.4.92 1.23 1.4.92 1.23 1.4.92 1.23 1.4.92 1.23 1.4.92 1.4.92 1.4.92 1.4.93 1.4.92 1.4.93 1.4.92 1.4.93 1.4.92 1.4.93 1.4.93 1.4.93 1.4.93 1.4.93 1.4.93 1.4.93 1.4.93 1.4.94 1.4.93 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.95 1.4.	LENGTH	ġ	N
K S S S S S S S S S S S S S	DIAMETER	ę	Z
K 237.95 IN 337.95 IN 337.95 IN 445.70 IN 455.70 IN 455.70 IN 455.70 IN 456.112 IL 550.25 IL 550.55 I	ELEMENT CHANNEL	0.01	Z
A 27-50 31.95 IN 34.15 IN 34.15 IN 45.70 IN 45.70 IN 45.70 IN 45.70 IN 45.70 IN 44.00 J 41.00	FRACTION OF FUEL	n c	
KSSES (1.1.55) (1.1.55 (1.1.55 (1.1.55)	TO AVERAGE CHAM	4 4	7
A 44.02 IN 44.02 IN 44.0	EFFECT	Ρd	
MSSES MS		<u>,</u> .	
MSSES 14.02 IN 14.05 IN	21	. ^	
MSSES MS	5		
MSSES MS	۲, L	9	Z
KSSES 140 34 LB 147.37 IN 15555 158 1440.34 LB 147.37 IN 1440.34 LB 1440.34 LB 1440.34 LB 1440.34 LB 1440.34 LB 1440.34 LB 1550.29 LB 1550.20 LE 1550.20 L			N
Asses 140.34 [B 147.37 [N 140.34 [B 147.37 [N 140.34 [B 144.34 [B			N
MSSES MSSES 140.34 140.34 140.34 140.34 140.21 150.39 150.39 150.39 150.39 150.39 150.39 150.39 150.39 150.39 150.39 150.39 150.39 150.39 150.39 150.39 150.45 150.39 150.45 172.16 172.76 161.12 16 172.76 16 172.16 16 172.16 16 172.16 16 172.16 16 172.16 16 172.16 16 172.76 16 172.16 16 16 172.16 16 16 172.16 16 16 16 172.16 16 16 172.16 16 16 16 172.16 16 16 172.16 16 16 172.16 16 16 173.16 16 16 16 16 16 16 16 16 16			Z
MSSES 1400.34 739.59 739.59 739.59 739.55 739.55 739.55 739.55 739.55 739.55 738.31 738.95 71.29 661.12 778.55 861.12 778.55 831.35 838.21 348.91 7728.59 831.35 831.35 831.35 831.35 831.35 8328.22 832.83 7328.23 8328.22 83		111	IN3
MSSES 1400.34 739.59 739.59 739.59 739.59 739.59 739.59 739.59 739.59 739.59 739.59 71.29 661.12 778.59 661.12 778.59 661.12 7378.59 661.12 7378.59 661.12 7378.59 661.12 7378.59 661.12 7378.59 661.12 7378.59 661.12 7378.59 661.12 7378.59 661.12 7378.59 661.12 7378.59 7378.59 661.12 7378.59 7378.59 661.12 7378.59 7378.59 7378.59 661.12 7378.59 7378.59 661.12 7378.59 7388.59 7388.50 7388.50 73888.50 73888.50 73888.50 73888.50 738885.50 738885.50 738885.50 738855.50 738855555555555555555555555555555555555			
SS SS SS SS SS SS SS SS SS SS			0
2739.59 2739.59 457.65 156.23 156.23 156.23 126.23 126.23 126.23 126.23 126.23 126.23 126.23 126.23 128.23 128.23 172.76 172.76 172.76 172.76 172.35 172.35 172.55 172.55 172.55 172.55 172.55 172.55 172.	UEL MASS	•	3
Land and a constraint of the c	NASS	•	<u> </u>
LSS 138 138 138 138 138 138 138 138 138 138	ASS	•	9
1367.68 1367.69 1367.69 126.29 126	EXS	•	<u>9</u> <u>-</u>
LSS 108.29 128.29 128.29 108.21 108.21 108.21 108.21 108.21 108.21 108.21 108.21 108.21 172.76 128.91 172.76 128.91 172.76 128.91 172.76 128.91 172.76 128.91 172.76 168.128 172.76 172.776 172.7776 172.776 172.776 172.776 172.776 172.776 1	TRUCTURE MASS		39
SS 126.39 126.39 126.39 126.39 126.39 126.39 126.39 126.39 126.39 126.39 126.39 126.39 126.39 1172.76 172.76 172.76 172.76 172.76 172.76 172.93 16.61,12 172.76 172.85 16.61,12 172.76 172.85 16.61,12 172.76 175.85 16.61,12 172.76 175.85 1		88.	9
I26.39 I26.39 I26.39 I28.95 I28.79 I28.79 I28.79 I28.31 I72.76 I72.76 I72.76 I72.76 I72.76 I72.76 I72.76 I72.76 I72.76 I71.29 I71.29 I71.29 I71.29 I71.29 I71.29 I71.29 I71.29 I71.29 I71.29 I71.29 I71.29 I72.63 I72.76 I72.776 I72.7776 I72.7776 I72.77777777777777777777777777777777777	ENU HARUMARE	•	9
A40.21 38.95 38.95 38.95 38.95 440.21 28.59 440.21 28.59 440.21 28.59 440.21 28.59 440.21 28.59 440.21 28.59 440.21 28.59 68.16 77.29 68.16 77.29 68.16 77.29 75.20 75.20 7	F KETLEULUN MAJO	26.	9
A 95 A 95 A 95 A 95 A 95 A 95 A 96 A 96 A 96 A 91 A 96 A 16 A 98 A 98 A 98 A 98 A 98 A 98 A 98 A 98	ICKE INLET FLENUM MAJO HIDDADT DI ATF MASS		9
NSS 105.04 29.59 28.70 28.70 28.31 5298.31 748.91 772.76 712.26 68.16 68.16 68.16 68.16 68.18 738.82 778.53 68.18 68.18 738.82 738.82 5959.42 8386.22 8386.22	ATEDAL SUPPORT FORMARD MASS	•	8
29.59 28.70 28.70 28.71 28.31 5298.31 772.76 712.76 68.16 68.16 68.16 68.16 68.16 712.85 9.18 5959.42 8386.22 8386.22	-	٠	
ASS 28.76 28.76 5298.31 6.68.68 772.76 772.76 68.16 68.16 68.16 68.16 68.16 68.16 68.16 73.59 59.62 8.654 8.654 8.654 8.654 8.86 8.282 8.86 8.654 8.86 8.654 8.86 8.282 8.86 8.654 8.86 8.654 8.655 8.654 8.655 8.654 8.654 8.654 8.654 8.655 8.654 8.654 8.654 8.555 8.5555 8.5555 8.5555 8.5555 8.5555 8.5555 8.5555 8.5555 8.5555 8.5555 8.55555 8.5555 8.55555 8.55555 8.55555 8.55555555	UPPORT PLATE PLENUM MASS	٠	9
ASS 22.81 52.98.31 348.91 348.91 772.76 661.12 931.35 9.18 778.59 9.18 8.54 8.54 8.54 8.54 8.54 8.36.24 8.36.24 8.36.24 8.36.24 8.36.22	NSTRUMENTATION RING MASS	28.70	9
5298.31 9.00 9.00 7.129 7.129 7.1.29 7.1.29 6.1.15 9.116 9.18 9.18 9.18 9.18 5.54 5.54 5.54 5.54 5.54 5.54 5.54 5.5	ORWARD REFLECTOR HARDWARE MASS	28	99
5298.31 348.91 348.91 772.76 71.29 661.12 661.12 9.18 0.18 0.18 9.18 9.18 554 2426.89 8386.22	UBTOTAL CORE A	282	<u>ב</u>
5298.31 348.51 348.51 771.29 661.12 661.12 9.18 0.18 0.18 0.18 5426.89 5426.89 5359.42 8386.22	LOW BAFFLE MASS		99
5426.91 772.76 71.29 68.16 68.16 68.16 68.16 68.16 68.16 778.59 9.98 9.98 9.98 5426.89 5426.89 8386.22	LOW BAFFLE 1 MASS	5708 11	3 4
71.29 71.29 68.16 68.16 68.16 68.16 68.16 68.16 778.59 9.18 0.18 0.18 5.426.89 5.426.89 5.426.89 8386.22	TOTAL CORE SUBSTSTEM MASS	1780.01) c
S 71.29 ASS 68.16 SS 68.112 SS 68.112 ASS 282.03 MSS 282.03 MASS 0.18 MASS 0.18 MASS 5426.89 MASS 2426.89 MASS 2426.89 2426.89 2426.80 2426.80 2426.80 2426.80 2539.42	PRESSURE VESSEL A MAJO	172.76	8
ASS 68.16 ASS 661.12 ASS 25 ASS 282.03 ASS 282.03 ASS 0.18 ASS 0.18 ASS 0.18 ASS 0.18 ASS 0.18 ASS 0.18 ASS 0.18 ASS 0.18 ASS 0.18	PRESSURE VESSEL D MAJO	71.29	8
MSS 541.12 MSS 591.35 MSS 778.59 MSS 282.03 MSS 0.18 MSS 0.18 MASS 54 MASS 2426.89 8366.22	PRESSURE VESSEL DUME MAJO	68.16	8
MSS 778.59 MSS 778.59 MASS 282.03 MSS 0.18 MASS 0.18 MASS 2426.80 MASS 2426.80 8386.22	40/2/LE/KEAGIUM AUAFIEM MAGS	AA1 12	
ASS 778.59 MASS 282.03 MASS 0.18 MASS 0.18 MASS 0.18 36.54 MASS 2426.80 5959.42 8386.22	TOTAL PRESSURE VESSEE MAJO	0.11.35	
MASS 282.03 98.02 ASS 0.18 MASS 0.18 MASS 2426.88 2426.88 8386.22	BAIN CENIKAL SHIELU MAGA	778.59	8
MASS 5426.02 MASS 6.08 MASS 2426.89 MASS 2426.89 8386.22	-	282.63	8
MSS 0.18 MASS 0.08 MASS 2426.89 5959.42 8386.22		398.02	9
MASS MASS 36.54 MASS 2426.80 5959.42 8386.22	LEAU VERIKAL STIELV 2000 Tan dereuedat suifin Mass	0.18	9
MASS 36.54 MASS 2426.80 5959.42 8386.22	LEAU PERIFICARI ONICLU MAGO		
DIALEU FLATE MASS 2426.80 DIASS 258 % 541ELD 5959.42 SS % 541ELD 8386.22	LEAD PERIPHERAL SHIELU Z MASS) MC	<u>e</u>
55959.42 SS w/o SHIELD SS w/o SHIELD S386.22 8386.22	SHIELU TLAT	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	8
MASS W/O SHIELU SAURTEU SAURTE SAURTEU MASS W/O SHIELU B386.22			<u>a</u>
	MASS W/o	86.2	39

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311.34 6270.77 8697.56
SAFETY RODS-FOR LAUNCH ONLY REACTOR MASS W/o SHIELD-LAUNCH WT. REACTOR MASS W/ SHIELD-LAUNCH WT.

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••• TPA SUMMARY FOR STAGE #1 ••• EXPANDER CYCLE 2 PROPELLANT FEED LEGS CENTRIFUGAL PUMPS TPA SIZE/WT/PERFORMANCE IS USER DEFINED

... PROPELLANT PUMP ...

29037. 936. 2000. 2000. 86.00	e.ee 1646.2e 4333.12 41.27	5483.94 0.709 9.91 122.23
- ₩o " δ " 2	LET PRESSURE LET PRESSURE IC FLOWRATE (WATE (LBM/SE)	PLAND EFFICIENCY PLAND DIAMETER(IN) PLAND DIAMETER(IN) PLAND WT.(LB) ~ EACH PLAND

... FUEL BOOST PUMP ... 4-82

... TURBINE ...

ADMISSION FRACTION EFFICIENCY	PRESSURE RATIO MASS FLOWRATE(LB/SEC) DIAMETER(IN)	55	RESS SPEED C SPEED	TURBINE SPEED(RPM) TURBINE WT(LB) - EACH TURBINE TURBINE ANNULUS AREA(IN2) 11 Over 0	

1.000 0.691 0.691 1.316 5.58 5.58 5.58 5.58 5.2963 1.3598 2.3598 2.3598 2.357 3.2,879 0.38 0.38

... TPA ...

0.00		52.24 9 9 9		31.42	165.90	194.65 .00			1524 54	A BICE	11-0070 11-0071	26.07	•••••••	107.30	8	16.52	0.0	256.20	487.84	11.31		56.81		5959.42	2426.80		N		00		206.77	10 24	99.9	0.00	394.65	0.00	99.99 99	00°.0	86.98	12822.23	
	GEN	CONTITION SYSTEM WITOIAL	AUT GAS MANIFULD WITUTAL Geadany we -tatai	UNP WT EACH	TURBOPUMP WI	TOTAL TURBOPUMP WT.	TOTAL TPA WT.	STAGE \$1 WEIGHTS (POUNDS)	AFT TANK		^	TANK LINES		AFI BAIRI Fremadn skirt		STRUCTURAL WALL	PRESSURE TANK INSULATION	~	OXIDIZER TANK INSULATION	FILE ACOUTSTITON SYSTEM	IZER ACOUISITIC		ENCINE WEIGHTS:	-	I REACTOR INTERNAL SHIELD	1 NOZZLE	1 THRUST MOUNT(S)	1 GIMBAL SYSTEM(S)	2 ENGINE BAY LINE(S)	Z MAIN VALVE(S)	I GIMBAL POWER SUPPLY	(3)MJI3AS MULLINUL ¢	2 HOT GAS MANIFOLD(S)	2 GAS GENERATOR/PREBURNER	2 TPA ASSY(S)	1 GEARBOX(S)	2 TPA START SYSTEM(S)	1 GAS GENERATOR/PREBURNER(S)	NON-NUCLEAR WEIGHT MARGIN	TOTAL ENGINE WEIGHT	

744.28 6.66 6.66 6.66 6.86 8.88 311.34	23327.36	239.76 0.99 0.99 0.99 0.99 0.99 0.99 0.99 0.9	31565.01 22499.47 0.00	•	STAGE #1	100.00 148.06 1 905.21	9.00 906.21	75000.0 75000.0 500.0 200.00 3600.00 3600.00 3600.00
FLIGHT FUEL BOILOFF FLIGHT OXIDIZER BOILOFF EXPENDABLE WEIGHT MISCELLANEOUS WEIGHT USER DEFINED WEIGHT REACTOR SAFETY ROD WT.	TOTAL INERT WEIGHT	INTERSTAGE WEIGHT BURNED FUEL BURNED OXIDIZER FUEL RESIDUAL OXIDIZER AUTOGENOUS PRESSURANT STORED PRESSURANT MISC ON-BOARD FUEL MISC ON-BOARD OXIDIZER	GROSS IGNITION WEIGHT GROSS BURNOUT WEIGHT HOLD TIME FUEL BOILOFF HOLD TIME OX BOILOFF	Nuclear Thermal Vehicle •••• VEHICLE SUMMARY •••	DIMENSIONS, IN.		TOTAL VEH LENGTH	PERFORMANCE PROPELLANT THRUST,VACUUM DELIVERED,LBF PC,PSIA NOZZLE AREA RATIO BURN TIME,SEC ISP,VACUUM DELIVERED,SEC

1

ISP EFFICIENCY 0.978 TOTAL PROP. FLOWRATE, LB/SEC 82.55 CORE PROP. FLOWRATE, LB/SEC 80.89 OUTPUT FOR SINGLE PUMP AT REDUCED THRUST

PRESSURE AND TEMPERATURE SCHEDULES FOR STAGE \$1 FOR ONE PUMP AT REDUCED THRUST LEVEL 69999. EXPANDER CYCLE

TEMPERATURE(DEG R) Jel oxidizer	0.0 (SATURATION TEMP OF PROPELLANT) 0.0	0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,	S Chânges (deg R)
TEMPERATU FUEL	PRESSURANT 550.0	PRUFELLANI 38.5 40.2 72.5 772.5 647.8 544.8 544.8 544.8 560.0 599.2	COMPONENT PRESSURE/TEMPERATURE CHANGES Changes (PSID) TEMPERATURE CHANGES (DEG R)
SIA) OXIDIZER			COMPONENT (PSID)
PRESSURE(PSIA) FUEL		977.0 400.0 1251.1 977.0	CHANGES
PRE	4365.0 38.5 35.0	35.0 112.4 112.4 1569.5 1561.1 1251.1 1251.1 1022.0 977.0	PRESSURE
	MAX STORAGE Vent Ullage	TANK PROPELLANT BOOST PUMP OUTLET MAIN PUMP INLET MAIN VALVE UNLET MAIN VALVE OUTLET MAIN VALVE OUTLET REGEN OUTLET (REFL I REACTOR OUTLET REACTOR ONLET REACTOR ONTLET TURBINE INLET	

0
CHANK C C C C C C C C C C C C C C C C C C C
E CHANGES DERATURE CI DERATURE
MPERATURE (TEMPEr 9.9 32.3 575.3 24.9 24.9 225.4
E:: (PSID) 0:0 0.0 0:0 <t< td=""></t<>
COMPONENT (PSID) 0.0 0.0 0.0 0.0
CHANG
PRESSURE (77.4 9.8 1466.9 1466.9 256.4 4.5 4.5 25.9
ON DEVICE
ACQUISITION BOOST PUMP FEED LINE MAIN VALVE TIE TUBES REGEN JACKET REFLECTOR TURBINE

FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 Expander Cycle

0X I D I Z E R 0.000

> FUEL 66.003

> > TANK OUTFLOW

0.000 0.000 0.000		0.000 0.000	
	1.326 48 580		0 0 . 0
66.003 66.003 48.508 17.496	16.169	48.508 0.000	64.677
	ING 0 CORE	ANT (AVE)	
UBES T_INFLOW	ARRIER COOLING FL OUTLET TO CORE		
MAIN PUMP MAIN VALVE TOTAL TIE TUBES REGEN JACKET IN	u N N N N N N N N N N N N N N N N N N N	URBINE TO CORE UTOGENOUS PRESS TORED PRESSURAN	
I AN I OF	REGEN TURBI	STOR STOR	CORE

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••• TPA SUMMARY FOR STAGE #1 ••• SUMMARY FOR TPA AT THRUST LEVEL FRACTION •.80 EXPANDER CYCLE SINGLE SHAFT TPA CENTRIFUGAL PUMPS

PROPELLANT PUMP :

	28935. 1223. 28999. 22. 82.61 82.61 1569.54 629.46 629.46 629.45 9.91 9.91 122.23	28935. 6773. 15.00 112.39 383.22 0.789 5.20 31.42	44 4 4
··· PROPELLANT PUMP	PUMP SPEED (RPW) SPECIFIC SPEED SUCTION SPECIFIC SPEED NUMBER OF PUMP STAGES NET POS SUCTION PRESSURE (PSIA) ACCELERATION HEAD (PSIA) ACCELERATION HEAD (PSIA) ACCELERATION HEAD (PSIA) ACCELERATION HEAD (PSIA) NUMP OUTLET PRESSURE (PSIA) ACCELERATION HEAD (PSIA) PUMP OUTLET PRESSURE (PSIA) PUMP HORSEPOWER (HP) PUMP DIAMETER (IN) PUMP DIAMETER (IN) PUMP DIAMETER (IN)	FUEL BOOST PUMP PUMP SPEED(RPM) SPECIFIC SPEED SPECIFIC SPEED SUCTION SPECIFIC SPEED SUCTION SPECIFIC SPEED SUCTION SPECIFIC SPEED SUCTION SPECIFIC SPEED SUCTION SPECIFIC SPEED SUCTION SPECIFIC SPEED SPECIFIC SPECIFIC SPEED SPECIFIC SPEED SPECIFIC SPECIFIC SPEED SPECIFIC SPECIFIC SPEED SPECIFIC SPECIFIC SPEC	··· TURBINE ADMISSION FRACTION

	333690.0 3447.5 2700.0 200.0 37.4	8.67 2762.7 1166.6 114.1 221.0 36.7	79.4 79.4 79.5 736.2 736.2 736.6 736.6 736.6 736.6 736.6 736.6 736.6 736.6 74.1 756.6 756.6 756.6 756.6 756.6 757.5 7575	28 88 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0		2011.8 5815.1
8	lbf peiq deg R ibm/s	1 ban 1 ban 1 ban 1 ban 2 c c		****		11 1
2. 52388. 33997. 88. 88. 28935. 32.879 32.879	75000.0 5000.0 1888.0 200.0 200.0 82.5	6.67 5959.4 2426.8 44.9 87.9	175.0 117.9 741.2 741.2 200.0 10.5 10.5 10.5 228.5 228.5 228.6 7500.0	LEGS) 331.8 62.8 0.0 32.2 9.0		4436.0 12822.2
NUMBER OF TURBINE STAGES BLADE ROOT STRESS LIMIT(PSI) ROOT STRESS SPEED LIMIT(RPM) SPECIFIC SPEED TURBINE SPEED(RPM) TURBINE WT(LB) TURBINE ANNULUS AREA(IN2) ENGINE SUMMARY	EXPANDER CYCLE ENABLER II ENABLER II CENTRIFUCAL PUMPS THRUST LEVEL = CHAMBER PRESSURE = CHAMBER PRESSURE = NOZZLE EXIT AREA RATIO = NUMBER OF FEED LEGS = TOTAL PROPELLANT FLOMRATE =	REACTOR COMPOSITE FUEL FUEL SCALING FACTOR REACTOR WEIGHT SHIELD WEIGHT PRESSURE VESSEL LENGTH CORE PROPELLANT MASS FLOW	MOZZLE CONVERGIMG MOZZLE WEIGHT MOZZLE EXTENSION WEIGHT SECOND MOZZLE EXTENSION WEIGHT TOTAL MOZZLE WEIGHT AREA RATIO AREA RATIO AREA RATIO AREA RATIO THROAT DIAMETER EXIT DIAMETER MOZZLE LENGTH DELIVERED VACUUM ISP DELIVERED THRUST	TURBOPUMP ASSEMBLY (TOTAL FOR ALL FEED MAIN PROP. TURBOPUMP WT PROPELLANT BOOST PUMP WT MAIN OX PUMP WEIGHT TPA IGNITION WEIGHT BLEED LINE/VALVE WEIGHT	MISC. HARDWARE WEIGHTS THRUST MOUNT SUPPORT HARDWARE Encine Lines Main Valve Gimbal + Power Supply Margin (2.0%)	TOTAL NONNUCLEAR WEIGHT Total Engine System Total Engine Weight

kg accar kg accar

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kg/s

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4714.5 kg 57.4 N/kg 70.8 N/kg 141.2 kg 5956.3 kg 4855.7 kg	266889.0 N 2758.0 KPa 8908.7 N-sec/kg 2760.0 deg K	1027.0 cm 376.1 cm	
1035.4 Ibm 5.8 Ibf/lbm 7.2 Ibf/lbm 311.3 Ibm 13133.6 Ibm 10706.8 Ibm	69998.8 - 15f 496.8 - 5 - 5 985.8 - 8-6 4868.8 - 4-6 R	404.5 in 148.1 in	
TOTAL ENGINE WEIGHT WITHOUT SHIELD THRUST/WEIGHT RATIO WITH SHIELD THRUST/WEIGHT RATIO WITHOUT SHIELD REACTOR SAFETY ROD WTLAUNCH ONLY TOTAL ENGINE LAUNCH WT. W/O SHIELD	PUMP-OUT CONDITIONS PUMP-OUT THRUST PUMP-OUT CHAMBER PRESSURE PUMP-OUT ISP PUMP-OUT CHAMBER TEMPERATURE	OVERALL DIMENSIONS OVERALL ENGINE LENGTH = OVERALL ENGINE DIAMETER =	••

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THE FOLLOWING WARNINGS OCCUR FOR STAGE 1

TWO PHASE FLUID ENCOUNTERED IN REGEN

CR = 9.110 RECOMMENDED RANGE = 1.5 TO 4

NOZZLE EXIT DIAM = 148.1 STAGE DIAM = 166.6

AXIAL BUCKLING DESIGNS STRUCTURAL WALL THICKNESS Minimum Gauge designs aft tank wall thickness

HOOP STRESS DESIGNS FORWARD TANK WALL THICKNESS AFT TANK ULLAGE INCREASED BY GEOMETRY CONSTRAINT

GAS PHASE ENCOUNTERED IN REGEN JACKET TPA CALCULATIONS TERMINATED BY ACHIEVING DESIRED ACCURACY

END NOMINAL STAGE DESIGN

Table 4-4. Sample Case No. 3

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Input Listing

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PROP WISC WEXPND WEXPND WEXPND WEXPND WEXPND WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE WEXCLE UNTRO CPLINT CPL	Chamber Propeliant flag Kropeliant flag Kropeliant flag Kropeliant flag Cycle type at a Cycle type at a Cycle type at a Cold bleed flag Cold bleed flag Cold bleed flag Turbine inie inie Cold bleed flag Cold bleed fl
	Pump type (decentr. lacking) Bleed cycle solver (ISOLVE=1) Het bleed fraction (ISOLVE=0) Cold bleed fine loss fraction Turbine intel ing valve loss Turbine throttling valve loss Turbine throttling valve loss Thrust fraction Double run flag Thrust fraction Double run solver Engine burn time Margin weight fraction Barrier liquid film length Barrier liquid film length Barrier and angle
	Bleed cycle solver (ae works) Hot bleed fraction (ISOLVE=0) Hot bleed ine loss fraction Cold bleed ine loss fraction Turbine inie in eloss fraction Turbine thrott ing valve loss Thrust fraction Use ox boost pump? Number of identical turbopumps Double run solver Input engine burn time? Margine burn time Margine burn time Margine area ratio Barrier liquid film length Barrier sixing angle
	Hot bied fraction (ISOLVE=1) Hot bied fraction (ISOLVE=0) Cold bied fraction (ISOLVE=0) Hot bied ine loss fraction Turbine throttiing valve loss Turbine throttiing valve loss Turbine throttiing valve loss Use osst pump? Number of identical turbopumps Thrust fraction Double run flag Thrust fraction Barrier liquid film length Engine burn time? Barrier mixing angle Use a nozzie extension?
0.01 0.01	<pre>Cold bleed fraction (ISOLVE=0) Hot bleed fine loss fraction Turbine intet line loss fraction Turbine throttling valve loss Turbine throttling valve loss Use out boost pump? Use of identical turbopumps Number of identical turbopumps Thrust fraction Double run solver Input engine burn time? Engine burn time Barrier liquid film length Engine area ratio Use a nozzle extension?</pre>
0.01 0.01	Hot bied line loss fraction Turbine inlet line loss fraction Turbine inlet line loss fraction Turbine throttling valve loss Use of dentical turbopumps Number of identical turbopumps Number of identical turbopumps Thrust fraction Double run flag Thrust fraction Barrier liquid flam length Engine burn time Barrier mixing angle Engine area catio
	Cold bleed line loss fraction Turbine inlet line loss fraction Turbine throttling valve loss Use or boost pump? Use or identical turbopumps Number of identical turbopumps Thrust fraction Pouble run flag Thrust fraction Barrier liquid flam length Barrier liquid flam length Engine burn time Barrier mixing angle Engine area ratio
2011-0-1-0-1-0-1-0-1-0-1-0-1-0-1-0-0-1-0	Turbine throttling volve focti Use fuel boost pump? Use ox boost pump? Use ox boost pump? Use ox boost pump? Number of identical turbopumps Thrust fraction Pouble run flag Thrust fraction Barrier liquid film length Barrier liquid film length Engine area ratio Use a nozzle extension?
6 1 6 1 7 6 1 7 6 1 7 6 1 7 6 1 7 6 1 7 6 1 7 6 1 7 7 7 6 1 7 7 7 7	We fuel boost pump? Use ox boost pump? Wumber of identical turbopumps Double run flag Thrust fraction Double tun solver Input engine burn time? Engine burn time Barrier liquid film length Barrier mixing angle Engine area ratio
2	Wumber of identical Number of identical Thrust fraction Double run solver Input engine burn tim Engine burn time Barrier liquid fiim Barrier liquid fiim Use a nozzle extensio
	N Double run identical Thrust fraction Double run solver Input engine burn ti Engine burn time Barrier mixing angie Engine area ratio Use a nozzle extensio
2.51 2.51 2.51 2.51 2.51 2.51 2.51 2.51	Thrust fraction Thrust fraction Double run solver Input engine burn ti Margine burn time Barrier mixing angie Engine area ratio Use a nozzle extensio
3690 3690 3690 3690 361 361 351 351 351 351 351 351 351 351 351 35	Double run solver Input engine burn tim Engine burn time Barrier liquid film I Barrier mixing angle Engine area ratio Use a nozzle extensio
8.89 9.92 9.15 9.15 1.18 8.11 1.18 8.11 1.46 8.11 1.46 8.11 1.46	Input engine burn time Engine burn time Margin weight fractio Barrier liquid film I Barrier mixing angle Engine area ratio Use a nozzle extensio
9.9 9.15 9.15 1.12 9.12 1.186 9.13 1.146 0.51 0.51	Rengine burn time Margin weight fractio Barrier liquid film I Barrier mixing angle Engine area ratio Use a nozzle extensio
1	Morgin weight fractio Barrier liquid film Barrier mixing angle Engine area ratio Use a nozzle extensio
0.15 25. 25. 25. 25. 25. 2.51 2.51 2.51 2	Barrier liquid film Barrier mixing angle Engine area ratio Use a nozzle extensio
25. 6. 7.51 7.51 7.51 7.51 8.6 8.6 8.51 7.51	Engine area rati Use a nozzle ext
6. 25. 9.12. 9.1368 3.51 2.51 5.51	
6. 25. 6. 1.12. 6. 1.46 3.51 2.51 5.51	
8	Use a 3-port
50 m	Nozzie extension 1
۳ ۳	Conversation 2 attach area Conversation 2 attach area
80 m	
	GG mixture ratio
	PB GC aperific heats
	8
2 IDEACTD	Chomber tempe
	Reactor model flag (
	Fuel electric (teold, 2=new)
8.1/3 1.2	
	Peak to average
2 FTVBE	Number of holes per element
	Fuel type
52.0 LC	Suppo
	· in and classes from as
0.31 NFF	=
-106.0 UTANY	Heat pickup
22	Enthalpy of cool
	heat pickup in ref
e.eel/3 FCS	Freetional hast sistents -
FALPHA	Fuel scalin

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Uncoated fuel hex flat dimension Scalable fuel element (overrides LC) Channel coating thickness at injet Channel coating thickness at outlet Element external coating thickness Pressure vessel material specific grav. Pressure vessel mat. allowedle stress Beryllium reflector thickness Fraction of max ZrM loading in tie tubes	opellant fraction ig fract ition de isition reseriz ron-seuriz	belight tank heat transfer I tank SOFI thickness Lank SOFI thickness Lank MLI thickness Lank SOFI thickness Lank MLI thickness	Gas wall thermal conductivity see worksheet Nominal nozzie material temp Pressure drop across ox valve Pressure drop across fuel valve Pressure drop across fuel lines Translating nozzie attach area ratio Number of gimballing engines Convergent mazzle attenty Convergent mazzle attenty	real and an art
HEX ZRCI ZRCO ZRCH PVSG PVSG FZCH FZCH FZCH	WTLPRP WTLPRP ULLFFL ULLFFL KACOFL KGASFL KGASFL FICG	FFULCG KNOCPT TSOFTF TSOFTO TSOFTO TML IF TSOFTO TOP TMAX KOOLAZ FCOMOM	CALLIK DIFTBF DIFTBF DIFTBF CPVLVG CPVLVF CP	RHOCLS SIGCLS SIGCLS RHOCK RHOCK RHOCK RHOCK SIGNZE SIGNZ
6.756 5.2.6 5.2.6 6.862 6.862 6.862 5.74 5.74 5.74 5.74 5.74 5.74	6. 62 6. 62 7. 62	8.9 9.9 9.9 9.9 9.9 9.9 9.9 9.9 9.9 9.9	4-97	8.28 9.322 9.322 9.322 9.322 9.322 9.328 9.93 9.93 9.93 9.93 9.71 9.71

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	GG bleed efficiency adjustment Boundary layer efficiency adjustment Divergence efficiency adjustment Barrier cooling efficiency adjustment Weight multiplier: non-conv. tanks Weight multiplier: non-conv. tanks Weight multiplier: pres. tank Weight multiplier: pres. tank Weight multiplier: pres. tank Weight multiplier: forward tank lines Weight multiplier: forward tank lines Weight multiplier: forward tank lines Weight multiplier: forward tank lines Weight multiplier: pres. tank lines Weight multiplier: forward tank lines	Weight multiplier: convergent nozzie Weight multiplier: hot gas ducts Weight multiplier: hot gas ducts Weight multiplier: gimbol Weight multiplier: turbines Weight multiplier: turbines Weight multiplier: pumps Weight multiplier: pumps Weight multiplier: pumps Weight multiplier: pumpatic system Weight multiplier: instrumentation Weight multiplier: gonition system Input turbomachinery characteristics?	diometer icometer trupump diometer furbine stage furbine stage ox turbine st icometer ine diometer e diometer ine diometer ine diometer ind dission fr admission fr nulus ored ne onnulus ored
CHMULT EPIPE HOMMAX NCON NCON NCON NUTHR NTHR INTHR INTHR INTHR INTHR INTHR INTHR INTHR INTHR INTHR INTHR INTHR	ADJGGB ADJBL ADJBLV CXWFHC CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL	CXWICE CXWINZE CXWINZE CXWINZE CXWINE CXWINE CXWINE CXWINST CXWINST CXWINST CXWINST CXWINST CXWINST CXWINST CXWINST CXWINST CXWINST CXWINST CXWINST CXWINST	PDIAFL PDIAFL BPDIAF BPDIAF TSTAGF TSTAGF TSTAGF TDIAN TDIAFL ADMFR ADMFR ADMFR ADMFR ADMFR
		-8-808-8-8	

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	INPTPA	Input turbopump assembly weights? TPA weight
0.0	WSTART	tart system we
	WIGNIT	ion system t
	WHOME	gas manifold we
	WGBOX	Dox we
	WTHTX	neat exchanger weight CC/araburaar meinte
0.0	TUSACG	Mave user-defined ges generator?
	WDBLNZ	d nozzie flowrate
6.99	ETAGGB	ficie
5000.0	TTLINT	
		turbine/de inter temp. Aushine flourate
	WOUSAN USRGGI	- 8
	PUSRTI	bine inlet pressure
10.0	WPUSRG	defined drive fluid
	MIUSRG	user defined drive fluid tank Weight Asseits of Arive fluid
0.01	SALVON CONTRACT	tress of drive
20 00. 0	ROUSHT	ty of drive fluid tank
2.000	IDTRAN	ration cooling criteria
•	QMAXTR	t flux before transp. c
2.0	EPSTRU	area ratio for tr
1.2	EPS1R0	dognatreom greg ratio for trunep. Atobad alatalat thickness
	TGFOI	et land thick
	TGEDS	tor plat
	TGEON	idthe
0.28	RHTRIN	p. cooling insert density
	TRINST	. cooling insert thickness
	TRANKM	nap. cooling
•	NCTNK	Use non-conventiondi tankst A4A Ant Docconter
æ 1		
- (KDONE	ae typ
	KPRESS	aure t
	BUGN	pressure bottles
1.38	ELDOME	tank head eilipse rati
•	ELRP	rant tank head ellipse f
-	KXATAH	
Ī	KXAIFH VVETAU	orientati
īī	KXFTFH	jant tank dome orientati
	KPRPA	llant location
•	NTANKS	er of nor
15+1.0	ELTNKI	-
15+1		tona types tast contasts
	TANCI 1	
	RADLOT	radial
	KALMOD	of dime
15+2.0	RD I M1	\geq
15+8.8	RMAJ1	
5+0.0	ENGAN	gine angular
•	ENGRUT	engine radial location
160.6		stage diameter forward skirt length
9 (FASKTI	kirt lengt
9	MTNKFL	uel tank mat
		•••

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ox tank material	tank	s and skirts material	defined tor enterior	defined tank	defined tank material	defined tank material	tank material conducti	defined bateria: etriction ();	ty factor	2	Pressure tank safety factor	structure solety factor lines and the factor		engine mounting length adjustment	fuel exputsion efficiency flag	pulsion ef	DY ANDISION OFFICIONCY	fuel acquisition device density	vice de	forward shroud cross-sect. area	indut brobelignt temperature.			TUEL BOX TERP Ox Bin terp	ox nominal temp		Lines Tuli at burnout? Discellaneous fuel or borned			uspended tank & w		insulation density	stode critical beading exampt	rry moment	forward tank	Pressure tank insulation density	insulation thickness for pressure tank	non-conv. tank usable volume ratios	between non-c		2	velocity heads lost in fuel lines	In ox II	ox line surface roughness ox line surface roughness	rati	o of specific heats (p	
MTNKOX	I J I VIII		RHO	UON.	SIGNAX	CONDCT	TWING	TMINGS	SFFLTK	SFDATK	SFSTRC	SFLINE	SFTNKI	XIMOUNT	INPEXF	EXPLFL	EXPLOX	DACQFL	DACQOX	AFSSR	IPUTMP	TPMINF	TEMAN	TPMINO	TPNONO	I MAXO	WMI SFL	XOSIMA	TSPCA	TSPCF	TSPCP	KLINEA	CBM	CIMMAX	CLRFP	RHPT IN	TINSUL		ENCSPC	KNEST	KTHCK1		RUFFFL	RUFFOX	GAMICG	TIMPCG	
- 0	11	15+11	0.29 20 afr	28.0E0	•	8.800 23	0.035	0.035 1 25	1.25	1.5	1.25	2.0	15+1.5			0.995	6.995		0.152	0.25	u 0 1 -	0.00	0.07	•••		-	•	9.9	 	e.e	0.0 0.0414	9	9.9	9.9	9.9	6.64	15e1.0	•	2.0	01 	- Call	5.8	0.0001	0.0001 1 EE	. 60	240.0	

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molecular weight of pressurant solid GG min port to throat area ratio solid GG burn rate coefficient solid GG burn rate coefficient solid GG burn rate coefficient solid GG grain burn rate synonent solid GG ulloge pressure multiplier solid GG ulloge pressure multiplier solid GG ulloge pressure multiplier solid GG unloge pressure multiplier solid GG unloge pressure multiplier solid GG unloge pressure multiplier solid GG area bansitivity solid GG area bansitivity solid GG resp density solid GG resp decoy time constant solid GG resp decoy time constant solid GG control valve pressure solid GG control valve pressure solid GG control valve pressure tuel pressure ratio across GG turbine outlet pressure for burn rate cost boost pump fraction of total head rise GG control valve pressure for bed varian succion specific speed variant value of turbine pressure ratio fuel boost pump suction specific speed variant value of turbine pressure ratio furbine velocity ratio furbine velocity ratio furbine velocity ratio furbine velocity ratio for furbine furbine furbine furbine for furbine furbine furbine for furbine furbine for fu	
WTMCG APATGG BTEQGG CBRGG CBRGG CDBSGG CDBSGG CONCG FPUCG FPUCGG	CASME NR RHOBOT RHOOSPH RHOCYL RHOCSPH ROCRAN SYBOT SYCART
4. 9 4. 9 5. 9 5	28.9 6.9 6.16 6.16 6.16 6.16 6.16 75900.0 75900.0 6.298 6.36 6.36 6.298 6.298

4-101

turbine blade ultimate strength turbine blade vield strength	engine bay line density	-	accumulator valve material density	tank insulation conductivity flag	of MLI	SOFI thereal conductivity of SOFI	SOFI thermal conductivity constants		SOFI density	MLI radiation shields per inch	iteration constant on	fuel tank ullare present transfer calce	ox tonk ullose pressure fraction-vent.	stoge action time	stage hold time	MLI environment flag	MLI purge gas pressure at space hold	external tank boundary temperature	Earth infrared heat flux	curun reriectonce (albedo)	everage orbital altitude orbital anota	stage absorbativity	solar heat flux	relative humidity	ambient temperature	wind velocity	space between ox bladder and wall	space between fuel bladder and wall	fuel bonded rolling diaphrage density	ox bladder thickness first fuel bladder thickness	
SU SY SY	ROLINE SVI IN	ROSPVL	ROACVL	COMPLE	CNSOFI	SOFIA	SOF IB			SACCEL	NITHX	FVENTF	FVENTO	FLTTW	HLDTIM	MLIENV		FARID	EARREF	HXALT	ORBANG	SABSOR	SULCON				BLSPFI	DBMDOX	DBNDFL	TBLDFL	
134000.0 120000.0 0.208	30000.0	ю. С		2.59175-9	9.5647E-8	0.4000-00 5.6765-19	0.002	0.00127	40.0	•	, 0 -		259288 8		.	2.06-7	560.0	1.356-4	00.00	250.0		8.28E-4			• • •			0.07	6.625	0.025	

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Output Listing

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Nuclear Thermal Vehicle

OUTPUT FOR MULTIPLE PUMPS AT FULL THRUST LEVEL

PROPELLANTS LIQUID OXYGEN - LIQUID HYDROGEN ASSUMPTIONS: TEMP ENTHALPY 90.18 K -3003. CAL/MOL 20.27 K -2154. CAL/MOL

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ODK VALUES CORRESPOND TO THROAT RADIUS-2.289 IN. C-STAR & CHAMBER TEAP DATA EVALUATED AT ODE PC & ODE MR VAL

KEY INPUTS

75000. (15f) Bleed Cycle	ENABLER II 0.67	cumostie fuel 200. LH2	500. (psid) 4860. (deg R) 35 = 2
			Ĕ
THRUST LEVEL = CYCLE TYPE =	FUEL SCALING FACTOR -	NOZZLE EXIT AREA RATIO - PROPELLANT USED -	CHAMBER PRESSURE = CHAMBER TEMPERATURE = NUMBER OF PROPELLANT FEED LEGS =

TANKAGE SUMMARY FOR STAGE #1 BLEED CYCLE

AFT TANK CONTAINS OXIDIZER ... (USER DEFINED GG) AFT TANK CONTAINS OXIDIZER ... FORWARD TANK CONTAINS FUEL FUEL TANK IS PRESSURIZED WITH COLD GAS TANK MATERIALS (OX -- USER DEF) (FUEL - dlumainum) (PRESSURANT -- USER DEF)

.. DIMENSIONS (INCHES) ...

11.31	60.05 26.07 26.07	8000.00	10.32 0.80	272.49 0.00	744.20	8.88 8.98 9.98	0.00 0.00	2.00 1.25 1.25 2.60 1.25
FUEL ACQUISITION SYSTEM	DAIDILER AUDITION STATEM PRESSURANT CONTROL HARDWARE TANK LINES	BURNED FUEL	FUEL RESIDUAL OXIDIZER RESIDUAL	STORED PRESSURANT HOLD TIME FUEL BOILOFF	FLIGHT FUEL BOILOFF	MISC EXPENDED FUEL MISC EXPENDED OXIDIZER	MISCELLANEOUS WEIGHT INTERSTAGE WEIGHT	INPUT MINIMUM SAFETY FACTORS STRUCTURAL WALL LINES OXIDIZER TANK FUEL TANK PRESSURE TANK
0.00	0.00 4.16 371.29	10.01	0.090 0.030	0.048 0.864		9 . 9 2 9.59		8 8 9 9
PRESSURE TANK CYLINDRICAL LNGTH	AFT LINE DIAMETER Forward Line Diameter AFT skirt i Farth	FORWARD SKIRT LENGTH	STRUCTURAL WALL THICKNESS AFT TANK WALL THICKNESS	FORWARD TAMK WALL THICKNESS PRESSURE TAMK WALL THICKNESS	FORWARD TANK DOME THICKNESS	FUEL TANK MLI THICKNESS FUEL TANK SOFI THICKNESS	DAIDILER TANK MLI THICKNESS DXIDIZER TANK SOFI THICKNESS PRESSURE TANK INSULATION THICK	FUEL TWK HEAT FLUX(BTU/NR IN++2) OX TANK HEAT FLUX(BTU/NR IN++2) FUEL BOILOFF RATE (LB/SEC) DX BOILOFF RATE (LB/SEC)

PROPELLANT SUMMARY FOR STAGE #1 PROPELLANT IS LH2

NOMINAL PROPELLANT BULK DENSITY(LB/IN++3)=

0.0025

	35.0	38.5 0.0025 20.0	40.0 0.0025 25.0	38.5 0.0025 20.0
FUEL	NOMINAL TANK PRESSURE(PSIA)	NOWINAL PROPELLANT TEMP(DEGR) NOWINAL DENSITY(LB/IN++3) NOWINAL VAPOR PRESSURE(PSIA)	MAX PROPELLANT TEMP(DEGR) MAX TEMP DENSITY(LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA)	MIN PROPELLANT TEMP(DEGR) MIN TEMP DENSITY(LB/IN+3) MIN TEMP VAPOR PRESSURE(PSIA)
	• •	•••• •••• ••••	8.8 8.9 9.9 9.9	0.0 0.0 0.0
	NOMINAL TANK PRESSURE(PSIA)	NOMINAL PROPELLANT TEMP(DEGR) NOMINAL DENSITY(LB/IN++3) NOMINAL VAPOR PRESSURE(PSIA)	MAX PROPELLANT TEMP(DEGR) MAX TEMP DENSITY(LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA)	MIN PROPELLANT TEMP(DEGR) MIN TEMP DENSITY(LB/IN++3) MIN TEMP VAPOR PRESSURE(PSIA)

ENGINE SIZE, WEIGHT, & PERFORMANCE SUMMARY FOR STAGE #1 BLEED CYCLE

(USER DEFINED GG)

CONVERGENT NOZZLE IS REGEN COOLED (MILLED SLOT CONSTRUCTION) NOZZLE IS REGEN COOLED (TUBE CONSTRUCTION) PROPELLANT IS LH2

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	878.34 928.88	16446. 16597.	500. 75000. 75000. 3600.00	0.946	6 6 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	8.88 82.55 82.55	4860 - 1630 - 0.00 0.02
··· PERFORMANCE	DELIVERED ISP(VAC).SEC IDEAL ISP(ODE).SEC	DELIVERED CSTAR,FT/SEC IDEAL CSTAR,FT/SEC	CHAMBER PRESSURE,PSIA THRUST PER ENGINE(VAC),LBF TOTAL VAC THRUST,LBF BURN TIME,SEC	OVERALL EFFICIENCY	KINETIC EFFICIENCY BARRIER COOLING EFFICIENCY BOUNDARY LAYER EFFICIENCY DIVERGENCE EFFICIENCY GG BLEED EFFICIENCY	FOR 1 ENGINE OXIDIZER FLOWRATE, LB/SEC FUEL FLOWRATE, LB/SEC TOTAL FLOWRATE, LB/SEC	CORE TEMPERATURE, DEG R BARRIER TEMPERATURE, DEG R ENGINE MIXTURE RATIO FUEL FILM COOLING FRACTION
18.47	ULANCIER . O.D. METER	LE LENGTH	N THICKNESS XTENSION THICKNESS A RATIO	NOZ EXTENSION ATTCH AREA RATIO 9.11 SECOND MOZ FYT ATTACH AREA RATIO 6.00	MIN RAO LENGTH)		

THE FOLLOWING IS THE REGENERATIVE COOLING SUMMARY FOR STAGE #1

THE ENGINE IS A FUEL COOLED CONVENTIONAL EXPANSION NOZZLE

	TGAS 539E+03 618E+03 739E+03 .739E+03 .948E+03
	E 259E+02 176E+02 116E+02 576E+01 324E+01
LIONS	HC .176E-03 .233E-03 .329E-03 .527E-03 .117E-03
MOZZLE SECTIONS CONVERGENT CHAMBER SECTIONS CYLIMDRICAL CHAMBER SECTIONS	HG 829E-04 .122E-03 .192E-03 .349E-03 .349E-03
ZZLE SECTI NVERGENT CI LIMDRICAL	TGW .2276+83 .2686+483 .3326+83 .444+83 .444+83
	TCW 0.222E+03 0.256E+03 0.256E+03 0.318E+03 0.411E+03 0.555E+03
S TO THE 5 8.376 INC S TO THE 5 3.197 INC S TO THE 6 0.000 INC 00039000 (BTU/IN SEC DEGR)	(JEG R) 259E-01 .259E-01 .429E-01 .793E-01 .176E+00 .564E+00
THE 5 THE 5 THE 6 11HE 0 8000 (BTU/I	1466. V .327E+82 .478E+82 .764E+82 .141E+83 .348E+83
0UNDS TO T 0UNDS TO T 0UNDS TO T 0UNDS TO T 3 3 3 5 6 100504711050	.2105400 .215425400 .4315400 .3215400 .2105400
STATIONS 1 THROUGH 6 ARE BOUNDS STATIONS 6 THROUGH 11 ARE BOUNDS STATIONS 11 THROUGH 11 ARE BOUNDS GAS WALL THICKNESS — 0.073 GAS WALL THICKNESS — 0.073 GAS WALL THERMAL CONDUCTIVITY =.0	TB .749E+02 .755E+02 .765E+02 .765E+02 .782E+02 .821E+02
FIONS 1 THROUGH 6 FIONS 6 THROUGH 1 FIONS 11 THROUGH 1 FIONS 11 THROUGH 1 WALL THICKNESS - WALL THERMAL CONDUC WALL MAXIMUM OPERAT	P 1046+04 1046+04 1046+04 1046+04 1046+04
STATIONS STATIONS STATIONS STATIONS GAS WALL GAS WALL GAS WALL	STATION 1 1 2 2 3 5

-02 4975-02 1005401 1635404 -02 2305-02 1975401 1635404 -02 1355-02 3275401 1635404 -03 9015-03 4895401 1635404 -03 4955-03 9115401 1635404				TEMPERATURE(DEG R) IEL OXIDIZER	550.0 0.0 (SATURATION TEMP OF PROPELLANT)	6 6 6 6 6 6
.532E+03 .940E+03 .317E-02 .669E+03 .916E+03 .185E-02 .736E+03 .897E+03 .1185E-02 .775E+03 .887E+03 .825E-03 .799E+03 .884E+03 .610E-03 .815E+03 .881E+03 .471E-03			STAGE #1 GG)	TEMPERATUR FUEL	RANT 550.0 43.2	LANT 38.5 40.0 73.5
.2196481 .1326481 .8676491 .8676498 .6116498 .4556498 .3536498		•2 SEC DEGR) //IN••2 SEC DEGR)	NTURE SCHEDULES FOR STAGE .e (USER DEFINED GG)	PRESSURE(PSIA) FUEL OXIDIZER	PRESSURANT 4365.0 0.0 0.0	PROPELLANT
2 .1005+00 .1795+04 2 .1565+00 .7605+04 2 .2115+00 .4235+03 2 .2355+00 .1895+03 2 .3235+00 .1895+03 2 .3795+00 .1405+03	.1 2.4 0.0 (BTU/SEC)	SIA) ATURE (DEGR) IH (IN) N/SEC) 2 SEC) ANT WLL (DEGR) MALL (DEGR) ANLL (DEGR) SFER COEFF (BTU/IN• RAMSFER COEFF (BTU/IN• FRATURE (DEGR)	PRESSURE AND TEMPERATURE BLEED CYCLE	PRESSURE(FUEL	4365.8 38.5 35.9	35.0 182.0 91.9
6 .103E+04 .912E+02 7 .103E+04 .930E+02 8 .103E+04 .945E+02 9 .103E+04 .945E+02 10 .103E+04 .972E+02 11 .103E+04 .972E+02	DELTA T= 23.5 DELTA P= -6.3 NOZZLE DELTA T = -6.3 NOZZLE DELTA P = -6.3 ADAPTER DELTA P = 2.4 ADAPTER DELTA P = 0.0 TOTAL HEAT TRANSFER = 1786.4 (BTU/SEC)	P - COOLANT PRESSURE (PSIA) TB - COOLANT BULK TEMPERATURE (DEGR) W - COOLANT GULK TEMPERATURE (DEGR) V - COOLANT VELOCITY (IN/SEC) O - HEAT FLUX (BTU/IN-2 SEC) TCW - TEMPERATURE OF COOLANT WALL (DEGR) TCW - TEMPERATURE OF GAS WALL (DEGR) TCM - TEMPERATURE OF GAS WALL (DEGR) TCM - COOLANT SIDE HEAT TRANSFER COEFF (BTU/IN-2 SEC HC - COOLANT SIDE HEAT TRANSFER COEFF (BTU/IN-2 SEC HC - COOLANT SIDE HEAT TRANSFER COEFF (BTU/IN-2 SEC HC - COOLANT SIDE HEAT TRANSFER COEFF (BTU/IN-2 HC - COOLANT SIDE HEAT TRANSFER COE	£		MAX STORAGE VENT ULLAGE	TANK PROPELLANT BOOST PLMP OUTLET MAIN PLMP INLET

MAX STORAGE VENT ULLAGE	4365.8 38.5 35.8	4 165 8.6 8.6 9.6 .0	PRESSURANT	558.8 43.2		558.8 8.8 (SAT	Υ.
TANK PROPELLANT BOOST PUMP OUTLET MAIN PUMP INLET MAIN VALVE INLET MAIN VALVE OUTLET COLD BLEED VALVE IN COLD BLEED VALVE OUT TIE TUBE OUTLET REGED OUTLET (REFL I REACTOR OUTLET REACTOR INLET REACTOR INLET	35.0 162.0 91.9 1327.8 1327.8 1327.8 1327.8 1697.3 1007.3		PROPELLANT	40.6 40.6 73.5 73.5 73.5 73.5 73.5 73.5 73.5 73.5	539.7 4869.8	• • • • • • • • • • • • • • • • • • •	
CHAMBER BLEED MIXER OUTLET TURB THROT VALVE IN TURBINE INLET	500.0 465.0	432.5 397.9	••	4868.8 1488.8	1488.8 1488.8		

4-107

URBINE (OUTLET	

545.7

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	(DEG R)	•										
	PRESSURE/TEMPERATURE CHANGES TEMPERATURE CHANGES	1.5	0.0 3.1 7.5		9.9						854.3	
•	CHANGES (PSID)			••			1			377.9		
	PRESSURE	67.0 10.1	1235.9	35.0	92.9 769 8	32.5	0.40 0.40	8.907	25.0			
	ACQUISITION DEVICE	FEED LINE	MAIN PUMP MAIN VALVE	HOT BLEED LINE	COLD BLEED VALVE	TURBINE INLET LINE	TIE TUBES	REGEN JACKET	REFLECTOR	IURBINE		

FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 BLEED CYCLE

(USER DEFINED GG)

OXIDIZER			0.00				0.000		0000				
					1 887	700.1		1.913		9.08			
FUEL 85 389	42.694	1.586	82.217	21.801		20.139	1.913		0 . 000		00.000	8.656 70 800	570.7
TANK OUTFLOW	MAIN PUMP - EACH	WAIN VALVE MAIN VALVE	TOTAL TIE TUBES	REGEN JACKET INFLOW	BARRIER	REGEN/REFL OUTLET TO CORE	TURBINE - FACH		E TO CORE	STURED PRESSURANT (AVE)	CHAMBER (HOT) BIEED FLOW	NOZZLE OUTFION	

BLEED CYCLE FLOW RATIOS

8.845 8.868 8.937 8.171 8.372	
OVERALL BLEED FLOW FRACTION OVERALL HOT BLEED FRACTION OVERALL COLD BLEED FRACTION HOT SIDE FRACTION OF TOTAL BLEED COLD SIDE FRACTION OF TOTAL BLEED	

REACTOR OPERATING CHARACTERISTICS AND MASSES

	6 LB/SEC	09 IN2	60 LB/IN2			0.00					_	56 BTU/S	58 BTU/S	-		BTU/S			DEG	34 IN	NI 62		9 0	NI 90	.97 IN				26 IN		.66 IN3		79 LB	85 L8							.01 LB			74 LB
		135.		0.80	- ;	878.	4860.	599.0	8764.	 1810.	•	131947.3	1786.	0.01 0.01	1 2002 I	2645.89	6	4948.99	5885	1.4N	5 8 .	9	D	27.	5		23	4	÷.	- 1	10179.		1404.	141		438.	1369.	88. 88	58.	120.	. 65	105.	29.	. 92
REACTOR OPERATING CHARACTERISTICS	TOTAL COOLANT FLOW	REACION POWER	CURE FLOW AREA CORE MASS FLOW RATE	FUEL ELEMENT POWER	8	NUMBER OF FUEL ELEMENTS	RATURE	PRESSURE					1777 M	FRACTIONAL HEAT PICKUP IN REFLECTOR	UFAT BICKID		FRACTIONAL EXTENSION SHIELD HEAT PICKUP	EXTENSION SHIELD HEAT FICKUP DEAV CHANNEL WALL TENDEDATIDE	PEAK FUEL TEMPERATURE	LENGTH	DIAMETER	ELEMENT CH	VOID FRACTION OF FUEL ELEMENIS Deav to average channel factor	EFFECTIVE	PPORT	STRUCTURE OD	REFLECTOR OD		OF BAT	5	PRESSURE VESSEL LENGTH	REACTOR MASSES	SS		CORE PERIPHERY MASS	CATERAL SULTON MASS	REFLECTOR MASS	HOT END HARDWARE MASS	AFT REFLECTOR MASS	CORE INLET PLENUM MASS	SUPPORT PLATE MASS LATERAL SUPPORT FORMARD MASS	REFLECTOR HARDWARE FORWARD WASS	LATE PLENUM MASS	INSTRUMENTATION RING MASS

20.83 LB 5309.86 LB 6.00 lr		3.89 8.35	662.51 LB 934.12 LB 779.52 LB	282.32 LB 399.21 LB 0.18 LB	0.08 LB 36.58 LB 2432.07 IR	284.74 216.7
D REFLEC AL CORE AFFLE MA	FFLE 1 MASS ORE SUBSYSTI E VESSEL A 1 F VESSEL A 1	PRESSURE VESSEL DOME MASS Nozzle/reactor Adapter Mass Total Pressure Vessel Lives	ATH CENTRAL SHIELD MAS	ENTPHERAL SHIELD 2 ENTRAL SHIELD MASS ERIPHERAL SHIELD MA	ERIPHER OTAL SH	REACTOR MASS VO SHIELD REACTOR MASS VO SHIELD SAFETY RODS-FOR LAUNCH ONLY REACTOR MASS VO SHIELD-LAUNCH WT. REACTOR MASS VSHIELD-LAUNCH WT.

• TPA SUMMARY FOR STAGE #1 BLEED CYCLE •

(USER DEFINED GG) 2 PROPELLANT FEED LEGS CENTRIFUGAL PUMPS TPA SIZE/WT/PERFORMANCE IS USER DEFINED

··· PROPELLANT PUMP ...

27995. 633. 633. 2000. 11. 71.88 1327.78 433.07 42.69 42.69 4891.71 4891.71 4891.71 12.31	
PUMP SPEED (RPM) SPECIFIC SPEED SUCTION SPECIFIC SPEED NUMBER OF PUMP STAGES NET POS SUCTION PRESSURE(PSIA) ACCELERATION HEAD(PSIA) PUMP OUTLET PRESSURE(PSIA) VOLUMETRIC FLOWRATE(GPM) MASS FLOWRATE(LOWRATE(GPM) MASS FLOWRATE(LOWRATE(GPM) MASS FLOWRATE(LOWRATE(GPM) PUMP HORSEPOWER(HP) PUMP DIAMETRIC(HP) PUMP DIAMETRIC(HP) PUMP DIAMETRIC(HP) PUMP DIAMETRIC(HP) PUMP DIAMETRIC(HP) PUMP DIAMETRIC(HP) PUMP DIAMETRIC(HP)	UEL BOOST PUMP

... FUE

22444. 4724. 20009. 15.00 101.96 201.07
PUMP SPEED(RPM) SPECIFIC SPEED SUCTION SPECIFIC SPEED NET POS SUCTION PRESSURE(PSIA) OUTLET PRESSURE(PSIA) PUMP HORSEPOWER(HP)

0.792 5.11 30.20	1.886 9.696 19.893 1.91 26.95 2.53286 3.4753 3.4753 3.4753 2.7995 762.59 3.2 8.36 9.36 1.22		e.ee 32.24 39.77 39.77 39.77 59.31 1.59 10.35 10.35 30.16 30.16 30.16 30.16 30.16 30.16 30.16 30.16 30.16 30.16 30.77 32.22 32.25 32.55 32		78.45 1524.54 3621.77 3797.32 26.67	347.51 187.38 8.88 16.52	8.88 256.28 487.84
PUMP EFFICIENCY PUMP DIAMETER(IN) PUMP WT(LB) - EACH PUMP TURBINE	ADMISSION FRACTION EFFICIENCY PRESSURE RATIO PRESSURE RATIO MARS FLOMRATE(LB/SEC) DIAMETER(IN) NAMBER OF TURBINE STAGES BLADE ROOT STRESS LIMIT(PSI) ROOT STRESS SPEED LIMIT(RPM) SPECIFIC SPEED TURBINE SPEED(RPM) TURBINE SPEED(RPM) TURBINE SPEED(RPM) TURBINE SPEED(RPM) TURBINE SPEED(RPM) TURBINE SPEED(RPM) TURBINE SPEED(RPM) TURBINE AMMULUS AREA(IN2) U OVER C INLET MACH MARBER	TPA	TPA START SYSTEM WT. GAS GENERATOR/PREDURNER WTEAC IGNITION SYSTEM WTTOTAL HOT GAS MANIFOLD WTTOTAL GEARBOX WTTOTAL GEARBOX WTTOTAL GEARBOX WTTOTAL COLL BLEED LINE WTEACH TURBINE INLET LINE WTEACH TURBINE THROTTLING VALVE WTEACH COLD BLEED VALVE WTEACH TURBINE THROTTLING VALVE WTEACH TURBINE THROTTLING VALVE WTEACH TURBINE THROTTLING VALVE WTEACH MIXER WTEACH TURBINE THROTTLING VALVE WTEACH	STAGE #1 WEIGHTS (POUNDS)	AFT TANK FORWARD TANK PRESSURE TANK TANK CONSTRUCTION WEIGHT TANK LINES	AFT SKIRT FORWARD SKIRT TANK MOUNT STRUCTURAL WALL	PRESSURE TANK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION

4-111

11.31 8.88 8.89	5972.37 2432.02 741.60 1679.98 151.82 433.95 616.34 206.77	32.24 39.77 8.00 2200.76 9.00 123.98	27.	744.28 9.98 9.98 9.98 9.98 312.32	25905.63	8886 886 886 88 18 . 32 18 . 32 2 72 . 49 89 8 . 89 8 . 89	34188.44 25131.92 8.88 8.88
FUEL ACOUISITION SYSTEM OXIDIZER ACOUISITION SYSTEM PRESSURANT CONTROL HARDWARE	ENGINE WEIGHTS: 1 REACTOR 1 REACTOR INTERNAL SHIELD 1 NOZZLE 1 THRUST MOUNT(S) 1 GIMBAL SYSTEM(S) 2 ENGINE BAY LINE(S) 2 MAIN VALVE(S) 1 SUPPORT HARDWARE 1 GIMBAL POWER SUPPLY	2 IGNITION SYSTEM(S) 2 HOT GAS MANIFOLD(S) 2 GAS GENERATOR/PREBURNER 2 TPA ASSY(S) 1 GEARBOX(S) NON -NUCLEAR WEIGHT MARGIN	E WEIGHT	FLIGHT FUEL BOILOFF FLIGHT OXIDIZER BOILOFF EXPENDABLE WEIGHT USER DEF. TPA DRIVE FLUID MISCELLANEOUS WEIGHT USER DEFINED WEIGHT REACTOR SAFETY ROD WT.	TOTAL INERT WEIGHT	INTERSTACE WEIGHT BURNED FUEL BURNED OXIDIZER FUEL RESIDUAL OXIDIZER RESIDUAL STORED PRESSURANT MISC ON-BOARD FUEL MISC ON-BOARD OXIDIZER	GROSS IGNITION WEIGHT GROSS BURNOUT WEIGHT HOLD TIME FUEL BOILOFF HOLD TIME OX BOILOFF

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Nuclear Thermal Vehicle

**** VEHICLE SUMMARY ****

STAGE #1

..DIMENSIONS, IN..

100.00 145.05	912.83		912.83
STAGE DIAMETER Mozzle exit diameter Mimber of Mozzies	STAGE LENGTH PAYLOAD LENGTH	TOTAL VEH LENGTH	

. . PERFORMANCE . .

LOX/LH2	200.00	878.3	85.39
75000.0	3600.00	0.946	80.56
PROPELLANT THRUST, VACUUM DELIVERED, LBF PC, PSIA	NOZZLE AREA RATIO BURN TIME, SEC	ISP.VACUUM DELIVERED.SEC ISP EFFICIENCY	

OUTPUT FOR SINGLE PUMP AT REDUCED THRUST

PRESSURE AND TEMPERATURE SCHEDULES FOR STAGE #1 FOR ONE PUMP AT REDUCED THRUST LEVEL 60000. BLEED CYCLE

TEMPERATURE(DEG R) UEL OXIDIZER	556.0 9.0 (SATURATION TEMP OF PROPELLANT)	6.9				Manual Ma Manual Manual Man		544.6
TEMPER	PRESSURANT 556.6	PROPELLANT 38.5	40.0 40.0	6.69 6.69	5.50 5.00	672.6		
PRESSURE(PSIA) FUEL OXIDIZER	4 6 6 6 6 6 6 6	•						977.8
PRES	4365.8 38.5 35.6	35.0 8	90.5 1295.4	1227.0	462.7	977.0	977 B	
	MAX STORAGE VENT ULLAGE	TANK PROPELLANT	MAIN PUMP INLET	MAIN VALVE OUTLET	COLD BLEED VALVE OUT	TIE TUBE OUTLET Decen antiet (been v	REFLECTOR OUTLET	REACTOR INLET

4860 0	1498.8 1498.8 585.4	
	4868 . 6 14 96 . 6	
400.0	346.0 318.3 20.0	
	400.0 372.0	
REACTOR CORE	CHAMBER BLEED MIXER OUTLET TURB THROT VALVE IN TURBINE INLET TURBINE OUTLET	

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(DEG R)							
IGES . Re changes	0.0	0.0 0.0					114.6
CE PRESSURE CHANGES (PSID) ICE 0.0 0.0 0.0 0.0	1.5 9.9	29.9 0.0	¢, 6) ¢ ¢	8. 6. 6 6		007.0 25.3	
COMPONENT CHANGES (PSID)							298.3
PRESSURE	65.2 9.8 1284 0	68.4	0.00	26.0	250.0	4.5	D . 67
ACOUISITION DEVICE	FEED LINE	MAIN VALVE Hot bleed line	COLD BLEED LINE COLD BLEED VALVE	TURBINE INLET LINE TURB THEATTI INC VALV	TIE TUBES	REGEN JACKET Reflector	TURBINE

FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 BLEED CYCLE

OXIDIZER 9.999 9.999 9.999 9.999
1.328 2.911 2.911 6.67
FUEL 68.149 68.149 68.149 65.734 65.736 48.296 17.425 17.425 17.425 17.425 17.425 64.387 64.387 64.387 64.387 63.916
TANK OUTFLOW MAIN PUMP MAIN PUMP COLD BLEED FLOW MAIN VALVE MAIN VALVE TOTAL TIE TUBES REGEN JACKET INFLOW NOZZLE BARRIER COOLING REGEN/REFL OUTLET TO CORE MIXER OUTLET TURBINE BLEED NOZZLE BLEED NOZZLE BLEED NOZZLE STORED PRESSURANT (AVE) CORE STORED PRESSURANT (AVE) CORE STORED BLEED FLOW

BLEED CYCLE FLOW RATIOS

0.643 0.667 0.636 0.636
OVERALL BLEED FLOW FRACTION OVERALL HOT BLEED FRACTION OVERALL COLD BLEED FRACTION HOT SIDE FRACTION OF TOTAL BLEED

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••• TPA SUMMARY FOR STAGE \$1 ••• SUMMARY FOR TPA AT THRUST LEVEL FRACTION 9.80 BLEED CYCLE SINGLE SHAFT TPA CENTRIFUGAL PUMPS

... PROPELLANT PUMP ...

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28792. 843. 2 9999 .	70.46	6996 63.12 68.12 7115.81	12.31
PEED PEED Peed State	TION P N HEAD		LETER(IN) (LB)
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... TURBINE ...

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UMAGED OF TINRIME STAGES	RBINE ANNULUS AR

ENGINE SUMMARY

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Γ Ι Ψ		WEIGHT 174 100 100 100 100 100 100 100 100 100 10	FOR ALL FEED LEGS)	1688 151 151 151 151 151 151 124 124 124	
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PUMP-OUT CONDITIONS

69999.9 1bf 266389.9 N 499.8 psia 2753.9 kPa 839.4 sec 8523.1 N-sec/kg 4869.9 deg R 2799.9 deg K	411.0 in 1043.8 cm 148.1 in 376.1 cm		•
PUMP-OUT THRUST PUMP-OUT CHAMBER PRESSURE PUMP-OUT ISP PUMP-OUT CHAMBER TEMPERATURE	OVERALL DIMENSIONS OVERALL ENGINE LENGTH = OVERALL ENGINE DIAMETER =		

THE FOLLOWING WARNINGS OCCUR FOR STAGE 1

TWO PHASE FLUID ENCOUNTERED IN REGEN

- RECOMMENDED RANGE = 1.5 TO 4 CR = 9.106
- STAGE DIAM 100.0 NOZZLE EXIT DIAM = 148.1
- AXIAL BUCKLING DESIGNS STRUCTURAL WALL THICKNESS MINIMUM GAUGE DESIGNS AFT TANK WALL THICKNESS 4-117

HOOP STRESS DESIGNS FORWARD TAME WALL THICKNESS AFT TAME ULLAGE INCREASED BY GEOMETRY CONSTRAINT

GAS PHASE ENCOUNTERED IN REGEN JACKET

END NOMINAL STAGE DESIGN

Table 4-5. Sample Case No. 4

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Input Listing

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		Engine burn time? Engine burn time Barrier mixing angie Barrier mixing angie Engine area ratio Engine area ratio Use a nozzle extension? Use a nozzle extension? Use a nozzle length Nozzle extension 1 attach area ratio Nozzle extension 2 attach area ratio Ge mixture ratio Ge mixture ratio Ge specific heat Ge apecific heat	Freetor model figg (1-enabler1.2-enabler2) Free path figg (1-enabler1.2-enabler2) Free path figg (1-enabler1.2-enabler2) Free per element factor Peak to average channel factor Number of holes per element Free type Support pattern Core length Power in each element (MW per 52 inches) Nozzle flow fraction Hadi pickup per tie tube Enthalpy of coolant entering system Fractional heat pickup in reflector Fractional heat pickup in ext shield fractional heat pickup in cent shield fractional heat pickup in cent shield
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Uncoated fuel her flat dimension Scalable fuel element (overrides LC) Channel coating thickness at inlet Channel coating thickness at outlet Element external coating thickness Pressure vessel mat. allowable stress Pressure vessel mat. allowable stress Beryllium reflector thickness Fraction of max ZrH loading in the tubes Burned propellant wt. Ox ullege fraction fuel ullege fraction Cual scalisition device fuel comk pressurization fuel tonk pressurization fuel tonk pressurization	lium storage pre- tonk final pre- lent tank heat tr ank SOFI thickness k MLI thickness k MLI thickness k MLI thickness t stoge operating a stoge operating cooling method	regen aumary? I thermal conductivity kabet acros across fuel valve a frop across fuel line ting nezzle attach area angle angle areal anaity angle attach area angle areal anaity ilessout material atrength attension 1 density attension 2 density attension 4 density attension 5 density attension 5 density attension 5 density attension 6 density attension 7 density attensity attensity attension 7 density attension 7 density att
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CDESGG Solid GC design complexity multiplier
CDESGG Solid GC design burn rate exponent
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FNUCG Solid GC control fract fract fract for GC
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FPULGG solid GG grain burn rate exponent
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BTEQGG Solid GG burn rate coefficient
CDESGG Solid GG brain complexity multiplier
CSGG Solid GG grain characteristic velocity
EBRGG Solid GG grain burn rate exponent
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FN2OGG Solid GG unlage pressure multiplier
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BTEQGG Solid GG burn rate coefficient
CDESGG Solid GG brain complexity multiplier
CSGG Solid GG grain characteristic velocity
EBRGG Solid GG grain burn rate exponent
FN2OGG Solid GG grain burn rate exponent
FN2OGG Solid GG unlage pressure multiplier
FN2OGG Solid GG unlage pressure fract.
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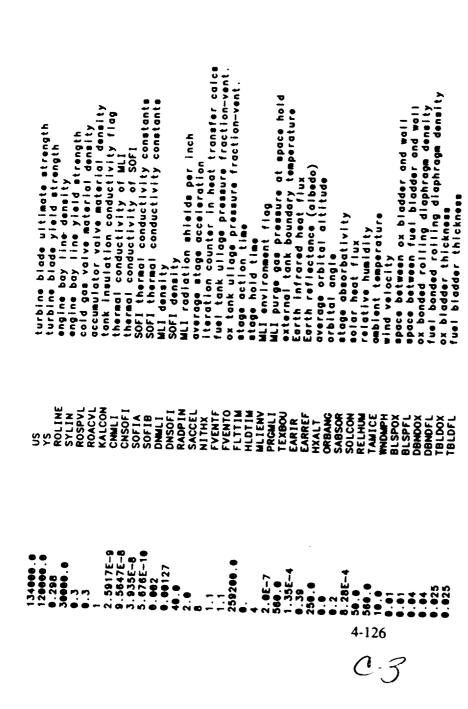
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Nuclear Thermal Vehicle

OUTPUT FOR MULTIPLE PUMPS AT FULL THRUST LEVEL

PROPELLANTS LIQUID OXYGEN - LIQUID HYDROGEN ASSUMPTIONS:

TEMP ENTHALPY LOX 90.18 K -3093. CAL/MOL LH2 20.27 K -2154. CAL/MOL

LHZ 20.2/ K -2154. GAL/MOL

ODK VALUES CORRESPOND TO THROAT RADIUS=2.289 IN. C-STAR & CHAMBER TEMP DATA EVALUATED AT ODE PC & ODE MR VAL

KEY INPUTS

THRUST LEVEL75000. (1bf)CYCLE TYPECAS GENERATOR CYCLEREACTOR TYPECAS GENERATOR CYCLEREACTOR TYPECAS GENERATOR CYCLEFUEL SCALING FACTORCAS GENERATOR CYCLEFUEL TYPECAMPOSITE FUELFUEL TYPE0.67FUEL TYPE0.67FUEL TYPE0.67FUEL TYPE0.67FUEL TYPE0.67FUEL TYPE0.67FUEL TYPE0.67FUEL TYPE0.67FUEL TYPE0.69PODELLANT SED0.200.CHAMBER PRESSURE0.610CHAMBER TEMPERATURE0.600.CHAMBER OF PROPELLANT FEED LEGS2

TANKAGE SUMMARY FOR STAGE 1 GAS GENERATOR CYCLE

AFT TANK CONTAINS OXIDIZER ... FORWARD TANK CONTAINS FUEL AFT TANK CONTAINS OXIDIZER ... FORWARD TANK CONTAINS FUEL FUEL TANK IS PRESSURIZED WITH COLD GAS OXIDIZER TANK IS PRESSURIZED WITH COLD GAS TANK MATERIALS (OX - USER DEF) (FUEL - diuminum) (PRESSURANT - USER DEF)

.. DIMENSIONS (INCHES) ...

78.43 1524.64 3832.31 3894.77 16.52 359.39 197.39 0.00 256.22 407.04 0.00 PRESSURE TANK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION TANK CONSTRUCTION WEIGHT STRUCTURAL WALL AFT SKIRT FORWARD SKIRT TANK MOUNT ... WEIGHTS (POUNDS) ... AFT TANK FORWARD TANK PRESSURE TANK 100.00 915.89 542.08 12.00 12.00 98.49 1.38 1.89 35.34 36.84 36.84 36.83 72.87 8.88 TANK HEAD ELLIPSE RATIO PRESSURE TANK ELLIPSE RATIO AFT TANK HEAD HEIGHT FORWARD TANK HEAD HEIGHT PRESSURE TANK HEAD HEIGHT PRESSURE TANK DIAMETER AFT TANK CYLINDRICAL LENGTH STAGE DIAMETER TOTAL STAGE LENGTH TOTAL TANK LENGTH NOZZLE LENGTH CONVERGENT NOZZLE LENGTH MOUNT LENGTH

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AGE	
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FOR STAGE	
SUMMARY	
ENGINE SIZE, WEIGHT, & PERFORMANCE	
RFOR	Ē
٩	5
HT. &	SAS GENERATOR CYCLE
FIG	ERA
н. Э	ц В
SIZ	NS.
ME	U
NG1	
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PRESSURE TANK CYLIMORICAL LNGTH 0.00
4.16 4.16 374.31
36.01
. 885
0.05 0.50
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PROPELLANT SUMMARY FOR STAGE #1 PROPELLANT COMBINATION IS LOX/LH2

NOMINAL PROPELLANT BULK DENSITY(LB/IN++3)= 0.0025

	35.0	38.5 0.0025 20.0	40.0 0.0025 25.0	38.5 0.0025 20.0
FUEL	NOMINAL TANK PRESSURE(PSIA)	NOMINAL PROPELLANT TEMP(DEGR) NOMINAL DENSITY(LB/IN••3) NOMINAL VAPOR PRESSURE(PSIA)	MAX PROPELLANT TEMP (DEGR) MAX TEMP DENSITY (LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA)	MIN PROPELLANT TEMP (DEGR) MIN TEMP DENSITY(LB/IN++5) MIN TEMP VAPOR PRESSURE(PSIA)
	32.9	160.0 0.0473 12.8	160.0 0.0473 12.8	160.0 0.0473 12.8
OXIDIZER	NOMINAL TANK PRESSURE(PSIA)	NOMINAL PROPELLANT TEMP(DEGR) NOMINAL DENSITY(LB/IM++5) NOMINAL VAPOR PRESSURE(PSIA)	MAX PROPELLANT TEMP(DECR) MAX TEMP DENSITY(LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA)	MIN PROPELLANT TEMP(DEGR) MIN TEMP DENSITY(LB/IN++3) MIN TEMP VAPOR PRESSURE(PSIA)

CONVERGENT MOZZLE IS REGEN COOLED (WILLED SLOT CONSTRUCTION) MOZZLE IS REGEN COOLED (WILLED SLOT CONSTRUCTION) PROPELLANT COMBINATION IS LOX/LH2

:

	848.01 928.88	16444. 16597.	588. 75888. 75888. 3688.88	0.913	0000 0.000 0000 0000 0000 0000 000 0000 0000 0000	3.19 82.55 82.55	4850. 1630. 0.00
··· PERFORMANCE	DELIVERED ISP(VAC).SEC Ideal ISP(ODE).SEC	DELIVERED CSTAR,FT/SEC IDEAL CSTAR,FT/SEC	CHAMBER PRESSURE, PSIA Thrust Per Engine(VAC), LBF Total VAC Thrust, LBF Burn Time, Sec	OVERALL EFFICIENCY	KINETIC EFFICIENCY BARRIER COOLING EFFICIENCY BOUMDARY LAYER EFFICIENCY DIVERGENCE EFFICIENCY GG BLEED EFFICIENCY	FOR 1 ENGINE OXIDIZER FLOWRATE,LB/SEC FUEL FLOWRATE,LB/SEC TOTAL FLOWRATE,LB/SEC	CORE TEMPERATURE, DEG R BARRIER TEMPERATURE, DEG R ENGINE MIXTURE RATIO FUEL FILM COOLING FRACTION
NCHES) 10.47	-	ATTACH DIAM 2 E LENGTH 1 LCTURAL THICK.	NOZZLE EXTENSION THICKNESS Nozzle Extension Thickness Second Nozzle Extension Thickness Nozzle Exit Area Ratio 200.00	NOZ EXTENSION ATTCH AREA RATIO 5.00	SECOND NOZ EXT ATTACH AREA RATI 25.00 Nozzle Length/(Min Rao Length) 1.187 Nozzle Length 228.49 Feed System Mount Length 228.49 Reactor Length 34.84		

5 THE FOLLOWING IS THE REGENERATIVE COOLING SUMMARY FOR STAGE

E . 258E+82 . 176E+82 . 116E+82 . 676E+81 HC .178E-03 .236E-03 .333E-03 .534E-03 MOZZLE SECTIONS CONVERGENT CHAMBER SECTIONS CYLINDRICAL CHAMBER SECTIONS ¥ .226**E+03** .267**E+03** .331**E+03** .442**E+03** TCW 0.221E+03 0.259E+03 0.316E+03 0.409E+03 8.374 INCH LONG N 3.199 INCH LONG C 9.000 INCH LONG C TCW GAS WALL THICKNESS = 0.073 GAS WALL THERMAL CONDUCTIVITY =.00039000 (BTU/IN SEC DEGR) GAS WALL MAXIMUM OPERATING TEMPERATURE= 1460. (DEG R) . 259E-01 . 430E-01 . 795E-01 . 176E+00 σ .331E+02 .484E+02 .774E+02 .143E+03 000 > STATIONS 1 THROUCH 6 ARE BOUNDS TO THE STATIONS 6 THROUCH 11 ARE BOUNDS TO THE STATIONS 11 THROUGH 11 ARE BOUNDS TO THE W .652E+00 .542E+00 .431E+00 .321E+00 THE ENGINE IS A FUEL COOLED CONVENTIONAL EXPANSION NOZZLE .755E+02 .762E+02 .772E+02 .788E+02 8 .104E+04 .104E+04 .104E+04 .104E+04 ٩ STATION - 010 +

TGAS .539E+03 .618E+03 .739E+03 .739E+03

.8295-04 .1225-03 .1955-03 .3495-03

.324E+01 .141E+04 .100E+01 .163E+04 .197E+01 .163E+04 .327E+01 .163E+04 .489E+01 .163E+04 .684E+01 .163E+04 .684E+01 .163E+04					ITION TEMP OF PROPELLANT)	
.1196-02 .5926-02 .2326-02 .1366-02 .1366-02 .9866-03 .6546-03				te(deg r) Oxidizer	550.0 179.5 (SATURATION	8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
.6656+03 .7626-03 .9386+03 .3176-02 .9136+03 .1856-02 .99156+03 .1186-02 .8956+03 .1186-02 .8866+03 .8246-03 .8816+03 .4716-03			ĩ	TEMPERATURE (DEG FUEL OXII	550.0 43.2	38.5 40.0 74.4 74.4 594.8 594.8 530.9 540.3 540.3 540.3
0.560E+03 0.529E+03 0.666E+03 0.733E+03 0.772E+03 0.772E+03 0.772E+03 0.812E+03		IEGR)	SCHEDULES FOR STAGE Sycle (User defined GG)		PRESSURANT	- PROPELLANT
.3536+03 .5666+00 .1816+04 .22066+0 .7706+03 .1336+01 .4286+03 .88596+00 .2746+03 .6136+00 .1916+03 .4566+00 .1426+03 .3546+00		GR) TU/IN++2 SEC DEGR) F (BTU/IN++2 SEC DEGR) R)	EMPERATURE SCHEDUL GENERATOR CYCLE (USER	SSURE(PSIA) OXIDIZER	4365.0 36.2 32.9	: 8, 8, 8, 9, 1 8, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
21064-00 .35 10664-00 .35 15664-00 .78 15664-00 .78 26764-00 .42 27 26764-00 .19 .37964-00 .19	(BTU/SEC)	SSURE (PSIA) K TEMPERATURE (DEGR) MMEL WIDTH (IN) OCITY (IN/SEC) BTU/IN+2 SEC) E OF COOLANT WALL (DEGR) CAT TRANSFER COEFF (BTU/I DE HEAT TRANSFER COEFF (B RATIO (-) CAS TEMPERATURE (DEGR)	PRESSURE AND TEMPE Gas gene	PRESSUR FUEL	4365.0 38.5 35.8	35.0 182.0 132.0 1327.9 1327.9 1807.4 1007.4 1987
84 .8276+02 94 .9176+02 94 .9356+02 94 .9516+02 94 .9656+02 84 .9786+02 94 .9896+02	23.4 -6.5 TA T = 21.0 TA P = -6.4 LTA P = -6.4 LTA P = -0.0	- COOLANT PRESSURE (PSIA) - COOLANT BULK TEMPERATURE (DEGR) - COOLANT BULK TEMPERATURE (DEGR) - COOLANT VELOCITY (IN/SEC) - HEAT FLUX (BTU/IN**2 SEC) - HEAT FLUX (BTU/IN**2 SEC) - TEMPERATURE OF COOLANT WALL (DEGR - TEMPERATURE OF COOLANT WALL (DEGR) - GAS SIDE HEAT TRANSFER COEFF (BTU - COOLANT SIDE HEAT TRANSFER COEFF - LOCAL AREA RATIO (-)	PRES		STORAGE GE	TANK PROPELLANT BOOST PUMP OUTLET MAIN PUMP INLET MAIN VALVE INLET MAIN VALVE OUTLET TIE TUBE OUTLET REGEN OUTLET (REFL I REACTOR INLET REACTOR INLET REACTOR CORE
5 .104E+04 6 .105E+04 7 .105E+04 8 .105E+04 8 .105E+04 10 .105E+04 10 .105E+04	DELTA T= 2: DELTA P=0 NOZZLE DELTA T NOZZLE DELTA P ADAPTER DELTA P ADAPTER DELTA P ADAPTER DELTA P ADAPTER DELTA P	P - COOLANT PRE TB - COOLANT BUL W - COOLANT BUL V - COOLANT VEL V - COOLANT VEL V - COOLANT VEL O - HEAT FLUX (O - HEAT FLUX (C - COOLANT SIDE HC - COOLANT VELO HC - COOLANT SIDE			MAX STO VENT ULLAGE	TANK PROPELLA BOOST PUMP OU MAIN PUMP INL MAIN VALVE IN MAIN VALVE IN MAIN VALVE OUTLET REFLECTOR OUTLET REACTOR INLET REACTOR CORE

1424.6 674.8

384.9

304.9

GG/PREBURNER INLET TURBINE INLET TURBINE OUTLET

304.9 20.0

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4-131

(DEG R)	
VGES JRE CHANGES 9.9 49.9	
PRESSURE/TEMPERATURE CHAI TEMPERATU 1.5 34.4 34.4 520.4 23.4 241.0 7	
COMPONENT 1 (PSID) 0.0 10.1 702.4 0.0	
CHANGES	
PRESSURE 67.0 67.0 10.1 1236.0 250.0 25.0 25.0 25.0	
ACQUISITION DEVICE BOOST PUMP FEED LINE MAIN PUMP MAIN VALVE TIE TUBES REGEN JACKET REFLECTOR GG/PREBURNER TURBINE	
ACC BOCC MAN TICL REC REC SC/ TUR TUR	

FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 GAS GENERATOR BLEED CYCLE

(USER DEFINED CC)

0XIDIZER 3.286	•••		1 641		•
		1.642		3.833 3.833	99.90
FUEL 85.156 47.575	59.350	21.425	19.783 2.191		0.000 79.134
TANK OUTFLOW MAIN PUMP - EACH	MAIN VALVE Total Tie Tubes Decen 10000	BARR	URNER IN	TURBINE - EACH BLEED NOZZLE - EACH TUBBINE TO COAF	4

REACTOR OPERATING CHARACTERISTICS AND MASSES

REACTOR OPERATING CHARACTERISTICSTOTAL COOLANT FLOWREACTOR POWERREACTOR POWERREACTOR POWERREACTOR POWERCORE FLOW AREACORE FLOW AREACORE LEMENT POWERFUEL ELEMENT POWERFUEL ELEMENT POWERFUEL ELEMENT POWERFUEL ELEMENTSFUEL ELEMENTSFUMBER PRESSUREFLAMBER PRESSURECORE INLET TEMPERATURECORE INLET TEMPERATURECORE INLET TEMPERATURECORE INLET TEMPERATUREFLAT PICKUP PER TIE TUBEFLAT PICKUP IN NOZZLEFRACTIONAL HEAT PICKUP IN NOZZLEFRACTIONAL HEAT PICKUP IN NEFLECTORFRACTIONAL HEAT PICKUP IN REFLECTORFRACTIONAL HEAT PICKUP IN REF

P 18199.37 BTU/S 9.945 BTU/S 7579.45 BTU/S 462.21 BTU/S 4948.98 DEG R 5985.42 DEG R	NS 34.84 IN 28.36 IN 0.32 1.20 1.32 1.45 IN 1.45 IN 1.45 IN 1.45 IN 1.46 IN 1.46 IN 1.46 IN 1.47 IN 1.48 IN 1.	6224 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
HEAT PICKUP IN REFLECTOR FRACTIONAL CENTRAL SHIELD HEAT PICKUP CENTRAL SHIELD HEAT PICKUP FRACTIONAL EXTENSION SHIELD HEAT PICKUP EXTENSION SHIELD HEAT PICKUP PEAK CHANNEL WALL TEMPERATURE PEAK FUEL TEMPERATURE	REACTOR DIMENSIONS CORE LEMGTH CORE DIAMETER FUEL ELEMENT CHANNEL DIAMETER VOID FRACTION OF FUEL ELEMENTS PEAK TO AVERAGE CHANNEL FACTOR CORE EFFECTIVE DIAMETER STRUCTURE OD REFLECTOR OF FATH SHIELD FRICKNESS OF BATH SHIELD FRICKNESS OF LEAD SHIELD	FUEL VOLUME REACTOR MASSES FUEL MASS SUPPORT MASS SUPPORT MASS STRUCTURE MASS STRUCTURE MASS STRUCTURE MASS FREFLECTOR MASS FREFLECTOR MASS AFT REFLECTOR MASS AFT REFLECTOR MASS AFT REFLECTOR MASS AFT REFLECTOR MASS AFT REFLECTOR MASS AFT REFLECTOR MASS SUPPORT PLATE PORTMARD MASS SUPPORT PLATE MASS SUPPORT PLATE PORTMARD MASS SUPPORT PLATE MASS SUPPORT PLATE ANSS INSTRUMENTATION RIMG MASS SUPPORT PLATE MASS INSTRUMENTATION RIMG MASS SUPPORT PLATE PLECTOR MASS SUPPORT PLATE SHIELD MASS SUPPORT PLEACTOR ADAPTER MASS SUPPORT SHIELD PLATE MASS SUPPORT PLEACTOR ADAPTER MASS SUPPORT PLATE SHIELD MASS SUPPORT PLATE SHIELD PLATE MASS SUPPORT PLATE SHIELD MASS SUPPORT

SAFETY RODS-FOR LAUNCH ONLY 304.55 REACTOR MASS W/o SHIELD-LAUNCH WT. 6174.16 REACTOR MASS W/ SHIELD-LAUNCH WT. 8564.73

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• • • TPA SUMMARY FOR STAGE #1 • • • GAS GENERATOR CYCLE

2 PROPELLANT FEED LEGS CENTRIFUGAL PUMPS TPA SIZE/WT/PERFORMANCE IS USER DEFINED

	26009. 1674. 20000.		17.98 1.64 4.83 1.58 1.88				
··· OXIDIZER PUMP	PUMP SPEED (RPM) Specific Speed Suction Specific Speed Number of Pland Staces	NET POS SUCTION PRESSURE(PSIA) ACCELERATION HEAD PUMP OUTLET PRESSURE(PSIA) VOLUMETRIC FLOMMATE(COM)	MASS FLOWRATE(LBM/SEC) PUMP HORSEPOWER(HP) PUMP EFFICIENCY PUMP DIAMETER(IN) PUMP WT(LB)				
	26009. 568. 2000.	71.88 0.00 1327.89 4333.53	42.58 5015.29 0.622 12.73 158.04		22443. 4724. 1524. 15.00 16.97 20.11 30.20 30.20		1.000 0.687 15.247 3.83 3.83 2.60 2.768 17 2609 50.157 50.157
PROPELLANT PUMP	PUMP SPEED (RPM) SPECIFIC SPEED SUCTION SPECIFIC SPEED NUMBER OF PUMP STAGES NET DOS SUCTION DECENTION	ACCELERATION HEAD (PSIA) PUMP OUTLET PRESSURE (PSIA) VOLUMETRIC FLOWRATE (PM)	PUMP FLOREPOWER (HP) PUMP EFFICIENCY PUMP DIAMETER(IN) PUMP WT.(LB) - EACH PUMP	··· FUEL BOOST PUMP	PUMP SPEED(RPM) SPECIFIC SPEED SUCTION SPECIFIC SPEED NET POS SUCTION PRESSURE(PSIA) NET POS SUCTION PRESSURE(PSIA) DUMP HORSEPOWER(HP) PUMP EFFICIENCY PUMP DIAMETER(IN) PUMP WT(LB) - EACH PUMP	TURBINE	ADMISSION FRACTION EFFICIENCY PRESSURE RATIO MASS FLOWRATE(LB/SEC) MASS FLOWRATE(LB/SEC) DIAMETR(IN) NUMBER OF TURBINE STAGES BLADE ROOT STRESS LIMIT(RPM) SPECIFIC SPEED TURBINE SPEED(RPM) TURBINE WT(LB) - EACH TURBINE TURBINE ANNULUS AREA(1N2)

0.37 1.18	6.00 19.07 32.24 62.20 6.0 0.00 611.26 611.26 11286.69	78.43 1524.64 3832.31 3894.77 3994.77 27.42	359.39 167.39 16.52		1. 28 90.98	5869.69 2399.57 742.29 1653.65 153.41 153.41 442.39 615.17 296.77	32.24 62.29 28.14 1286.69 0.00	196.41 11687 14	745.82
U OVER C Inlet Mach Number	TPA TPA TPA START SYSTEM WT. TPA START SYSTEM WT. GAS GENERATOR/PREBURNER WTEAC IGNITION SYSTEM WTTOTAL HOT GAS MANIFOLD WTTOTAL HOT GEARBOX WTTOTAL BOOST PUMP WT EACH MAIN TURBOPUMP WT EACH MAIN TURBOPUMP WT. TOTAL TPA WT.	STAGE #1 WEIGHTS (POUNDS) AFT TANK FORMARD TANK PRESSURE TANK TANK CONSTRUCTION WEIGHT TANK LINES	AFT SKIRT Forward Skirt Tank Mount Structural Wall	PRESSURE TAMK INSULATION FUEL TAMK INSULATION OXIDIZER TAMK INSULATION	FUEL ACQUISITION SYSTEM OXIDIZER ACQUISITION SYSTEM PRESSURANT CONTROL MARDWARE	ENCINE WEIGHTS: 1 REACTOR INTERNAL SHIELD 1 REACTOR INTERNAL SHIELD 1 NOZZLE 1 NOZZLE 1 NOUNT(S) 1 CIMBAL SYSTEM(S) 2 ENGINE BAY LINE(S) 2 MAIN VALVE(S) 1 SUPPORT HARDWARE 1 GIMBAL POWER SUPPLY	2 IGNITION SYSTEM(S) 2 HOT GAS MANIFOLD(S) 2 GAS GENERATOR/PREBURNER 2 TPA ASSY(S) 1 GEARBOX(S)	NON-NUCLEAR WEIGHT MARGIN	FUEL B

4 0.0 400.0 400.0 400.0 400.0 400.0 800.0	25230.41	7733.73 266.27 10.22 1.93 273.24 0.00	33515.81 24420.30 0.00 0.00	stage #1		100.00 148.04 15.89 0.00 015.89	LOX/LH2 7500.0 500.00 200.00 3600.00 848.0 848.0 8.913
FLIGHT OXIDIZER BOILOFF EXPENDABLE WEIGHT USER DEF. TPA DRIVE FLUID MISCELLANEOUS WEIGHT USER DEFINED WEIGHT REACTOR SAFETY ROD WT.	TOTAL INERT WEIGHT	INTERSTAGE WEIGHT BURNED FUEL BURNED OXIDIZER FUEL RESIDUAL OXIDIZER RESIDUAL STORED PRESSURANT MISC ON-BOARD FUEL MISC ON-BOARD OXIDIZER	GROSS IGNITION WEIGHT GROSS BURNOUT WEIGHT HOLD TIME FUEL BOILOFF HOLD TIME OX BOILOFF	Nuclear Thermal Vehicle **** VEHICLE SUMMARY •	DIMENSIONS, IN	STAGE DIAMETER NOZZLE EXIT DIAMETER NUMBER OF NOZZLES STAGE LENGTH PAYLOAD LENGTH TOTAL VEH LENGTH	PERFORMANCE PROPELLANT THRUST,VACUUM DELIVERED,LBF PC,PSIA NOZZLE AREA RATIO BURN TIME,SEC ISP.VACUUM DELIVERED,SEC ISP EFFICIENCY

TOTAL PROP. FLOWRATE, LB/SEC 86.44 CORE PROP. FLOWRATE, LB/SEC 79.13

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OUTPUT FOR SINCLE PUMP AT REDUCED THRUST

PRESSURE AND TEMPERATURE SCHEDULES FOR STAGE #1 For one pump at reduced thrust level 60000. Gas generator cycle

R) DIZER	550.0 179.3 (SATURATION TEMP OF PROPELLANT)	• • ?	
TEMPERATURE (DEG R) UEL OXIDIZER	559		مە
MPERATU		4 0 4 5 6 5 6 5 7 6 7 8	1424.6 674.8
TE	550.0		
PRESSURE (PSIA) FUEL OXIDIZER	4365.0 35.9 32.6	32.6 32.6 1111	365.9
sure (PS I	•	977.1 400.0	3 64 .9 20.0
PRES: FUEL	4365. 965. 96.5	35.0 199.5 1225.5 1227.1 1977.1 1977.1	453.4
	MAX STORAGE VENT ULLAGE	TANK PROPELLANT BOOST PUMP OUTLET MAIN PUMP OUTLET MAIN VALVE INLET MAIN VALVE OUTLET TIE TUBE OUTLET REGEN OUTLET REACTOR INLET REACTOR INLET REACTOR CORE	GG/PREBURNER INLET TURBINE INLET TURBINE OUTLET

COMPONENT PRESSURE/TEMPERATURE CHANGES ... TEMPERATURE CHANGES (DEG R)

•••

1.5 30.2 0.0 0.0 25.2 25.2 25.2 259.5

> 811.2 6.6

200 - 1 200 - 2 200 - 1 200 -

ACQUISTION DEVICE BOOST PUMP FEED LINE MAIN PUMP MAIN VALVE TIE TUBES REGEN JACKET REFLECTOR GG/PREBURNER TURBINE

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PRESSURE CHANGES

749.9

61.0

4.2 25.0 148.5

284.9

FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 GAS GENERATOR BLEED CYCLE

OXIDIZER

FUEL

2.337 2.337 0.000	2.337	000
	5.453 5.453 5.453	0.07
67.876 67.876 64.769 64.769 47.585 17.175	15.862 3.116	e. 666 63. 447
IFLOW COOLING	TO CORE	(AVE)
OW TUBES ET IN RIER	REFL OUTLET BURNER INLET E NOZZLE E TO COPF	RESSURANT
	REGEN/RE GG/PREBU TURBINE BLEED NO	STORED PRI

••• TPA SUMMARY FOR STAGE #1 ••• SUMMARY FOR TPA AT THRUST LEVEL FRACTION 0.80 Gas generator cycle Single Shaft tpa Centrifucal PUMPS

... PROPELLANT PUMP ...

27768. 813. 813. 2999. 1. 79.48 8.99 62.83 62.88 67.88 7181.91 12.73 158.94	28799. 7859. 2999.
PUMP SPEED (RPM) SPECIFIC SPEED SUCTION SPECIFIC SPEED NUMBER OF PUMP STAGES NET POS SUCTION PRESSURE(PSIA) ACCELERATION HEAD(PSIA) ACCELERATION HEAD(PSIA) PUMP OUTLET PRESSURE(PSIA) VOLUMETRIC FLOWRATE(CPM) MASS FLOWRATE(LBW/SEC) PUMP DIAMETER(IN) PUMP DIAMETER(IN) PUMP DIAMETER(IN)	FUEL BOOST PUMP PUMP SPEED(RPM) SPECIFIC SPEED SUCTION SPECIFIC SPEED NET POS SUCTION DESCURPTION

:

28796. 7856. 26666. 15.66 160.25 332.25 6.753 5.11 30.26	
PUMP SPEED (RPM) SPECIFIC SPEED SUCTION SPECIFIC SPEED NET POS SUCTION PRESSURE (PSIA) OUTLET PRESSURE (PSIA) PUMP HORSEDOWER (HP) PUMP HORSEDOWER (HP) PUMP DIAMETER (IN) PUMP DIAMETER (IN) PUMP WIT (LB)	

... TURBINE ...

ADMISSION FRACTION EFFICIENCY PRESSURE RATIO

1.000 0.700 15.247

... OXIDIZER PUMP ...

27768.	834. 2000	10.00	8.88 365.93	12.85 2.34	4.54 0.551	1.54 1.88
PUMP SPEED (RPM)	SPECIFI	NCT CEL PUMP STAGES NET POS SUCTION PRESSURE (PSIA)		MASS FLOWRATE (LBM/SEC) PUMP HORSEPOWER/LDM		WT (LB

	333566.9 A 3447.5 k 2766.9 d 2766.9 d 2766.9 d 4 0 1 4 0 1 1 4 0 1 1 4 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0.67 2662.0 k 1084.2 k 113.4 c 221.9 c 35.9 k	79.7 79.7 79.7 79.5 79.5 70.5 70.5 70.5 70.5 70.5 70.5 70.5 70	554.4 27.4 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 28.2 28.2	754.5 279.6 299.6 137.3 48.3
	ibf psia deg R ibm/s				
5.45 20.50 2. 53315. 2768. 21. 2768. 453.22 50.157	75000.0 500.0 4860.0 280.0 83.4	6.67 5869.6 2399.6 44.6 79.1	175.7 175.7 118.3 448.2 268.2 148.6 148.6 148.6 148.6 7560.3	LEGS) 1222.5 60.4 3.8 32.2 22.2 20.1 62.2 62.2	1663.6 615.2 153.4 153.4 192.3 196.4
MASS FLOWRATE(LB/SEC) DIAMETER(IN) NUMBER OF TURBINE STAGES NUMBER OF TURBINE STAGES BLADE ROOT STRESS LIMIT(PSI) ROOT STRESS SPEED LIMIT(RPM) SPECIFIC SPEED TURBINE SPEED(RPM) TURBINE WT(LB) TURBINE WT(LB) TURBINE WWULUS AREA(IM2) ENGINE SUMMARY	GAS GENERATOR CYCLE ENBLER 1 ENBLER 1 CENTRIFUGAL PUMPS THRUST LEVEL - CHAMBER PRESSURE - CHAMBER TEMPERATURE - MOZZLE EXIT AREA RATIO - NUMBER OF FEED LEGS - TOTAL PROPELLANT FLOWRATE -	REACTOR COMPOSITE FUEL FUEL SCALING FACTOR FUEL SCALING FACTOR REACTOR WEIGHT SHIELD WEIGHT PRESSURE VESSEL DIA. PRESSURE VESSEL LENGTH CORE PROPELLANT MASS FLOW	NOZZLE CONVERGING MOZZLE WEIGHT CONVERGING MOZZLE WEIGHT NOZZLE EXTENSION WEIGHT SECOND NOZZLE EXTENSION WEIGHT TOTAL MOZZLE WEIGHT AREA RATIO THROAT DIAMETER EXIT DIAMETER EXIT DIAMETER NOZZLE LENGTH DELIVERED VACUUM ISP DELIVERED THRUST	TURBOPUMP ASSEMBLY (TOTAL FOR ALL FEED MAIN PROP. TURBOPUMP WT PROPELLANT BOOST PUMP WT MAIN OX PUMP WEIGHT TPA IGNITION WEIGHT BLEED LINE/VALVE WEIGHT GAS GENERATOR HOT GAS MANIFOLD	MISC. HARDWARE WEIGHTS THRUST MOUNT Support Hardware Engine Lines Main Valve Gimbal + Power Supply Margin (2.0%)

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TOTAL NONNUCLEAR WEIGHT	5427.2 Ibm	l ba	2461.3	ka
TOTAL ENGINE SYSTEM TOTAL ENGINE WEIGHT TOTAL ENGINE WEIGHT WITHOUT SHIELD	13687.3 11296.8		6207.4 5123.2	
IHRUST/WEIGHT RATIO WITH SHIELD THRUST/WEIGHT RATIO WITHOUT SHIFID	50 K	1 bf/1bm	53.7	N/Kg
REACTOR SAFETY ROD WTLAUNCH ONLY	384.6		138.1	N/ 40
TOTAL ENGINE LAUNCH WT. W/O SHIELD	13891.9		6345.5 5261.4	0 0 0
PLUMP-OUT COMDITIONS PLUMP-OUT THRUST PLUMP-OUT CHANNBER PRESSURE PLUMP-OUT CHANNBER PRESSURE	6999. 9 499. 9 854. 5	- bf - bf - c	266880.0 2758.0 8374.5	k Pa N Pa N Pa N Pa
FUNIT-OUT CHAMBER TEMPERATURE	4860.0	deg R	2790.0	deg K
OVERALL DIMENSIONS OVERALL ENGINE LENGTH = OVERALL ENGINE DIAMETER =	414.0	<u> </u>	1051.5 115 - 5	
		-	0.0/0	80
- • • • • • • • •	¥		•••••••••••••••••••••••••••••••••••••••	•••••••••••••••••••••••••••••••••••••••

4-140

THE FOLLOWING WARNINGS OCCUR FOR STAGE 1

 CR = 9.121
 RECOMMENDED RANGE = 1.5 TO 4

 MOZZLE EXIT DIAM = 148.0
 STAGE DIAM = 100.0

AXIAL BUCKLING DESIGNS STRUCTURAL WALL THICKNESS MINIMUM GAUGE DESIGNS AFT TANK WALL THICKNESS

HOOP STRESS DESIGNS FORWARD TANK WALL THICKNESS AFT TANK ULLAGE INCREASED BY GEOMETRY CONSTRAINT

GAS PHASE ENCOUNTERED IN REGEN JACKET

END NOMINAL STAGE DESIGN

..... r Table 4-6. Sample Case No. 5

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Input Listing

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		-	Promiser Pressure (psid)			Expendable store	Cycle type (1-00 J-Funnal	Pumb configuration			ine inte	raction ~	bleed fraction	Hot bleed line loss fraction	eed line loss	Turbine injet line loss fraction	alve loss		ar of idention					Engine burn time		Barrier liquid film length	Easter Mixing angle Easter reft		Use d 3-portion nozzia?	1 attach area	2 attach	-	Use plug nozzie?	Mozzie length ratio	ratio	Ge marific becific heats	GG molecular weight	Chamber temperature	Reactor model flag (leenabier1 2-enabler2)	Flow path flag (leoid, 2=new)	Spacing between beton	chanal fact	holes		Support pattern		Nozzie flow frontion	c kup	Enthalpy of coolant antaring average	heat pickup in ref	heat pickup in	in cent
Thermal Vabicia	FVAC	PC	IPROP	WPAYLD	WWI SC	MEXPND	KCYCLE	JCNFIG	IPTYPE	ISOLVE	TURBTIN	FRACHB	FRACCB			CPVIVT	JBPFL	JBPOX	NTPA	IDBLRUN	FFRAC	ITRATE	11COOUT		XLFI	ALFMIX	EPS	KEXNOZ	NOZTYP	EPSAT T	XLN	KMOZ	IPLUG	NATHLK Officer	CAMCPB	CPGGPB	WICCPB	TCHAMBER	CONFIG	200	sc	PAC	HOLES	C I T P E			NFF	011	HTANK	55C	FCS	FAIDHA
5		1666.)))	D (• -	• •	- 6				•	•.•	•	- (•	N -	- 6			3666.6		•	• 10	• • •		- 6 13	150.	12.0	~ •	1.1868	0.0	•	J.55	5580	2	2	0 .11	e.1/3	10 .	(1 - C	0	52.0	1.2	CZ.8		6.012	0.00031	0.00173	0.67

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Uncoated fuel hex flat dimension Scalable fuel element (overrides LC) Channel coating thickness at injet Channel coating thickness at outlet Element external coating thickness Pressure vessel material specific grav. Pressure vessel material specific grav. Pressure vessel material specific grav. Pressure vessel material specific grav. Beryllium reflector thickness Fraction of max ZrM leading in the tubes Burned propellant wt.	wel ullage fraction wel ullage fraction wel acquisition dev x tank preserriza yee of non-autoge yee of non-autoge id helium storage old helium storage old helium storage id tank MLI thick w tank W ta		
HEX LEL ZRCI ZRCH PVSG PVSG FZRH WTLPRP	ULLFFU ULLFFL VACQOX KACQOX KACQOX KACQOX KACQOX KACQOX KACQOX FPULCG TMULIF TMULIF TMU TMU TMU	TCONNOL TCONNOL IRPRNT GMAING GMAING CPVLVG	RHCSTR SIGCHM SIGCLS SIGCLS SIGCLS RHOCLS RHOVLV RHOVLV RHOVLV SIGNZE SIGNZE SIGNZE SIGNZZ SIGNZ
6.756 6.756 6.802 6.802 7.74 5.906 5.74 5.806 5.74 5.80 5.74 5.80 5.74 5.80 5.74 5.80 5.74 5.74 5.74 5.74 5.74 5.75 5.75 5.75		4-144	6.55990 25990 25990 25990 25990 27990 6.28 6.1 6.9 6.9 6.9 71 6.9 71 6.9

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Cooling channel multiplier Regen channel surface roughnes Max depth to width ratio Mumber of regen segments in conv. sec. Number of regen segments in nozzie surface area multiplier Cooling channel width Cooling channel width Input regen delta T and P7 Input regen total delta P Fuel MPSP Ox MPSP		the sultiplier hot gas ducts the sultiplier gimbal multiplier turbines thuttiplier turbines thuttiplier pumps the sultiplier pumps the sultiplier pre- the sultiplier instrum- tautiplier instrum- ter tof due pump stages	Tuel boost pump diameter ox boost pump diameter number of turbine stages number of turbine stages number of ox turbine stages turbine diameter turbine diameter ox turbine diameter ox turbine admission fraction fuel turbine admission fraction turbine annulus area ox turbine annulus area
CHMULT EPIPE Hommax Mcon NV2L Samult Samult Uthr Indpdt Deltaf Deltaf	ADJGGB ADJDIV ADJMTD CXWTNK CXWFLT CXWFLT CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL	CXMCLM CXWTMA CXWTMA CXWTMA CXWTMA CXWTMA CXWTMA CXWTMAS CXWTMAS CXWTGA CXWTGA CXWTGA FSTAGF FSTAGF FSTAGF FSTAGF FSTAGF FSTAGF FSTAGF FSTAGF	BPDIAD TSTGES TSTGES TSTGES TSTGES TSTGES TDIAM TDIAM TDIAN ADMFRF ADMFRF ADMFRF AMARFEA AMARFEA AMARFEA
- 9 10 10 1 - 9 9 9 9 - 1 - 1 9 9 9 9 - 9 9 9 - 1 - 1 9 9 9 - 1 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	0 	49477.00007 000 49477.00007 000	• • • • • • • • • • • • • • • • • • •

restant res	turbine/GG inlet temp. turbine flowrate Isp of GG bleed turbine inlet preseure turbine inlet preseure user defined drive fluid weight user defined drive fluid tank weight visid atress of drive fluid tank material transpiration cooling criterie mox heat flux before transp. downstreem area ratio for transp. etched platelet thickness platelet land thickness separator platelet thickness flow possege widths	Ing insert thick ing insert thick ing insert to du entional tanke? cook bead ellips cank boas orienta tank dome orienta tank dome orienta tank dome orienta tank dome orienta tank dome orienta into ori
INPTPA TPANT WSTANT WSTANT WSTANT WSCANT WSCAN USCAPB IUSRGG WDBLMZ ETAGGB	TUSRGG WDUSRG USRTI PUSRG PUSRG WDUSRG WDUSRG ROUSRT ROUSRG ROUSC ROUSRG ROUSC RO	TRINKI TRANKA NCTWK NCCOA NCTWK NCCOA NCTWK KCATAH KCATA KCATAH KCATA KCATA KCATAH KCATA KCATAH KCATAH KCATAH KCAT
		4-146

onk moterial eure tank materia cture and skirts m materials (non-co defined tank mat defined tank mat defined tank mate defined tank mate defined tank mate	user defined material structural min gauge fuel tank sofety factor ox tank sofety factor pressure tank sofety factor structure sofety factor lines sofety factor cank sofety factor nonk sofety factor fuel expulsion efficiency flag ox expulsion efficiency flag	rue: exputation efficiency ox exputation efficiency fuel acquisition device denaity ox acquisition device denaity ferward ahroud cross-sect. area aft ahroud cross-sect. area input propellant temperatures? fuel min temp fuel min temp ox min temp ox mominal temp ox mominal temp ox mominal temp ox mominal temp	miscellaneous fuel on-board miscellaneous ox on-board number of temp schedule iterations space between of auspended tank & wall space between for auspended tank & wall space between for auspended tank & wall pressure tank insulation density propellant feed line flog atage critical bending moment max corry moment space between oft and forward tank space between oft and forward tank	Insulation thickness for pressure tonk mon-conv. tank usable volume ratios min clearance between non-conv tanks min clearance between non-conv tanks non-conv model engine nesting mode non-conv madel engine nesting mode velocity heads lost in fuel lines velocity heads lost in ox lines fuel line surface roughness ox line surface roughness pressurant ratio of specific heats (isen) pressurant ratio of specific heats (poly) time at which polytropic ratio is 1 1
MTNKOX MATPT MATPT MATSTR MATSTR MATSTR MATSTR MATSTR SIGMAX SPHEAT CONDCT TMING	SFELTX SFORTK SFORTK SFSTRC SFSTRC SFLINE SFLINE SFLINE SFLINE SFLINE SFLINE SFLINE SFLINE SFLINE SFLINE SFLINE SFLINE	EXPLOX EXPLOX DACOFL DACOFL AESSR AESSR AESSR IPUTMP IPUTMP TPMAXF TPMAXF TPMAXF TPMAXF TPMAXF	RISFL MISST NTMPIT TSPCA TSPCA TSPCA TSPCA TSPCA TSPCA TSPCA TSPCA TSPCA TSPCA CLAAF CLAAF CLAAF CLAAF	TING TING CLATNK CLATNK KNEST KNEST KNEST CLKFCT OXKFCT RUFFFL RUFFFL TINPCG GAMPCG
1 15:11 15:11 0:29 0:29 0:12360 0:035 0:035 0:035 0:055		••••••••••••••••••••••••••••••••••••••	• • • • • • • • • • • • • • • • • • •	21.00 21.00 21.00 21.00 00.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 20.000 20.000 20.000 20.00000000

ecular weight of pressuid GG min port to throad id GG min port to throad id GG burn rate coeffic id GG design complexity id GG grain characteris id GG grain burn rate e id GG combustion produc	bustion product specific medication perature sensitivity of GG pressure id GG qrain density id GG combustion temperature id GG temp decay time constant id GG ref temp for burn rate coef. id GG molecular weight of comb. prod ist pump fraction of total head rise.	niroi valve pressure drop multiplicature ratio across GG essure ratio across GG ne outlet pressure (for GG) negine assignments ingine assignments permo suction specific speed pound suction specific speed boost pump suction specific speed	ty ty gth multipli- iexity mu	molecular wt. of pres. gas for TPA start number of engine restarts TPA start bottle moterial density TPA start cylinder material density TPA start cartridge grain density TPA start cartridge grain density TPA start cartridge yield strength TPA start cylinder yield strength TPA start cylinder yield strength TPA start cylinder yield strength TPA start sphere yield strength TPA start bottle gas temp. TPA start bottle gas temp.
WTMCG APATGG APATGG BTEQGG CBRGG CBRGG CSEGG CSEGG CSEGG CNSGG FH20GG FH20GG	CAMGG PIPKGG SIGGG SIGGG TCCYGG NTREFGG BPFRGG BPFRGL	CVMLTF PBPRO PBPRO P1URBO F1URBO KPUMP TULLFL TULLFL SSSFL SSSBPF SSSBPF	TURBPE UOVERC EPSCGB CCCR CCCR SYINGC SYINGC SYUNCT ISTART CVACUM	CASIM RHOBOT RHOBOT RHOBOT RHOCYL RHOCYL RHOCYL SYCART SYC
4.0 3.6 0.55 1.25 3.65 3.64 0.264 0.264 1.1	1.27 0.0036 0.0013 0.0013 100.0 100.0 100.0 100.0	800 800 800 800 800 800 800 800 800 800		000 00 00 00 00 00 00 00 00 00 00 00 00

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turbine blade ultimate strength turbine blade yield strength engine boy line density engine boy line yield strength cold gas valve material density accumulator valve material density	tank insulation conductivity flag thermal conductivity of MLI thermal conductivity of SOFI SOFI thermal conductivity constants SOFI thermal conductivity constants MLI density SOFI density MLI radiation shields per inch average stage acceleration	iteration counter in heat transfer calca fuel tank uilage pressure fraction-vent. ox tank uilage pressure fraction-vent. stage action time stage action time MLI environment flag MLI purge gas pressure at space hold MLI purge gas pressure at space hold external tank boundary temperature Earth infrared heat flux Earth reflectance (albedo) average orbital altitude orbital angle	solar heat flux relative humidity ambient temperature wind velocity space between ox bladder and wall space between fuel bladder and wall ox bonded rolling diaphragm density fuel bladder thickness fuel bladder thickness
US YS ROLINE SYLIN ROSPYL ROACVL	KALCON CNMLI CNMLI SOFIA SOFIA SOFIA DNMLI DNMLI DNSOFI SADPIN SACCEL	RI HAX FLETTIM FLETTIM HLDTIM MLI ENV PRGMLI TEXBOU EARIR FAREF ABSOR SABSOR	SOLCON RELHUM TAMICE WNDMPH BLSPOX BLSPOX BBNDOX DBNDOX DBNDOX TBLDOX TBLDY
134999.0 1286999.0 36298.6 3699.6 3.3 6.3 6.3	1 2.5917 2.5517 3.93557 5.6767 6.6767 9.002 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0	25.00 25.000	

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Output Listing

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				78.43 1530.39 3069.52 3274.84 16.52
RUST LEVEL	A. B. ODE LER VAL		FORWARD TANK CONTAINS FUEL COLD GAS) (FUEL - dluminum)	WEIGHTS (POUNDS) AFT TANK FORWARD TANK FORWARD TANK PRESSURE TANK TANK CONSTRUCTION WEIGHT STRUCTURAL WALL
FOR MULTIPLE PUMPS AT FULL THRUST LEVEL XYGEN - LIQUID HYDROGEN ENTHALPY -3083. CAL/MOL -2154. CAL/MOL	SPOND TO THROAT RADIUS=2.289 IN. 1 TEMP DATA EVALUATED AT ODE PC 1 .308919936231828 1 .325538896618163 1 .348841636359766 1 .348841636359766 1 .348841636359766 1 .348841535359766 1 .3643835926359771 ANCE 1 .364383529329771 ANCE 1 .364383529329771 ANCE 1 .364383529329771 ANCE 1 .364383529326771 ANCE 1 .364383529326771 ANCE 1 .364383529326771 ANCE 1 .364383529326771 ANCE 1 .364383528326771 ANCE 1 .364383528326771 ANCE 1 .364383528326771 ANCE 1 .364383528326771 ANCE 1 .364383528326771 ANCE 1 .364384585 1 .364385528326771 ANCE 1 .36438558566 1 .36438555566 1 .36438555566 1 .3643855555766 1 .3643855555777 1 .36438555555777 1 .36438555555777 1 .36438555555777 1 .364385555555777 1 .36438555555555777 1 .364385555555777 1 .364385555555777 1 .36438555555555777 1 .36438555555555777 1 .36438555555555555777 1 .364355555555555555555555555555555555555	75900. (1bf) Expander cycle Enabler I 0.67 Carbide fuel 500. (psid) 5580. (dog R) 5580. (dog R)	STAGE #1 (FUEL SIDE) INS OXIDIZER RESSURIZED WITH (OX - USER DEF	100.00 996.14 542.14 325.97 12.00 80.87
OUTPUT FOR MULT PROPELLANTS LIQUID OXYGEN - I ASSUMPTIONS: TEMP ENTHAI LOX 90.18 K -3003. LH2 20.27 K -2154.	ODK VALUES CORRESPOND TO C-STAR & CHAMBER TEMP DA TURBINE PRESSURE RATIO- 1.306919 TURBINE PRESSURE RATIO- 1.332530 TURBINE PRESSURE RATIO- 1.332530 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO- 1.344303 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO- 1.364303 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO- 1.364303 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO- 1.364303 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO- 1.364303	KEY INPUTS THRUST LEVEL = CYCLE TYPE = REACTOR TYPE = FUEL SCALING FACTOR = FUEL SCALING FACTOR = FUEL SCALING FACTOR = NOZZLE EXIT AREA RATIO = NOZZLE EXIT AREA RATIO = CHAMBER PRESSURE = CHAMBER OF PROPELLANT FEED LEGS	TANKAGE SUMMARY FOR EXPANDER CYCLE AFT TANK CONTA FUEL TANK IS P TANK MATERIALS	DIMENSIONS (INCHES) STAGE DIAMETER TOTAL STAGE LENGTH TOTAL TANK LENGTH NOZZLE LENGTH CONVERGENT NOZZLE LENGTH MOUNT LENGTH

Nuclear Thermal Vehicle

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4-151

424.05 107.30 0.00	8.88 256.38 407.84	184.93 11.31 0.00 238.93 40.21	88.9 89.9 89.9	8.88 8.88 218.86	744.44 0.00		1.25 1.25 1.25
AFT SKIRT FORWARD SKIRT TANK MOUNT	PRESSURE TANK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION	REVERSE HEAD STIFFENER FUEL ACQUISITION SYSTEM OXIDIZER ACQUISITION SYSTEM PRESSURANT CONTROL HARDWARE TAMK LINES	BURNED FUEL Burned Oxidizer Fuel Residual	OXIDIZER RESIDUAL OXIDIZER AUTOGENOUS PRESSURANT STORED PRESSURANT	HOLD TIME FUEL BULLUF HOLD TIME OX BOILOFF FLIGHT FUEL BOILOFF FLIGHT OXIDIZER BOILOFF	MISC EXPENDED FUEL MISC EXPENDED OXIDIZER MISCELLANEOUS WEIGHT INTERSTAGE WEIGHT	INPUT MINIMUM SAFETY FACTORS Structural Wall Lines Oxidizer tank Fuel tank Pressure tank
80°-	40.00 46.00 46.00 46.00		454.18 36.04 8.090	0.030 0.049 0.822	e. e3e e. e33 e. 822	• • • • • • • • • • • •	
TANK HEAD ELLIPSE RATIO Pressure tank ellipse ratio	AFT TANK HEAD HEIGHT Forward Tank Head height Pressure Tank Head height Pressure Tank Diameter	AFT TANK CYLINDRICAL LENGTH Formard Tank Cylindrical Length Pressure Tank Cylindrical Lngth AFT Line Diameter Formard Line Diameter	AFT SKIRT LENGTH Forward skirt Length Structural Wall Thickness		AFT TANK DOME THICKNESS Formard Tank Dome Thickness Pressure Tank Dome Thickness	FUEL TAMK MLI THICKNESS FUEL TAMK SOFI THICKNESS OXIDIZER TAMK MLI THICKNESS OXIDIZER TAMK SOFI THICKNESS Pressure Tamk Insulation Thick	FUEL TMK HEAT FLUX(BTU/MR IN++2) OX TAMK HEAT FLUX(BTU/MR IN++2) FUEL BOILOFF RATE (LB/SEC) OX BOILOFF RATE (LB/SEC)

PROPELLANT SUMMARY FOR STAGE #1 PROPELLANT IS LH2

NOWINAL PROPELLANT TEMP(DEGR) NOWINAL DENSITY(LB/IN++3) NOWINAL VAPOR PRESSURE(PSIA) MAX PROPELLANT TEMP(DEGR) MAX TEMP DENSITY(LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA)

0.0 0.0 0.0

38.5 0.0025 20.0

MOMINAL PROPELLANT TEMP(DEGR) NOMINAL DENSITY(LB/IN++3) NOMINAL VAPOR PRESSURE(PSIA)

0.0 0.0 0.0

•••

NOMINAL TANK PRESSURE (PSIA)

.. OXIDIZER ...

35.1

MOMINAL TANK PRESSURE (PSIA)

:

... FUEL

0.0025

NOMINAL PROPELLANT BULK DENSITY(LB/IN++3)=

40.0 0.0025 25.0

MAX PROPELLANT TEMP(DEGR) MAX TEMP DENSITY(LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA)

38.5 8.882 29.82		1883.68 17788 17788 17788 18853 18853 8.998 8.996 8.906 8.90	
MIN PROPELLANT TEMP(DEGR) MIN TEMP DENSITY(LB/IN++3) MIN TEMP VAPOR PRESSURE(PSIA)	R STAGE #1 (MILLED SLOT CONSTRUCTION) JCTION)	PERFORMANCE DELIVERED ISP(VAC).SEC DELIVERED ISP(ODE).SEC DELIVERED CSTAR.FT/SEC DELIVERED CSTAR.FT/SEC CHAMBER PRESSURE.PSIA THRUST PER ENGINE(VAC).LBF DUTAL VAC THRUST.LBF THRUST PER ENGINE(VAC).LBF BURN TIME.SEC OVERALL EFFICIENCY BURN TIME.SEC OVERALL EFFICIENCY BURN TIME.SEC OVERALL EFFICIENCY BURN TIME.SEC OVERALL EFFICIENCY FOR 1 ENCINE FFICIENCY DIVERGENCE EFFICIENCY DIVERGENCE EFFICIENCY DIVERGENCE EFFICIENCY DIVERGENCE EFFICIENCY DIVERGENCE EFFICIENCY DIVERGENCE LB/SEC TOTAL FLOWRATE.LB/SEC CORE TEMPERATURE.DEG R ENGINE MIXTURE RATIO FUEL FILM COOLING FRACTION	NOZZLE SECTIONS CONVERGENT CHAMBER SECTIONS CYLINDRICAL CHAMBER SECTIONS
6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	E SIZE, WEIGHT, & PERFORMANCE SUMMARY FOR STAGE Expander cycle Convergent Mozzle is regen cooled (Milled Nozzle is regen cooled (Tube construction) Propellant is LH2	7.36 32.77 48.61 18.82 18.83 12.86 1.2882 12.86 12.86 19.86 19.86 19.86 19.87 34.84 34.84	IVE COOLING SUMMARY FOR STAGE \$1 WDS TO THE 5 16.560 INCH LONG 405 TO THE 5 3.481 INCH LONG 405 TO THE 6 0.000 INCH LONG 405 TO THE 6 0.000 INCH LONG 8.000 INCH LONG
MIN PROPELLANT TEMP(DEGR) MIN TEMP DENSITY(LB/IN++3) MIN TEMP VAPOR PRESSURE(PSIA)	ENGINE SIZE, WEIGHT, & P EXPANDER CYCLE CONVERGENT MOZZL MOZZLE IS REGEN PROPELLANT IS LH	ENGINE DIMENSIONS (INCHES) THROAT DIAMETER REACTOR SUPPORT DIAMETER REACTOR SUPPORT DIAMETER REACTOR SUPPORT DIAMETER RESCUE EXTENSION ATTACH DIAM CONVERCENT NOZZLE LENGTH CONVENCENT NOZZLE LENGTH CONV. NOZZLE EXTENSION THICKNESS NOZZLE EXIT AREA RATIO CONTRACTION RATIO NOZZLE EXIT AREA RATIO CONTRACTION RATIO NOZZLE LENGTH NOZZLE LENGTH NOZZLE LENGTH NOZZLE LENGTH NOZZLE LENGTH NOZZLE LENGTH NOZZLE LENGTH NOZZLE LENGTH SECOND NOZ EXTANTACH AREA RATIO NOZZLE LENGTH NOZZLE LENGTH NOZZLE LENGTH NOZZLE LENGTH SECOND NOZ EXTANTACH AREA RATIO SECOND NOZ EXTENTACH AREA RATIO SECOND NOZ EXTANTACH AR	THE FOLLOWING IS THE REGENERATIVE COOLING SI THE ENGINE IS A FUEL COOLED CONVENTIONAL EXPANSION NOZZLE STATIONS 1 THROUGH 11 ARE BOUNDS TO THE STATIONS 11 THROUGH 11 ARE BOUNDS TO THE STATIONS 11 THROUGH 11 ARE BOUNDS TO THE GAS WALL THROUGH 11 ARE BOUNDS TO THE BOUND
		4-153	F F S 1888

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	L C C C C C C C C C C C C C C C C C C C					TION TEMP OF PROPELLANT)	
!	KC 440 KC				EG R) XIDIZER	9.8 (SATURATION 9.8	
	.1886-04 .3826-04 .5456-04 .5456-04 .3826-04 .3826-04 .3826-04 .5666-03 .5666-03 .5666-03 .4186-03 .4186-03 .4186-03				TEMPERATURE(DEG R) EL OXIDIZER		637.0 5580.0
	16W 155E+05 155E+05 155E+05 241E+05 157E+05 157E+04 115E+04 115E+04 115E+04			E 🚺	TEL FUEL	550.0 43.2	
	TCW 170 1715 17		EGR)	ES FOR STAGE		PRESSURANT	
•. (DEG R)	9 2545E-02 2545E-02 2545E-02 2545E-01 2522E-01 31372E+00 3172E+00000000000		2 SEC DEGR) IN++2 SEC DEGR)	URE SCHEDULES CLE	SIA) OXIDIZER		
tE== 1460	V 1 7486401 1146402 0 1936402 0 1296402 0 1296404 0 2456404 0 3246403 0 1246403 0 1246403 0 1246403 0 1246403 0 1246403	()	R) (DEGR) (BTU/IN++) DEFF (BTU/ DEGR)	ND TEMPERATURE Expander Cycle	PRESSURE(PSIA) IEL OX	• r -	
T EMPERATURE	W 1586+01 28856+01 28856+01 28856+00 28965+00 28965+00 19965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 23965+00 2395555+00 2395555+00 2395555+00 2395555+00 239555555555555555555555555555555555555	9 4 	(PSIA) ERATURE (DEG IDTH (IN) (IN/SEC) 0+2A TWALL (DEG S WALL (DEG USFER COEFF VTRANSFER CO (-)	PRESSURE AND TE Expan	PR FUEL	4365.0 38.7 35.1	L I 1269 1255 1269 12755 12755 12255 17255
MAXIMUM OPERATING	TB 845E+02 845E+02 851E+02 851E+02 851E+02 107E+03 107E+03 107E+03 107E+03 107E+03 1107E+03 1107E+03 1107E+03 11111E+03		PRESSURE (P BULK TEMPER CHANNEL WID VELOCITY (1 VELOCITY (1 VELOCITY (1 UNE OF GAS UNE OF GAS SIDE HEAT TRANS SIDE HEAT TRANS	£		AGE	TANK PROPELLANT PUMP INLET MAIN VALVE INLET MAIN VALVE OUTLET TIE TUBE OUTLET REGEN OUTLET (REFL REFLECTOR OUTLET REACTOR INLET REACTOR CORE
	7316+04 1316+04 1316+04 1316+04 1316+04 1216+04 1296+04 1296+04	DELTA T= 27.4 DELTA P= -20.4 NOZZLE DELTA T = NOZZLE DELTA P = ADAPTER DELTA P = ADAPTER DELTA P = ADAPTER DELTA P = ADAPTER DELTA P =	COOLANT COOLANT COOLANT COOLANT COOLANT HEAT FLU HEAT FLU COOLANT COOLANT COOLANT COOLANT			MAX STORAGE VENT ULLAGE	TANK PROUPINE PUMP INLI MAIN VAL TIE TUBE REFLECTOR REACTOR REACTOR
GAS WALL	NTATION N-VN400V00011	DELTA P DELTA P DELTA P NOZZLE NDZZLE ADAPTER TOTAL H					

4-154

771.4 699.5	PRESSURE CHANGES (PSID) COMPONENT PRESSURE/TEMPERATURE CHANGES (DEG R) 0.0 0.0 0.1
1725.0 1264.4	PRESSURE CHANGES (PSID) 0.0 0.1 0.1 0.1 0.1 0.0 0.0 0.0
TURBINE INLET TURBINE OUTLET	ACQUISITION DEVICE FEED LINE PUMP MAIN VALVE TIE TUBES REGEN JACKET REFLECTOR TURBINE

FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 EXPANDER CYCLE

OXIDIZER •.••• •.•••			1
	7 27.160		
FUEL 74.725 37.362 74.725 54.320 54.320 20.404	E 18.107	54.329 0.000	72.427
TANK OUTFLOW MAIN PUMP - EACH MAIN VALVE TOTAL TIE TUBES REGEN JACKET INFLOW MOZZLE BARRIER CODIING		AUTOGENOUS PRESSURANT STORED PRESSURANT (AVF)	

REACTOR OPERATING CHARACTERISTICS AND MASSES

REACTOR OPERATING CHARACTERISTICSTOTAL COOLANT FLOWREACTOR POWERREACTOR POWERREACTOR POWERREACTOR POWERREACTOR POWERCORE FLOW AREACORE FLOW AREACORE LEMENT POWERFUEL ELEMENT POWERFUEL ELEMENT POWERFUEL ELEMENTSFUEL ELEMENTSFUEL ELEMENTSFUEL ELEMENTSNAMBER OF SUPPORT ELEMENTSNAMBER OF SUPPORT ELEMENTSNAMBER OF SUPPORT ELEMENTSNAMBER PRESSURECHAMBER TEMPERATURECHAMBER RESSURECHAMBER RESSURECHAMBER RESSURECHAMBER RESSURECHAMBER RESSURECORE INLET TEMPERATURECORE INLET TEMPERATUREFRACTIONAL HEAT PICKUP IN NOZZLEFRACTIONAL HEAT PICKUP IN REFLECTORFRACTIONAL HEAT PICKUP IN REFLECTOR<td

19784.99 81U/S CKUP 0.00 0.10/S PICKUP 2805.58 81U/S 50343.07 010/S 010/S 5343.07 010/S 010/S 5399.22 010/S 010/S	Ious 34.84 IN 29.49 IN 29.49 IN 27.22 IS 32.77 IN 32.77 IN 44.54 IN 14.57 IN 14.57 IN 14.57 IN 14.57 IN	1856.57 825.54 825.54 825.54 284.96 1397.12 96.35 96.35 96.35 95.39 95.99 95.99 95.19 95.19 95.19 95.19 95.19 95.99 95.99 95.99 95.99 95.19 222.12 222.55 75.17 95.99 95.99 95.99 95.99 95.19 222.12 222.17 222.17 222.17 222.17 222.17 222.17 222.17 222.17 222.17 222.17 222.17 222.17 222.17 222.17 222.17 25.17 25.17 25.17 25.17 25.17 25.17 25.17 25.17 25.17 25.17 25.17 25.18 25.19 25.100 25.100 25.100 25.1000000000000000000000000000000000000
HEAT PICKUP IN REFLECTOR FRACTIONAL CENTRAL SHIELD HEAT PICKUP CENTRAL SHIELD HEAT PICKUP FRACTIONAL EXTENSION SHIELD HEAT PICK EXTENSION SHIELD HEAT PICKUP PEAK CHANNEL WALL TEMPERATURE PEAK FUEL TEMPERATURE	REACTOR DIMENSIONS CORE LENGTH CORE DIAMETER FUEL ELEMENT CHANNEL DIAMETER FUEL ELEMENT CHANNEL DIAMETER FUEL ELEMENTS VOID FRACTION OF FUEL ELEMENTS PEAK TO AVERAGE CHANNEL FACTOR CORE EFFECTIVE DIAMETER LATERAL SUPPORT DIAMETER LATERAL SUPPORT DIAMETER STRUCTURE OD REFLECTOR OD REFLECTOR OD REFLECTOR OD PRESSURE VESSEL LO THICKNESS OF BATH SHIELD THICKNESS OF LEAD SHIELD PRESSURE VESSEL LENGTH FUEL VOLUME	CENT A STATE A

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331.00 7136.09 9667.17
SAFETY RODS-FOR LAUNCH ONLY REACTOR MASS w/o SHIELD-LAUNCH WT. REACTOR MASS w/ SHIELD-LAUNCH WT.

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••• TPA SUMMARY FOR STAGE #1 ••• EXPANDER CYCLE 2 PROPELLANT FEED LEGS AXIAL PUMPS TPA SIZE/WT/PERFORMANCE IS USER DEFINED

... PROPELLANT PUMP ...

28114. 2055. 4024. 2000	8.+ INDUCER 199.00 2063.55 207.47	52.63.73 62.63.73 0.73 0.80 0.80	5.91 5.91 244.32 73.18 317.49
	WAMBER OF PUMP STAGES NET POS SUCTION PRESSURE(PSIA) ACCELERATION HEAD(PSIA) PUMP OUTLET PRESSURE(PSIA) VOLUMETRIC FLOWRATE(GPM)	MASS FLOWRATE (LEW/SEC) PUMP HORSEPOWER (HP) PUMP EFFICIENCY INDUCER EFFICIENCY OVERALL PUMP EFFICIENCY	2122

... TURBINE ...

4-157

1.000 0.627 1.364 27.16		
ADMISSION FRACTION EFFICIENCY PRESSURE RATIO MASS FLOWRATE(LB/SEC) DIAMETER(IN)	人名英格兰克 医白白白	1PA

... TPA ...

TPA START SYSTEM WT.

8.88 32.24 8.88 357.58 715.15 747.48	78.43 1530.39 368.52 3274.84 40.21	424.05 107.30 0.00 16.52 256.38 407.04	11.31 0.00 238.93	6865.09 2531.08 2531.08 1719.90 96.00 344.76 619.14 206.77	32.24 9.90 9.90 715.16 9.90 9.90	101.35 14505.10	744.44 8.88 8.98 8.98 8.98 8.98 3.31.88
GAS GENERATOR/PREBURNER WTEAC IGNITION SYSTEM WTTOTAL HOT GAS MANIFOLD WTTOTAL GERBOX WTTOTAL GEARBOX WTTOTAL MAIN TURBOPUMP WT. TOTAL TURBOPUMP WT. TOTAL TPA WT. STAGE #1 WEIGHTS (POUNDS)	AFT TANK FORWARD TANK PRESSURE TANK TANK CONSTRUCTION WEIGHT TANK LINES	AFT SKIRT FORMARD SKIRT TANK MOUNT STRUCTURAL WALL PRESSURE TANK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION	FUEL ACQUISITION SYSTEM OXIDIZER ACQUISITION SYSTEM PRESSURANT CONTROL HARDWARE	ENGINE WEIGHTS: 1 REACTOR 1 REACTOR INTERNAL SHIELD 1 NOZZLE 1 THRUST MOUNT(S) 1 THRUST MOUNT(S) 2 ENGINE BAY LINE(S) 2 MAIN VALVE(S) 1 SUPPORT MARDWARE 1 GIMBAL POWER SUPPLY	2 IGNITION SYSTEM(S) 2 HOT GAS MANIFOLD(S) 2 GAS GENERATOR/PREBURNER 2 TPA ASSY(S) 1 GEARBOX(S) 2 TPA START SYSTEM(S) 1 GAS GENERATOR/PREBURNER(S)	NON-NUCLEAR WEIGHT MARGIN Total Emgine Weight	FLIGHT FUEL BOILOFF FLIGHT OXIDIZER BOILOFF EXPENDABLE WEIGHT MISCELLANEOUS WEIGHT USER DEFINED WEIGHT REACTOR SAFETY ROD WT.

25035.45	17 8998.99 8998.99 8.89 8.89 9.98 9.98 9.	33261.20 24175.76 0.00 0.00	•• Stage #1	100.00 100.00 000.14 000.14 000.14	LOX/LH2 75000.0 1000.0 560.00 3600.00 3600.00 1003.7 0.275 72.43
TOTAL INERT WEIGHT	INTERSTAGE WEIGHT BURNED FUEL BURNED OXIDIZER FUEL RESIDUAL OXIDIZER RESIDUAL OXIDIZER RESIDUAL OXIDIZER RESIDUAL OXIDIZER AUTOGENOUS PRESSURANT STORED PRESSURANT MISC ON-BOARD FUEL MISC ON-BOARD OXIDIZER	GROSS IGNITION WEIGHT GROSS BURNOUT WEIGHT Hold Time Fuel Boiloff Hold Time ox Boiloff	Nuclear Thermal Vehicle •••• VEHICLE SUMMARY ••	DIMENSIONS, IN STAGE DIAMETER NOZZLE EXIT DIAMETER NUMBER OF NOZZLES STAGE LENGTH PAYLOAD LENGTH TOTAL VEH LENGTH	PROPELLANT PROPELLANT THRUST,VACUUM DELIVERED,LBF PC,PSIA NOZZLE AREA RATIO BURN TIME,SEC ISP,VACUUM DELIVERED,SEC ISP,VACUUM DELIVERED,SEC ISP,VACUUM DELIVERED,SEC ISP, VACUUM DELIVERED,SEC CORE PROP. FLOWRATE, LB/SEC

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PRESSURE AND TEMPERATURE SCHEDULES FOR STAGE #1 FOR ONE PUMP AT REDUCED THRUST LEVEL 69999. EXPANDER CYCLE

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	PRESSURE (PSIA) FUEL	SIA) OXIDIZER	TEMPERATURE (DEG R) FUEL OXIDIZER
MAX STORAGE VENT ULLAGE	4365.0 38.6 35.1		PRESSURANT 550.0 550.0
	35.1 35.8 35.8 1712.8 1633.8 1633.8 1543.1 1145.1 1118.1 1118.1 1383.8		PROPELLANT 38.5 0.0 40.2 0.0 73.7 0.0 73.7 0.0 75.8 104.6 104.6 100 5500.0 643.5 100 5530.0 100
	1118.1 Pafssiur Charles	COMPONENT (DETD)	
ACOUISITION DEVICE FEED LINE PUMP MAIN VALVE TIE TUBES REGEN JACKET REFLECTOR TIMPRINE			0.0 0.0 0.0 0.0 35.2 0.0 0.0 36.9 0.0 0.0 255.6 0.0
	FLOWRATE SCHEDULI EXPANDER CYCLE	E (LB/SEC)	SCHEDULE (LB/SEC) FOR STAGE #1 CYCLE

0XIDIZER 8.888 8.888	0.000			0.000 0.000
		1.836	43.292	
FUEL 59.559 50.559	59.559 43.292	16.267	14.431	43.292 0.000
TANK OUTFLOW MAIN PLMP	MAIN VALVE Total Tie Tubes	REGEN JACKET INFLOW NOZZLE BARRIER COOLING	REGEN/REFL OUTLET TO CORE TURBINE	TURBINE TO CORE AUTOGENOUS PRESSURANT

57.723

0.05

STORED PRESSURANT (AVE) CORE

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● ● ● TPA SUMMARY FOR STAGE \$1 ● ● ● SUMMARY FOR TPA AT THRUST LEVEL FRACTION 0.80 EXPANDER CYCLE SINGLE SHAFT TPA AXIAL PUMPS

... PROPELLANT PUMP ...

30460 3243 6349	2000. B.+ INOUCER 92.70	1712.05 6252.76 59.56 744.11	24.32 73.18 317.49
PUMP SPEED (RPM) SPECIFIC SPEED INDUCER SPECIFIC SPEED SUMTION SPECIFIC SPEED	OF PUMP ST SUCTION P	iα	 WT. (LB) ER WT.

... TURBINE ...

4-161

-	9.766	1.238	43.29	6.32	2	52531.	35563.	80	30460.	40.00	30.128	
ADMISSION FRACTION	EFFICIENCY	PRESSURE RATIO	MASS FLOWRATE(LB/SEC)	DIAMETER(IN)	NUMBER OF TURBINE STAGES	_	ROOT STRESS SPEED LIMIT (RPM)	SPECIFIC SPEED	TURBINE SPEED (RPM)	TURBINE WT(LB)	TURBINE ANNULUS AREA(IN2)	

ENGINE SUMMARY

EXPANDER CYCLE ENABLER I AXIAL PUMPS THRUST LEVEL = CHAMBER PRESSURE =

75868.8 Hbf 1888.8 psig

333600.0 N 6895.0 kPa

3196.0 deg K 596.6 deg K 2 2 kg/a	546 .6	81.8 kg 178.4 kg 266.5 kg 526.8 kg 598.6 18.7 cm 418.1 cm 828.6 cm 333600.0 N		2344.2 kg 6578.3 kg 5430.4 kg 5430.4 kg 540.1 kg 150.1 kg 6728.4 kg 5580.5 kg 5580.6 kPg 9872.6 N-mec/kg 3100.0 deg K
deg R Ibm/s	4 5 c c 5		<u> </u>	
5580.0 560.0 74.7	0.67 6805.1 2531.1 86.0 87.0 72.4	180.4 393.4 587.7 587.7 590.6 590.6 326.6 7590.0	LEGS) 	
CHAMBER TEMPERATURE = NOZZLE EXIT AREA RATIO = NUMBER OF FEED LEGS = TOTAL PROPELLANT FLOWRATE =	REACTOR CARBIDE FUEL FUEL SCALING FACTOR FUEL SCALING FACTOR REACTOR WEIGHT SHIELD WEIGHT PRESSURE VESSEL LENGTH PRESSURE VESSEL LENGTH CORE PROPELLANT MASS FLOW	CONVERGIMG MOZZLE WEIGHT MOZZLE EXTENSION WEIGHT SECOND MOZZLE WEIGHT TOTAL MOZZLE WEIGHT AREA RATIO THROAT DIAMETER EXIT DIAMETER MOZZLE LENGTH DELIVERED VACUUM ISP DELIVERED THRUST	TURBOPUMP ASSEMBLY (TOTAL FOR ALL FEED MAIN PROP. TURBOPUMP WT PROPELLANT BOOST PUMP WT PROPELLANT BOOST PUMP WT MAIN OX PUMP WEIGHT PA IGNITION WEIGHT BLEED LINE/VALVE WEIGHT BLEED LINE/VALVE WEIGHT MISC. HARDWARE WEIGHTS THRUST MOUNT SUPPORT HARDWARE ENGINE LINES MAIN VALVE MARGIN (2.0K)	TOTAL NOWNUCLÉAR WEIGHT TOTAL ENGINE SYSTEM TOTAL ENGINE WEIGHT TOTAL ENGINE WEIGHT WITHOUT SHIELD THRUST/WEIGHT RATIO WITHOUT SHIELD THRUST/WEIGHT RATIO WITHOUT SHIELD REACTOR SAFETY ROD WTLAUNCH ONLY TOTAL ENGINE LAUNCH WEIGHT TOTAL ENGINE LAUNCH WT. W/O SHIELD PUMP-OUT CONDITIONS PUMP-OUT THRUST PUMP-OUT THRUST PUMP-OUT CHAMBER PRESSURE PUMP-OUT CHAMBER PRESSURE PUMP-OUT CHAMBER TEMPERATURE OVERALL ENGINE LENGTH =

OVERALL ENGINE DIAMETER -

418.1

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164.6

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THE FOLLOWING WARNINGS OCCUR FOR STAGE 1

TWO PHASE FLUID ENCOUNTERED IN REGEN

RECOMMENDED RANGE = 1.5 TO 4 CR = 19.577

STAGE DIAM = 100.0 NOZZLE EXIT DIAM = 164.6

AXIAL BUCKLING DESIGNS STRUCTURAL WALL THICKNESS MINIMUM GAUGE DESIGNS AFT TANK WALL THICKNESS

HOOP STRESS DESIGNS FORWARD TAMK WALL THICKNESS AFT TAMK ULLAGE INCREASED BY GEOMETRY CONSTRAINT

4-163

GAS PHASE ENCOUNTERED IN REGEN JACKET TPA CALCULATIONS TERMINATED BY ACHIEVING DESIRED ACCURACY

END NOMINAL STAGE DESIGN

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Input Listing

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0.00 0.00 0.00	500. I VAC	
	PC	ust (1bf
	WPAYID	l a l
	WMISC	Vehicle payload wt.
	MEXPND	Expendable atom wt.
~ •	JCNFIG	Cycle type (1=66.3=Expander 7-Bires)
	IPTYPE	guration
858.8	ISOLVE	type (decentr.
•		bine inlet tean
	FRACCB	bieed fr
0.07	CPLINH	l fraction
0.07	CPLINC	
9.98	CPLINT	inter loss fract
	JAPEI	bine throttling volue incti
•	JBPOX	fuel
- •	NTPA	boost pump?
9.9	IDBLRUN	Double of identical turbopumpa
	FFRAC	traction
	I RATE	
	TISABAN	-
•. •2	FILARG	burn time
	XLFL	n weight 1
	ALFMIX	
	Sd3	mixing angle
	KEXNOZ	0 1027 =
	TT ADD	
12.8	EPSAT2	• extension 1 attach grad reit
	XLN	2 ottoch
	KNOZ	zie length
1868	IPLUG	
•	NATHLR Decess	Nozzie length ratio
46	CreePB CAMPOD	xture rat
	CPGGPR	ratio of spe
4868	WMGGPB	eat
	TCHAMBER	
	IREACTR	Model flor /·
=		h flac
· · / ·		ment chamber
~ •	PAC	between holes
2	HOLES	o dverage cha
	FTYPE	
35.8	SPAT	Subort
		Core length
6. 25 6		n each element (ww
	911	le flow fraction
.0122	HTANK	up per tie
. 00031	FREF	÷.
.00173	FES	heat pickup in ref
67	FCS	ctional hast ctup in ext shi
	FALPHA	calina fraction

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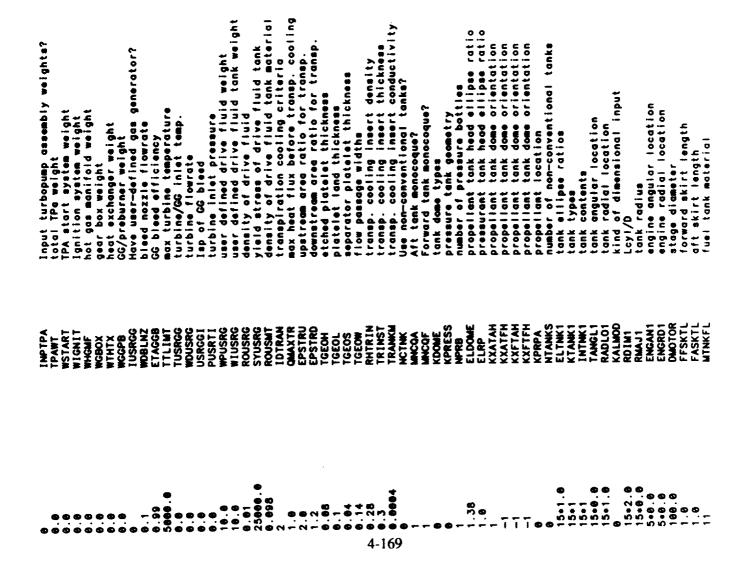
	iraction rection rection antion dev rection antion tant atorage MLI thic MLI thic FI thic recton age ope age ope age ope	I minimum gouge it thermal conduct thermal conduct i merzie material i merzie material te drop across ox re drop across fue re	Regen closeout material density Regen closeout material strength Regen gas well density Valve material density Nozzle extension 1 density Nozzle extension 1 minimum thickness Nozzle extension 2 density Nozzle extension 2 density Nozzle extension 2 density Engine weight model Input nozzle length Input nozzle throat diameter Input nozzle throat diameter Input nozzle throat diameter
HEX LEL ZRCI ZRCO ZRCO PVSG FZRH FZRH	WTLPRP WTLPRP ULLFFL ULLFFL KACQOX KGASOX KGASOX KGASOX KGASOX KGASOX KGASOX KGASOX KGASOX KGASOX FPULCG FPULCG TMLI TMLI TMLI TMLI TMLI TMLI TMLI TMLI	CMMING WALLK DIFTBF THEF THEF CPLLVF CPLLF CPLLVF CPLLF	RHOCLS SIGCLS RHOCLS RHOWLV RHOWLV RHOWZE SIGNZE SIGNZE TNZMIN SIGNZE SIGNZE SIGNZE TNZMIN SIGNZE TNZMIN SIGNZE TNZMIN SIGNZE TNZMIN SIGNZE TNZMIN SIGNZE TNZMIN SIGNZE TNZMIN SIGNZE TNZMIN SIGNZE SIGNZE TNZMIN SIGNZE SI
6,756 55,6 6,862 6,865 8,865 2,74 5,74 1,85 1,85 1,85	- 7 8 9 9 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9		6

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. 80088 . 2	CHMULT EPIPE HOMMAX	9 5 5 5 5 4 5 6 5 4 5 4 5 7
•	NCON NNZL SAMU T	if regen segment
. 18		surface area multiplier Cooling channel land width
•	INDPDT DELTAT	ta Tan
• • •	DELTAP	tal deita
°	OXNPSP AD-1008	
5.	ADJBL	GG DIGGG afficiency adjustment Boundary layer afficiency adjustment
	ADUDIA	ancy adjustment
.7 5•1.0	CXWTNK	ght multiplier:
-	CXWFLT	muitiplier: muitiplier:
	CXWOXT	ght multiplier:
	CXWSTR	ght multiplier;
• •	CXWATL	ght multiplier:
	CXWFTL	ght multiplier: forward t
•	CXWENG	ont multiplier; pres. tank line
•0 •	CXVALV	ght multiplier;
b	CXWCHW	ight multiplier;
- 40	CXWNZE	multiplier; nozzle extension
•	CXWGIM	oht multiplier;
	CXWTHM	ght multiplier; thrust
•	CXWTPA	autiplier: 66 injec
1 . 10	CXWPMP	9 t
25	CXWLIN	ght multiplier: engine bay
	CXWINST	
	CXWTNKAS	ght multiplier; r
	ISTSFT	multiplier; ignition system
	PSTAGF	umber of fuel bumb stoces. Dumber of fuel bumb stoces
	PSTAGO	ox pump stoges
	PDIAFL DDIACV	I pump diameter
	BPDIAF	d i gene t
_	BPDIAO	ost punn diamet
	TSTGES	of turbine st
		of fuel turbine
	TDIAM	rumber of ox turbine stages turbine diameter
	TDIAFL	fuel turbine diameter
0	1DIAOX Anmed	-
	ADMFRF	fuel turbine admission traction fuel turbine admission fraction
	ADMFRO	urbine admission f
	ANAKEA ANARFI	annutus area

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4-168



user defined tank material density user defined tank material elastic mod user defined tank material elastic mod user defined tank material strength user defined tank material specific heat user defined tank material specific heat user defined tank material min gauge miscellansous fuel on-board miscellansous fuel on-board number of temp schedule iterations space between aft suspended tank & wall space between for suspended tank & wall space between pres. suspended tank & wall pressure tank insulation density pressure tank material structure and skirts material tank materials (non-conventional tanks) space between forward and pressure tanks Pressurant ratio of specific heats (isen) Pressurant ratio of specific heats (poly) pressure tank safety factor structure safety factor lines safety factor tank safety factor tank safety factors - non-conv. tanke preserve tank insulation density insulation thickness for pressure tank non-conv. tank usable volume ratios The second secon time at which polytropic ratio is 1.1 min clearance between non-conv tanks max carry moment space between aft and forward tank non-conv model engine nesting mode non-conv tank thickness mode velocity heads lost in fuel lines velocity heads lost in ox lines ox acquisition device density forward shroud cross-sect area aft shroud cross-sect area nput propellant temperatures? propellant feed line flag stage critical bending moment min clearance between nozzies fuel line surface roughness fuel tank safety factor ox line surface roughness ox tank safety factor Lines full at burnout? fuel min temp fuel nominal temp fuel max temp tank material ox nominal temp ox max temp ox min temp SIGMAX MATSTR CONDCT MATNK1 SFOXTK SFPRTK SFSTRC SFLINE SFLINE **UTNKOX** SPHEAT XMOUNT INPEXF INPEXO EXPLFL EXPLFL **THINGS** DACQFL DACQOX AESSR AFSSR AFSSR SFFLT TPNOMF TPNAXF TPM1N0 TPNOM0 **WATPT** WMISFL WMISOX NTMPIT YHOD **PMAXO** RHOINS KLINEA PNINF ENGSPC KNEST KTHCK1 FLKFCT LNFULL RATNK1 ISPCA ISPCF ISPCF CLRAF RHPTIN CLRTNK RUFFOX GAMICG GAMPCG RHO CLRFP TINSUL **LIMPCG** OXKFC1 RUFFFL CBM 29.0E6 112300.0 0.12 0.00023 0.035 0.035 1.25 1.25 1.25 2.0 15+1.5 15+11 0.29 .995 .152 0.0414 'n • . 25 58.5 5+1.0 9.000.0 .000. 1.0 240.0 0.04 5+1 . 66 0.0 ٠ 6 e ¢ ¢ 4-170

molecular weight of pressurant solid GG min port to throat orea ratio solid GG burn rate complexity multiplier solid GG burn rate complexity multiplier solid GG grain characteristic velocity solid GG grain burn rate exponent solid GG grain burn rate exponent solid GG grain burn rate exponent solid GG grain burn rate sportific heat ratio temperature sensitivity of GG pressure solid GG rate density solid GG rate density solid GG rate density solid GG rate pressure from solid GG frain density solid GG frain density fraction of total head rise boost pump fraction of total head rise boost pump suction specific speed fruel pressurent temp fruel pressurent temp fr	ber of engine rest start bottle mate start cutlinder rest start cutlinder a start cutridge start cutridge start cutridge start bottle viel start bottle gas turbine blade density bine blade density
WINCG APATGG APATGG CBRGG CSESGG CSESGG CSESGG CSESGG CSESGG CSESGG CSESGG CSESGG CSESGG CSESGG CSESGG CSESS CSSSFL CVC CVC CVC CVC CVC CVC CVC CVC CVC CV	CASAM NR RHOCYL RHOCYL RHOCYL ROCRAT SYBOT SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL SYCAL
9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	00000000000000000000000000000000000000

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turbine blade ultimate strength turbine blade vield strength engine bay line density engine bay line vield strength cold gas valve material density accumulator valve material density tank insulation conductivity of MLI thermal conductivity of SOFI thermal conductivity constants SOFI thermal conductivity constants SOFI thermal conductivity constants MLI density SOFI density SOFI density SOFI density MLI radiation shields per inch average stage acceleration iteration conduct in heat transfer calce	ox tank wildage pressure fraction-vent. stage hold time MLI environment flag MLI environment flag MLI purge gas pressure at space hold MLI purge gas pressure at space hold external tank boundary temperature Earth infrared heat flux Earth reflectance (albedo) orbital angle orbital angle stage orbital altitude orbital angle stage obsorbativity solar heat flux relative humidity ambient temperature wind velocity space between fuel bladder and wall space between fuel bladder and wall space between fuel bladder and wall ox bonded rolling diaphragm density fuel bladder thickness
US YS SYLIN SYLIN SYLIN ROSPVL ROSPVL RACCVL CNNLI CNNCI SOFIA SOFIA SOFIA SOFIA SOFIA NSOFI FVLTX NITHX	FVENTO HLITIM HLIENV MLIENV MRGMLI TEXBOU TEXBOU ARALT ORBALT Solcon Solcon Solcon Solcon Blend Blend DBND Solcon Tallum TBLDOX TBLDOX
13490 12490 1220 1200 1200 1200 1200 1200 1200 12	

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Output Listing

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Nuclear Thermal Vehicle

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KEY INPUTS

35000. (Ibf) Bleed Cycle Enabler I	COMPOSITE FUEL 200. 1H2	4
) LEG
THRUST LEVEL - CYCLE TYPE - REACTOR TYPE -	FUEL TYPE	CHAMBER PRESSURE = CHAMBER TEMPERATURE = NUMBER OF PROPELLANT FEED LEGS =

TANKAGE SUMMARY FOR STAGE ∯1 BLEED CYCLE AFT TANK CONTAINS OXIDIZER ... FORWARD TANK CONTAINS FUEL FUEL TANK IS PRESSURIZED WITH COLD GAS TANK MATERIALS (OX - USER DEF) (FUEL - dlumainum) (PRESSURANT - USER DEF)

1524.49 1986.42 2512.54 272.64 75.76 8.88 8000.00 0.00 0.00 0.00 141.63 0.00 744.20 0.00 256.20 407.04 33.44 18.99 78.43 9.99 11.29 0.00 11.31 0.00 0.00 84.69 0.00 0.00 2.00 2.00 1.25 1.25 REVERSE HEAD STIFFENER FUEL ACQUISITION SYSTEM OXIDIZER ACQUISITION SYSTEM PRESSURANT CONTROL HARDWARE TANK LINES AFT TANK Forward Tank Pressure tank Tank construction weight PRESSURE TANK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION FUEL RESIDUAL OXIDIZER RESIDUAL STORED PRESSURANT HOLD TIME EVEL BOILOFF HOLD TIME OX BOILOFF FLIGHT FUEL BOILOFF FLIGHT OXIDIZER BOILOFF ... INPUT MINIMUM SAFETY FACTORS MISC EXPENDED FUEL MISC EXPENDED OXIDIZER MISCELLANEOUS WEIGHT INTERSTAGE WEIGHT : STRUCTURAL WALL BURNED FUEL BURNED OXIDIZER STRUCTURAL WALL AFT SKIRT FORWARD SKIRT TANK MOUNT OXIDIZER TANK FUEL TANK PRESSURE TANK ... WEIGHTS (POUNDS) LINES 0.040 0.040 0.040 0.030 0.033 0.033 1.38 35.34 36.95 57.89 6.66 0.69 0.99 100.00 831.89 542.02 156.82 12.00 86.06 0.00 3.33 290.21 36.04 0.061 0.08 6.00 0.003 0.003 0.50 0.50 0.50 0.50 TANK HEAD ELLIPSE RATIO PRESSURE TANK ELLIPSE RATIO AFT TANK HEAD HEIGHT FORWARD TANK HEAD HEIGHT PRESSURE TANK HEAD HEIGHT PRESSURE TANK DIAMETER AFT TANK CYLINDRICAL LENGTH FORWARD TANK CYLINDRICAL LENGTH PRESSURE TANK CYLINDRICAL LENGTH FUEL TNK HEAT FLUX(BTU/HR IN...2) OX TANK HEAT FLUX(BTU/HR IN...2) FUEL BOILOFF RATE (LB/SEC) OX BOILOFF RATE (LB/SEC) STRUCTURAL WALL THICKNESS AFT TANK WALL THICKNESS FORWARD TANK WALL THICKNESS PRESSURE TANK WALL THICKNESS AFT TANK DOME THICKNESS FORWARD TANK DOME THICKNESS PRESSURE TANK DOME THICKNESS FUEL TANK MLI THICKNESS FUEL TANK SOFI THICKNESS OXIDIZER TANK MLI THICKNESS OXIDIZER TANK SOFI THICKNESS PRESSURE TANK INSULATION THICK STAGE DIAMETER TOTAL STAGE LENGTH TOTAL TANK LENGTH NOZZLE LENGTH CONVERGENT NOZZLE LENGTH MOUNT LENGTH AFT LINE DIAMETER FORWARD LINE DIAMETER AFT SKIRT LENGTH FORWARD SKIRT LENGTH : .. DIMENSIONS (INCHES)

PROPELLANT SUMMARY FOR STAGE #1 PROPELLANT IS LH2

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NOMINAL PROPELLANT BULK DENSITY(LB/IN++3)- 0.0025

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N
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35.0	38.5	40.0	38.5
	0.0025	0.0025	0.0025
	20.0	25.0	20.0
NOMINAL TANK PRESSURE(PSIA)	NOMINAL PROPELLANT TEMP(DEGR)	MAX PROPELLANT TEMP(DEGR)	MIN PROPELLANT TEMP(DEGR)
	Nominal Density(LB/IN++3)	MAX TEMP DENSITY(LB/IN++3)	MIN TEMP DENSITY(LB/IN++3)
	Nominal Vapor Pressure(PSIA)	MAX TEMP VAPOR PRESSURE(PSIA)	MIN TEMP VAPOR PRESSURE(PSIA)
•••	0 . 0 0 . 0 0 . 0	6 . 6 6 . 6 6 . 6 6 . 6	6 6 6 7 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
NOMINAL TANK PRESSURE(PSIA)	NOMINAL PROPELLANT TEMP(DEGR)	MAX PROPELLANT TEMP(DEGR)	MIN PROPELLANT TEMP(DEGR)
	NOMINAL DENSITY(LB/IN++3)	MAX TEMP DENSITY(LB/IN++3)	MIN TEMP DENSITY(LB/IN++3)
	NOMINAL VAPOR PRESSURE(PSIA)	MAX TEMP VAPOR PRESSURE(PSIA)	MIN TEMP VAPOR PRESSURE(PSIA)

ENGINE SIZE, WEIGHT, & PERFORMANCE SUMMARY FOR STAGE ∯1 BLEED CYCLE CONVERGENT NOZZLE IS REGEN COOLED (MILLED SLOT CONSTRUCTION) NOZZLE IS REGEN COOLED (TUBE CONSTRUCTION) PROPELLANT IS LH2

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0.072 CHAMBER PRESSURE, PSIA 500 0.100 0.100 THRUST PER ENGINE (VAC), LBF 35000 0.100 0.100 DURN TIME, SEC 35000 0.100 BURN TIME, SEC 35000 0.941 200.00 OVERALL EFFICIENCY 0.941 0.941 0.1187 BURN TIME, SEC 35000 0.941 0.00 BURN TIME, SEC 0.941 0.941 0.1187 BURN TIME, SEC 0.941 0.941 0.1187 BURN TIME EFFICIENCY 0.995 0.995 0.00 BURN TAFER EFFICIENCY 0.995 0.995 0.00 BURN TAFER EFFICIENCY 0.995 0.995 0.00 BURN TAFER EFFICIENCY 0.995 0.995

4868. 1638. 8.88 8.88

CORE TEMPERATURE, DEG R BARRIER TEMPERATURE, DEG R ENGINE MIXTURE RATIO FUEL FILM COOLING FRACTION

THE FOLLOWING IS THE REGENERATIVE COOLING SUMMARY FOR STAGE #1

-2586+82 -1766+82 -1766+82 -1166+82 -5246+81 -3246+81 -3246+81 -3416+81 -3416+81 -3416+81 -72466+81 -72466+81 -72466+81 .9955-94 .1226-93 .1776-93 .2946-93 .3976-93 .3976-93 .3976-92 .3416-93 .5526-93 .5116-93 오 LONG NOZZLE SECTIONS LONG CONVERGENT CHAMBER SECTIONS LONG CYLINDRICAL CHAMBER SECTIONS .8976-04 .1326-03 .2116-03 .3776-03 .3776-03 .3436-02 .3436-02 .1256-02 .1256-02 .6276-03 .6276-03 Ŷ .353£+83 .353£+83 .353£+83 .571£+83 .571£+83 .829£+84 .186£+84 .185£+84 .185£+84 . 104E+04 TGW 8.2965+03 8.3475+03 8.3475+03 9.5455+03 9.5455+03 8.7845+03 8.7845+03 9.9585+03 8.9235+03 8.9235+03 8.92575+03 8.92775+03 TCW COOLANT PRESSURE (PSIA)
 COOLANT BULK TEMPERATURE (DEGR)
 COOLANT BULK TEMPERATURE (DEGR)
 COOLANT VELOCITY (IN/SEC)
 HEAT FLUX (BTU/IN++2 SEC)
 TEMPERATURE OF COOLANT WALL (DEGR)
 TEMPERATURE OF COOLANT WALL (DEGR)
 GAS SIDE HEAT TRANSFER COEFF (BTU/IN++2 SEC DEGR)
 COOLANT SIDE HEAT TRANSFER COEFF (BTU/IN++2 SEC DEGR)
 COMBUSTION GAS TEMPERATURE (DEGR) 5.748 INCH L 2.840 INCH L 0.000 INCH L GAS WALL THICKNESS = 0.072 GAS WALL THERMAL CONDUCTIVITY =.00039000 (BTU/IN SEC DEGR) GAS WALL MAXIMUM OPERATING TEMPERATURE= 1460. (DEG R) Q .3515E-01 .3515E-01 .6416-01 .6416-01 .1426+00 .1946+01 .1115+01 .1956+00 .3676+00 .3676+00 V 207E+02 302E+02 481E+02 887E+02 887E+02 217E+02 116E+03 116E+03 256E+03 1556E+03 115E+03 115E+03 500 STATIONS 1 THROUGH 6 ARE BOUNDS TO THE STATIONS 6 THROUGH 11 ARE BOUNDS TO THE STATIONS 11 THROUGH 11 ARE BOUNDS TO THE DELTA T=16.9DELTA P=-1.9DELTA P=-1.9MOZZLE DELTA T=16.9MOZZLE DELTA P=-1.9ADAPTER DELTA T=1.9ADAPTER DELTA P=0.0ADAPTER DELTA P=0.0ADAPTER DELTA P=0.0 .649E+90 .539E+90 .429E+90 .329E+90 .210E+90 .158E+90 .158E+90 .216E+90 .332E+90 .332E+90 3 THE ENGINE IS A FUEL COOLED CONVENTIONAL EXPANSION NOZZLE TB .586E+02 .586E+02 .660E+02 .647E+02 .647E+02 .714E+02 .736E+02 .736E+02 .755E+02 .755E+02 .755E+02 6386+83 6386+83 6386+83 6386+83 6386+83 6386+83 6386+83 6286+83 6286+83 6286+83 6286+83 6286+83 6286+83 6286+83 6286+83 STATION 00400000000 A L L L C K L D C K L D C K L D C K L D C K K L D C K K L D C K K L D C K K L D C K L

4-178

5396403 6186403 7396403 9486403 9486403 1416404 1636404 1636404 1636404 1636404

TGAS

PRESSURE AND TEMPERATURE SCHEDULES FOR STAGE #1 BLEED CYCLE

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TEMPERATURE(DEG R) FUEL OXIDIZER	PRESSURANT 550.0 550.0 10 TEMP OF PROPELLANT)	PROPELLANT 38.5 0.0 0.0 39.7 0.0 0.0 39.7 0.0 0.0 39.7 0.0 58.3 58.3 58.3 58.3 58.3 58.3 58.3 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10	4866.0 856.0 856.0 856.0 362.6 362.6	COMPONENT PRESSURE/TEMPERATURE CHANGES (DEG R) (PSID) 0.0 0.0 11.2 0.0 11.2 0.0 0.0 <
PRESSURE(PSIA) Fuel oxidizer	4365.0 4365.0 PRESS 38.5 0.0 35.0 0.0	35.6 78.9 72.9 894.9 694.9 692.7 692.7 692.7 692.7 598.0	50.0 465.0 482.5 397.9 15.0	PRESSURE CHANGES (PSID) 0.0 0.0 13.9 13.9 13.9 12.2 12.2 12.5 1.9 256.0 1.9 256.0 1.9 256.0 1.9 25.0 382.9 382.9 382.9
	MAX STORAGE 4. VENT ULLAGE	TANK PROPELLANT BOOST PUMP OUTLET MAIN PUMP INLET MAIN VALVE OUTLET MAIN VALVE OUTLET COLD BLEED VALVE IN COLD BLEED VALVE OUT TIE TUBE OUTLET REGEN OUTLET (REFL I REACTOR OUTLET REACTOR OUTLET REACTOR OUTLET	CHAMBER BLEED MIXER OUTLET TURB THROT VALVE IN TURBINE INLET TURBINE OUTLET	PRE ACQUISITION DEVICE BOOST PUMP FEED LINE MAIN VOLVE MAIN VOLVE VOLVE MAIN VOLVE MAIN VOLVE MAIN VOLVE MAIN VOLVE MAIN VOLVE MAIN VOLVE MAIN VOLVE MAIN

FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 BLEED CYCLE

TANK OUTFLOW	10 LL		OXIDIZER
MAIN PUMP	770.01		000 · 0
	40.022		0.000
	1.474		
	38.548		A 000
TOTAL TIE TUBES	28 850		000.0
REGEN JACKET INFLOW			
CLE RAPPIE	1 Q . 4 Q S		
SEN/REEL OUTLET		1.136	
	9.353		
THERINE	1.647		0.000
BLEED NO771 F		1.647	
URBIN		1.647	
D PRESSIDANT	000 · 0		0.000
}		0.04	
CHAMBER BIFED FLOW	214.70		
	Ø.173		
MULTER UNIFLUM	37.239		

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BLEED CYCLE FLOW RATIOS

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0.041 0.004 0.004 0.105 0.105
OVERALL BLEED FLOW FRACTION OVERALL HOT BLEED FRACTION OVERALL COLD BLEED FRACTION HOT SIDE FRACTION OF TOTAL BLEED COLD SIDE FRACTION OF TOTAL BLEED

REACTOR OPERATING CHARACTERISTICS AND MASSES

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	8683.86 BTU/S 8633.86 BTU/S 1231.40 BTU/S 220.66 BTU/S 5024.13 DEG R 5191.86 DEG R	35.00 IN 29.27 IN 29.27 IN 0.11 IN 21.23 IN 22.55 IN 24.75 IN 24.75 IN 22.55 IN 12.03 IN 12.03 IN 12.03 IN 12.22 IN 12.22 IN 13.22 IN	1456.43 LB 861.33 LB 204.44 LB 204.44 LB 447.57 LB 1365.72 LB 94.83 LB 60.24 LB 132.24 LB 132.24 LB 456.30 LB
LL ELEMENTS POORT ELEMENTS CRATURE CRATURE CRATURE CRATURE AMPERATURE CLPY CLPY CLPY TITALPY FER TIE TUBE CAT PICKUP IN N NOZZLE	FRACTIONAL HEAT PICKUP IN REFLECTOR HEAT PICKUP IN REFLECTOR FRACTIONAL CENTRAL SHIELD HEAT PICKUP FRACTIONAL ENTRAL SHIELD HEAT PICKUP FRACTIONAL EXTENSION SHIELD HEAT PICKUP EXTENSION SHIELD HEAT PICKUP PEAK CHANNEL WALL TEMPERATURE PEAK FUEL TEMPERATURE	REACTOR DIMENSIONS CORE LENGTH CORE DIAMETER FUEL ELEMENT CHANNEL DIAMETER VOID FRACTION OF FUEL ELEMENTS VOID FRACTION OF FUEL ELEMENTS CORE EFFECTIVE DIAMETER LATERAL SUPPORT DIAMETER STRUCTURE OO REFLECTOR OO REFLECTOR OO REFLECTOR OO REFLECTOR OO REFLECTOR OO RESSURE VESSEL ID PRESSURE VESSEL LENGTH THICKNESS OF BATH SHIELD THICKNESS OF LEAD SHIELD PRESSURE VESSEL LENGTH	FUEL MASS SUPPORT MASS SUPPORT MASS CORE PERIPHERY MASS LATERAL SUPPORT MASS SERUCTURE MASS REFLECTOR MASS AFT REFLECTOR MASS AFT REFLECTOR MASS CORE INLET PLENUM MASS SUPPORT PLATE MASS

••	30.88		5556.70	-	0.00 5555 70	2	107.59	64.40	0.00	370.00	813.62	654.19	230.63	79.8	-	0.08	37.18	015.6	5926.70	Ó.	m)	3	
ATERAL SUPPORT FORWA EFFLECTOR HARDWARE FO UPPORT PLATE PLENUM	ON RING MASS	VL CORE A	BAFF	ON BAFFLE 1	SUBSYST	ESSUR	ESSURE VESSEL DO	ZZLE/REACTOR ADAPTE	OTAL PRESSURE VESSEN	CENTRAL SHIELD WA	ATH PERIPHERAL SHIFID	PERIPHERAL SHIFLD 3	ENTRAL SHIELD MACE	PERIPHERAL SHIFID W	PERIPHERAL SHIELD 3	HERAL SHIELD PLATE U	TAL SHIELD MASS	EACTOR MASS //	ACTOR MASS W/ SHIFL	AFETY RODS-FOR	EACTOR MASS W/ SHIFLD	SS w/ SHIFLD	

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TPA SUMMARY FOR STAGE #1 BLEED CYCLE SINGLE SHAFT TPA CENTRIFUGAL PUMPS

... PROPELLANT PUMP ...

37607. 1123. 20000.	52.85 8.86 8.96 8.91 4162.19 2642.95 8.74 8.74	. A.
SPEED (RPM IFIC SPEED ION SPECIFI	NUMBER UF TOW SILVELS NET POS SUCTION PRESSURE (PSIA) ACCELERATION HEAD (PSIA) PUMP OUTLET PRESSURE (PSIA) VOLUMETRIC FLOMMATE (GPM) MASS FLOMMATE (LBM/SEC) PUMP DAMETE (LP) PUMP DIAMETER (HP)	PLMP WT. (LB)

... FUEL BOOST PUMP ...

37687. 10458.	20000. 15.00	78.90	135.26 .646	3.77	15.86
PUMP SPEED(RPM) Safcific Speed	SUCTION SPECIFIC SPEED	OUTLET PRESSURE (PSIA)	PUMP HORSEPOWER(NP)	PUMP DIAMETER(IN)	PUMP WT(LB)

4-183

... TURBINE ...

1.000	٠	26.524	1.65	16.90	3	52636.	48000.	15.	37607.	389.37	16.571	
ADMISSION FRACTION	EFFICIENCY	PRESSURE RATIO	ŝ	ETER(IN)	F TURBINE	BLADE ROOT STRESS LIMIT(PSI)	ESS SPEED	SPECIFIC SPEED	TURBINE SPEED (RPW)	TURBINE WT(LB)	TURBINE ANNULUS AREA(IN2)	

... TPA ...

TPA START SYSTEM WT.

0.00 16.12		16.83 1.95 46.61	85.93 85.93 369.28 369.28 385.17 498.89
GAS GENERATOR/PREBURNER WT. IGNITION SYSTEM WTTOTAL HOT GAS MANIFOLD WTTOTAL	ω	WT TH	TOTAL BLEED CYCLE LINE/VALVE WT BOOST PUMP WT EACH MAIN TURBOPUMP WT EACH TOTAL TURBOPUMP WT. TOTAL TPA WT.

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	78.43 1524.49 1986.42 2512.54 18.99	272.64 75.76 0.00 11.29	8.80 256.29 487.84	11.31 8.88 33.44	5926.78 2015.68 344.87 766.15 76.15 34.98 34.98 34.98 157.77 591.27 591.27	16.12 10.79 0.00 0.00 0.00 0.00	63.32 11171.79	744.29 9.99 9.99 9.99 327.26	19349,32 0.00	8000.00
ke ∦1 weights (Pounds)	AFT TANK FORWARD TANK PRESSURE TANK TANK CONSTRUCTION WEIGHT TANK LINES	AFT SKIRT FORWARD SKIRT TAMK MOUNT STRUCTURAL WALL	PRESSURE TANK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION	FUEL ACQUISITION SYSTEM OXIDIZER ACQUISITION SYSTEM PRESSURANT CONTROL HARDWARE	ENGINE WEIGHTS: REACTOR INTERNAL SHIELD REACTOR INTERNAL SHIELD HOZZLE HAZZLE THRUST MOUNT(S) THRUST M	1 IGNITION SYSTEM(S) HOT GAS MANIFOLD(S) GAS GENERATOR/PREBURNER TPA ASSY(S) GEARBOX(S) TPA START SYSTEM(S) TPA START SYSTEM(S) GAS GENERATOR/PREBURNER(S)	NON-NUCLEAR WEIGHT MARGIN TOTAL ENGINE WEIGHT	FLIGHT FUEL BOILOFF FLIGHT OXIDIZER BOILOFF EXPENDABLE WEIGHT MISCELLANEOUS WEIGHT USER DEFINED WEIGHT REACTOR SAFETY ROD WT.	TOTAL INERT WEIGHT Interstage Weight	BURNED FUEL

.. STAGE #1

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4-185

6000 6000 6000 6000 6000 6000 6000 600	27500.03 18418.58 0.00
BURNED OXIDIZER FUEL RESIDUAL OXIDIZER RESIDUAL STORED PRESSURANT MISC ON-BOARD FUEL MISC ON-BOARD OXIDIZER	GROSS IGNITION WEIGHT GROSS BURNOUT WEIGHT HOLD TIME FUEL BOILOFF HOLD TIME OX BOILOFF

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Nuctear Thermol Vehicle

···· VEHICLE SUMMARY ····

STAGE #1

	100.00 101.60 11 131.89 0.00	631.89	LOX/LH2 35000.0 2500.0 2500.00	874.5 874.5 9.941 49.02 37.41
DIMENSIONS, IN	STAGE DIAMETER Nozzle exit diameter Number of Nozzles Stage length Payload length	TOTAL VEH LENGTH PERFORMANCE	PROPELLANT THRUST, VACUUM DELIVERED, LBF PC, PSIA NOZZLE AREA RATIO	DOWN THE JEC ISP VACUUM DELIVERED, SEC ISP EFFICIENCY TOTAL PROP. FLOWRATE, LB/SEC CORE PROP. FLOWRATE, LB/SEC

LOX/L 35888. 588.	200. 3600. 874.	49. 1.
PROPELLANT	NOZZLE AREA RATIO	IST EFFLORENCE
THRUST, VACUUM DELIVERED, LBF	Burn Time.sec	TOTAL PROP. FLOWRATE, LB/SEC
PC, PSIA	isp.vacuum delivered.sec	CORE PROP. FLOWRATE, LB/SEC

		0	3447.5 KPa	0	ο.					øÖ.	-	114.8 CM				*	≚.	20.8 Kg	×	18.2 Cm		m	8578.3	z		5	2	•	.	D G	0× 0.4		Ś	9 01	15.8 kg	6	n	28.7 kg	×		5066.6 kg				5215.0 kg	
				4556.6 deg R	0.001	40.0 bm/s			-				•		:				•	7.2 in				P	FEED LEGS)	•							1366.2 Ibm	- n	124.00 D340	 • -		3720 A 175	-		9156 1 150	-	.8 161/	327.3 1	11499.00 [bm	-
ENGINE SUMMARY	BLEED CYCLE ENABLER I CENTRIFUGAL PUMPS	IMKUST LEVEL - Chamber Pressinge -	CHAMBER TEMPERATURE	NOZZLE EXIT AREA RATIO -	NUMBER OF FEED LEGS	IVIAL FROPELLANT FLOWRATE -	REACTOR	COMPOSITE FUEL	REACTOR WEIGHT				CONE LAURELLANT MASS FLOW	NOZZLE	CONVERGING NOZZLE WEIGHT	NOZZLE EXTENSION WEIGHT	SECOND NOZZLE EXTENSION WEIGHT	IUIAL NOZZLE WEIGHT	THEAT DIANETER	EXIT DIAMETER	NOZZLE LENGTH	DELIVERED VACUUN ISP	DELIVERED THRUST		FOR ALL		MAIN OX PUMP WEIGHT	TPA IGNITION WEIGHT	BLEED LINE/VALVE WEIGHT	HOT CAN WANTED		MISC. HARDWARE WEIGHTS	SUPPORT HADDWADE	ENGINE LINES	ALVE	GIMBAL + POWER SUPPLY	MARGIN (2.0%)	TOTAL NONNUCLÉAR WEIGHT		TOTAL ENGINE SYSTEM TOTAL ENGINE WEIGHT	TOTAL ENGINE WEIGHT WITHOUT SHIELD	TUDIST ANTIONE CONTRACTION TUDIST ANTELD	REACTOR SAFETY DOD WITHOUT SHIELD	TOTAL ENGINE LAUNCH WFICHT	TOTAL ENGINE LAUNCH WT. W/O SHIFID	

4-188

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6.6 N 6.6 kPa 6.6 N-sec/kg 6.6 deg K	830.4 cm 258.1 cm
	326.9 in 191.6 in
PUMP-OUT CONDITIONS PUMP-OUT THRUST PUMP-OUT CHAMBER PRESSURE PUMP-OUT ISP PUMP-OUT CHAMBER TEMPERATURE	OVERALL DIMENSIONS OVERALL ENGINE LENGTH = OVERALL ENGINE DIAMETER =

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THE FOLLOWING WARNINGS OCCUR FOR STAGE 1

TWO PHASE FLUID ENCOUNTERED IN REGEN

RECOMMENDED RANGE = 1.5 TO 4 CR = 9.693

NOZZLE EXIT DIAM = 101.6 STAGE DIAM = 100.0

AXIAL BUCKLING DESIGNS STRUCTURAL WALL THICKNESS MINIMUM GAUGE DESIGNS AFT TANK WALL THICKNESS

HOOP STRESS DESIGNS FORWARD TANK WALL THICKNESS AFT TANK ULLAGE INCREASED BY GEOMETRY CONSTRAINT

GAS PHASE ENCOUNTERED IN REGEN JACKET

4-190

Table 4-8. Sample Case No. 7

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Input Listing

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I Vehicie FVAC PC MPAYLD WMISC WKISC JCNFIG IPTYPE	ISOLVE TURBTIN FRACHB FRACCB CPLINH CPLINT CPLINT JBPFL JBPFL JBPFL JBPFL JBPFL	FFRAC ITRATE IUSRBRN TUSRBRN FMARG KEXNOZ KEXNOZ KEXNOZ KEXNOZ KEXNOZ KEXNOZ KENZ	KNOZ IPLUG RATHLR OFGGPB GANGCPB CPGGPB MAGGPB TCHAMBER	COMPTC DC SC PAC PAC PAC PAC PAC PAC PAC PAC PAC PA
Nuclear Thera 55,000 6.0 6.0 6.0 7.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1	• • • • • • • • • • • • • • • • • • •	4-193	6 + 6 + 6 + 6 6 + 6 - 7 6 - 7 + 6 6 - 7 6 - 7 6 - 7 6 - 7 6 - 7 6 - 7 7 7 7 7 7 7 7 7 7 7 7 7 7	6.11 2.2 5.2 6.7 6.0 6.0 6.0 6.0 7 7 6.0 6.0 7 7 3 6.0 7 7 3 6.0 7 7 3 6.0 7 7 8 6.0 7 7 8 7 8 7 8 8 8 7 8 8 8 8 8 8 8 8 8

Type of nozzie Use plug nozzie? Wozzie length ratio GG miture ratio GG ratio of specific heats GG molecular weight GG molecular weight Chamber temperature Reactor model flag (1=enabler1, 2=enabler2) Flow path flag (1=enabler1, 2=enabler2) Fuel element chamber diameter Power in each element (NWW per 52 inches) Nozzle flow fraction Heat pickup per tie tube Enthalpy of coolont entering system Margin weight fraction Barrier miquid film length Barrier mixing angle Engine area ratio Use a nozzle extension? Use a 3-portion nozzie? Nozzle extension 1 attach area ratio Convergent nozzle length Expendable stage wt. Cycle type (1=66.3=Expander,7=Bleed) Fractional heat pickup in reflector Fractional heat pickup in ext shield Fractional heat pickup in cent shield Cold bleed line loss fraction Turbine inlet line loss fraction Turbine throttling valve loss fract Use fuel boost pump? Use ox boost pump? Bleed Cycle zolver (zee worksheet) Turbine inlet temp (ISOLVE=1) Hot bleed fraction (ISOLVE=0) Cold bleed fraction (ISOLVE=0) Hot bleed line loss fraction Number of identical turbopumps Double run flag Pump configuration Pump type (Omcentr., 1-axia) Spacing between holes Peak to average channel factor Number of holes per element Vehicle payload wt. Miscellaneous stage wt. Chamber pressure (psia) Propeliant flag Input engine burn time? Engine burn time fuel scaling fraction Vacuum thrust (Ibf) Thrust fraction Double run solver Support pattern Core length Fuel type

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Regen channel surface roughness Max depth to width ratio Number of regen segments in conv. sec. Number of regen segments in nozzie surface area multiplier Weight muitiplier: giaboi Weight muitiplier: thrust mount Weight muitiplier: turbines Weight muitiplier: turbines Weight muitiplier: pumps Weight muitiplier: matrumentation Weight muitiplier: reactor cooldown Input turbomachinery characteristics? number of fuel pump stages fuel pump diameter Boundary layer efficiency adjustment Divergence efficiency adjustment Barrier cooling efficiency adjustment Weight multiplier: all tank Weight multiplier: non-conv. tanks forward tank lines nozzie + hardware convergent nozzie pres. tank lines nozzie extension Cooling channel land width Cooling channel width Cooling channel width Input regen delta T and P? Input regen total delta T Fuel MPSP Ox MPSP GG bleed efficiency adjustment : aft tank lines hot gas ducts gimbal uel turbine admission fraction Pres. tank structure number of fuel turbine stages ox turbine admission fraction Cooling channel multiplier multiplier; ox tank number of ox turbine stages ex turbine diometer turbine admission fraction uel turbine annulus area fuel boost pump diameter ox boost pump diameter number of turbine stages ox turbine annulus area fuel turbine diameter muitiplier; plier; turbine annulus area piler turbine diameter ā ā multi ŝ Ĩų CXWLIN CXWPNEU CXWINST CXWTNKAS CXWTNKAS CHMULT EPIPE HOMMAX NCON FLNPSP OXNPSP ADJGGB ADJBL ADJJIV ADJJIV CXWTNK DELTAP SAMULT INDPOT CXMPTN CXMSTR CXMSTL CXMSTL CXMFTL CXMFTL CXMFLV CXMENG CXMNZE CXMNZE CXMDUC WLTHR DELTAT CXNCT1 CXNFLT CXWTPA PSTAGF PSTAG6 PDIAFL PDIAOX BPDIAF CXINOX1 CXWG IM CXWTHM CXW1GG NNZL ISTSET TSTGES TSTAGF TSTAGO TDIAM TDIAFL TDIAOX ADMFR ADMFRF ADMFRO ANARFL ANAREA **e** . • • • **0** 0 17 •

user defined drive fluid weight user defined drive fluid tank weight density of drive fluid tank yield stress of drive fluid tank density of drive fluid tank materia transpiration cooling criteria max heat flux before transp. cooling upstrees area ratio for transp. etched platelet thickness platelet land thickness tenk domo types pressure tank goometry number of pressure bottles propellant tank head ellipse ratio propellant tank head ellipse ratio propellant tank dome erientation restant the first thickness separator platelet thickness flow pasage widths transp. cooling insert thickness transp. cooling insert conductivity use non-conventional tanks? propellant tank dome erientation propellant tank dome erientation propellant location number of non-conventional tanks aput turbepump cesembly weights? geer box weight heat exchanger weight GC/preburner weight Have user-defined gas generator? bleed nezzie flowrate angular location radial location of dimensional input angine angular location Ferwerd tank monocoque? angine radial location GG blood officiency max turbine temperature turbine/GG inlet temp. tetal TPo weight TPA start system weight Ignition system weight hot gas monifold weight turbine intet pressure lorward skirt length tenk eilipse ratios Aft tank monocoque? uel tank material oft skirt length urbine flowrete stage diameter contents tank radius cank types Ley1/D tonk tenk (ank kind KXATFH KXFTAH KXFTAH KZFTAH KPRPA NTAMKS ELTMK1 KTAMK1 INTMK1 KALMOO RDIM1 FASKTL RMAJ1 ENGAN1 TTANNER NCTINK NNCOA NNCOA KINCOA KINCOA KINCOA KINCOA KINCOA **NIOTOR TANGLI** ENGR01 FSKTL TGEOH TGEOL TGEOS TGEOW RHTRIN TRINST ELRP **RADLO1** TTL IMT TTL IMT USROG USROG USROG PUSRC PUSRC ROUSRC ROUSRC ROUSRC ROUSRC CORAN LDTAN CORAN CORAN **KXATAH** INPTPA TPANT WSTART WSTART WICHIT WCBOX WTHTX WCBOX WTHTX WCBOX WTHTX WCBOX ULWZ ETACCB 15+2. 5+0.0 5+0.0 100.0 5.1.0 25000.0 5.0.0 5-1.1 5.1 :: ŝ ē

Preseure tank material structure and skirts material tank materials (non-conventional tanks) user defined tank material elasity user defined tank material elastic mod user defined tank material strength user defined tank material specific heat user defined tank material specific heat user defined tank material specific heat user defined tank material min gauge user defined material structural min gauge fuel tank safety factor ox tank safety factor space between aft euspended tank & wall space between for, suspended tank & wall space between pres, suspended tank & wall pressure tank insulation density Pressure tank insulation density insulation thickness for pressure tank non-conv. tank usable volume ratios min clearance between non-conv tanks non-conv madel engine nesting mode non-conv tank thickness mode velocity heads lost in fuel lines velocity heads lost in ox lines max carry moment space between aft and forward tank space between forward and pressure tanks pressurant ratio of specific heats (isen) pressurant ratio of specific heats (poly) time at which polytropic ratio is 1.1 pressure tank adfety factor structure adfety factor lines adfety factor tank adfety factor - non-conv. tanke engine mounting length adjustment fuel expulsion efficiency flag ox expulsion efficiency flag number of temp schedule iterations ox acquisition device density forward shroud cross-sect area ox exputation efficiency fuel acquisition device density input propellant temperatures? propellant feed line flag stage critical bending moment aft shroud cross-sect, area Lines full at burnout? Miscellaneous fuel on-board fuel line surface roughness fuel exputsion efficiency miscellaneous ox on-board ox line surface roughness fuel min temp fuel nominal temp fuel max temp ox min temp ox tank material ox nominal temp ox max temp MATSTR MATNK1 RHO SIGMAX SPHEAT CONDCT TMING SFFLTK SFOXTK SFSTRC SFLINE SFLINE SFLINE SFLINE SFLINE SFLINE SFLINE SFLINE SFLINE INPEXO INPEXO DACOPL DACOPL DACOPL DACOPL TPMINF TPMINF TPMINO **ININGS** MTNKOX TPMAXO LUFULL WMISFL WMISSX RHOINS KLINEA CBM RATNKI CLRTNK CLRTNK ENGSPC KNEST KTHCKI CLRFP RHPTIN MATPT NTMP IT 100 ISPCF ISPCF CLRAF LINSUL **CAMPCG** TIMPCG FLKFCT CANICC OXKFCT RUFFOX RUFFF 29.0E6 112300.0 0.12 . 00023 . 035 . 035 . 255 . 255 5+1.5 .0414 .152 5+11 588 288 . 29 5+1.0 9.52 8.0001 5 000 240.0 -. 66 5+1 • • • • e e ė 6 4-197

molecular weight of press. ,nt solid GG min port to throat area ratio solid GG equilibrium temp ratio solid GG burn rate coefficient solid GG grain characteristic velocity solid GG grain characteristic velocity solid GG grain burn rate exponent solid GG grain burn rate exponent	lid GG uliage pressure multiplier mbustion product specific heat rat mperature sensitivity of GG pressu lid GG grain density lid GC combustion temperature lid GC ref temp decay time constant lid GC ref temp for burn rate constant	lid GG molecular weight of com out pump fraction of total hea control valve preserve drop m elopreseure ratio across GG rbine outlet preseure (for GG) Adengine assignments togenous fuel preseurant temp togenous duel preseurant temp	3 0		TPA start bottle gas temp. TPA start sphere temp. fuel turbine blade density ox turbine blade density turbine blade density TPA effective material density
WTMCG APATGG BTEQGG CBNGG CBNGG CDESGG CSGG CSGG DMINSG EBNGG FH20GG	FPULGC CAMBG CAMBG CAMBG FIPKGG FIPKGG TCCYGG TREFGG	WTINGC BPFRFL BPFRFL BPFROX COMLTF PBPNO PPDNO P	SSSOX SSSBPF SSSBPO SSSBPO UOVERC LOVERC EPSGGB GGCR ROINGG ROINGG ROINGG	SYDUCT SYDUCT ISTART CV CV CV CV CV CV CV RHOBOT RHOSPH RHOSPH ROCCART SYCOL SYCOL SYCOL	TERMIN TRADTFL RHOTFL RHOTOX RHOTUR RHOTPA
2862 255 2662 2862 2862					

4-198

turbine blade ultimate strength turbine blade yield strength engine bay line density engine bay line yield strength	contract of the material density dork insulation conductivity flag thermal conductivity of Mil		SOFI density MLI radiation shields per inch average stage acceleration iteration counter in heat transfer calca	variant uliage pressure fraction-vent. stage action time stage hold time MLI environment flag	MLI Purge gas pressure at space hold external tank boundary temperature Earth infrared heat flux Earth reflectance (albedo) average orbital altitude orbital angle stage absorbativity	solar heat flux relative humidity ambient temperature wind velocity space between ox bladder and wall space between ox bladder and wall ox bonded rolling diaphrage density fuel bonded rolling diaphrage density fuel bladder thickness
US YS ROLINE SYLIN ROSPYL	ROACVL KALCON CNML1	CNSOFI SOFIA SOFIB DNMLI	RADPUL RADPIN SACCEL NITHX FVENTF	FVENTO FLTTIM HLDTIM MLDTIM DELLENV	T T T T T T T T T T T T T T T T T T T	SOLCOM RELIHUM TAMICE WNAMPH BLSPOX BLSPOX BLSPOX DBMDOX TBLDOX TBLDOX TBLDOX
134999.9 128989.9 2988.9 39899.9 1.0	0.3 1 2.59176-9 2.59176-9	8.939//E-8 3.935E-8 5.676E-10 6.002 0.00177	40.0 1.1	1.1 259200.0 4. 2.6E-7	20 20 20 20 20 20 20 20 20 20 20 20 20 2	1 • • • • • • • • • • • • • • • • • • •

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Output Listing

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Nuclear Thermal Vehicle

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OUTPUT FOR MULTIPLE PUMPS AT FULL THRUST LEVEL

PROPELLANTS LIQUID OXYGEN - LIQUID HYDROGEN ASSUMPTIONS:

TEMP ENTHALPY LOX 99.18 K -3093. CAL/MOL LH2 20.27 K -2154. CAL/MOL

ODK VALUES CORRESPOND TO THROAT RADIUS-2.289 IN. C-STAR & CHAMBER TEMP DATA EVALUATED AT ODE PC & ODE MR VAL

KEY INPUTS

250000. (Ibf)	CUMPOSITE FUEL	500. (peia)
Bleed Cycle	200.	4860. (deg R)
Enabler I	LH2	3 - 3
THRUST LEVEL = CYCLE TYPE = REACTOR TYPE = FUEL TYPE =	NOZZLE EXIT AREA RATIO	COMMER PRESSURE - CHAMBER TEMPERATURE - NUMBER OF PROPELLANT FEED LEGS -

TANKAGE SUMMARY FOR STAGE 1 BLEED CYCLE

AFT TAMK CONTAINS OXIDIZER ... (USER DEFINED GG) AFT TAMK CONTAINS OXIDIZER ... FORWARD TAMK CONTAINS FUEL FUEL TAMK IS PRESSURIZED WITH COLD GAS TAMK MATERIALS (OX - USER DEF) (FUEL - glumainum) (PRESSURANT - USER DEF)

··· DIMENSIONS (INCHES) ...

	78.43 1532.78 5258.60 4808.87	30.13 523.47 189.41 8.00	0.00 257.11 407.04	184.83 11.31
···· WEIGHTS (POUNDS)	AFT TANK FORWARD TANK PRESSURE TANK TANK CONSTRUCTION WEIGHT	STRUCTURAL WALL AFT SKIRT FORWARD SKIRT TANK MOUNT	PRESSURE TANK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION	REVERSE HEAD STIFFENER FUEL ACQUISITION SYSTEM
	199.99 1122.72 544.28 415.47 12.99	1.38 1.38 35.34	100,00 00,00 00,00 00,00 00,00 00,00	466.84 6.00
	STAGE DIAMETER TOTAL STAGE LENGTH TOTAL TANK LENGTH NOZZLE LENGTH CONVERGENT NOZZLE LENGTH MOUNT LENGTH	TAMK HEAD ELLIPSE RATIO Pressure tamk ellipse ratio Aft tamk head height Formard tamk head height	PRESSURE TANK HEAD HEIGHT PRESSURE TANK HEAD HEIGHT PRESSURE TANK DIAMETER AFT TANK CYLINDRICAL LENGTH FORMARD TANK CYLINDRICAL LENGTH	PRESSURE TANK CYLINDRICAL LENGTH

STEM 6.00 WARE 1068.10 80.37	80.00 90.00	138.82	374.94 0.00 0.00		000 00 00	90°. 90°.	5 2.00 1.25 1.25
OXIDIZER ACQUISITION SYSTEM PRESSURANT CONTROL MARDWARE TANK LINES	BURNED FUEL BURNED OXIDIZER	FUEL RESIDUAL OXIDIZER RESIDUAL	STORED PRESSURANT HOLD TIME FUEL BOILOFF HOLD TIME OX BOILOFF	FLIGHT FUEL BOILOFF FLIGHT OXIDIZER BOILOFF	MISC EXPENDED FUEL MISC EXPENDED OXIDIZER	MISCELLANEOUS WEIGHT INTERSTAGE WEIGHT	INPUT MINIMUM SAFETY FACTORS STRUCTURAL WALL LINES OXIDIZER TANK FUEL TANK PRESSURE TANK
8.88 25.76		0.164 6.038	•. •18 •. 96 •. •	0.011 0.001 0.001	9.9 9.9 9.9		2222
AFT LIME DIAMETER Formand Lime Diameter	AFT SKIRT LENGTH FORWARD SKIRT LENGTH	STRUCTURAL WALL THICKNESS AFT TANK WALL THICKNESS	FORMARD TANK WALL THICKNESS PRESSURE TANK WALL THICKNESS AFT TAMK DOME THICKNESS	FORMARD TANK DOME THICKNESS PRESSURE TANK DOME THICKNESS	FUEL TANK MLI THICKNESS FUEL TANK SOFI THICKNESS	OXIDIZER TAME MLI THICKNESS OXIDIZER TAME SOFI THICKNESS PRESSURE TAME INSULATION THICK	FUEL THK HEAT FLUX(BTU/HR IN••2) OX TANK HEAT FLUX(BTU/HR IN••2) FUEL BOILOFF RATE (LB/SEC) OX BOILOFF RATE (LB/SEC)

PROPELLANT SUMMARY FOR STAGE #1 PROPELLANT IS LH2

0.0025 NOMENAL. PROPELLANT BULK DENSITY(LB/IN++3)=

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	VOMINAL TANK PRESSURE(PSIA) 35.1	NOMINAL PROPELLANT TEMP(DEGR) 38.5 Nominal density(LB/IN++3) 0.0025 Nominal vapor pressure(PSIA) 20.0	MAX PROPELLANT TEMP(DEGR) 40.0 Max temp density(LB/IN++3) 0.0025 Max temp vapor pressure(PSIA) 25.0	MIN PROPELLANT TEMP(DEGR) 38.5 MIN TEMP DENSITY(LB/IN++3) 0.9625 MIN TEMP VAPOR PRESSURE(PSIA) 20.9
··· FUEL ···	CMINAL TAN	6.00 0.0000 MOMINAL PROMINAL PRO NOMINAL VE	E.E. MAX PROPELL E.eeae Max TEMP DI E.E. MAX TEMP VI	6.6 MIN PROPELI 6.6666 MIN TEMP DI 6.6 MIN TEMP V
OXIDIZER	NOMIMAL TANK PRESSURE(PSIA)	NOMINAL PROPELLANT TEMP(DEGR) NOMINAL DENSITY(LB/IN++3) NOMINAL VAPOR PRESSURE(PSIA)	MAX PROPELLANT TEMP(DEGR) MAX TEMP DENSITY(LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA)	MIN PROPELLANT TEMP(DEGR) MIN TEMP DENSITY(LB/IN++3) MIN TEMP VAPOR PRESSURE(PSIA)

ENGINE SIZE, WEIGHT, & PERFORMANCE SUMMARY FOR STAGE #1 BLEED CYCLE

CONVERGENT NOZZLE IS REGEN COOLED (MILLED SLOT CONSTRUCTION)

NOZZLE IS REGEN COOLED (TUBE CONSTRUCTION) PROPELLANT IS LH2

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	888.66 928.88	16514. 16597.	500. 250000. 250000. 3660.00	6.957	8.995 8.995 9.995 9.995 9.975	0.00 274.17 274.17	4868. 1638. 8.88
··· PERFORMANCE	DELIVERED ISP(VAC),SEC Ideal ISP(ODE),SEC	DELIVERED CSTAR,FT/SEC Ideal Cstar,Ft/Sec	CHAMBER PRESSURE, PSIA THRUST PER ENGINE (VAC), LBF TOTAL VAC THRUST, LBF BURN TIME, SEC	OVERALL EFFICIENCY	KINETIC EFFICIENCY BARRIER COOLING EFFICIENCY BOUNDARY LAYER EFFICIENCY DIVERGENCE EFFICIENCY GG BLEED EFFICIENCY	FOR 1 ENCINE OXIDIZER FLOWRATE,LB/SEC FUEL FLOWRATE,LB/SEC TOTAL FLOWRATE,LB/SEC	CORE TEMPERATURE, DEG R BARRIER TEMPERATURE, DEG R ENGINE MIXTURE RATIO FUEL FILM COOLING FRACTION
NCHES)	PRESSURE VESSEL 0.0. PRESSURE VESSEL 0.0. NOZZLE EXIT DIAMETER 269.19	LE LENGTH	TICKRESS THICKNESS TENSION THICKNESS A RATIO 20		NOZZLE LENGTH/ (MIN RAO LENGTH) 25.00 NOZZLE LENGTH/ (MIN RAO LENGTH) 1.187 NOZZLE LENGTH ADUNI LENGTH 415.47 FEED SYSTEM MOUNT LENGTH 99.04 REACTOR LENGTH 52.00		

THE FOLLOWING IS THE REGENERATIVE COOLING SUMMARY FOR STAGE #1

			TGAS 539E+03 618E+03 739E+03 739E+03 948E+03 141E+04
			E 259E+82 176E+82 116E+82 676E+81 .324E+81 .324E+81
	SNOT		HC 5855-03 .7685-03 .7685-03 .1665-02 .3475-02 .3475-02
	LONG NOZZLE SECTIONS LONG CONVERGENT CHAMBER SECTIONS LONG CYLINDRICAL CHAMBER SECTIONS		HG .733E-04 .108E-03 .172E-03 .309E-03 .673E-03 .281E-03
	ZLE SECTIO		TGW -121E+03 -141E+03 -174E+03 -238E+03 -238E+03 -335E+03
	LONG LONG	1	TCW 0.116E+03 0.131E+03 0.156E+03 0.156E+03 0.264E+03 0.266E+03 0.256E+03
	15.228 INCH 3.981 INCH 0.000 INCH	.00039000 (BTU/IN SEC DEGR) Rature- 1460. (deg r)	.3066-01 .5176-01 .5176-01 .21946-01 .21946-01 .21946-01 .2546+01
	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	00 (BTU/IN 1460.	V 1386+03 20166+03 31966+03 31966+03 5826+03 1396404
u	OUNDS TO THE DUNDS TO THE DUNDS TO THE		W 656E+00 545E+00 433E+00 322E+00 322E+00 211E+00 100E+00
THE ENGINE IS A FUEL COOLED CONVENTIONAL EXPANSION NOZZLE	H 6 ARE BOUNDS H 11 ARE BOUNDS H 11 ARE BOUNDS	- 0.073 ONDUCTIVITY PERATING TEI	TB 632E+02 636E+02 641E+02 651E+02 653E+02 712E+02
NE IS A FU ONAL EXPAN	STATIONS 1 THROUGH 6 STATIONS 6 THROUGH 11 STATIONS 11 THROUGH 11	WALL THICKNESS = Wall Thermal Cond Wall Maximum Oper	P .1136+04 .1136+04 .1136+04 .1136+04 .1126+04 .7736+03
THE ENGI CONVENTI	STATIONS STATIONS STATIONS STATIONS	GAS WALL GAS WALL GAS WALL	514110N 1 2 2 6 5 5 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5

550.0 0.0 (SATURATION TEMP OF PROPELLANT) 63E+0+ 63E+04 40+3E9 163E+04 63E+04 .1785+01 .2785+01 .4015+01 .5455+01 .7125+01 .7366-62 .4526-62 .3166-62 .2276-62 .1756-62 TEMPERATURE (DEG R) UEL OXIDIZER •••|||||||| .1795-92 .1215-92 .8725-93 .6615-93 325.3 4860.0 .645E+03 .587E+03 .552E+03 .529E+03 .514E+03 38.5 85.5 85.5 85.5 85.5 73.9 157.8 550.0 43.2 FUEL PRESSURE AND TEMPERATURE SCHEDULES FOR STAGE #1 BLEED CYCLE : .314E+03 .351E+03 .356E+03 .395E+03 .393E+03 .405E+03 PROPELLANT PRESSURANT (USER DEFINED GG) COOLANT VELOCITY (IN/SEC) HEAT FLUX (BTU/IN++2 SEC) HEAT FLUX (BTU/IN++2 SEC) TEMPERATURE OF COOLANT WALL (DEGR) TEMPERATURE OF GAS WALL (DEGR) GAS SIDE HEAT TRANSFER COEFF (BTU/IN++2 SEC DEGR) COOLANT SIDE HEAT TRANSFER COEFF (BTU/IN++2 SEC DEGR) .126E+01 .939E+00 .727E+00 .580E+00 : .177E+01 PRESSURE(PSIA) JEL OXIDIZER + 7965. + • • • • • • ••• 1996+04 1316+04 9266+03 6916+03 342E+04 737.1 500.0 - COOLANT PRESSURE (PSIA) - COOLANT BULK TEMPERATURE (DEGR) - COOLANT CHANNEL WIDTH (IN) - COOLANT VELOCITY (IM/SEC) - MEAT FLUX (BTU/IM++2 SEC) - TEMPERATURE OF COOLANT WALL (DEGR) LOCAL AREA RATIO (-) COMBUSTION GAS TEMPERATURE (DEGR) 35.1 35.0 1178.7 1178.7 1178.7 547.5 737.1 762.1 + 1055. + 105. -105. -FUEL .1936+00 .2596+00 .2856+00 .3326+00 146E+00 MAIN VALVE INLET MAIN VALVE OUTLET COLD BLEED VALVE IN COLD BLEED VALVE IN COLD BLEED VALVE OUT TIE TUBE OUTLET REGEN OUTLET (REFL I REFLECTOR OUTLET 7166+02 7236+02 7286+02 7326+02 7326+02 7366+02 PROPELLANT REACTOR INLET REACTOR CORE MAX STORAGE VENT 4.8-6.490-INLET 7656+03 7636+03 7636+03 7636+03 7626+03 ULLAGE ¥5 ŧ 1 1 1 1 I -----DELTA TGAS <u> 앞</u>

1400.0

1400.0 1400.0 545.7

432.5 397.9 20.0

500.0 465.0

CHAMBER BLEED MIXER OUTLET TURB THROT VALVE IN TURBINE INLET TURBINE OUTLET

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4-204

	LB/SEC MN
RACTERISTICS	270.31 5403.12

REACTOR OPERATING CHAI TOTAL COOLANT FLOW REACTOR POWER

REACTOR OPERATING CHARACTERISTICS AND MASSES

0.034 0.034 0.028 0.178 0.178 0.28	
OVERALL BLEED FLOW FRACTION OVERALL HOT BLEED FRACTION OVERALL COLD BLEED FRACTION HOT SIDE FRACTION OF TOTAL BLEED COLD SIDE FRACTION OF TOTAL BLEED	REACTING MEREATING SILLS

BLEED CYCLE FLOW RATIOS

0X I D I ZER 0.000		•••	3.038	000	3.232 3.232	e. 1e e. 1e		
FUEL 281.321	93.774 2.657	273.350 81.093	907 . 7AI	159.218 3.232		000 · 0	270.312	268.586
TANK OUTFLOW	COLD BLEED FLOW-EACH LEG	TOTAL TIE TUBES Regen Jacket inflow	NOZZLE BARRIER COOLING REGEN/REFL MITIET TO COOL	MIXER OUTLET-EACH TURBINE - EACH	BLEED NOZZLE - EACH TURBINE TO CORF	SSURANT (AVE)	BER (HOT) BLEED FLOW	

(USER DEFINED GG) FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 BLEED CYCLE

854.3

377.9

0.0 762.9 10.4 83.9

PRESSURE CHANGES (PSID) TEMPERATURE CHANGES (PSID) TEMPERATURE CHANGES (DEG R)

000

1143.6 35.6 82.5 631.1 631.1 34.6 34.9 364.9 25.0

ACQUISITION DEVICE FEED LINE PUMP MAIN VALVE HOT BLEED LINE COLD BLEED VALVE TURBINE INLET LINE TURBINE TURES REGEN JACKET REFLECTOR TURBINE

000 000

4-205

675.28 IN2 0.40 LB/IN2 1.20 MM/Element 1.79 HR 4349.52 760.92		21.00	_	62496 8661	UP 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.		1.20 56.53 61.44 10 73.21 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		16480.71 LB 1957.53 LB 588.29 LB 587.65 LB 1170.99 LB 396.80 LB 396.80 LB 164.26 LB 164.26 LB 164.26 LB 164.69 LB 177.95 LB 177.95 LB 181.59 LB 181.59 LB 181.59 LB 181.59 LB 181.59 LB 181.59 LB 181.59 LB 181.59 LB 181.59 LB 181.50 LB 18
CORE FLOW AREA CORE MASS FLOW RATE FUEL ELEMENT POWER FUEL ELEMENT OPERATING LIFE WUMBER OF FUEL ELEMENTS	NUMBER OF SUPPORT ELEMENTS CHAMBER TEMPERATURE CHAMBER PRESSURE COMABER ENTHALPY CORE INLET TEMPERATURE	INLET INLET PICKUP	PICKUP	IN REFLEC	CENTRAL STIELD THE PICKUP FRACTIONAL EXTENSION SHIELD HEAT PICKUP EXTENSION SHIELD HEAT PICKUP PEAK CHANNEL WALL TEMPERATURE PEAK FUEL TEMPERATURE	LENGTH DIAMETER ELEMENT CI FRACTION	ETAGE CHANNI TIVE DIAMET PPORT DIAME OD CO ESSEL ID	PRESSURE VESSEL OD THICKNESS OF BATH SHIELD THICKNESS OF LEAD SHIELD PRESSURE VESSEL LENGTH FUEL VOLUME	REACTOR MASSES FUEL MASS SUPPORT MASS CORE PERIPHERY MASS LATERAL SUPPORT MASS STRUCTURE MASS STRUCTURE MASS REFLECTOR MASS AFT REFLECTOR MASS AFT REFLECTOR MASS AFT REFLECTOR MASS CORE TNLET PLENUM MASS CORE TNLET PLENUM MASS SUPPORT PLATE PLENUM MASS INSTRUMENTION RING MASS INSTRUMENTION RING MASS SUPPORT PLATE PLENUM MASS SUPPORT REFLECTOR HARDWARE MASS SUBTOTAL CORE A SUBTOTAL CORE A FLOW BAFFLE MASS

•

0.00 LB 21506.01 LB	938.30 LB 354.93 LR	242.70 LB 120 12 LD	1656.04 LB	1221.05 LB	403.49	1201.26 LB	0.13 LB	66.85	0218.31 LB 23162.05 IR	380.36	2034.45 LB	5196.50	31414.81 LB
FLOW BAFFLE 1 MASS TOTAL CORE SUBSYSTEM MASS PRESSIBE VESSEL 1 MASS	ESSURE VESSEL B	NOZZLE/REACTOR ADAPTER MASS	IOTAL PRESSURE VESSEL MASS BATH CENTRAL SHIELD MASS	IPHERAL	n remirmenal SHJELD D CENTRAL SHJELD	PERIPHER	HIELD 2	ן שייין	MASS #/0	S W/ SHIELD	FACTOR MASS - V.		

••• TPA SUMMARY FOR STAGE #1 ••• Bleed cycle

3 PROPELLANT FEED LEGS (USER DEFINED GG) AXIAL PUMPS TPA SIZE/WI/PERFORMANCE IS USER DEFINED

17065. 2417.		67.99	1178.65	93.77	0.780 0.780	e. 532 e. 782	8.91 490.56 127 55	648.15
EED (RPM) C SPEED	INDUCEN SPECIFIC SPEED SUCTION SPECIFIC SPEED NAMBER OF PUMP STARFS	POS SUCTION	PUMP OUTLET PRESSURE(PSIA) Volumetric flomrate(GPM)	MASS FLOWRATE(LBM/SEC) PUMP HORSEPOWER(HP)	PUMP EFFICIENCY	OVERALL PUMP EFFICIENCY PUMP DIAMETER/INJ	PUMP WT. (LB) - EACH PUMP INDUCER WT. (LB) - EACH	OVERALL PUMP WT.(LB) - EACH

... TURBINE ...

ADMISSION FRACTION

0.663 19.893 3.23 39.75 39.75 39.75 2. 29154 17855 17855 17855 17855 17855 17855 17855 17855 17855 17855 17855 17855 17855	e.ee e.ee 48.36 48.36 86.71 86.71 2.65 2.62 2.62 2.62 2.62 2.63 2.63 2.63 2.63	78.43 1532.78 5256.69 4898.87 80.37	523.47 189.41 0.00 30.13		1068.10 1068.10 23162.05 6218.31 2519.96 3907.32
EFFICIENCY PRESSURE RATIO MASS FLOWRATE(LB/SEC) DIAMETER(IN) NUMBER OF TURBINE STAGES BLADE ROOT STRESS LIMIT(RPM) SPECIFIC SPEED TURBINE SPEED(RPM) TURBINE SPEED(RPM) TURBINE SPEED(RPM) TURBINE SPEED(RPM) U OVER C INLET MACH NUMBER	TPA TPA START SYSTEM WT. TPA START SYSTEM WT. GAS GENERATOR/PREBURNER WTEAC IGNITION SYSTEM WTTOTAL HOT GAS MANIFOLD WTTOTAL HOT GAS MANIFOLD WTTOTAL GEARBOX WTTOTAL CHAMBER BLEED LINE WTEACH COLD BLEED LINE WTEACH TUMBINE INLET LINE WTEACH COLD BLEED VALVE WTEACH TUMBINE INLET LINE WTEACH TUMBINE INTER VALVE WTEACH TUMBINE THAOTTLING VALVE WTEACH TOTAL BLEED CYCLE LINE/VALVE WTEACH TOTAL BLEED CYCLE LINE/VALVE WTEACH TOTAL BLEED CYCLE LINE/VALVE WTEACH TOTAL BLEED CYCLE LINE/VALVE WTEACH TOTAL TUMBOPUMP WT EACH	STAGE #1 WEIGHTS (POUNDS) AFT TANK FORWARD TANK PRESSURE TANK TANK CONSTRUCTION WEIGHT TANK LINES	AFT SKIRT FORWARD SKIRT TANK MOUNT STRUCTURAL WALL	PRESSURE TANK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION FUEL ACQUISITION SYSTEM	OXIDIZER ACQUISITION SYSTEM PRESSURANT CONTROL MARDWARE ENGINE WEIGHTS: 1 REACTOR INTERNAL SHIELD 1 NOZZLE 1 THRUST WOUNT(S)

126.59 810.94 810.59 721.18 721.18 689.24 86.71 740.90	• •	744.34 9.99 9.99 9.99 9.99 2.93 2.99	65055.02	69 69 13 13 13 14 19 19 19 19 19 10 10 10 10 10 10 10 10 10 10 10 10 10	73567.98 62789.19 0.00 0.00	••• Stage #1	100.00 269.19
1 GIMBAL SYSTEM(S) 3 ENGINE BAY LINE(S) 3 MAIN VALVE(S) 1 SUPPORT HARDWARE 1 GIMBAL POWER SUPPLY 3 IGNITION SYSTEM(S) 3 HOT GAS MANIFOLD(S) 3 GAS GENERATOR/PREBURNER 3 TPA ASSY(S)	V VERNOUX(S) Non-Nuclear Weight Margin Total Engine Weight		TOTAL INERT WEIGHT	INTERSTAGE WEIGHT BURNED FUEL BURNED OXIDIZER FUEL RESIDUAL OXIDIZER RESIDUAL STORED PRESSURANT MISC ON-BOARD FUEL MISC ON-BOARD OXIDIZER	GROSS IGNITION WEIGHT GROSS BURNOUT WEIGHT HOLD TIME FUEL BOILOFF HOLD TIME OX BOILOFF	Nuclear Thermal Vehicle •••• VEHICLE SUMMARY ••	DIMENSIONS, IN STAGE DIAMETER NOZZLE EXIT DIAMETER

.

1 1122.72 8.88	1122.72		LOX/LH2
NUMBER OF NOZZLES Stage Length Payload Length	TOTAL VEH LENGTH	PERFORMANCE	PROPELLANT

LOX/LH2	250000.0	500.0	200.00	3600.00	866.7	0.957	281.32	270.31	
PROPELLANT	TUDIST VACIUM DELIVERED LBF		MOTIF ARFA RATIO	DILAN TIME SEC	ISP VACIUM DELIVERED. SEC	ISD FFFICIENCY	TOTAL PROP. FLOWRATE, LB/SEC	CORE PROP. FLOWRATE, LB/SEC	

OUTPUT FOR SINGLE PUMP AT REDUCED THRUST

PRESSURE AND TEMPERATURE SCHEDULES FOR STAGE #1 FOR ONE PUMP AT REDUCED THRUST LEVEL 250000. BLEED CYCLE

TEMPERATURE(DEG R) Fuel oxidizer	550.0 0.0 (SATURATION TEMP OF PROPELLANT)	6.6 6.6 6.6 6.6 6.6 6.6 1400.6 1400.6 1400.6 1400.6 545.7
TEI FUEL	550.0	38.35 822.55 822.55 822.55 822.55 840 156.0 157.0 156.0 157.0 156.0 156.0 156.0 157.0 156.0 157.0 156.0 157.0 156.
IZER	PRESSURANT	PROPELLANT
PRESSURE(PSIA) JEL OXIDIZER	4365.4 8.8 8.8	
SURE (P		737.1 588.8 442.9 287.9 28.8
PRES FUEL	4365.0 38.6 35.1	35.1 35.6 1178.9 1178.9 1178.9 737.1 737.1 737.1 737.1 737.1 737.1
	MAX STORAGE VENT ULLAGE	TANK PROPELLANT PUMP INLET MAIN VALVE INLET MAIN VALVE UNLET COLD BLEED VALVE UN COLD BLEED VALVE UN TIE TUBE OUTLET REGEN OUTLET (REFL I REGEN OUTLET (REFL I REACTOR OUTLET REACTOR OUTLET REACTOR OUTLET REACTOR OUTLET TURBINE OUTLET TURBINE OUTLET TURBINE OUTLET

COMPONENT PRESSURE/TEMPERATURE CHANGES

TEMPERATURE CHANGES (DEG R)	6.6 23.3 6.6				6.6 768.6		834.3
PRESSURE CHANGES (PSID) 0.0	1 1 1 1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0	8	624.0 624.0	32.5 34 6	250.0	25.0 377.9	•
ACQUISITION DEVICE	FLEU LINE PUMP MAIN VALVE	HOT BLEED LINE	COLD BLEED VALVE	TURBINE INLET LINE TURB THROTTLING VALV	TIE TUBES REGEN JACKET	REFLECTOR TURBINE	

•

FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 BLEED CYCLE

ł

OXIDIZER 9.899 9.968 9.968 9.968 9.999 9.999	
00000000000000000000000000000000000000	
FUEL 288.732 140.362 3.599 273.534 81.149 192.385 192.385 192.385 192.385 192.385 192.385 192.385 192.385 192.385 192.385 192.385 192.385 192.385 192.385 193.45 194 194 194 194 194 194 194 194 194 194	268.927
TANK OUTFLOW MAIN PUMP - EACH MAIN PUMP - EACH COLD BLEED FLOW-EACH LEG MAIN VALVE TOTAL TIE TUBES REGEN JACKET INFLOW NOZZLE BARRIER COOLING REGEN/REFL OUTLET TO CORE MIXER OUTLET-EACH MIXER OUTLET-EACH BLEED NOZZLE - EACH BLEED NOZZLE - EACH TURBINE TO CORE STORED PRESSURANT (AVE) CORE	CHAMBER (HOT) BLEED FLOW NOZZLE OUTFLOW

BLEED CYCLE FLOW RATIOS

			_ <	ç
N	¥		SIDE FRACTION OF TOTAL BLEED	
VERALL BLEED FLOW FRACTION	BLEED FRACTION	COLD BLEED FRACTION		5
EED FLO	T BLEED	PACTION	FRACTION	
RALL BL		UVERALL CU	OLD SIDE	
2		59	20	•

0.031 0.006 0.026 0.179 0.821 ••• TPA SUMMARY FOR STAGE #1 ••• SUMMARY FOR TPA AT THRUST LEVEL FRACTION 1.00 BLEED CYCLE 2 PROPELLANT FEED LEGS AXIAL PUMPS

... PROPELLANT PUMP ...

•

19978. 3580. 8583. 2 990 .	6.+ INDUCER 67.63 0.00	11/0.95 14535.93 140.37 11660.17	e. 53e e. 766 e. 827 8. 91	499.56 157.58 648.15
M) IC SPE	MBER O	PUMP OUTLET PRESSURE(PSIA) VOLUMETRIC FLOMRATE(GPM) MASS FLOMRATE(LBM/SEC) PUMP HORSEPOWER(HP)	PUMP EFFICIENCY INDUCER EFFICIENCY OVERALL PUMP EFFICIENCY PUMP DIAMFTER(IN)	PUMP WT.(LB) - EACH PUMP INDUCER WT.(LB) - EACH OVERALL PUMP WT.(LB) - EACH

... TURBINE ...

1.700 0.700 19.893 19.75 2.75	53286. 29154. 19. 19978. 1593.12 45.477
ADMISSION FRACTION	BLADE ROOT STRESS LIMIT(PSI)
EFFICIENCY	ROOT STRESS SPEED LIMIT(RPM)
PRESSURE RATIO	SPECIFIC SPEED
MASS FLOWATE(L8/SEC)	TURBINE SPEED(RPM)
DIAMETER(IN)	TURBINE WT(LB) EACH TURBINE
MADER OF TURBINE SIAGES	TURBINE AMMULUS AREA(IN2)

ENGINE SUMMARY

1bf 1112899.6 N paid 3447.5 kPd deg R 2769.6 deg K	1 bm/s 127.6 kg/s	lbm 10504.3 kg 1bm 2820.1 kg in 282.6 cm in 258.1 cm in 258.1 cm
258888.8 15f 589.8 paid 486.8 deg R 289.8	281.3 Ibm/s	23162.0 1 bm 23162.0 1 bm 6218.3 1 bm 74.7 1 n 101.6 in 270.3 1 bm/sec
BLEED CYCLE ENABLER I AXIAL PUMPS THRUST LEVEL = CHAMBER PRESSURE = NOZZLE EXIT AREA RATIO = MOZZLE EXIT AREA RATIO =	TOTAL PROPELLANT FLOWRATE -	REACTOR COMPOSITE FUEL REACTOR WEIGHT SHIELD WEIGHT PRESSURE VESSEL DIA. PRESSURE VESSEL LENGTH CORE PROPELLANT MASS FLOW

EXTENSION WEIGHT 1492.0 Ibn 1472.0 Ibn 1477.0 Ibn 14777.0 Ibn 14777.0 Ibn 14777.0 Ibn 14777.0 Ibn 14777.0 Ibn 14777.0 Ibn	(I ISP 1402.0 1402.0 1402.0 1402.0 2522.0 19.0 11 240.0 2522.0 10 145.2 10 11 2522.0 10 155.2 10 11 2522.0 10 10 11 1055.3 PUMP <wt< td=""> 255.00 10 11 1055.3 PUMP<wt< td=""> 6453.2 10 1112.000.0 PUMP<wt< td=""> 6453.3 10 1112.000.0 PUMP<wt< td=""> 6453.4 10 1112.000.0 PUMP 10 10.0 10.0 10.0 PUMP 11 100.7 10.0 10.0 PUMP 136.1 10.0 10.0 PUMP 136.3 10.0 10.0 PUMP 10.0 10.0 10.0 PUMP 10.0 10.0 10.0 <tr< th=""><th>TAL MOZZLE EXTENSION WEIGHT 1482.0 TAL MOZZLE WEIGHT 2520.0 REA ATIO REA ATIO REA ATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATION REATION REATION REATION REGULINT BOOST PUMP WT A 16NITION WEIGHT A 16NITION B 1000 B 10000 B 100000 B 10000 B 100000 B 1000000 B 1000000 B 100000 B 1000000 B 1000000 B 10000000 B 10000000 B 1000000000 B 1000000000000000000000000000000000000</th><th></th><th></th></tr<></wt<></wt<></wt<></wt<></wt<></wt<></wt<></wt<></wt<></wt<>	TAL MOZZLE EXTENSION WEIGHT 1482.0 TAL MOZZLE WEIGHT 2520.0 REA ATIO REA ATIO REA ATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATIO REATION REATION REATION REATION REGULINT BOOST PUMP WT A 16NITION WEIGHT A 16NITION B 1000 B 10000 B 100000 B 10000 B 100000 B 1000000 B 1000000 B 100000 B 1000000 B 1000000 B 10000000 B 10000000 B 1000000000 B 1000000000000000000000000000000000000		
Relight 2520.0 Ibn 1122 R 19.0 1 2520.0 101 11220 R 19.0 1 2520.0 101 1112000.0 R 19.0 101 1112000.0 1112000.0 1112000.0 R 100.0 101 101 1112000.0 1112000.0 1112000.0 R 100.0 101 101 101 101 1112000.0 1112000.0 R R 100.0 101	Relight 2530.0 15 1 2500.0 1 1 2500.0 Relight 100.1 100.1 100.1 100.1 100.1 100.1 100.1 ST Pueze WT 2500.0 101 101.1 100.1 100.1 100.1 ST Pueze WT 2500.0 101 101.2 2500.0 1112000.0 1112000.0 ST Pueze WT 453.1 100.1 100.1 100.1 100.1 100.1 ST Pueze WT 453.0 100.1 100.1 100.1 100.1 100.1 100.1 Structure WT 633.0 100.1 100.1 100.1 100.1 100.1 100.1 100.1 Superuv WT 600.1 100.1 <td< td=""><td>REA RATIO FRAINING TENTION FRAINING TENTION FRAINING TENTION FRAINING TENTION FRAINING TENTION FRAINING TENTION FULTEED THRUST FLIVERED THRUST FLIVERED THRUST FLIVERED THRUST FLIVERED THRUST FLIVERED THRUST FROP. TURBOPUMP WT FROP. TURBOPUMP</td><td></td><td></td></td<>	REA RATIO FRAINING TENTION FRAINING TENTION FRAINING TENTION FRAINING TENTION FRAINING TENTION FRAINING TENTION FULTEED THRUST FLIVERED THRUST FLIVERED THRUST FLIVERED THRUST FLIVERED THRUST FLIVERED THRUST FROP. TURBOPUMP WT FROP. TURBOPUMP		
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X TOTAL FOR ALL FEED LEGS) 25000.0 1112000.0 Y TOTAL FOR ALL FEED LEGS) 6433.8 150 2926.9 FEIGHT 6433.8 150 1112000.0 2926.9 FEIGHT 6433.8 150 1112000.0 2926.9 FEIGHT 6437.1 150 150 2926.9 VE WEIGHT 6437.1 150 1772.0 293.3 LD 810.1 151.1 150 337.4 RE 721.2 150 377.4 337.4 SUPPLY 810.1.4 150.7 337.4 337.4 SUPPLY 211.2 150 377.4 377.4 SUPPLY 210.5 150 377.4 377.4 SUPPLY 295.8 150 377.4 377.4 SUPPLY 305.8 150 377.4 377.4 SUPPLY 300.7 100.7 377.4 377.4 SUPPLY 300.7 100.7 100.7 377.4 SUPPLY 300.7 100.7 100.7 377.7 SUPLY	X (TOTAL FOR ALL FEED LEGS) 25000.0 1112000.0 Y (TOTAL FOR ALL FEED LEGS) 643.4 150 2026.0 Y VE WEIGHT 643.4 150 2119 Y WIT 0.0 0.0 0.0 0.0 Y WE 0.0 0.0 0.0 0.0 Y 0.0 0.0 0.0 0.0 0.0 Y 0.0 0.0 0.0 0.0 0.0 0.0 Y 0.0	PLAND ASSEMBLY (TOTAL FOR ALL FEED LEGS) IN PROP. TURBOPUMP WT OPELLANT BOOST PUMP WT IN OX PUMP WEIGHT A IGNITION WEIGHT A IGNITION WEIGHT EED LINE/VALVE WEIGHT S GENERATOR T GAS MANIFOLD HARDWARE WEIGHTS T GAS WANIFOLD T CAS WANIFOLD HARDWARE WEIGHTS T CAS WANIFOLD T CA	—	
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IGHTS IGHTS RE SUPPLY SUPP	IGHTS IGHTS RE SUPPLY SUPP	HARDWARE WEIGHTS RUST MOUNT PPORT MARDWARE 211.2 1		, XXXX X 9 99999 8
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UR WEIGHT 365.8 lbm 175.0 kg Mail 175.0 kg 175.0 kg Mail 175.0 kg 175.0 kg Mail 100 with shield 365.8 lbm 175.0 kg Mail with shield 35.1 lbf/lbm 37.2 kg Mail with shield 37.2 kg 37.2 kg Mach with shield 37.4 kg 37.4 kg S statter 35.4 kg 37.2 kg S stater 36.2 kg 3	Mericht 365.8 15 577.6 15 6 Mericht 365.8 15 155.6 6 Main 175.6 16677.6 15 6 Main 175.6 16677.6 15 6 Main 100 17 16657.6 15 175.6 6 Main 100 17 16657.6 15 16 175.6 6 Main 1710 17 16 22248.5 16 175.6 6 Main 16 16 16 16 16 175.6 6 Main 16 16 16 16 175.6 6 175.6 Main 16 16 16 16 175.6 16 175.6 Main 16 16 16 16 16 175.6 16 Main 16 16 16 16 1112000 16 175.6 Main 16 16 16 16 16 16 16 17	ONER SUPPLY	9.9/5	0 0 X X
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IGHT #1657.9 Ibm 22248.5 kg IGHT WITHOUT \$116711bh 59.6 by 59.4 ATIO WITHOUT \$116711bh 59.6 by 59.4 ATIO WITHOUT \$116711bh 59.6 by 59.2 AND WT-LAUWCH ONLY \$5.1 16171bh 59.2 59.2 ROD WT-LAUWCH ONLY \$51992.4 1bh \$57.2 by UNCH WEIGHT 23171.1 \$4874.1 1bh 23171.1 \$49 UNCH WEIGHT 25900.0 1bf 23171.1 \$49 \$2377.2 by S FRESSURE 500.0 1bf 3447.5 by \$40 <td>IGHT #1657.9 Ibm 22248.5 kg ATIO WITHOUT \$1157.9 19457.9 ibm 22248.5 kg ATIO WITHOUT \$1157.1 \$16711bh \$50.6 N/kg \$50.7 N/kg ATIO WITHOUT \$116711bh \$57.2 N/kg \$57.2 N/kg ANDO WT-LAUWCH ONLY \$5192.4 Ibm \$57.2 N/kg ANDU WITHOUT \$1107.1 \$5192.4 Ibm \$57.2 N/kg UNCH WIC Yoo \$1112800.0 \$23771.1 \$29351.0 \$23777.1 UNCH WE \$500.0 \$101 \$1112800.0 \$2447.5 \$Poo S TEMPERATURE \$500.0 \$910 \$2447.5 \$Poo \$400 <t< td=""><td>FMCINE EVETEN</td><td>•</td><td>A</td></t<></td>	IGHT #1657.9 Ibm 22248.5 kg ATIO WITHOUT \$1157.9 19457.9 ibm 22248.5 kg ATIO WITHOUT \$1157.1 \$16711bh \$50.6 N/kg \$50.7 N/kg ATIO WITHOUT \$116711bh \$57.2 N/kg \$57.2 N/kg ANDO WT-LAUWCH ONLY \$5192.4 Ibm \$57.2 N/kg ANDU WITHOUT \$1107.1 \$5192.4 Ibm \$57.2 N/kg UNCH WIC Yoo \$1112800.0 \$23771.1 \$29351.0 \$23777.1 UNCH WE \$500.0 \$101 \$1112800.0 \$2447.5 \$Poo S TEMPERATURE \$500.0 \$910 \$2447.5 \$Poo \$400 <t< td=""><td>FMCINE EVETEN</td><td>•</td><td>A</td></t<>	FMCINE EVETEN	•	A
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ATTO WITH SHIELD 5.1 19428.4 49 ATTO WITHOUT SHIELD 5.1 16/(1)bh 59.6 1/kg ANTIO WITHOUT SHIELD 5.34.5 1bh/(1)bh 59.6 1/kg ROD WTLAUNCH ONLY 2.34.5 1bh/(1)bh 59.6 1/kg UNCH WEIGHT 2.3171.1 kg 22171.1 kg UNCH WEIGHT 2.3171.1 kg 23171.1 kg UNCH WEIGHT 2.3171.1 kg 23171.1 kg UNCH WEIGHT 2.3171.1 2.851.0 kg SS 1bh/(1) 2.8551.0 kg 2.877.2 MWCH WT. W/O SHIELD 1000.0 0.0 8727.2 N-0.0/kg S 1112000.0 0.0 8727.2 N-0.0/kg S 1000.0 0.0 8727.2 N-0.0/kg S 10.0 0.0 8727.2 N-0.0/kg S 10.0 1000.0 0.0 8727.2 N-0.0/kg S 10.0 1000.0 1000.0 1000.0 0.0 K/kg S 10.0 0.0	ATTO WITH SHIELD 5.1 19428.4 49 ATTO WITH SHIELD 5.1 16//1bh 59.6 1//49 ANDO WTLAUNCH ONLY 5.1922.4 1bh 59.2 1//49 ROD WTLAUNCH ONLY 51992.4 1bh 59.2 1//49 UNCH WEIGHT 23171.1 4974.1 1bh 23171.1 49 UNCH WEIGHT 23102.4 1bh 23171.1 49 23171.1 49 UNCH WEIGHT 2000.0 1bf 1112000.0 823171.1 49 S 250000.0 1bf 1112000.0 0 40 K S 700.0 0 8727.2 N-40 K 40 K S 1112000.0 10 1112000.0 0 8727.2 N-40 K S TEMPERATURE 260.2 1n 1565.0 C 2633.7 C DIAMETER 0 0 0 833.7 C 0 0 0 0 0 0 0 0 0 0 0 0 0 0		22248.5	k g
ATTO WITHOUT SHIELD 3.1 10//10 3.1 4.6 ROD WTLAUNCH ONLY 3.10 10//10 572.0 1/kg ROD WTLAUNCH ONLY 3.102.4 1bh 923721 kg UNCH WEIGHT 5.1002.4 1bh 233171.1 kg UNCH WT. W/O SHIELD 44874.1 1bh 233171.1 kg UNCH WT. W/O SHIELD 51002.4 1bh 20351.6 kg S 235000.0 1bf 1112000.0 N kg S 25000.0 1bf 1112000.0 N kg S 25000.0 1bf 1112000.0 N kg S 700.0 0 7 3447.5 kPo R TEMPERATURE 360.0 0 8727.2 N-soc/k LENGTH = 269.2 1 1565.0 C 2693.7 C DIAMETER 0 0 883.7 C 2693.7 C	ATTO WITHOUT SHIELD 5.1 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10 5.1.0 0.1/10	0.8007t	19428	0 ¥
ROD WTLAUNCH ONLY 233.15 100 232.72 0/149 UNCH WEIGHT 51992.4 15m 233.171.1 89 UNCH WT. W/O SHIELD 44874.1 15m 233.171.1 89 LWCH WT. W/O SHIELD 44874.1 15m 233.171.1 89 S 2695.6 15f 1112000.0 1 82 S 25000.0 15f 1112000.0 0 9 S 2500.0 15f 1112000.0 0 6 S 2500.0 15f 1112000.0 0 0 6 R TEMPERATURE 2500.0 0 0 8 7 0	ROD WTLAUNCH ONLY 233.15 Ibn 371.11 UNCH WEIGHT 51992.4 Ibn 233.171.1 UNCH WT. W/O SHIELD 44374.1 Ibn 233.171.1 UNCH WT. W/O SHIELD 44374.1 Ibn 233.171.1 S 20351.6 KP 20351.6 S 269.6 Ibf 1112000.6 N S 269.6 PRESSURE 3590.6 N 20351.6 R PRESSURE 256000.6 Ibf 1112000.6 N S TEMPERATURE 25600.6 B 2700.6 deg K LENGTH 616.1 In 1565.6 C DIAMETER 269.2 In 565.6 C			N/kg
UNICH WEIGHT 51992.4 15 23171.1 Kg UNICH WT. W/O SHIELD 44874.1 15 20351.6 kg S S R PRESSURE 259990.0 15f 1112990.6 N 3447.5 kPo 890.5 sec 4800.6 dog R 27700.0 dog K 2790.0 dog K 2790.0 dog K 2700.0 dog K 2700.0 dog K 280.2 in 1565.0 cm	UNICH WEIGHT 51992.4 154 23171.1 49 UNICH WEIGHT 51992.4 154 23171.1 49 IS 23171.1 23171.1 49 8 IS 235000.0 151 154 8 IS 235000.0 151 1112000.0 8 IS 2347.5 8 8 8 R <temperature< td=""> 500.0 151 10 3447.5 N=0.0 R<temperature< td=""> 500.5 60 8 2700.0 0 9 6 I 1565.0 6 8 2700.0 0 6</temperature<></temperature<>	2034.5	10	N/Kg
UWCH WT. W/O SHIELD 44874.1 15m 20351.0 kg S S PRESSURE 25000.0 15f 1112000.0 N 3447.5 kpo 500.0 paid 3447.5 kpo 500.0 paid 3477.2 N-ac/k B727.2 N-ac/k B727.2 N-ac/k C B90.5 acc 8727.2 N-ac/k C B01.1 in 1565.0 cm 616.1 in 1565.0 cm 633.7 cm	UWCH WT. W/O SHIELD 44874.1 1bm 20031.0 kg S R PRESSURE 25000.0 1bf 1112000.0 N R PRESSURE 2500.0 1bf 1112000.0 N 3447.5 kPo 890.5 est 3727.2 N-soc/k 4860.0 dog R 2729.2 N-soc/k 1565.0 cm 616.1 in 1565.0 cm 633.7 cm	ENGINE LAUNCH WEIGHT 51092.4	97171 C	
S R PRESSURE 25000.0 Ibf 1112000.0 N 3477.5 kpd 500.0 psid 3477.5 kpd 500.0 psid 3477.5 kpd 500.5 sec 8727.2 N-sec/k 1565.0 c 616.1 in 1565.0 c 633.7 cs 633.7 cs	S R PRESSURE 25000.0 bid 1112000.0 N R TEMPERATURE 2500.0 psid 3447.5 kPo 8727.2 N-900 kPo 4860.0 dog R 2700.0 dog K 2800.1 in 1565.0 cm 683.7 cm 683.7 cm	ENGINE LAUNCH WT. W/O SHIELD 44874.1	20351 0	C (
R PRESSURE 250000.0 1bf 1112000.0 N Statt 500.0 psid 3447.5 kPq Statt 500.0 psid 3447.5 kPq Statt 500.0 psid 3447.5 kPq Statt 500.0 dog R 3747.5 kPq Statt 500.0 dog R 2770.0 dog K EtendTH 616.1 in 1565.0 cs DIAMETER 269.2 in 563.7 cs	R PRESSURE 250000.0 1bf 1112000.0 N 500.0 500.0 500.0 5447.5 KPq 500.5 500.0 500.0 34475.5 KPq 500.5 500.0 600.5 500.0 34475.5 KPq 600.5 500.0 600.7 600.8 34475.5 KPq 87272.5 500.0 600.8 600.7 600.6 600.6 KPq FEMCTH 616.1 10 1565.0 600.6 600.6 600.7 600.7 600.7 DIAMETER 209.2 10 1565.0 600.6 <td></td> <td></td> <td>2</td>			2
R PRESSURE 560.0 510.1 1112600.0 847.5 840.0 R TEMPERATURE 680.0 690.0 690.0 3447.5 8727.2 N-sec/k R TEMPERATURE 690.0 690.0 690.0 690.0 690.0 690.0 600.0	R PRESSURE 500.0 PIC 11200.0 N 11200.0 N 11200.0 N 1247.5 KPG 1347.5 KPG 1347			
R TEMPERATURE 4860.5 400 8 40 K 2760.6 40	R TEMPERATURE 899.5 ***********************************	CHAMBER PRESSURE	•	z
R TEMPERATURE 4880.0 dog R 2700.0 dog K 2700.0 dog K 2700.0 dog K 200.0 dog K	R TEMPERATURE 4880.0 dog R 2700.0 dog K 2700.0 dog K 2700.0 dog K 200.1 in 1565.0 cm 6833.7 cm 68333.7 cm 683333.7 cm 68333.7 cm 68333.7 cm 683333.7 cm	I SP		;
LENGTH - 616.1 in 1565.0 ca	LENGTH = 616.1 in 1565.0 cm 269.2 in 263.7 cm 263.7 cm	CHAMBER TEMPERATURE 4869.0 deg	2700.0	<u>د د</u>
LEWGTH - 616.1 in 1565.0	LENGTH = 616.1 in 1565.0			
		LENGTH - 616.1 i	222	5
Å • • • • •	8 • • • • • • • • • • • • • • • • • • •	ENGINE DIAMETER - 269.2	583.	
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	8-0	0000 0000		8
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THE FOLLOWING WARNINGS OCCUR FOR STAGE 1

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TWO PHASE FLUID ENCOUNTERED IN REGEN

CR = 7.123 RECOMMENDED RANGE = 1.5 TO 4

NOZZLE EXIT DIAM = 289.2 STAGE DIAM = 100.0

AXIAL BUCKLING DESIGNS STRUCTURAL WALL THICKNESS MINIMUM GAUGE DESIGNS AFT TANK WALL THICKNESS HOOP STRESS DESIGNS FORWARD TANK WALL THICKNESS AFT TANK ULLAGE INCREASED BY GEOMETRY CONSTRAINT

GAS PHASE ENCOUNTERED IN REGEN JACKET

END NOMINAL STAGE DESIGN

Table 4-9. Sample Case No. 8

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Input Listing

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	FVAC	thrust (1b
•	I PROP	crameer pressure (psia) Propellant figa
•••	INVISC INVISC	load wt.
	MEXPND	
	JCNFIG	Cycle type (1=66.3=Expander,7=Bleed)
	IPTYPE	Puer type American terms
•	ISOLVE	1=0×101) (3=0 worksho
•	FRACHA	ine injet temp (ISOLVE-1)
	FRACCB	[] [] []
•	CPLINH	
•		-
	CPLINI CPVI VT	intet tine to
	JBPFL	ling valve loss
	XOder	tuel boost pump?
	MTPA	ux noost pump?
•0	IDBLRUN	
)	FFRAC	
	1 KATE 1 Kebeu	
3600.0		-
• • •	FMARG	burn time
•	XLFL	weight f
<u> </u>	ALFMIX	
	EPS.	Encine Arabia ongle
	KEXNOZ	Use a nozzla aktanalono
	4 1 7 0M	J-port
	EPSAT2	-
•	XLN	2 attach area
	KNOZ	Type of nozzia
1868		Use plug nozzie?
	OFCOD	Nozzle length ratio
6	GAMGPB	GG mixture ratio
	CPGGPB	ratio of
	MICCPB	GG Delecular medi
	TCHAMBER	Chamber temperature
	INEAC IR	
-		h flag (1=oid.2=new)
173	8	
	PAC	petween holes
	HOLES	everage channel fa
	FTYPE	Fuel type
_	SPAT	Subbort out are
		Core length
		th element (MM par 52
0.31	011	le flow fraction
•	HTANK	i c kup
9.8122 9.9441	FREF	f coolant enteri
	FES	t pickup in reflecto
5.13 1	FCS	heat pickup in ext a

•

4-217

Uncoated fuel hex flat dimunsion Scalable fuel element (overrides LC) Channel coating thickness at inlet Channel coating thickness at outlet Element external coating thickness Pressure vessel material specific grav. Pressure vessel material specific grav. Pressure vessel mat. allowable stress Beryllium reflector thickness	opellant v fraction iga fraction ition dev isition dev ressuriza c pressuriza ius torege	2		0 6464
HEK LEL ZRCO ZRCH PVSG PVSG TRCH ZRCH ZRCH ZRCH ZRCH ZRCH ZRCH ZRCH Z	WILPRP WILLFOX ULLFFL ULLFFL KACQOX KGASSOX KGASS KGAS KGAS KGAS	FPULCG KHXQPT TSOFIF TSOFIO TMLIF TSOFIO TMAL TMAX TMAX TMAX TMAX TMAX	NALLK DIFTBF DIFTBF CPULVF CPULVF CPULVF CPULVF CPULVF CPULVF CPULVF CPULVF CPULVF CPULVF SIGCLS SIGCLS SIGCLS SIGCLS	SIGNZE TNZMIN RHOMZ2 SIGNZ2 SIGNZ2 ROTRNZ KUTNOZ XLNOZ WTLTCA THDUSR BYPTUR
e. 75e 52. e 6. ee2 e. ee6 e. ee15 5eee6 4. 785			4-218	2

Cooling channel multiplie. Regen channel surface roughnes. Max depth to width ratio Number of regen segments in conv. sec. Number of regen segments in nozzie surface area multiplier Cooling channel land width Cooling channel width Input regen delta T and P? Input regen total delta P fuel NPSP	Hency adjustment efficiency adjustment ciency adjustment deficiency adjustment deficiency adjust er: all tank er: pres. tank er: aft tank line er: aft tank line er: aft tank line er: pres. tank line er: nozzie + hardment er: vaives		
CHMULT EPIPE HOMMAX HOMMAX NCON NCON NCON NTHR NTHR INPDI DELTAF DELTAF DELTAF DELTAF	ADJGGB ADJBL ADJBL CXWFMC CXWFLT CXWFLT CXWFLT CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL CXWFTL	CXMNZE CXMDUC CXNDUC CXNTMM CXNTMM CXNTMM CXNTMM CXNTMA CXNTA	PDIAOX BPDIAO 146 151665 151665 15166 151760 1014M 101161 100100000000
е е е е е е е е е е е е е е е е е е е			

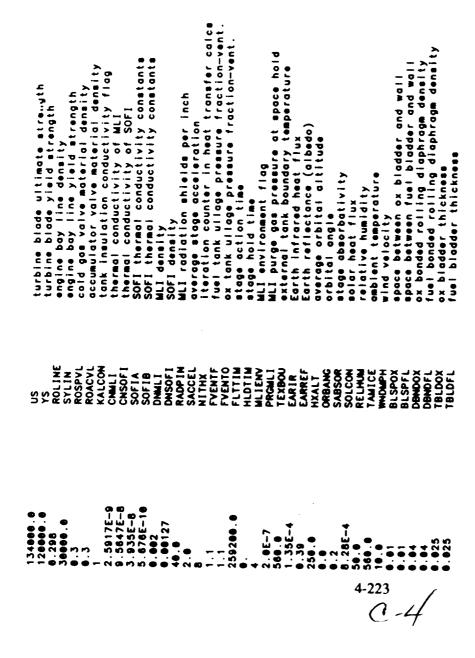
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riow pesage vigtor transp. cooling insert thickness transp. cooling insert thickness transp. cooling insert conductivity Use non-conventional tanks? Aft tank monocoque? Forward tank monocoque? Forward tank monocoque? tank dome types pressure tank geometry number of pressure bottles propellant tank head ellipse ratio propellant tank dome orientation vield atreas of drive fluid tank material density of drive fluid tank material transpiration cooling criteria max heat flux before transp. cooling upstream area ratio for transp. downatream area ratio for transp. user defined drive fluid weight user defined drive fluid tank weight density of drive fluid input tureupture useruuty u total Tpa weight TPA atart system weight Ignition system weight hot gos manifold weight heat exchanger weight GG/preburner weight GG/preburner weight GG/preburner weight GG bleed efficiency max turbine temperature turbine/GG iniet temp. turbopunt assembly a Jhts? platelet land thickness separator platelet thickness of dimensional input engine angular location engine rodial location angular location redial location 'orward skirt length turbine iniet pressure flow pessage widths fuel tank material aft skirt length stage diameter turbine flowrate Isp of GG blood contente tank radius types Lcy1/D tank tank kank tank k nd nput KXFTFH KPRPA NTANKS ELTNK1 KTANK1 INTNK1 TANGL 1 RADLO1 KALMOD RDIM1 RMAJ 1 ENGRD 1 ENGRD 1 FFSKTL FASKTL MTNKFL TRINST TRANKM NCTNK NACOA MACOA KPOME KPOME KPRESS ELDOME TGEOL TGEOS TGEOW RHTRIN KXATAH KXATFH KXFTAH CMAXTR EPSTRU EPSTRO TGEOH WTHTX WGGPB IUSRGG WDBLNZ WDBLNZ TTLIMT TUSRGG WDUSRG WDUSRG WDUSRG ROUSRG ROUSRG SYUSRG ROUSRG ROUSRG ROUSRG INPTPA TPAWT WSTART WIGNIT WHGMF WGBOX 15+0.0 5.1.6 25000 1.5 5+1 e.e. 38 ø •.• •.• 8 1 ī 4-220

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defined define	0 L 0 1	ox exputation officiency flog fuel exputation officiency ox exputation officiency fuel acquisition device density or acquisition device density forward shroud cross-sect. area input propellant temperatures? fuel ain temp	ox min temp ox nominal temp ox max temp Lines full at burnout? Miscellaneous fuel on-board miscellaneous ox on-board number of temp schedule iterations space between aft suspended tank & wall space between for. suspended tank & wall proseitant feed line flag stage critical bending moment	<pre>ppdce between off and forward tank pressure tank insulation density insulation thickness for pressure tank insulation thickness for pressure tank non-conv tank usable volume ratios min clearance between nor-conv tanks min clearance between nozzles non-conv tank thickness mode non-conv tank thickness mode velocity heads lost in fuel lines velocity heads lost in fuel lines velocity heads lost in ox lines fuel line surface roughness pressurant ratio of specific heats (isen) time at which polytropic ratio is 1,1</pre>
MTMKOX MATPT MATSTR MATSTR MATSTR MATSTR THKI THKI TWING TWING	SFFLTK SFOXTK SFOXTK SFOXTK SFLINE SFLINE SFLINE SFLINE SFUNT MPEXF	TWPEXO EXPLFL EXPLFL DACOOX AESSR AESSR AFSSR TPWINF TPWINF TPWAKF	TPMINO TPMOMO TPMOMO LUNEULL LUNEVCO MMISOL NUISECA TSPCF TSPCF TSPCF CIMA KUINEA CIMA	CLEAF RHPTIN RHPTIN RATINKI RUSPIC CLRTNK CLRSPC KNEST KTHCKI FLKFCT OXKFCT RUFFFL RUFFFL RUFFFL SAMPCG GAMFCG GAMFCG
1 2 15-11 9.29 9.956 9.12399. 9.12399. 9.015 9.035	1.25 1.25 2.05 2.05 2.05	• • • • • • • • • • • • • • • • • • •		••••••••••••••••••••••••••••••••••••••

use yang auction specific speed ox boost pump auction specific speed ex boost pump auction specific speed of urbine velocity ratio furbine velocity ratio furbine velocity ratio cc contraction ratio cc injector atrangth bot ges duct atrangth hot ges duct atrangth hot ges duct anterial density pha stort valve complexity multiplier TPA stort valve complexity multiplier TPA stort under valve complexity multiplier TPA stort bottle density fPA stort bottle density TPA stort bottle density TPA stort cortridge anderial density TPA stort bottle velot anterial density TPA stort cortridge anderial density TPA stort cortridge and atrength TPA stort cortridge and atrength TPA stort cortridge and atrength TPA stort bottle ges temp. solid grain burn rate temp sensitivity solid GG combustion temperature solid GG temp decay time constant solid GG ref temp for burn rate coef. solid GG molecular weight of comb. prod solid GG molecular weight of comb. rise boost pump fraction of total head rise fuel pressure ratio across GG would GG min port to throat area ratio solid GG aquilibrium temp ratio solid GG burn rate coefficient solid GG burn rate coefficient solid GG grain characteristic velocity solid GG min allowable grain diameter solid GG unlage preserve multiplier solid GG ullage preserve multiplier combustion product specific heat ratio temperature sensitivity of GG pressure ruel pump suction specific speed ox turbine blade density turbine blade density TPA effective material density ox pressure ratio across 66 turbine outlet pressure (for 66) autogenous fuel preseurant temp autogenous ox preseurant temp weight of pressurant fuel turbine blade density [PA/engine assignments solid GG grain density ROCART SYBOT SYCART SYCART SYCART SYCART SYCART SYBOAS TBOGAS TBOGAS TBOGAS TBOCAS TBOTOX RHOTOX RHOTOX CVACUM BURNRA GASMI ROSTAK SYDUCT ISTART RHOCYL SSSOX SSSBP6 SSSBP0 TURBPR UOVERC EPSGB GGCR R01MGG SY1MGG RHOBOT PBPRG PBPRO PTURBO KPUMP TULLFL SSSFL FPULGG GAMGG PIPKGG RHOGG SIGGG TCMBGG TDCYGG BPFRFL BPFROX WTMCG APATGG BTEQGG CBRGG CDESGG CDESGG CSGG DMINSG EBRGG FH20GG CMLTF **REFCG** IT NGG <u></u>2 ¥ 75600.0 30000.0 47000.0 47000.0 210.0 210.0 50000.0 305 298 0.0464 0.0464 . 298 6 0.0036 58.0 80 0.16 0.0013 2130.0 .2662 .0 - 1. 9:020 100.0 5932.0 n. 20.0 1.27 . 500 10 25 . • 'n 4-222



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Output Listing

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Nuclear Thermal Vehicle

OUTPUT FOR MULTIPLE PUMPS AT FULL THRUST LEVEL

LIQUID OXYGEN - LIQUID HYDROGEN PROPELLANTS ASSUMPTIONS:

ENTHALPY -3095. CAL/MOL -2154. CAL/MOL 90.18 K 20.27 K TELP ËČ

ODK VALUES CORRESPOND TO THROAT RADIUS=2.289 IN. C-STAR & CHAMBER TEMP DATA EVALUATED AT ODE PC & ODE MR VAL TURBINE PRESSURE RATIO- 1.591013860383789 TURBINE PRESSURE RATIO- 1.591221774110766 TURBINE PRESSURE RATIO- 1.591221774110766 TURBINE PRESSURE RATIO- 1.591221774110766 TURBINE PRESSURE RATIO- 1.592239791011710 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO- 1.739229791011710 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO- 1.739228791011710 SUCCESSFUL CYCLE POWER BALANCE TURBINE PRESSURE RATIO- 1.739228791011710

KEY INPUTS

75000. (1bf) EXPANDER CYCLE EMABLER I COMPOSITE FUEL 1900. (psid) 1000. (dog R) 2 NOZZLE EXIT AREA RATIO = PROPELLANT USED = THRUST LEVEL = CYCLE TYPE = REACTOR TYPE = FUEL TYPE -

TANKAGE SUMMARY FOR STAGE ∲1 EXPANDER CYCLE (FUEL SIDE) AFT TAMK CONTAINS OXIDIZER ... FORWARD TANK CONTAINS FUEL FUEL TANK IS PRESSURIZED WITH COLD GAS TAMK MATERIALS (OX - USER DEF) (FUEL - qiuminum)

.. DIMENSIONS (INCHES)

:

78.43 2317.37 4540.87 4855.67	16.52
AFT TANK Forward tank Pressure tank Tank comstruction weight	STRUCTURAL WALL
100.00 1013.63 541.46 328.85 12.00	79.32
STAGE DIAMETER Total Stage Length Total Tank Length Nozzle Length Convergent Nozzle Length	MOUNT LENGTH

:

... WEIGHTS (POUNDS)

425.27 107.30 0.90	e.e 255.96 407.04	217.00 11.30 0.00	56.79 25.81 8999.96	6.99 6.99 323.76 6.99 6.99		2.25
AFT SKIRT Forward skirt Tame Mount	PRESSURE TANK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION	REVERSE MEAD STIFFENER FUEL ACQUISITION SYSTEM OXIDIZER ACQUISITION SYSTEM	PRESSURANT CONTROL MARDWARE TANK LINES BURNED FUEL BURNED AVIOTTED	FUEL RESIDUAL OXIDIZER AUTOGENOUS PRESSURANT OXIDIZER AUTOGENOUS PRESSURANT STORED PRESSURANT HOLD TIME FUEL BOILOFF HOLD TIME OX BOILOFF	FLIGHT FUEL BOILOFF FLIGHT OXIDIZER BOILOFF MISC EXPENDED FUEL MISC EXPENDED OXIDIZER MISCELLANEOUS WEIGHT INTERSTAGE WEIGHT	INPUT MINIMUM SAFETY FACTORS STRUCTURAL WALL LINES OXIDIZER TAMK FUEL TAMK PRESSURE TAMK
7 . 	50.04 56.04 58.15 76.26	8.2.8. 	8.9 29.7 29.5 29.5 29.5 29.5 29.5 29.5 29.5 29.5	e. e9 e. e3 e. e78 e. e37 e. e35 e. e56	• • • • • • • • • • • • • • • • • • •	
TANK HEAD ELLIPSE RATIO Pressure tank ellipse ratio	AFT TANK HEAD HEIGHT FORWARD TANK HEAD HEIGHT PRESSURE TANK HEAD HEIGHT PRESSURE TANK DIAMETER	AFT TAMK CYLINDRICAL LENGTH Forward Tamk Cylindrical length Pressure Tamk Cylindrical lngth	AFT LIME DIAMETER Forward Lime Diameter AFT Skirt Length Forward Skirt Length	STRUCTURAL WALL THICKNESS AFT TANK WALL THICKNESS FORWARD TANK WALL THICKNESS PRESSURE TANK WALL THICKNESS AFT TANK DOME THICKNESS FORWARD TANK DOME THICKNESS	PRESSURE TANK DOME THICKNESS FUEL TANK MLI THICKNESS FUEL TANK SOFI THICKNESS OXIDIZER TAMK MLI THICKNESS OXIDIZER TAMK MLI THICKNESS PRESSURE TAMK INSULATION THICK	FUEL TWK HEAT FLUX(0TU/HR IN++2) OX TAMK HEAT FLUX(0TU/HR IN++2) FUEL 001LDFF AATE (12)/SEC) OX 001LDFF RATE (12)/SEC)

PROPELLANT SUMMARY FOR STAGE #1 PROPELLANT IS LH2

NOMINAL PROPELLANT BULK DENSITY(LB/IN++3)=

··· FUEL ···

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38.5 8.0025 20.0 48.0 0.0025 25.0 56.3 MAX PROPELLANT TEMP(DEGR) MAX TEMP DENSITY(LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA) NOMINAL PROPELLANT TEMP (DEGR) NOMINAL DENSITY (LB/IN++3) NOMINAL VAPOR PRESSURE (PSIA) NOMINAL TANK PRESSURE(PSIA) 0.000 MAX PROPELLANT TEMP(DEGR) MAX TEMP DENSITY(LB/IN++3) MAX TEMP VAPOR PRESSURE(PSIA) NONIMAL PROPELLANT TEMP(DEGR) NONIMAL DENSITY(LB/IN++3) NONIMAL VAPOR PRESSURE(PSIA) NOMINAL TANK PRESSURE (PSIA) .. OXIDIZER ...

4-226

38.5 0.0025 20.0 MIN PROPELLANT TEMP(DEGR) MIN TEMP DENSITY(LB/IN++3) MIN TEMP VAPOR PRESSURE(PSIA) ENGINE SIZE, WEIGHT, & PERFORMANCE SUMMARY FOR STAGE #1 EXPANDER CYCLE CONVERGENT NOZZLE IS REGEN COOLED (MILLED SLOT CONSTRUCTION) NOZZLE IS REGEN COOLED (TUBE CONSTRUCTION) PROPELLANT IS LH2 0.0 0.0000 0.0000 MIN PROPELLANT TEMP(DEGR) MIN TEMP DEWSITY(LB/1N++3) MIN TEMP VAPOR PRESSURE(PSIA) ·· ENGINE DIMENSIONS / INCHES

.

	912.78 933.79	16491. 16789.	1000. 75000. 75000. 3680.00	0.977		8.00 82.17 82.17	4868, 1638, 8.88 8.88
· · · PERFORMANCE	DELIVERED ISP(VAC),SEC Ideal ISP(ODE),SEC	DELIVERED CSTAR,FT/SEC Ideal Cstar,Ft/sec	CHAMBER PRESSURE, PSIA Thrust Per Engine(VAC), LBF Total VAC Thrust, LBF Burn Time, Sec	OVERALL EFFICIENCY	KINETIC EFFICIENCY BARRIER COOLING EFFICIENCY BOUNDARY LAYER EFFICIENCY DIVERGENCE EFFICIENCY	FOR 1 ENGINE OXIDIZER FLOWRATE,LB/SEC FUEL FLOWRATE,LB/SEC TOTAL FLOWRATE,LB/SEC	CORE TEMPERATURE, DEG R Barrier temperature, deg r Engine mixture ratio fuel film cooling fraction
EMUTHE DIMIENSIONS (INCHES) 7.43		ATTACH DIAM	GAS SIDE WALL THICKNESS 0.248 Nozzle Extension Thickness 0.010 Second Mozzle Extension Thickness 0.100 Nozzle Exit Area Ratio 500.00	H AREA RATIO	- 7		

THE FOLLOWING IS THE REGENERATIVE COOLING SUMMARY FOR STAGE #1

THE ENGINE IS A FUEL COOLED CONVENTIONAL EXPANSION NOZZLE

16.796 INCH LONG NOZZLE SECTIONS 3.220 INCH LONG CONVERGENT CHAMBER SECTIONS 0.000 INCH LONG CYLINDRICAL CHAMBER SECTIONS GAS WALL THICKNESS = 0.248 Gas Wall Thermal Conductivity =.00039000 (BTU/IN SEC DEGR) **000** STATIONS I THROUGH 6 ARE BOUNDS TO THE STATIONS 6 THROUGH 11 ARE BOUNDS TO THE STATIONS 11 THROUGH 11 ARE BOUNDS TO THE

3266+03 3906+03 5016+03 7696+03 1636+04 1636+04 1636+04 1636+04 TGAS . 283E+03 163E+04 .100E+03 .500E+02 .302E+02 .106E+02 .106E+01 .249E+01 .249E+01 .7476+01 .1106+02 .150E+03 .151E+02 L. .1876-03 .2636-03 .4026-03 .4026-03 .1466-03 .1766-03 .1766-03 .1766-03 .1766-03 .1216-02 891E-03 HG . 197E-04 12055403 1365403 3265403 1335404 1175404 1175404 1045404 0555403 08975403 08975403 .1116+03 0.1965+03 0.1165+03 0.1276+03 0.1565+03 0.2365+03 0.3365+03 0.3365+03 0.5355+03 0.5555+03 0.5555+03 0.5555+03 TCW - COOLANT PRESSURE (PSIA) - COOLANT BULK TEMPERATURE (DEGR) - COOLANT BULK TEMPERATURE (DEGR) - COOLANT VELOCITY (IM/SEC) - HEAT FLUX (BTU/IN++2 SEC) - TEMPERATURE OF COOLANT WALL (DEGR) - TEMPERATURE OF GAS WALL (DEGR) - GAS SIDE MEAT TRANSFER COEFF (BTU/IN++2 SEC DEGR) - LOCAL AREA RATIO (-) - COMBUSTION GAS TEMPERATURE (DEGR) Q .336E-02 .651E-02 .145E-01 .177E-01 .177E+01 .177E+01 .130E+01 .784E+00 .544E+00 .544E+00 2 1460. (DEG .1676+02 .2856+02 .8796+02 .9836+02 .3836+02 .5196+04 .1596+04 .1596+04 .3266+03 .3266+03 .3266+03 MAXIMUM OPERATING TEMPERATURE-MOZZLE DELTA T = 11.0 MOZZLE DELTA P = -204.2 Adapter delta P = -2.04.2 Adapter delta P = -0.1 Total Heat Transfer = 1054.0 (01U/SEC) .1585+01 12855+01 59855+00 59855+00 59855+00 59855+00 17955+00 17955+00 17955+00 17955+00 17955+00 17955+00 17955+00 9075+02 9115+02 9115+02 9165+02 9325+02 1015+03 1015+03 102E+03 103E+03 .1054-03 18 12.8 2296404 2005404 1995404 1995404 1995404 2206+04 2206+04 2206+04 ٩ DELTA T-GAS WALL STATION **** TCAS A F B > G F F H M

(SATURATION TEMP OF PROPELLANT) TEMPERATURE (DEG R) JEL OXIDIZER 0.0 349.8 4860.8 38.5 46.7 99.2 915.0 193.2 550.0 47.2 FUEL : PROPELLANT PRESSURANT : OXIDIZER ••• PRESSURE (PSIA) FUEL OX 1132.1 56.3 45.6 45.6 2296.3 2219.0 1989.0 1989.0 4365. 62. 56. -MAIN VALVE INLET MAIN VALVE UNLET MAIN VALVE OUTLET TIE TUBE OUTLET REGEN OUTLET (REFL I REFLECTOR OUTLET REACTOR INLET REACTOR CORE PROPELLANT MAX STORAGE VENT ULLAGE INLET TANK PURK

PRESSUME AND TEMPERATURE SCHEDULES FOR STAGE #1 EXPANDER CYCLE

622.3 520.1	PRESSURE COMPONENT PRESSURE CHANGES 0.0 0.0 0.0 11.3 0.0 0.0 11.3 0.0 0.0 2255.3 0.0 0.0 2255.3 0.0 0.0 256.0 0.0 0.0 </th
1969.0 1132.1	PRESSURE CHANGES (PSID) 0.0 11.3 2253.3 79.2 256.9 256.9 6.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
TURBINE INLET TURBINE OUTLET	ACQUISITION DEVICE FEED LINE PUMP MAIN VALVE TIE TUBES REGEN JACKET REFLECTOR TURBINE

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FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 EXPANDER CYCLE

0XIDIZER 0.000 0.000		 	
FUEL 82.167 41.083	39.673 2.342	40.152 20.076 0.000	79.625
	TO CORE	MBINE TO CORE 41	

REACTOR OPERATING CHARACTERISTICS AND MASSES

	LB/SEC	ŝ	IN2	LB/IN2	MW/Elenent	Ŧ		DEG R	PSIA	BTU/LB	DEGR	PSIA	BTU/LB	MW/TUBE	BTU/S		BTU/S
	79.82	1587.01	198.34	0.40	1.20	1.78	248.92	8	0.00	4.53	348.97	1132.13	2.04	.31	3.64	0.00	1854,04 0.01
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REACTOR OPERATING CHARACTERISTICS																	R
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REAC		ARFA	FLOW	NT PC	io In	FUEL		I EMPERATURE			PRESSIDE	FNTHAL DV			HEAT	N	HEAT
REACTOR	REACTOR POWER	CORE FLOW AREA	MASS FLOW RATE	ELEMENT POWER	ELEMENT OPERATING ITEE	NUMBER OF FUEL ELEMENTS		۲ à 2 à		CORE INLET TENDED	NLET	NLET	ICKUE	PICKUP IN TIF TUBE	FRACTIONAL HEAT PICKUP IN NO771 F	HEAT PICKUP IN MA7715	FRACTIONAL HEAT PICKUP
UTA!	ENCI	ORE 1	CORE	-	UEL	UNBER		NAMBER 2	AMB	u al		CORE	AT P	ATP	ACT I	AT P	I T DA
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HEAT PICKUP 2002.76 BTU/ HEAT PICKUP 2002.76 BTU/ A66.39 BTU/ A66.39 BTU/ A66.39 BTU/ A66.39 BTU/ A66.39 BTU/ A66.39 BTU/ 32.55 BEG 32.53 IN 33.81 IN 33.81 IN 33.81 IN 47.56 LB 334.44 B 335.21 B 334.44 B 335.21 B 335.25 LB 334.44 B 335.25 LB 335.25 LB 355.25 LB 355.		16000		
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Classical 3978.44 12000 CR 5977.55 10 CR 5977.56 10 CR 5977.55 10 CR 5977.56 10 CR 5978.67 10 CR 5978.66 10 CR 5977.56 10 CR 597.56 10 CR 596.57 10 CR 596.56 10 CR 596.56 10 CR 596.55 10 CR 596.55 10 CR 596.55 10 CR 596.55 10 <	SHIELD HEAT	•	22	971176
Diwensions 527.55 577.55 567 Diwensions 52.66 111 18 32.53 111 18 32.53 18 32.53 111 18 32.53 18 32.53 33.61 112 18 35.61 18 47.96 35.61 18 47.96 35.61 18 12.43 115.54 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 19 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 18 335.77 19 335.16 18 <t< td=""><td>(TENSION SHIELD HEAT PICKUP</td><td></td><td>, </td><td></td></t<>	(TENSION SHIELD HEAT PICKUP		, 	
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MSSES 38.61 IN 47.56 IN 47.56 IN 47.56 IN 47.56 IN 47.56 IN 47.56 IN 47.55 IN 48.55 IN 48.55 IN 115.55 IN 115	ERAGE CHANNEL	-		W1
MSSES 39.61 IN 47.56 IN 47.57 IN 48.52 IN 48.52 IN 48.55 IN 118.55 IN	=1			
MASSES 3691.66 LB 1.31 IN 1.2.43 IN 1.2.43 IN 1.2.43 IN 1.2.13 IN 1.3.11 IN 1.3.11 IN 1.3.14 - 01 LB 1.3.14 - 14 LB 1.3.14 - 15 LB 1	Ł			
MASSES 369: 69: 61: 54: 11: 54: 11: 15: 154: 11: 15: 154: 11: 15: 154: 11: 15: 154: 154	38	47		
MASSES 39-01 11 31	200	47.		N
MASES 3978.44 LB MASSES 3978.44 LB 3.9.8.44 LB 3.9.8.14 LB 3.0.8.14 LB 3.0.14 LB 3.0.14 LB 3.0.14 LB 3.0.14 LB 3.0.14 LB 3.0.				N
MASSES 3078.40 L8 MASSES 3078.40 L8 304.04 L8 304.04 L8 304.04 L8 304.04 L8 304.04 L8 305.20 L8 44.08 L8 305.13 L8 105.21	OF BATH	12.	7	N
MASSES 3078.40 LB MASSES 3078.40 LB 640.38 LB 640.38 LB 640.38 LB 640.38 LB 640.38 LB 640.38 LB 710.52 LB 713.52 LB 713.52 LB 713.52 LB 713.52 LB 714.05 LB 735.13 LB 735.14 LB 735.14 LB 735.15 LB 735.15 LB 735.15 LB 735.15 LB 735.51 LB 735.51 LB 735.51 LB 735.55 LB 744.65	OF LEND	-	5	X :
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355.02 354.44 354.44 354.44 355.22 545.23 44.08 355.02 115.50 115.50 115.50 115.50 115.50 115.51 105.13 105.11 105.51 105.55	REACTOR MASSES			
MSS 85.22 118.52 118.52 118.52 118.52 118.52 118.52 118.52 115.58 115	5	۲	\$	9
MSS 85.22 118.52 118.52 118.52 118.52 118.52 118.52 115.56 115	MASS	640.	80	9
MSS 23.77 535.77 541.61 118.52 545.28 44.61 118.52 545.28 44.61 118.52 115.56 115.55 115.56 115.57 115.56 115.56 115.57 115.56 115.57 115.56 115.5	RIPHERY MASS	384.	3	9
ASS 2244.61 118.52 65.28 65.28 118.52 118.52 122.28 122.25 125.13 125.55 125.13 125	ATERAL SUPPORT MASS	335		.
MSS 22.88 MSS 245.93 115.28 MSS 22.88 115.13 115.28 115.13 115.13 115.13 115.13 115.13 115.13 125.	reucture mass	- 189 - 1995	8 . 8 .	5
MSS 852 85 25 85 28 115 28 14 68 28 15 28 15 54 68 23 15 54 68 23 15 54 68 23 15 54 68 23 15 54 68 23 15 54 55 55 13 15 55 15 15 15 15 15 15 15 15 15 15 15	EFLECTOR MASS	118		99
MSS 115.28 44.68 MSS 115.28 115.59 115.15 122.28 125.13	U) EMU TANUTATA MAJJ FT BEFLECTOR MASS	65.		9
A 55. 63 A 4. 68 A 55 A 56 A 115. 56 A 115. 56 A 115. 56 A 115. 56 A 115. 56 A 22. 88 A 22. 88 A 22. 88 A 14. 14 A 14. 14 A 165. 13 A 14. 15 A 165. 55 A 16. 57 A 165. 55 A 16. 57 A 165. 55 A 16. 57 A 16. 52 A 17.	NET LEVION MASS	165.	28	9
MSS 115.56 MSS 115.56 32.14 32.14 32.15 36.02 185.13 185.13 185.14 185.14 185.13 184.14 185.13 195.13 195.55 105.55 12989.67	UPPORT PLATE MASS	545.	5	9
MSS 115.56 38.14 38.14 38.15 38.25 38.25 3982.62 3984.44 3984.44 3984.44 3984.44 372.31 372.31 855 46.59 10545.55 10545.55	ATERAL SUPPORT FORWARD MASS	ŧ	8	9
ASS 38.14 38.14 32.25 32.25 185.02 185.02 185.13 185.14 185.14 185.15 737.18 737.18 85 257.78 85 257.78 85 255.55 10545.55 10545.55	EFLECTOR HARDWARE FORWARD MASS	115.	3	9
ASS 22.25 22.25 185.02 185.02 185.02 185.02 195.15 1943.16 1743.36 1743.36 1743.36 1743.36 1743.36 1743.36 1743.36 1743.36 1743.36 1743.36 1743.36 184.14 185.13 195.13	UPPORT PLATE PLENUM MASS			<u> </u>
85.22.03 195.02 195.02 195.02 195.02 195.19 195.19 1743.36 1743.36 1743.36 1743.36 1743.36 172.31 0.20 0.00 0.20 0.20 0.20 0.20 10545.55 12989.67		2.5		<u> </u>
S 195.02 S 195.02 195.02 195.02 195.02 195.01 MSS 194.14 195.01 MSS 25778 105.55 105.55 105.45.55 105.45.55 105.45.55 105.45.55	2	A582		99
ISS 195.02 ISS 195.02 ISS 195.44 ISS 194.14 ISS 194.14 ISS 195.91 ISS 257.19 IASS 257.19 IASS 257.19 IASS 254.11 ISS 269.67	UDIVIAL VUNE A	105.		9
S 8002.19 S 1054.44 S 1054.44 S 1054.44 MSS 1054.14 MSS 1054.13 MSS 1743.36 1036.13 MSS 257.78 1036.13 10365.55 10545.55 10545.55	LOW BAFFIF 1 MASS	195.		8
MASS 184.14 MSS 184.14 MSS 184.14 MSS 1743.36 MASS 257.78 MASS 257.78 MASS 257.78 1036.13 10545.55 12989.67	OTAL CORE SUBSYSTEM MASS	8662.		8
SS 184.14 SS 184.14 SS 184.14 MSS 737.18 MSS 737.18 MASS 257.78 1936.13 MASS 257.78 1936.13 19545.55 10545.55	RESSURE VESSEL A MASS	1054.		9
MSS 184.14 MSS 194.14 MSS 737.18 MSS 737.18 MASS 257.78 1936.13 MASS 257.78 1936.13 19345.55 19345.55	RESSURE VESSEL B MASS	398.		99
MSS 1743.36 MSS 737.16 MSS 737.16 MASS 257.78 372.31 MASS 0.29 MASS 0.29 MASS 254.15 10545.55	0			99
MSS 737.16 MSS 737.16 MSS 257.78 MSS 0.26 MASS 0.26 MASS 2444.15 10545.55 10545.55	Š			9 9
MSS 737.16 MASS 257.78 772.31 MASS 6.26 MASS 6.52 10545.55 12989.67	OTAL PRESSURE VESSEL MASS			9 9
MASS 257.78 372.31 MSS 0.20 MASS 0.52 MASS 2440.15 10545.55 12989.67	AIM CENIKAL SHIELU MASS Atu dediquedai shifin Mass	7.77		99
MASS 572.31 MASS 6.09 MASS 6.09 MASS 2444.13 10545.55 12989.67	١.			
MASS 0.20 MASS 0.09 MASS 2444.13 10545.55 12989.67		372		9
MASS 0.09 MASS 2444.13 10545.55 12989.67	. 2			9
40.52 44.13 2444.13 16545.55 12989.67			6	9
2444.13 10545.55 12989.67	MAS	4	52	L B
10545.55 12989.67		4	1.	LB
EACTOR MASS W/ SHIELD 12989.67	FACTOR MASS W/o SHIELD	0	.55	6
	EACTOR MASS W/ SHIE	12989.	.67	8

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607.68 11153.23 13597.36 SAFETY RODS-FOR LAUNCH ONLY REACTOR MASS "/O SHIELD-LAUNCH WT. REACTOR MASS "/ SHIELD-LAUNCH WT.

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TPA SUMMARY FOR STAGE #1 ••• EXPANDER CYCLE 2 PROPELLANT FEED LEGS AXIAL PUMPS TPA SIZE/WT/PERFORMANCE IS USER DEFINED •

··· PROPELLANT PUMP ...

38582. 1973. 5485. 2 988 .	5.4 INDUCER 118.23 0.00 2208.20	4297.88 41.08 7753.93	•./20 •.805 •.729 5.52	131.07 64.90 195.97
PUMP SPEED (RPM) SPECIFIC SPEED INDUCER SPECIFIC SPEED SUCTION SPECIFIC SPEED MUMBER OF PIMP STACE	OS SUCTION ERATION HE OUTLET PRE	FLOWRATE (LE HORSEPOWER(EFFICIENCY	INDUCER EFFICIENCY OVERALL PUMP EFFICIENCY PUMP DIAMETER(IN)	INDUCER WT. (LB) - EACH OVERALL PLUE WT. (LB) - EACH

4-231

··· TURBINE ...

1.969 9.617 9.617 5.65 5.65 5.65 5.65 5.65 5.65 5.65 1.78 17.195 9.39 6.39 ADMISSION FRACTION EFFICIENCY PRESSURE RATIO MASS FLOWRATE(LB/SEC) MASS FLOWRATE(LB/SEC) MAMBER OF TURBINE STAGES BLADE ROOT STRESS LIMIT(PSI) ROOT STRESS SPEED LIMIT(RPM) TURBINE SPEED(RPM) TURBINE SPEED(RPM) TURBINE WIT(LB) - EACH TURBINE U OVER C INLET MACH NUMBER

TPA START SYSTEM WT. ... TPA ...

8.00 32.24 9.00 9.00 227.75 455.49 487.73 78.43 78.43	455.81 4855.87 425.81 425.81 107.30 16.52	0.00 255.96 407.04 11.30 00.79	18545.55 2444.15 1178.87 1869.35 96.99 197.39 197.39 615.58 615.58	32.24 6.00 455.49 8.00 8.00 8.00 9.00 9.00 9.22 97.22	17947.77	754.19 6.00 6.00 6.00 6.00 6.00 6.00 6.00	
GAS GENERATOR/PREBURNER WTEAC IGNITION SYSTEM WTTOTAL IGNITION SYSTEM WTTOTAL HOT GAS MANIFOLD WTTOTAL GEARBOX WTTOTAL GEARBOX WTTOTAL GEARBOX WTTOTAL AIN TURBOPUMP WT. TOTAL TURBOPUMP WT. TOTAL TPA WT. STAGE \$1 WEIGHTS (POUNDS)	FORMARD TANK PRESSURE TANK TANK CONSTRUCTION WEIGHT TANK LINES AFT SKIRT FORMARD SKIRT TANK MOUNT STRUCTURAL WALL	PRESSURE TANK INSULATION FUEL TANK INSULATION OXIDIZER TANK INSULATION FUEL ACQUISITION SYSTEM OXIDIZER ACQUISITION SYSTEM PRESSURANT CONTROL HARDWARE	ENGINE WEIGHTS: 1 REACTOR INTERNAL SHIELD 1 REACTOR INTERNAL SHIELD 1 NOZZLE NOUNT(S) 1 TIMUST NOUNT(S) 1 CIMBAL SYSTEM(S) 2 MAIN VALVE(S) 2 MAIN VALVE(S) 1 GIMBAL POWER SUPPLY	2 IGNITION SYSTEM(S) 2 MOT GAS MANIFOLD(S) 2 GAS GENERATOR/PREBURNER 2 TPA ASSY(S) 1 GEARBOX(S) 2 TPA START SYSTEM(S) 2 TPA START SYSTEM(S) 1 GAS GENERATOR/PREBURNER(S)	TOTAL ENGINE WEIGHT	FLIGHT FUEL BOILOFF FLIGHT OXIDIZER BOILOFF EXPENDABLE WEIGHT MISCELLANEOUS WEIGHT USER DEFINED WEIGHT	OK SAFET NUC

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32411.97	88. 88. 88. 88. 88. 88. 88. 88. 88. 88.	40742.63 31370.76 0.00	stage #1	100.00 166.06 113.63 0.00 1013.63	LOX/LH2 7500.0 1000.0 360.0 3600.0 312.8 812.8 82.17 79.82
TOTAL INERT WEIGHT	INTERSTAGE WEIGHT BURNED FUEL BURNED OXIDIZER FUEL RESIDUAL OXIDIZER AUTOGENOUS PRESSURANT OXIDIZER AUTOGENOUS PRESSURANT STORED PRESSURANT MISC ON-BOARD FUEL MISC ON-BOARD OXIDIZER	GROSS IGNITION WEIGHT GROSS BURNOUT WEIGHT HOLD TIME FUEL BOILOFF HOLD TIME OX BOILOFF	Nuclear Thermal Vehicle **** VEHICLE SUMMARY **	DIMENSIONS, IN STAGE DIAMETER NOZZLE EXIT DIAMETER NAMBER OF NOZZLES STAGE LENGTH PAYLOAD LENGTH TOTAL VEH LENGTH	PERFORMANCE PROPELLANT THRUST,VACUUM DELIVERED,LBF PC,PSIA NOZZLE AREA RATIO BURN TIME,SEC ISP,VACUUM DELIVERED,SEC ISP,VACUUM DELIVERED,SEC ISP EFFICIENCY TOTAL PROP. FLOWRATE, LB/SEC CORE PROP. FLOWRATE, LB/SEC

OUTPUT FOR SINGLE PUMP AT REDUCED THRUST

PRESSURE AND TEMPERATURE SCHEDULES FOR STAGE #1 FOR ONE PUMP AT REDUCED THRUST LEVEL 60000. EXPANDER CYCLE

TEMPERATURE (DEG R) Fuel oxidizer	550.0 46.9 0.0 (SATURATION TEMP OF PROPELLANT)	38.5 40.3 72.2 926.9 86.5 175.6 4866.6 618.7 559.6	EMPERATURE CHANCES (DEG R) TEMPERATURE CHANCES (DEG R) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
IDIZER	PRESSURANT 	9.9 9.9 9.9 1.1	CHANGES (PSID) CHANGES (PSID) CHANGES (PSID) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	The second real office 41
PRESSURE(PSIA) FUEL	4365.0 60.1 54.6	54.6 45.0 45.0 1633.8 1633.8 1316.5 1316.5 962.5 962.5 962.5	PRESSURE CHANGES 0.0 1588.8 1588.8 133.6 133.6 354.0	
	MAX STORAGE VENT ULLAGE	TANK PROPELLANT PUMP INLET MAIN VALVE INLET MAIN VALVE OUTLET TIE TUBE OUTLET REGEN OUTLET (REFL I REGEN OUTLET (REFL I REACTOR OUTLET REACTOR OUTLET REACTOR CORE TURBINE INLET TURBINE INLET	ACQUISITION DEVICE FEED LINE PUMP MAIN VALVE TIE TUBES REGEN JACKET REFLECTOR TURBINE	

FLOWRATE SCHEDULE (LB/SEC) FOR STAGE #1 EXPANDER CYCLE

0X I D I Z E R 8 . 888 8 . 888 8 . 888			0.000 0.000
FUEL 65.663 65.663 65.663	19.138 46.525	31.705	32.087 0.000
	Ŧ	DLING TO CORE	RANT
8	TIE TUBES JACKET INFLOW	RRIER COOLING L OUTLET TO CORE	D CORE S PRESSURANT
TAMK OUTFLOW MAIN PUMP MAIN VALVE	JACIE	₩ N N	URBINE TO URBINE TO UTOGENOUS

STORED PRESSURANT (AVE) 6.08 Core 63.792

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••• TPA SUMMARY FOR STAGE ∯1 ••• SUMMARY FOR TPA AT THRUST LEVEL FRACTION 0.80 EXPANDER CYCLE SINGLE SHAFT TPA AXIAL PUMPS

... PROPELLANT PULP ...

49583. 3323. 9256. 29256. 29956. 29956. 89.19 89.19 16.33.85 657.14 8571.14 8571.56 8571.56	0.796 0.717 0.722 5.52 131.07 185.90 195.97
PUMP SPEED (RPW) SPECIFIC SPEED INDUCER SPECIFIC SPEED INDUCER SPECIFIC SPEED NUMBER OF PUMP STAGES NET POS SUCTION PRESSURE (PSIA) ACCELERATION HEAD (PSIA) PUMP OUTLET PRESSURE (PSIA) NOLLUMETRIC FLOWRATE (PW) MASS FLOWRATE (LBW/SEC) PUMP HORSEPOWER (PP)	INDUCER EFFICIENCY OVERALL PUMP EFFICIENCY PUMP DIANETER(IN) PUMP WT.(LB) INDUCER WT.(LB) OVERALL PUMP WT.(LB)

... TURBINE ...

1.900 9.700 1.368 32.00	<i>6</i> .₹	40583. 31.78 17.196	
ADMISSION FRACTION EFFICIENCY PRESSURE RATIO MASS FLOWRATE(LB/SEC) DIAMETER/IM)	LO O E C	TURBINE SPEED(RPM) TURBINE WT(LB) TURBINE ANNULUS AREA(IN2)	ENGINE SUMMARY

	75888.0 Ibf 1888.0 psig
EXPANDER CYCLE ENABLER I AXIAL PUMPS	CHAMBER PRESSURE -

333600.0 N 6895.0 kpg

4866.8 deg R 2769.6 deg K 586.6 599.9 599.9 2 2 2 82.2 lbm/s 37.3 kg/s	545.5 Ibm 4782.6 kg 444.1 ibm 4782.6 kg 49.8 in 1108.4 kg 191.5 in 257.9 cm 79.8 ibm/eec 35.2 kg/sec	181.6 Ibn 82.3 kg 399.2 Ibn 181.6 kg 598.1 Ibn 271.3 kg 71.6 kg 504.6 kg 50	135:5 155:5 155 0.0 155 155 0.0 155 155 0.0 155 14.6 0.1 155.6 155 0.2 155 155 0.3 155 14.6 0.4 14.6 49 0.5 155.6 155 197.4 157.1 49 197.2 155 44.1 137.3 44.1 49	47.8 1 bm 47.8 1 bm 4.2 1 bf 4.2 1 bf 4.2 1 bf 4.2 1 bf 4.2 1 bf 7631.1 1 7631.1 1 7	569.7 in 1294.7 cm 156.1 in 421.8 cm
CHAMBER TEMPERATURE = 480 NOZZLE EXIT AREA RATIO = 50 NUMBER OF FEED LEGS = 50 TOTAL PROPELLANT FLOWRATE = 50	REACTOR COMPOSITE FUEL COMPOSITE FUEL REACTOR WEIGHT SHIELD WEIGHT PRESSURE VESSEL DIA. PRESSURE VESSEL LENGTH CORE PROPELLANT MASS FLOW 70	NOZZLE CONVERGING NOZZLE WEIGHT 181 CONVERGING NOZZLE WEIGHT 1399 NOZZLE EXTENSION WEIGHT 178 SECOND NOZZLE EXTENSION WEIGHT 178 TOTAL NOZZLE WEIGHT 598 AREA RATIO AREA RATIO A	TURBOPHME ASSEMBLY (TOTAL FOR ALL FEED LEGS) MAIN PROPE. TURBOPUME WT PROPELLANT BOOST PUME WT MAIN OX PUME WEIGHT MAIN OX PUME WEIGHT BLEED LINE/VALVE WEIGHT BLEED LINE/VALVE WEIGHT MISC. HARDWARE WEIGHTS THRUST MOUNT SUPPORT HARDWARE ENGINE LINES MAIN VALVE GIMBAL + POWER SUPPLY MARGIN (2.0%)	HOUT SHIELD HOUT SHIELD HOUT SHIELD HOUT SHIELD HOUT SHIELD HOUT SHIELD HI M/O SHIELD M/O SHIELD HE M/O SHIELD HE M/O SHIELD HE	OVERALL DIMENSIONS OVERALL ENGINE LENGTH -

4-236

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THE FOLLOWING WARNINGS OCCUR FOR STAGE 1

TWO PHASE FLUID ENCOUNTERED IN REGEN

CR = 15.130 RECOMMENDED RANGE = 1.5 TO 4

NOZZLE EXIT DIAM = 166.1 STAGE DIAM = 100.0

AXIAL BUCKLING DESIGNS STRUCTURAL WALL THICKNESS MINIMUM GAUGE DESIGNS AFT TANK WALL THICKNESS HOOP STRESS DESIGNS FORWARD TANK WALL THICKNESS AFT TANK ULLAGE INCREASED BY GEOMETRY CONSTRAINT GAS PHASE ENCOUNTERED IN REGEN JACKET TPA CALCULATIONS TERMINATED BY ACHIEVING DESIRED ACCURACY

LEED NOMINAL STAGE DESIGN

5.0 MODEL VERIFICATION/COMPARISON

NESS NTP engine system design, Sample Case No. 8 presented in Section 4.0, was compared to past preliminary engine system designs to support in verification of the models. Since no past detailed ENABLER-based NTP engine system designs are available that incorporate state-of-the-art engine system technologies, a comparison to similar, but not exact, engine system designs was undertaken. The 75,000 lbf thrust, 1000 psia chamber pressure, composite fueled, 2700 °K (4860 °R) chamber temperature, 500:1 area ratio nozzle sample case was compared to a similar Rocketdyne NTP engine system design and a past ELES-NTP engine system design that are described in Refs. 2-3 and 5-1. The past ELES-NTP engine system design example did not incorporate an integrated ENABLER reactor system design, but included a reactor system design that only approximated in matching engine system cycle parameters.

Tables 5-1 and 5-2 compare the NESS sample design case to similar Rocketdyne and past ELES-NTP engine system designs. Tables 5-1 and 5-2 compare key engine cycle parameters and major engine subsystem weights of the NESS sample case design to the Rocketdyne and ELES-NTP designs, respectively. One key observation is that the NESS design exhibits a delivered Isp of approximately 1% lower than that associated with the other designs. This is because the integrated NESS model more accurately calculates nozzle cooling losses. It was found that film cooling of the nozzle wall was required to keep its maximum wall temperature at or under the acceptable limit of 1460 °R. Table 5-3 shows the effect of wall temperature on engine system performance as predicted by NESS. The ELES-NTP did not properly model this effect. It is unknown if the Rocketdyne engine design properly represents this integrated design effect. The reduced Isp also increased the engine system flow rate slightly to offset this effect.

The NESS program also more accurately models the pressure and temperature drops associated with cooling the nozzle and reactor system. This corresponds to the difference in the cycle pressures, temperatures, and turbopump operating parameters compared to the other referenced designs.

It is believed that the NESS weights (and size) more accurately represents the reactor system because its model of the reactor is sized to take advantage of heat captured by the coolant before it enters the reactor. Likewise, the NESS integrated ENABLER reactor system module more accurately determines the reactor system weight and size for a given design point, when compared to past modeling methods, see Refs. 2-3 and 5-1.

Parameter	Rocketdyne	SAIC - ELES NTP	SAIC NESS
Total Flowrate (kg/s)	36.7	36.9	37.27
Pump Discharge Pres. (psia)	1,544	1,538.3	2,298.3
Turbine Flowrate, % Pump	50	50	50
Turbine Inlet Temp. (°K)	555.6	555.3	622.3
Turbine Inlet Pres. (psia)	1,412	1,416.8	1,969.0
Turbine Pressure Ratio	1.25	1.295	1.739
Reactor Inlet Pres. (psia)	1,130	1,255.4	1,132.1
Reactor Power, (MW)	1,645	-	1,587
Reactor Core Flowrate (kg/s)	36.7	36.9	36.2
Nozzle Chamber Temp (°K)	2,700	2,700	2,700
Nozzle Chamber Pres. (psia)	1,000	1,000	1,000
Nozzle Exit Diameter (m)	4.15	4.15	4.22
Nozzle Expansion Ratio	500	500	500
Specific Impulse-Vac (sec)	923	922.8	912.9
Pump Speed (rpm)	37,500	34,913	40,583

Table 5-1 Engine Cycle Parameter Comparison*

* Rocketdyne uses their Mark 25 type axial turbopump (4 stages); SAIC ELES-NTP used a single-stage centrifugal pump; SAIC NESS, Sample Case No. 8, uses a 5-stage axial pump.

Parameter	Rocketdyne	SAIC Eles-NTP	SAIC NESS
Specific Impulse - Vac (sec)	923	922.8	912.9
Reactor (kg)	5,824	5,823	4,783
Internal Shield (kg)		1,523	1,108
Nozzle Assembly (kg)	440	421	535
Turbopump Assembly (kg)	304	104	221
Nonnuclear Support Hardware (kg) - Lines, Values, Actuators, Instrumen- tation Thrust Structure	1,815	1,264	1,493

Table 5-2. Engine Component Weight Comparison*

* Rocketdyne uses their Mark 25 type axial turbopump (4 stages); SAIC ELES-NTP used a single-stage centrifugal pump; SAIC NESS, Sample Case No. 8, uses a 5-stage axial pump.

Wall Temperature (°R)	Barrier Temperature (°R)	Isp (Sec.)	Fuel Film Cooling Fraction
1460	1630	912.9	0.03
1800	2106	915.9	0.03
2000	2429	917.5	0.02
2400	2892	919.4	0.02
2800	3418	921.2	0.02
3000	3651	921.9	0.02
3200	3864	922.4	0.02

Table 5-3. Effect of Wall Temperature on Performance*

* Core Temperature = 4860° R (2700°K)

The ELES-NTP reactor system weight was approximated by reading off a reactor power versus weight graph that can have some inherent inconsistencies. The increase in the NESS weight for the TPA is due to the more stressing operating conditions under which the turbopumps must perform to meet the increased pumping requirements of the NESS design. Likewise, the NESS design comparison example includes axial turbopumps, which are not used in the ELES-NTP design example. The increase in the NESS design nozzle weight is attributed to a more accurate nozzle weight calculation that has been embedded in the NESS program. The ELES-NTP design approach only estimated nozzle weight by using multiple program runs to represent the various design portions of the nozzle. These results were then summed together which approximated the engine weight. NESS now calculates nozzle weight using exact geometric equations from which weight is determined.

The nonnuclear support hardware weight is somewhat higher for the NESS design than the ELES-NTP design. The NESS design weight is believed to be more accurate than the ELES-NTP design weight because it uses true design calculations derived by TRW, see Ref. 1-1, during the past NERVA program effort that have been adjusted for today's technologies, as discussed in Section 2.2.5. Additionally, the NESS nonnuclear support hardware weight calculations are more representative of an NTP engine system because they include options, such as those associated with a gimbal power supply, that can be a significant weight factor for long NTP engine burns and a weight allocation associated with a lower pressure cooldown propellant coolant feed leg. The past ELES-NTP nonnuclear weight was estimated, based on a percentage of the reactor weight typical of the NERVA flight engine. This method has a greater degree of uncertainty. It is felt that the NESS program accurately models representative designs of solid core NERVA-type NTP engine systems to support preliminary design and mission studies.

6.0 CONCLUDING REMARKS

The NESS preliminary design analysis program characterizes, in detail, complete near-term and next-generation solid core NERVA-type NTP engine system in terms of performance, weight and size, and key operating parameters for the overall system and its associated subsystem. The NESS program incorporates numerous state-of-the-art engine system technology design options and design features unique to NTP systems such as a multiple leg turbopump propellant feed system assembly and a low pressure cooldown propellant coolant feed system. The NESS program is easy to use and is flexible to address various NTP engine system design options efficiently. Though an initial validation effort, the NESS program is deemed accurate to support preliminary engine and vehicle system design and mission analysis efforts.

Development of the NESS program is considered to be one of many key first steps required to support NTP development. Because of the modular nature of the NESS program, it has great potential for further upgrades in its design/technology option and analysis capabilities. Recommended future upgrade activities include: incorporation of other representative reactor system design modules such as for a particle bed and/or a pellet bed and/or cermet system; upgrade performance prediction correlations; include and upgrade materials option capability which considers radiation effects/compatibility; include a radiation heating model; integration of an efficient design optimization capability and perform more detailed analysis code verification. It is envisioned that NESS program could be a key design tool element when integrated into an advanced NTP engine system design workstation. ------

7.0 REFERENCES

- 1-0 "Nuclear Engine System Simulation (NESS); Volume 1 Program User's Guide," SAIC Report No. 265-070, NASA Contract No. NAS3-25809, December 1991.
- 1-1 Plebuch, R. K., J. R. McDougall, R. B. Spencer, and K. R. Wener, "Volume IV: Detailed Technical Report, Nuclear Rocket Engine Analysis," TRW Report No. 8423-6008-RL000, TRW Space Technology Laboratories, Redondo Beach, CA, March 1965.
- 1-2 Taylor, C. E., "Expanded Liquid Engine Simulation Computer Program Technical Information Manual," Aerojet Report No. ELES-1984, Aerojet TechSystems Company, Sacramento, CA, August 1984.
- 1-3 Taylor, C. E., "Expanded Liquid Engine Simulation Computer Program Programmer's Manual," Aerojet Report No. ELES-1984, Aerojet TechSystems Company, Sacramento, CA, December 1984.
- 1-4 Livingstone, J. M. and B. L. Pierce, "The ENABLER Based on Proven NERVA Technology," Proceedings of the Eight Symposium on Space Nuclear Power Systems, Vol. 2, pp. 598-620, January 1991.
- 2-1 Nickerson, G. R., L. D. Dang, and D. E. Coats, "Two-Dimensional Kinetic Reference Computer Program – Engineering and Programming Manual, "Software and Engineering Associates, Inc., Contract No. NAS8-35931, Report No. SN63, April 1985
- 2-2 "JANNAF Rocket Engine Performance Prediction and Calculation Manual," CPIA Publication 246, April 1975.
- 2-3 "NASA Manned Lunar and Mars Mission Propulsion System Assessment Studies; Task Order No. 9, Nuclear Thermal Rocket (NTR) System Assessment Studies – Nuclear Engine System Weight Scaling Results," Inter-Office Memorandum from D. Pelaccio to M. Stancati/H. Feingold, Contract No. NAS3-25809, dated 9 April 1991.
- 2-4 Pieper, J. L., "ICRPC Liquid Propellant Thruss Chamber Performance Evaluation Manual," CPIA Publication 178, September 1968.
- 2-5 "SSME Orientation (Part A Engine)," Space Transportation System Technical Manual, Course No. ME-110(A) RIR, Rockwell International Corporation, Rocketdyne Division, Contract No. NASS-27980, 1 November 1984.
- 2-6 "Space Shuttle Main Engine," <u>Space Transportation System Technical Manual</u>, Rockwell International Corporation, Rocketdyne Division, Contract No. NA38-27980, DPD No. 341, DR No. LS-090-1, 1 September 1983.
- 2-7 McCarty, R. D., Hord, J. and Roder, H. M., "Selected Properties of Hydrogen," U.S. Department of Commerce, National Bureau of Stands, NBS Honograph 188, February 1981.

- 2-8 Liquid Rocket Engine Axial-Flow Turbopumps, NASA SP-8125, April 1978.
- 2-9 Personal Communications with Dr. Stanley K. Borowski, NASA Lewis Research Center, June 1992.
- 2-10 "Nuclear Rocket Program Terminal Report," Argonne National Laboratory, ANL-7236, June 30, 1966, Published February, 1988.
- 3-1 Petrosky, L J "Scaling Laws of Prismatic Fuel Nuclear Rocket Engines," Paper AIAA-91-2337. AIAA/SAE/ASME/ASEE 27th Joint Propulsion Conference, June 1991, available from the American Institute of Aeronautics and Astronautics, 370 L'Enfant Promenade S.W., Washington, D.C., 1991.

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- 3-2 Petrosky, L. J. "Optimal Scaling of Prismatic Fuel Elements in Nuclear Rocket Engines," Paper AIAA-91-3506, AIAA/NASA/OAI Conference on Advanced SEI Technologies, September 1991, available from the American Institute of Aeronautics and Astronautics, 370 L'Enfant Promenade S.W., Washington, D.C., 1991.
- 3-3 Lyon, L. L. "Performance of (U,Zr)C-Graphic (Composite) and of (U,Zr)C (Carbide) Fuel Elements in the Nuclear Furnace 1 Test Reactor," I A-5398-MS, Los Alamos National Laboratory, 1973.
- 3-4 Taub, J. M. "A Review of Fuel Element Development for Nuclear Rocket Engines," LA-5931, Los Alamos National Laboratory, 1975.
- 3-5 McCarthy, J. R. and H. Wolf "Forced Convection Heat Transfer to Gaseous Hydrogen at High Heat Flux and High Pressure in a Smooth, Round, Electrically Heated Tank," ARS Journal p. 43, April 1991.
- 3-6 Taylor, M. F. "A Method of Correlating Local and Average Friction Coefficients for Both Laminar and Turbulent Flow of Gases Through a Smooth Tube with Surface to Fluid Bulk Temperature Ratios from 0.35 to 7.35," International Heat and Mass Transfer Shorten Communications, August 1967.
- 3-7 WANL "Radiation Heating Rates for the Type C Components of the Preliminary Reference Design (939J723)," DRM-52852, Westinghouse Astronuclear Laboratory (currently Westinghouse AES), November 1970.
- 5-1 Pelaccio, D, C. Scheil and J. Livingstone, "Updated Solid-Core Nuclear Thermal Propulsion. Engine Trades," AIAA Paper No. AIAA-91-3507. Presented at the AIAA/NASA/OAI Conference on Advanced SEI Technologies, Cleveland, OH, 4-6 September 1991.

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