NASA Technical Memorandum 82636

KONFIG and REKONFIG – Two Interactive Preprocessing Programs to the NAVY/NASA Engine Program (NNEP)

Laurence H. Fishbach
Lewis Research Center
Cleveland, Ohio

May 1981

NASA

KONFIG AND REKONFIG - TWO INTERACTIVE PREPROCESSING PROGRAMS TO THE NAVY/NASA ENGINE PROGRAM (NNEP)

Laurence H. Fishbach

National Aeronautics and Space Administration

Lewis Research Center

Cleveland, Ohio

E-889

SUMMARY

The NAVY/NASA Engine Program (NNEP) is a computer program that is currently being used to simulate the thermodynamic cycle performance of almost all types of turbine engines by many government, industry, and university personnel. NNEP uses arrays of input data to set up the engine simulation and component matching method as well as to describe the characteristics of the components. This report describes a preprocessing program (KONFIG) in which the user at a terminal on a time shared computer can interactively prepare the arrays of data required. It is intended to make it easier for the occasional or new user to operate NNEP. This report also describes REKONFIG, another preprocessing program, in which the user can modify the component specifications of a previously configured NNEP dataset. It is intended to aid in preparing data for parametric studies and/or studies of similar engines such as mixed flow turbofans, turboshafts, etc.

INTRODUCTION

The NASA Lewis Research Center in conjunction with the Naval Air Development Center jointly developed a computer code for simulating the thermodynamic cycle performance for arbitrary turbine engines, i.e., the code can assemble arbitrary combinations of specified types of components (such as ducts, compressors, turbines, etc.) through the use of input variables rather than having to build a computer code exclusively for each engine configuration. This computer code, the NAVY/NASA Engine Program (NNEP), reference 1, extended the capabilities of an existing Navy code, NEPCOMP (ref. 2), to include flow switching capabilities for variable cycle engines, "stacked" component maps for variable geometry, optimization capability, a simple installation effects model as well as other changes either discussed in reference 1 or described in a previously unpublished User's Manual which was sent to each user of the code. It is assumed that the reader of this report is already familiar with NNEP or has access to reference 1.

As of the present time, NNEP has been supplied to 41 government, industry, or university installations. While NNEP was created to use a simplified input method, the occasional or new user still makes input errors of either omission

N81-25698 #

or commission, namely, leaving out required inputs or putting the data in the wrong slots in the input arrays. Therefore, it was decided that a separate, preprocessor program to prompt the user in an interactive mode for the required input data, which would then prepare the data in the correct format for NNEP, would be beneficial. This report presents the User's Manual for NNEP (Appendix A), the listing of the code "KONFIG" (Appendix B), and an illustration of it in use (Appendix C). The preprocessor program is available from the author in card form (318 cards).

The versatility of the NNEP code in computer simulation of wide varieties of engine cycle and component arrangements is its most prominent feature, but it is also frequently used for conducting parametric studies of an engine once this engine has been configured through the use of inputs.

To aid in the conducting of parametric studies and in studying similar engines, another preprocessor computer code has been written that starts with an existing dataset, tells the user what all the design (SPEC) values for each variable are and makes it exceptionally easy to change these values. When the user has implemented all the changes, the code creates a new dataset incorporating the changes. Note that the CNTL, OPTV, and LIMV "components" cannot be changed using REKONFIG. This report presents the listing (Appendix D) of the code "REKONFIG" and an illustration of it in use (Appendix E). REKONFIG is also available from the author in card form (240 cards).

USER'S MANUAL

As previously mentioned in the Introduction, the latest version (December 9, 1980) of the NNEP User's Manual has been included as Appendix A. This manual, not previously formally published, was sent with each request for NNEP. It defines the SPEC and DATOUT definitions for each component type and will allow the user to compare his/her final dataset with the manual to verify the input values.

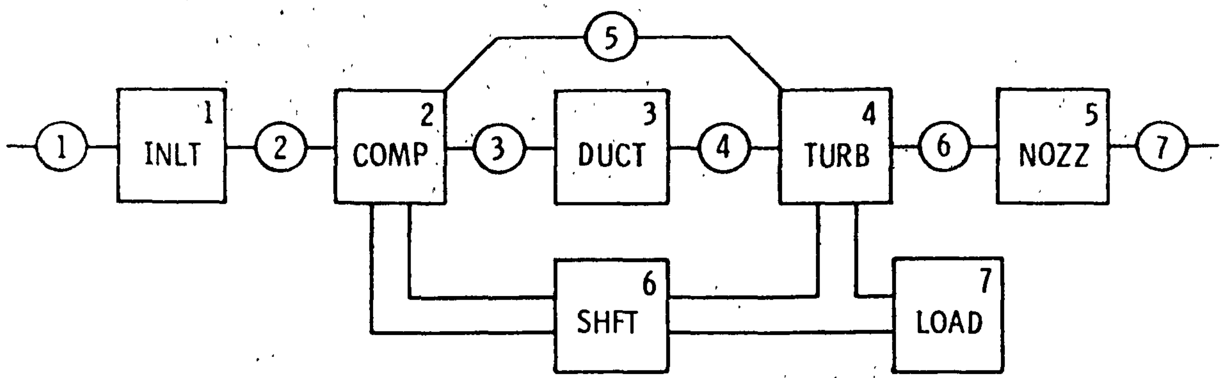
OPERATION OF KONFIG

"KONFIG" has been written in Fortran IV to be used in an interactive mode. To accomplish this, all "READs" are from unit 35. All "WRITEs" for which the user will be expected to respond are written on unit 30. After each individual component in the engine has had its input data supplied by the user, a copy of KONFIG and SPEC (or SPCNTL or SPLIMV) (see ref. 1) input images for that component is written onto unit 30 and another copy onto unit 6. If the user defines a dataset as being unit 6, the images will be saved for incorporation as NNEP input.

"KONFIG" uses fixed field inputs. Each field is indicated at the terminal. The user can enter the input anywhere in this field if a decimal point is specified, otherwise the inputs must be RIGHT adjusted.

EXAMPLE CASE

Appendix C contains a photocopy of the five (5) pages from an actual terminal session for generating the input cards for a one-spool turbojet which uses maps for compressor and turbine performance. A block diagram of the engine showing component and flow station numbers is shown below.



Controls are set to eliminate three flow errors and one shaft-horsepower error. The pressure ratio of the turbine will be used to reduce the flow error in the nozzle to zero. The "R" value of the compressor will reduce the flow error at the turbine face to zero. The inlet airflow will reduce the flow error at the compressor face to zero, and the shaft speed will be used to reduce the shaft net horsepower error to zero. An optimization variable will be included but not turned on so that, when generating throttle curves, the nozzle area will be optimized to minimize the SFC of the engine.

After the end (of configuring the engine) was indicated by inputting the word "done," the dataset written out onto unit 6 was processed through a text editor to eliminate all blanks to the right of column one. This set of processed images are shown in Appendix C. They would form the basis of the final dataset that the user would prepare for running NNEP.

The final dataset would be generated by adding to the dataset a title card, the NAMELIST input identifying the variables shown on pages A2 and A3 of the User's Manual, and the "&D MODE = 1" and "&END" cards. The off-design cases would then be added.

OPERATION OF REKONFIG

REKONFIG has been written in Fortran IV to be used in an interactive mode. To accomplish this, all "READs" of the initial dataset are from unit 9 and all "WRITEs" of the final dataset are to unit 10, and unit 8 is used as a scratch unit. This is identical to the way NNEP operates. The interactive capability of modifying the dataset has been added by prompting the user for inputs by "WRITEs" on unit 30 and the user's responses "READ" from unit 35. Upon executing the program, the user is prompted to tell the code whether a change is desired in the input values for particular components (called out by component numbers) or the entire engine (signalled by the user by just hitting "RETURN"). An example of each type of use will be shown.

In operation, the code will print on unit 30 the component number that is being processed followed by a list of the input variables, their current values and a key letter which is used to identify each variable. Figure 1 shows a typical list for a compressor. To change a value, the user types in column one the key letter followed by at least one blank followed by the new value which must have the decimal point included. For the current component, the user continues to change as many values as desired including rechanging any value.

Three other key letters appear on the list, namely R, T, and Q. They serve the following purposes: R (review) will cause the code to print the entire list over again for this component including the updated values of the variables; T (terminate) signals the computer to go on to the next component (either in the prescribed list or by next higher component number if doing entire engine); and Q (quit) the user is done, finish creating the final dataset.

EXAMPLE CASES

Two example cases are shown in Appendix E. In the first, just the inlet and burner inputs will be changed. In the second, all the components will be changed. In both cases, the initial dataset is named SAMPLE.SEPFLOTF and represents a separate-flow turbofan engine. The identification to the computer of the various input and output units is shown. The final dataset has been processed through an additional editor to eliminate extraneous zeros and eliminate unnecessary blanks.

CONCLUSIONS

The preprocessor programs described in this report can help to eliminate input errors to the NNEP computer program and are easy to use. KONFIG leads the user through the engine component by component, prompting the user for the required inputs. REKONFIG is used to modify existing input datasets and can greatly reduce the time to prepare new datasets to be run on the NAVY/NASA engine program NNEP. These codes are not, however, teaching devices. The user is expected to know how to run NNEP, how to "configure" an engine, and how to set up the control philosophy.

REFERENCES

1. Fishbach, L. H.; and Caddy, M. J.: NNEP - The NAVY/NASA Engine Program. NASA TM X-71857, 1975.

2. Shapiro, S. R.; and Caddy, M. J.: NEPCOMP - The Navy Engine Performance Program. ASME Paper 74-GT-83, Mar. 1974.

INDEX	VALUE	DEFINITION
A	1.3000	R VALUE
B	0.50000D-01	BLEED FLOW FRACTION
C	1.0000	SCALE F ON CORR.SPEED
D	1004.0	CORR AIRFLOW OR TABLE NO.
E	1.0000	SCALE F ON CORR AIRFLOW
F	1005.0	EFF. OR TABLE NO.
G	1.0000	SCALE F ON EFF.
H	1006.0	PRATIO OR MAP NO.
I	1.0000	SCALE F ON PRATIO
J	0.00000	3D MAP Z VALUE
K	0.00000	FRACT. BLEED HP LOSS
L	0.86000	EFFICIENCY
M	6.0000	PRATIO
N	1.0000	CORRECTED SPEED
R		REVIEW ALL VALUES
T		TERMINATE-GO ON TO NEXT COMPONENT
Q		QUIT-END OF PROCESSING FOR ENTIRE ENGINE

Figure 1. - Typical key letter list for compressor.

APPENDIX A

NNEP USER'S MANUAL

NNEP MANUAL - VERSION 3

Table of Contents

NNEP Input Instructions

Revision as of December 9,1980

The variable cycle version of NEP differs greatly from the original in terms of inputs. This writeup will attempt to educate the user as to the new input form and to additions which have been made to the code.

NAMELIST is now used with &D the NAMELIST call. Data is read in on Unit 9 except for the component maps which are read on Unit 12. Output is on Unit 10.

The first card read in on 9 is a title card for the cases and can be 60 characters in length.

Following this card will come the NAMELIST data. The first set of data read in consists of the following:

NCOMP - the total number of components including controls that will be configured through all the modes. Note that it is not necessary that any one mode use all of the components. Note also that if a component is used in more than one mode, its number must not change from mode to mode and that the same number may not be used for more than one component.

NOSTAT - the number of stations configured through all of the modes. It is NOT necessary that these remain the same through all modes, but it is advisable to keep as many the same as possible for clarity.

NMODES - the total number of modes to be configured.
(Default value is 1)

MODESN - designates the design mode. (Default is 1)

IWAY - input IWAY=1 if design point (Default is 1 for first point, and 0 for all other points)

TABLES - TRUE if maps are used, FALSE if not. (Default:T)

ITPRT - if = 0 do not print tables (maps) on output
if = 1 print tables on output (Default is 0)

NCODE - if = 1 normal running
if = 2 debug running (output after each pass)
if = -1 or -2, same as +1 & +2 BUT FULL PASS thru cycle is made on each pass
if = 3 indicates that a sequence of design points follows (shortens output) and obviates need to supply a &D IWAY=1 &END for each case

LABEL - a control for printing a label at the top of a page to identify the point being run. Set LABEL=F until off-design points are run. Then, if labels are desired, set LABEL=T and follow the NAMELIST data with the label card (similar to the title card) See also PINPUT. (Default is F)

PUNT - set PUNT = T to use last good point as set of first guesses for next point. It is advisable to always have PUNT=T. (Default:T)

LONG - control for printing of history of the convergence process. It is advisable to have LONG=T for new problems. (Default:T)

PINPUT - a control for causing the NAMELIST input for a case to be printed on the output sheets prior to the results for that case. PINPUT causes a write on Unit 8 which must therefore be DDEF'd. If PINPUT is FALSE, no NAMELIST output will occur. (Default:T)

NCASE - set = to 1 for new design case with NEW KONFIG (Default initially = 1, then set to 0)

DRAW - set = T for figure to be drawn (Default:F)

AMAC - set = T to punch data cards for AMAC (Default:F)

Installation effects have now been added to the program. The following inputs must appear on the first set of NAMELIST data cards if installation effects are desired. If they are not desired, there is no need to input any of them as the default values will eliminate the installation effects calculations.

BOAT - set BOAT=T for boattail drag calculations

SPILL - set SPILL=T for spillage & lip drag for inlet

INLTDS - set = T at operating condition for sizing the inlet (ie. may or may not be set T on first set of cards)

SPLDES - amount of design spillage when INLTDS=T (fraction)

AMINDS - flight Mach number at point where INLTDS is TRUE

BLMAX - no longer an input. The inlet bleed is now set = to .016 * am**1.5

BPMAX - maximum inlet bypass flow fraction (usually at a Mach number of 1.6) not currently used.

This is all of the data that is read on the first NAMELIST read. If TABLES=T, the code will now go to Unit 12 and read in the maps. The form of data for the maps is different from that in the original NEP report. These maps can now be stacked. It is best to look at a set of existing maps to determine the new format. At this point we have told the code how many modes are to be read in. We will now read in the configuration data and specifications for these modes. This is accomplished in NNEP through a DO LOOP. After NMODES of data have been read in, the program will run MODESN as the design point.

Thus we now input &D MODE=1, and read in the data for mode 1. We end this read with &END, then input &D MODE=2, etc.

Each of the component types has a different set of input variables. The form however is invariate except for controls. Each of these types will now be discussed.

For all types except controls and optimization variables, data is read in the following form.

```
KONFIG(1,N)='NAME',JM1,JM2,JP1,JP2,
SPEC(1,N) or SPECS(1,N)=V1,V2,.....V15  (both names work)
```

where N is the component number

JM1 is the primary upstream airflow station number for flow components or the first component hooked onto a shaft.

JM2 is the secondary upstream station number, or the second component hooked onto a shaft.

JP1 is the primary downstream station number, or the third component hooked onto a shaft.

JP2 is the secondary downstream station number, or fourth component hooked onto a shaft.

NAME identifies the type of component and is entered in single quotes as follows

- 'INLT' = inlet
- 'DUCT' = duct or burner
- 'COMP' = compressor
- 'TURB' = turbine
- 'HTEX' = heat exchanger
- 'SPLT' = splitter
- 'MIXR' = mixer
- 'NOZZ' = nozzle
- 'WINJ' = water injector
- 'LOAD' = load
- 'SHFT' = shaft
- 'CNTL' = control

'OPTV' = optimization variable
'LIMV' = limit variable

SPECS are now used to fill an array DATINP inside NNEP. Some DATINP are not required as inputs or have their values changed internally. We will now discuss SPEC, DATINP, and an updated DATINP* printed on the output, and DATOUT for each component type.

By setting the variable ENDIT=1 any place in an input dataset, execution will terminate at the PREVIOUS case.

* *

The following sums up the major changes to NNEP that are incorporated in this MANUAL:

The ability to calculate COOLING requirements on a row by row basis in the turbine has been added. Cooling type may be different for each row. Decreases in turbine efficiency can also be accounted for. The method is documented in NASA TM 81453, Feb. 1980 by J. W. Gauntner of NASA Lewis (see PAGE 10)

The ability to override the standard THERMO routine of NNEP with one capable of calculating the properties for any carbon to hydrogen ratio and account for dissociation (see PAGE 25)

INLT-JTYPE=1

INPUTS

```
SPEC( 1)= DATINP( 1)= DATINP*( 1)-inlet weight flow-lb/sec
SPEC( 2)= DATINP( 2)= DATINP*( 2)-Tos - free stream temp -R
SPEC( 3)= DATINP( 3)= DATINP*( 3)-Pos - free stream P-lb/in2
SPEC( 4)= DATINP( 4)= DATINP*( 4)-inlet drag Table ref.
                                  number- if blank computed
SPEC( 5)= DATINP( 5)= DATINP*( 5)-Mach number at inlet
SPEC( 6)= DATINP( 6)= DATINP*( 6)-inlet recovery, constant
                                  or Table ref. number
                                  If =0, Mil Spec is used
SPEC( 7)= DATINP( 7)= DATINP*( 7)-if SPEC(6)= Ref #,7=max
                                  permitted flow in table
SPEC( 8)= DATINP( 8)= DATINP*( 8)-if SPEC(6)= Ref #,8=scale
                                  factor on flow
SPEC( 9)= DATINP( 9)= DATINP*( 9)-Altitude-feet, only used
                                  if Tos and Pos=0 (see a)
                                  (geometric altitude)
SPEC(10)= DATINP(10)=            -f/a at inlet,usually = 0
SPEC(11)= DATINP(11)              If non zero, SPEC(9) is
                                  geopotential altitude
SPEC(12)= DATINP(12)=            -del T to be added to Tos
                                  (usually 0) (see a)
SPEC(13)= thru                   -BLANK
SPEC(15)=                        -BLANK
```

(a) If Del T is to be added to Tos, Altitude (SPEC(9)) cannot be zero, thus for SLS, set SPEC(9)=.00001

NOTE: MACH,ALTP, and ETAR can replace SPECS 5,9,and 6

OUTPUTS

```
DATOUT(1) -inlet drag from Table or computed
DATOUT(2) -velocity - ft/sec
DATOUT(3) -velocity - knots
DATOUT(4) -ram temperature ratio
DATOUT(5) -ram pressure ratio
DATOUT(6) -Mach number
DATOUT(7) -inlet recovery -exit total pressure/ram pressure
DATOUT(8) -exit temperature/518.67
DATOUT(9) -altitude - feet
```

'DUCT'-TYPE=2

Component type 'DUCT' is used for ducts, burners, and afterburners.

INPUTS

SPEC(1)= DATINP(1)= DATINP*(1)-del P/P pressure drop or Table ref number

SPEC(2)= DATINP(2)= DATINP*(2)-optional,design duct Mach number, see (a)

SPEC(3)= DATINP(3)= DATINP*(3)-BLANK

SPEC(4)= DATINP(4)= DATINP*(4)-burner outlet temp -R if DUCT-BLANK

SPEC(5)= DATINP(5)= DATINP*(5)-burner efficiency or Table reference number if DUCT-BLANK

SPEC(6)= DATINP(6)= DATINP*(6)-fuel heating value or Table ref. number - usually 18,300 if DUCT-BLANK

SPEC(7)= DATINP(7)= DATINP*(7)-cross sectional area of duct or burner (see a)

SPEC(8)= DATINP(8)= DATINP*(8)-ratio of inlet entrance bleed flow/total bleed available -DUCT only

SPEC(9)= DATINP(9)= DATINP*(9)-exit bleed/ total flow

SPEC(10)= DATINP(10)= -fract. air not heated

SPEC(11)- thru BLANK

SPEC(15)- BLANK

(a) If SPEC(2) is input, then area DATINP*(7) will be calculated at the design point. This area is then used to calculate momentum pressure drop.

OUTPUTS

DATOUT(1) -del P/P from momentum pressure drop (SPEC(2) or SPEC(7) was specified)

DATOUT(2) -del P/P from DATINP(1)=SPEC(1)

DATOUT(3) -pressure ratio at duct inlet used to compute inlet Mach number (Total/Static)

DATOUT(4) -fuel flow/ duct inlet weight flow

DATOUT(5) -cross sectional area - in2

DATOUT(6) -fuel flow - lb/hr

DATOUT(7) -inlet Mach number (if SPEC(2) or (7) was specified at the design point)

DATOUT(8) -burner efficiency

DATOUT(9) -burner outlet temperature (before bypass added)

'COMP' JTYPE=4

INPUTS

```
SPEC( 1)= DATINP( 1)= DATINP*( 1)-R value used to read Tables
SPEC( 2)= DATINP( 2)= DATINP*( 2)-comp. bleed flow/total flow
SPEC( 3)= DATINP( 3)=            -scale factor on N/  = 0
                                  ( usually = 1 )
                      DATINP*( 3)-N/   from map * scale f
SPEC( 4)= DATINP( 4)= DATINP*( 4)-W  /  or Table ref no. = 0
SPEC( 5)= DATINP( 5)=            -Scale f on W  /   = 0
                                  ( usually = 1 )
                      DATINP*( 5)-W  /  actual scale factor
                                  = Wcomp/Wmap
SPEC( 6)= DATINP( 6)= DATINP*( 6)-  comp. adia. eff or Tab. #
SPEC( 7)= DATINP( 7)=            -  comp. adia. eff at design
                      DATINP*( 7)-scale f on   for maps
SPEC( 8)= DATINP( 8)= DATINP*( 8)-comp PR or table ref. no.
SPEC( 9)= DATINP( 9)=            -scale f on pressure ratio
                      DATINP*( 9)-if SPEC(13) is input, *9
                                  is calculated scale f
SPEC(10)= DATINP(10)=            -3rd dim. arg value on map
SPEC(11)= DATINP(11)=            -fractional bleed horsepower
                                  loss due to interstage bleed
                                  = 0 means all bleed after
                                  full compression
SPEC(12)= DATINP(12)=            -desired adia. eff. at des.pt.
SPEC(13)= DATINP(13)=**          -desired PR at R and N/
SPEC(14)= DATINP(14)=            -N/  for design pt. on maps
SPEC(15)=                        -BLANK
```

OUTPUTS

```
DATOUT(1) -horsepower required (negative)
DATOUT(2) -physical rpm
DATOUT(3) -3rd. Dim. argument on compressor maps
DATOUT(4) -R value used on maps
DATOUT(5) -surge margin in percent
DATOUT(6) -N/   used to read maps
DATOUT(7) -scale factor on W  /
DATOUT(8) -compressor efficiency
DATOUT(9) -compressor pressure ratio
```

** overrides SPEC(9) if nonzero. If Tables are not used
   leave SPEC(9)=0.

'TURB' - JTYPE=5

INPUTS

```
SPEC( 1)= DATINP( 1)= DATINP*( 1)-pressure ratio at design
                                   point on maps
SPEC( 2)= DATINP( 2)= DATINP*( 2)-total bleed into turbine/
                                   total bleed available
SPEC( 3)= DATINP( 3)=            -scale f on N/   (usu.=1)
                      DATINP*( 3)-calculated scale f to
                                   match speeds at des.pt.
SPEC( 4)= DATINP( 4)= DATINP*( 4)-W   /P or Table ref. no.
SPEC( 5)= DATINP( 5)=            -scale f on W   /P (usu.=1)
                      DATINP*( 5)-calculated scale f to
                                   match airflow at des.pt.
SPEC( 6)= DATINP( 6)= DATINP*( 6)-turb adia. eff or Tab.no.
SPEC( 7)= DATINP( 7)=            -design turb. adia. eff.
                      DATINP*( 7)-scale f to set design eff
                                   at design point on maps
SPEC( 8)= DATINP( 8)=            -scale f on PR (usually=1)
                      DATINP*( 8)-scale f calculated to set
                                   desired PR on map
SPEC( 9)= DATINP( 9)= DATINP*( 9)-turb. bleed flow at ent./
                                   total bleed flow
SPEC(10)= DATINP(10)=            -3rd dim. arg value on map
SPEC(11)= DATINP(11)=            -desired   at design pt.
SPEC(12)= DATINP(12)=            -N/   at design pt. on map
SPEC(13)= DATINP(13)=            -turbine horsepower split
                                   (usually=1)
SPEC(14)= DATINP(14)= **         -factor for cooling type
SPEC(15)= DATINP(15)= **         -number of turbine stages
```

OUTPUTS

```
DATOUT(1) -horsepower produced by turbine (positive)
DATOUT(2) -physical rpm
DATOUT(3) -3rd.dimension argument value on turbine maps
DATOUT(4) -pressure ratio used in Table lookup
DATOUT(5) -scale factor on N/
DATOUT(6) -N/   used in Table lookup
DATOUT(7) -scale factor on W   /P
DATOUT(8) -turbine efficiency
DATOUT(9) -turbine overall pressure ratio
```

(** see next page for defs. + more cooling instructions)

Cooling Calculations per TM 81453

In order to calculate bleed requirements, the following procedures are to be followed:

CALBLD is set TRUE where bleed requirement is to be determined.

A control must be set to vary SPEC(2) of the compressor where bleed is being removed to drive 'PERF' 15 to zero.

Your other controls may or may not be turned on - make sure you set them to operate the way you want them to! For example, do you want BPR to be changing at the design point?

SPEC(14) is set to indicate type of cooling row by row:
SPEC(14)=cooling type row by row thru turbine
See TABLE I
Default value=88 (1 stage turbine with full film cooling)

SPEC(15)= number of turbine stages and is only used in sizing bleed requirements. (Default is 1 stage)

ELIFE=desired engine life (Default 10000 hrs.)
YEARV=year of first service of vane (Default 1985)
YEARB=year of first service of blade (Default 1985)
NEWEFF=calculate new turbine efficiency due to cooling (Default=.FALSE.)

For all other cases after sizing the bleed, you MUST set SPEC(9) of the bleed control to ZERO and CALBLD=.FALSE.

'HTEX'=JTYPE=6

INPUTS

```
SPEC( 1)= DATINP( 1)= DATINP*( 1)-del P/P or Tab. ref # Main
SPEC( 2)= DATINP( 2)= DATINP*( 2)-del P/P or Table # Sec'd
SPEC( 3)= DATINP( 3)= DATINP*( 3)-del T rise (guess value)
SPEC( 4)= DATINP( 4)= DATINP*( 4)-effectiveness or Tab ref #
SPEC( 5)= DATINP( 5)= DATINP*( 5)-scale f on effectiveness
SPEC( 6)= thru                      -BLANK
SPEC(15)=                           -BLANK
```

OUTPUTS

```
DATOUT(1) -delta P/P main flow
DATOUT(2) -delta P/P secondary flow
DATOUT(3) -BLANK
DATOUT(4) -effectiveness
DATOUT(5) -scale factor on effectiveness
DATOUT(6) -delta T calculated
DATOUT(7) -delta T/ (T hot- T cold)
DATOUT(8) -temperature rise difference((guess value/calc'd)-1)
DATOUT(9) -BLANK
```

'SPLT'=JTYPE=7

INPUTS

```
SPEC( 1)= DATINP( 1)= DATINP*( 1)-by pass ratio
                                   (W bypass/W main)
SPEC( 2)= DATINP( 2)= DATINP*( 2)-del P/P main stream
SPEC( 3)= DATINP( 3)= DATINP*( 3)-del P/P 2nd. stream
ALL REST BLANK
```

OUTPUTS

```
DATOUT(1) -by pass ratio
DATOUT(2) -delta P/P in the primary flow stream
DATOUT(3) -delta P/P in the secondary flow stream
ALL REST BLANK
```

WARNING: The program expects each splitter to result in an extra nozzle or a mixer. If such is not the case, use a DUCT with SPEC=8*0, (bypass flow/ total flow)

'MIXR'=JTYPE=8

INPUTS

```
SPEC( 1)= DATINP( 1)=                   -inlet area of main flow
                                         not needed if SPEC(3) is
                                         specified
                      DATINP*( 1)-inlet area of main flow
SPEC( 2)= DATINP( 2)=                   -inlet area of secondary
                                         not needed if SPEC(3) is
                                         specified
                      DATINP*( 2)-inlet area of secondary
SPEC( 3)= DATINP( 3)=                   -total to static pressure
                                         ratio at main flow inlet
                                         if > 1, if < 1 = Mach #
                                         (at design point)
                      DATINP*( 3)-total to static pressure
                                         ratio (calculated if both
                                         SPEC(1) & SPEC(7) given
SPEC( 4)= DATINP( 4)= DATINP*( 4)-velocity coefficient on
                                         mixed flow velocity
                                         1=ideal,<1=less than id.
SPEC( 5)= DATINP( 5)= DATINP*( 5)-if=1 total inlet area is
                                         held fixed as 2nd area
                                         varies.(see Note). If=0
                                         runs as before.
SPEC( 6)= thru                          -BLANK
SPEC(15)=                               -BLANK
```

Note: To simulate a VABI set SPEC(5)=1. Then as you change the secondary inlet area either through a control or OPTV the primary area will adjust to maintain fixed total. The primary area may NOT be varied- it will be over-ridden.

OUTPUTS

```
DATOUT(1) -main flow area - in2
DATOUT(2) -secondary flow area - in2
DATOUT(3) -total to static pressure ratio at main flow inlet
DATOUT(4) -total to static pressure ratio at secondary flow
DATOUT(5) -velocity at main flow inlet
DATOUT(6) -velocity at secondary flow inlet
DATOUT(7) -exit mixed flow velocity
DATOUT(8) -static pressure difference between streams
DATOUT(9) -total mixed to average static pressure ratio
           inlet
```

NOZZ--TYPE=9

INPUTS

```
SPEC( 1)= DATINP( 1)=            -flow area (in2), exit for
                                  conv.,throat for C-D nozz
                     DATINP*( 1)-calc. flow area at des.pt.
SPEC( 2)= DATINP( 2)= DATINP*( 2)-flow coeff. or Tab. ref. #
SPEC( 3)= DATINP( 3)= DATINP*( 3)-BLANK
SPEC( 4)= DATINP( 4)=            -nozz exit static pressure
                                  lb/in2 (if 0 see SPEC(9))
                     DATINP*( 4)-nozz exit static pressure
                                 or component no. (see 9)
SPEC( 5)= DATINP( 5)= DATINP*( 5)-Cv,vel. coeff or Tab #
SPEC( 6)= DATINP( 6)= DATINP*( 6)-switch,=0=conv,=1=C-D
SPEC( 7)= DATINP( 7)= DATINP*( 7)-area switch,=0 fix area to
                                  input value, =1 vary area
                                  to match flow required
                                  (see a)
SPEC( 8)= DATINP( 8)= DATINP*( 8)-BLANK
SPEC( 9)= DATINP( 9)= DATINP*( 9)-if SPEC(4)=0,set SPEC(9)
                                  to component # of inlet
SPEC(10)= thru                   -BLANK
SPEC(15)=                        -BLANK
```

(a) When running duct or afterburning cases, SPEC(7) is usually set = to 1 after a dry case has been run. Be sure to reset to 0 before a new dry case is attempted.

OUTPUTS

```
DATOUT(1) -gross jet thrust -lb
DATOUT(2) -actual jet velocity -ft/sec
DATOUT(3) -total to static pressure ratio at throat
DATOUT(4) -nozzle exit area - in**2
DATOUT(5) -nozzle throat area -in**2
DATOUT(6) -Cd - flow coefficient
DATOUT(7) -Cv - velocity coefficient
DATOUT(8) -critical pressure ratio at throat
DATOUT(9) -overall pressure ratio, inlet total to exit
            static
```

'WINJ' JTYPE=3

A reasonable approximation to water injector results is now available. Cp, R, and gamma are changed as if the water was fuel. No map changes are built in.

INPUTS

```
SPEC( 1)= DATINP( 1)= DATINP*( 1)-water / airflow ratio
SPEC( 2)= DATINP( 2)= DATINP*( 2)-fraction vaporized
SPEC( 3)= DATINP( 3)= DATINP*( 3)-pressure drop
SPEC( 4)= DATINP( 4)= DATINP*( 4)-saturation switch,
                                    0=use SPEC(1),1=saturate
SPEC( 5)= thru                     -BLANK
SPEC(15)=                          -BLANK
```

OUTPUTS

```
DATOUT(1) -actual water / air  ratio
DATOUT(2) -input value of fraction vaporized
DATOUT(3) -saturation value of water / air
DATOUT(4) -actual fraction vaporized
DATOUT(5) -delta T
DATOUT(6) -water flow rate in lbs/hr
DATOUT(7) -pressure drop
DATOUT(8) -BLANK
DATOUT(9) -BLANK
```

NOTE: To turn ON the water injector, SPEC(1) MUST be non-zero. The input value of SPEC(1) will be used unless SPEC(4) is equal to 1 in which case SPEC(1) will be over-ridden by the saturation value.

To turn OFF the water injector, set SPEC(1) to ZERO. Even though SPEC(4) may be equal to 1 (saturation) NO water will be injected.

'SHFT' TYPE=11

INPUTS

```
SPEC( 1)= DATINP( 1)= DATINP*( 1)-actual shaft rpm
SPEC( 2)= DATINP( 2)= DATINP*( 2)-gear ratio JM1 component
                                   comp. rpm/ shaft rpm
SPEC( 3)= DATINP( 3)= DATINP*( 3)-gear ratio JM2 component
                                   comp. rpm/ shaft rpm
SPEC( 4)= DATINP( 4)= DATINP*( 4)-gear ratio JP1 component
                                   comp. rpm/ shaft rpm
SPEC( 5)= DATINP( 5)= DATINP*( 5)-gear ratio JP2 component
                                   comp. rpm/ shaft rpm
SPEC( 6)= DATINP( 6)= DATINP*( 6)-mech. eff. JM1 component
                                   actual HP / ideal HP
SPEC( 7)= DATINP( 7)= DATINP*( 7)-mech. eff. JM2 component
                                   actual HP / ideal HP
SPEC( 8)= DATINP( 8)= DATINP*( 8)-mech. eff. JP1 component
                                   actual HP / ideal HP
SPEC( 9)= DATINP( 9)= DATINP*( 9)-mech. eff. JP2 component
                                   actual HP / ideal HP
SPEC(10)= thru                    -BLANK
SPEC(15)=                         -BLANK
```

OUTPUTS

```
DATOUT(1) -net shaft horsepower (required-delivered)
DATOUT(2) -actual shaft rpm
DATOUT(3) -actual shaft rpm of JM1
DATOUT(4) -actual shaft rpm of JM2
DATOUT(5) -actual shaft rpm of JP1
DATOUT(6) -actual shaft rpm JP2
DATOUT(7) -BLANK
DATOUT(8) -net shaft horsepower / total horsepower
DATOUT(9) -BLANK
```

NOTE: If one shaft is to be connected to another shaft in order to have more than 4 components on the same shaft, then: the LOWER component number shaft must be the FIRST component of the HIGHER number shaft. At least one TURBINE must be on the HIGHER number shaft. The control on horsepower balance must vary the SHAFT SPEED of the LOWER number shaft to drive DATOUT(8) of the HIGHER number shaft to ZERO!

'LOAD'=JTYPE=10

INPUTS

SPEC(1)= DATINP(1)= DATINP*(1)-load HP (negative) or
                                  Table reference number
SPEC(2)= DATINP(2)= DATINP*(2)-propeller effic. or 0.
SPEC(3)= DATINP(3)= DATINP*(3)-thrust/SHP at SLS
ALL THE REST ARE BLANK

Note - there are no JM1,JM2,JP1,JP2 numbers on the KONFIG card, thus: KONFIG(1,N)='LOAD',

OUTPUTS

DATOUT(1) -load horsepower (negative)
DATOUT(2) -actual shaft rpm
DATOUT(3) -propeller thrust **
ALL THE REST ARE BLANK

** WARNING: When the flight velocity is zero,the equation for propeller thrust becomes indeterminate and the thrust is set to zero.

'CNTL'-JTYPE=12

As previously mentioned, the SPECIFICATION and KONFIG cards for controls differ from those of the other "components"

The configuration card reads:

```
       KONFIG(1,N)='CNTL',
```

The specifications are read in as follows:

```
       SPCNTL(1,N)=N1,N2,NAME,N3,N4,VALUE,TOL,MINV,MAXV
```

Where:

```
      N1=the DATINP(N1) of N2 which is to be varied
      N2=the component number of the component being varied
    NAME='STAP' if station property (STATP)
        ='DOUT' if DATOUT
        ='PERF' if performance property
      N3=number of station property
         or DATOUT(N3)
         or PERFOR(N3)
      N4=flow station number if 'STAP'
        =component number if 'DOUT'
        =0 if 'PERF'
   VALUE=value to be achieved
     TOL=tolerance as fraction of value, if =1,
         default value of .001 will be used,
         (0.0005 if Optimizing)
         if = zero, control is turned off
    MINV=minimum allowable value - if zero ignored
    MAXV=maximum allowable value - if zero ignored
```

For PERFOR or STATP, the following Table applies

N3	PERFOR	STATP
1	total engine airflow	weight flow
2	gross jet thrust	total pressure
3	fuel flow	total temperature
4	net jet thrust	fuel to air ratio
5	TSFC	corrected flow W T/P
6	net thrust/airflow	Mach number
7	total inlet drag	static pressure
8	total brake shaft HP	interface corrected flow error
9	net thrust with installation drags	
10	net SFC	
11	inlet drag (lip + spillage)	
12	boattail drag	

You would read the SPCNTL card as follows:
Vary DATINP(N1) of component N2 to make either
a) station property(N3) at flow station(N4) equal to VALUE
   with tolerance TOL; or
b) DATOUT(N3) of component(N4) equal to VALUE with tolerance
   TOL; or
c) performance property(N3) equal to VALUE with tolerance TOL

NOTE: in the case of 'STAP' and 'DOUT' controls, N3 will usually
      =8 (flow interface error for STAP,
      static pressure difference in mixers,
      delta T error in HX's and net HP error in shafts)

If TOL=0. the control is turned off, to turn it back on see below. SPCNTL input can ONLY be used at the DESIGN POINT. Off-design point data is read in with SPEC data as below.

```
SPEC(1)= DATINP(1)= DATINP*(1)-fraction of VALUE used for
                               marching (see MARCHING)
SPEC(2)= DATINP(2)= DATINP*(2)-minimum allowable value
SPEC(3)= DATINP(3)= DATINP*(3)-maximum allowable value
SPEC(4)= DATINP(4)= DATINP*(4)-N1
SPEC(5)= DATINP(5)= DATINP*(5)-VALUE
SPEC(6)= DATINP(6)= DATINP*(6)-N3 if 'STAP',otherwise BLANK
SPEC(7)= DATINP(7)= DATINP*(7)-N3 if 'DOUT',otherwise BLANK
SPEC(8)= DATINP(8)= DATINP*(8)-N3 if 'PERF',otherwise BLANK
SPEC(9)= DATINP(9)= DATINP*(9)-TOL,if = 0, control inactive
                               if value given for TOL, then
                               control is activated
```

There is no DATOUT array for controls.

'OPTV'-JTYPE=13

The ability to optimize variables is now possible in NNEP. The form of the KONFIG card for an 'OPTV' is as follows:

KONFIG(1,N)='OPTV',0,0,NC,0,

where NC is the number of the component having the independent variable

The specifications are read in as for normal components

```
SPEC(1)=DATINP(1)-BLANK
SPEC(2)=DATINP(2)-minimum allowable value of the variable
                  (if = 0, there is no minimum constraint)
SPEC(3)=DATINP(3)-maximum allowable value of the variable
                  (if = 0, there is no maximum constraint)
SPEC(4)=DATINP(4)-a value of 1 to 15 indicating which DATINP
                  of component NC is the independent
                  variable
SPEC(5 to 8)= DATINP(5 to 8)-BLANK
SPEC(9)=DATINP(9)-switch to turn ON or OFF this variable
                  If set=0, this variable is OFF
                  If set=1, this variable is ON
```

There is no DATOUT array for optimization variables

There are additional inputs to NNEP when 'OPTV' components are present. These are:

```
TOLOPT - Criteria of convergence on DEPENDENT variable.
         Default value is 0.0002

NJOPT  - Component number which indicates the location
         of the dependent variable (if 0, the dependent
         variable is not a DATOUT parameter)

NVOPT  - if NJOPT = 0
>0=min   A value of 1 to 12 indicating which performance
<0=max   property is the dependent variable

         if NJOPT = 0
         A value of 1 to 9 indicating which DATOUT of
         component NJOPT is the dependent variable
```

To turn off the optimization, NVOPT must be set to 0

As an example of the use of an 'OPTV', let us assume that we have MARCHED to Mach 1.4 at 40000 feet and then throttled back to 50 percent F/Wa (see page 19)

We can now set SPEC(1,20)=1 to hold the F/Wa at the present value. If we want to minimize the SFC holding F/Wa constant and optimizing TIT, we would do the following.

Assume that component 5 was the main burner, and that we have used only 20 components. We would have created at the beginning another component as follows.

```
KONFIG(1,21)='OPTV',0,0,5,0,SPEC(1,21)=0,0,0,4,0,0,0,0,0,
```

Which says that DATINP(4) (burner outlet T) of component 5 (the main burner) is the independent variable. There is no minimum value or maximum and since SPEC(9)=0 it is OFF

Now we set SPEC(9,21)=1 and NVOPT=5 to minimize SFC
The max increment in TIT would be = 50 degrees in 1 step

NOTE: A variable DEBUG is defaulted to zero. If you want to see each iteration of the optimization on your OUTPUT, set DEBUG=1.

'LIMV'=JTYPE=14

Limit Variables

It is now possible to specify minimum and maximum allowable values for any DATOUT, STATION PROPERTY, or PERFORMANCE PROPERTY.

This ability already exists for CONTROL and OPTIMIZATION variables (see 'CNTL' and 'OPTV')

Now, when a limit has been exceeded, a WARNING will be printed on the output sheet.

If optimization is in effect, the criteria of merit will be penalized by a penalty function to drive you away from the boundary.

The form of a 'LIMV' is as follows:

KONFIG(1,N)='LIMV'

The inputs at the DESIGN POINT are:

SPLIMV(1)= BLANK
SPLIMV(2)= minimum allowable value
SPLIMV(3)= maximum allowable value
SPLIMV(4)= 'DOUT', or 'STAP', or 'PERF'
SPLIMV(5)= DATOUT No., or Station Prop. No. or Perfor. No.
SPLIMV(6)= Component No. or Station No. or BLANK
SPLIMV(7)= BLANK
SPLIMV(8)= BLANK
SPLIMV(9)= On/Off switch, 1=on, 0=off

Off-design use SPEC(2) to change minimum value
SPEC(3) to change maximum value
SPEC(9) to turn On and Off

MARCHING

A new feature has been added to NNEP. The best way to tell the user about it is to demonstrate its use.

Let us suppose you wish to make a plot of F/Wa versus nozzle area at Mach 1.4, 40000 feet. You could run the engine at 1.4,40000, note what F/Wa is, and then use a control on nozzle area to drive F/Wa to various values. The dogwork of doing this has been eliminated as follows.

When you configure the engine, build in a control on nozzle area and F/Wa as follows - suppose component 10 is the nozzle, and if component 20 is the new control,

```
KONFIG(1,20)='cntl',spcntl(1,20)=1,10,'PERF',6,0,anyvalue,0
```

which says - vary DATINP(1) (nozzle area) of component(10) (nozzle) so that performance property(6) (F/Wa) has a value of (doesn't matter) with a tolerance of zero (turns OFF the control)

Then run the engine up to 1.4,40000 feet. Now input the following

```
SPEC(1,20)=f1,SPEC(9,20)=TOL
followed by
&D  &END
 .
 .
 .
&D  &END
```

What this will do is detect from SPEC(1,20) not equal to 0, that you want to store the last value of PERF(6) in VALUE (the target answer) and will then set

TARGET VALUE=f1 * the present VALUE Thus, the present value of (F/Wa) is calculated by the program, and DATINP(1) of component(10) will now be used to drive PERF(6) (F/Wa) to the TARGET VALUE. We could at the same time for instance have held thrust constant by putting a control on TIT to make thrust anything and when we came to 1.4,40000 set f1 for this control=1.

TABLE DATA INPUTS

Consider the TABLE DATA as 3 Dimensional, composed of a series of planes with each plane assigned a value called Z. Then, on each Z plane, the Dependent Variable (ordinate axis), F(X,Y,Z=Constant) is a 2 Dimensional Function of X, (absicca axis or column position) and Y (row position).

Each TABLE representing a single Table Look-up has the following INPUT DATA CARD Setup.

Card 1 TABLE Reference Number (Integer, col 2-5)
TABLE Identification Label, Col 6-75

Card 2 Z-Identifier (4 Character Symbol, col 1-4)
NZ-Number of Z values (Integer, col 6 & 7)
Z-Variable values,7F10., Beginning in Column 11. If needed, extra cards follow 10X,7F10. Format.
Z values MUST be in ascending order.

Card 3 Y-Identifier (4 Character Symbol, col 1-4)
NY-Number of Y values (Integer, col 6 & 7)
Y-Variable values,7F10., Beginning in Column 11. If needed, extra cards follow 10X,7F10. Format.
Y values MUST be in ascending order.

Card 4 X-Identifier (4 Character Symbol, col 1-4)
NX-Number of X values (Integer, col 6 & 7)
X-Variable values,7F10., Beginning in Column 11. If needed, extra cards follow 10X,7F10. Format.
X values MUST be in ascending order.

Card 5 F(X,Y,Z)-Identifier (4 Character Symbol, col 1-4)
NX-Number of X values (Integer, col 6 & 7)
F(X,Y,Z)-Variable values,7F10., Beginning in Column 11. If needed, extra cards follow 10X,7F10. Format.
These Values correspond to the values on the X Identifier Card.

Last Card 3 Character Symbol EOT in col 1-3

The remaining cards follow the same basic format as the cards before. The first X and F(X,Y,Z) cards are for the first Y value in the first Z plane. This series of Card 4 & 5 types is repeated for each Y value until the Y values in the first plane are exhausted. Following this last F(X,Y,Z) identifier is a Y identifier card (type 3) with the next Y values for the second Z plane. This series is repeated for the remaining Z planes. In each plane where X variable values are not changing, once defined, they need not be repeated. See example for a sample listing.

LIMITATIONS

1) NZ, NY, and NX may not be blank or zero
2) 30 TABLES Maximum
3) NZ, NY, and NX are limitted to 100 or less
4) A zero or blank table reference number will halt the read
5) A storage overflow message will result if TABLE storage exceeds limits set in TREAD Subroutine.

SAMPLE MAP

```
  269       TURBINE EFFICIENCY vs. PR, RPM, and BETA
BETA  2          40.       60.
RPM   3         100.      110.      140.
PR    4          1.1       1.3       1.4       2.0
EFF   4          0.8      0.82      0.82      0.81
PR    3          1.1       1.8       1.9
EFF   3          0.8      0.83      0.82
EFF   3         0.79      0.82      0.83
RPM   3         100.      110.      140.
PR    5          1.1       1.3       1.4       2.0       2.2
EFF   5          0.8      0.81     0.815      0.82      0.81
EFF   5         0.81      0.81      0.82      0.84      0.83
EFF   5         0.83      0.84      0.85      0.84      0.83
EOT
```

Note: For Compressors- X=R, Y=N, Z=BETA, F(X,Y,Z)=W,PR,& ETA
For Turbines - X=PR, Y=N, Z=BETA, F(X,Y,Z)=W and ETA

MISCELLANEOUS

IDONE(1 to 60) is an array of switches telling whether or not a component N has been designed. IDONE(N)=0 means NO, IDONE(N)=1 means YES. If a component N is entered and the code detects that IDONE(N)=0 then, the component will be designed based on the conditions at that moment. This may or may not be what you desire. Thus, if you switch modes and encounter a new nozzle, you may want to input IDONE(N)=1 and a value for the throat area for the nozzle. On the other hand, if as in the example input case which follows, you want to redesign the main nozzle and design the new nozzle when you go from mixed to separate flow mode, you can reset IDONE(N) for the main nozzle to zero and both nozzles will be designed. How and when to use IDONE as a tool will best come from experience.

Other Fuels and Dissociation

In order to run either other fuels and/or dissociation, two subroutines must be added. The first, THERM, overrides the standard THERM in NNEP and calls TLAN which is a coding of the method developed at NASA Langley by Mascitti (TN D-4747).

Two new inputs are required:
C2HRAT-carbon to hydrogen ratio (by atoms)
 (Default 0.5245035801 (JP4))
TFUEL-fuel temperature (Default 530. R)

at NASA Lewis set NEWLIB=NEWNNEP.LIB.DIS

APPENDIX B

PROGRAM LISTING FOR KONFIG

```
      REAL MACH
      DIMENSION IWORD(15), KONFIG(5,60), SPEC(15,60), SPCNTL(9,60), SPLI
     1MV(15,60)
      DATA IWORD/4HINLT,4HDUCT,4HWINJ,4HCOMP,4HTURB,4HHTEX,4HSPLT,4HMIXR
     1,4HNOZZ,4HLOAD,4HSHFT,4HCNTL,4HOPTV,4HLIMV,4H****/,STAP,DOUT,PERF/
     24HSTAP,4HDOUT,4HPERF/,KDONE/4HDONE/
      WRITE (30,800)
      DO 330 JCX=1,60
      XM1=0
      XM2=0
      XM3=0
      DO 10 K=1,15
      IF (K.LT.6) KONFIG(K,JCX)=0
      IF (K.LT.12) SPCNTL(K,JCX)=0.
      SPLIMV(K,JCX)=0.
   10 SPEC(K,JCX)=0
   20 WRITE (30,810) JCX
      READ (35,820) JTOPE
      IF (JTOPE.EQ.KDONE) GO TO 340
      KONFIG(1,JCX)=JTOPE
      ITT=15
      DO 30 IT=1,15
      IF (JTOPE.NE.IWORD(IT)) GO TO 30
      ITT=IT
   30 CONTINUE
      IF (ITT.LE.9) GO TO 40
      IF (ITT.LE.14) GO TO 210
      WRITE (30,580) JTOPE
      GO TO 20
C     PROCESS THIS COMPONENT
   40 WRITE (30,830)
      READ (35,840) (KONFIG(J,JCX),J=2,5)
C     WHAT KIND OF COMPONENT IS THIS?
      GO TO (50,90,100,110,130,150,160,170,190),ITT
C     INLET
   50 WRITE (30,850)
      READ (35,860) SPEC(1,JCX),SPEC(5,JCX),SPEC(9,JCX),SPEC(6,JCX),SPEC
     1(12,JCX)
      WRITE (30,870)
      READ (35,960) XM1,XM2
      IF (XM1.NE.0.) SPEC(4,JCX)=XM1
      IF (XM2.NE.0.) SPEC(6,JCX)=XM2
   60 DO 70 IJK=1,15
      KJI=16-IJK
      IF (SPEC(KJI,JCX).NE.0.) GO TO 80
   70 CONTINUE
   80 WRITE (6,880) JCX,(KONFIG(J,JCX),J=1,5),JCX,(SPEC(K,JCX),K=1,KJI)
      WRITE (30,880) JCX,(KONFIG(J,JCX),J=1,5),JCX,(SPEC(K,JCX),K=1,KJI)
      GO TO 330
C    COME HERE FOR DUCTS
   90 WRITE (30,890)
      READ (35,900) SPEC(1,JCX),SPEC(2,JCX),SPEC(4,JCX),SPEC(5,JCX),SPEC
     1(6,JCX)
      WRITE (30,910)
      READ (35,710) SPEC(8,JCX),SPEC(9,JCX),SPEC(10,JCX)
```

```
      WRITE (30,920)
      READ (35,960) XM1,XM2
      IF (XM1.NE.0.) SPEC(5,JCX)=XM1
      IF (XM2.NE.0.) SPEC(6,JCX)=XM2
      GO TO 60
C     COME HERE FOR WATER INJECTORS
100   WRITE (30,650)
      READ (35,660) IWON
      SPEC(1,JCX)=IWON
      WRITE (30,670)
      READ (35,680) SPEC(2,JCX),SPEC(3,JCX),SPEC(4,JCX)
      IF (IWON.EQ.1.AND.SPEC(4,JCX).EQ.0.) WRITE (30,690)
      IF (IWON.EQ.1.AND.SPEC(4,JCX).EQ.0.) READ (35,710) SPEC(1,JCX)
      GO TO 60
C     COME HERE FOR COMPRESSORS
110   WRITE (30,930)
      READ (35,940) SPEC(1,JCX),SPEC(2,JCX),SPEC(6,JCX),SPEC(8,JCX),SPEC
     1(14,JCX)
      SPEC(12,JCX)=SPEC(6,JCX)
      SPEC(13,JCX)=SPEC(8,JCX)
      DO 120 JJ=3,9,2
120   SPEC(JJ,JCX)=1.
      WRITE (30,950)
      READ (35,960) XM1,XM2,XM3,SPEC(10,JCX)
      IF (XM1.NE.0.) SPEC(4,JCX)=XM1
      IF (XM2.NE.0.) SPEC(6,JCX)=XM2
      IF (XM3.NE.0.) SPEC(8,JCX)=XM3
      GO TO 60
C      COME HERE FOR TURBINES
130   WRITE (30,700)
      READ (35,710) SPEC(1,JCX),SPEC(11,JCX),SPEC(12,JCX),SPEC(2,JCX),SP
     1EC(9,JCX)
      WRITE (30,720)
      READ (35,730) SPEC(14,JCX),SPEC(15,JCX),SPEC(13,JCX)
      WRITE (30,740)
      READ (35,750) XM1,XM2,SPEC(10,JCX)
      SPEC(8,JCX)=1.
      DO 140 J=3,7,2
140   SPEC(J,JCX)=1.
      SPEC(4,JCX)=AMAX1(1.,XM1)
      SPEC(6,JCX)=AMAX1(SPEC(11,JCX),XM2)
      GO TO 60
C      COME HERE FOR HEAT EXCHANGERS
150   WRITE (30,760)
      READ (35,710) SPEC(1,JCX),SPEC(2,JCX),SPEC(3,JCX),SPEC(4,JCX)
      WRITE (30,770)
      READ (35,960) XM1,XM2,XM3
      SPEC(5,JCX)=1.
      IF (XM1.NE.0.) SPEC(1,JCX)=XM1
      IF (XM2.NE.0.) SPEC(2,JCX)=XM2
      IF (XM3.NE.0.) SPEC(4,JCX)=XM3
      IF (XM3.EQ.0.) GO TO 60
      WRITE (30,780)
      READ (35,900) SPEC(5,JCX)
      GO TO 60
```

```
C     COME HERE FOR SPLITTERS
160   WRITE (30,790)
      READ (35,710) SPEC(1,JCX),SPEC(2,JCX),SPEC(3,JCX)
      GO TO 60
C     COME HERE IF MIXER
170   WRITE (30,590)
      READ (35,440) SPEC(3,JCX)
      IF (SPEC(3,JCX).NE.0.) GO TO 180
      WRITE (30,600)
      READ (35,440) SPEC(1,JCX),SPEC(2,JCX)
180   WRITE (30,610)
      READ (35,470) SPEC(4,JCX),SPEC(5,JCX)
      GO TO 60
C     COME HERE IF NOZZLE
190   WRITE (30,620)
      READ (35,710) SPEC(2,JCX),SPEC(5,JCX),SPEC(9,JCX)
      WRITE (30,410)
      READ (35,900) SPEC(6,JCX),SPEC(7,JCX),STATIC
      IF (STATIC.EQ.0.) GO TO 200
      WRITE (30,630)
      READ (35,710) SPEC(4,JCX)
      SPEC(9,JCX)=0.
200   WRITE (30,640)
      READ (35,960) XM1,XM2
      IF (XM1.NE.0.) SPEC(2,JCX)=XM1
      IF (XM2.NE.0.) SPEC(5,JCX)=XM2
      GO TO 60
C     COME HERE FOR LOADS, SHAFTS, CONTROLS, OPTVS, AND LIMVS
210   IGO=ITT-9
      GO TO (220,230,240,280,290),IGO
C     COME HERE FOR LOADS
220   WRITE (30,420)
      READ (35,440) SPEC(1,JCX)
      WRITE (30,430)
      READ (35,440) SPEC(2,JCX),SPEC(3,JCX)
      GO TO 60
C     COME HERE FOR SHAFT
230   WRITE (30,450)
      READ (35,840) (KONFIG(K,JCX),K=2,5)
      WRITE (30,460)
      READ (35,470) (SPEC(K,JCX),K=1,5)
      WRITE (30,480)
      READ (35,900) (SPEC(K,JCX),K=6,9)
      GO TO 60
C     COME HERE FOR CONTROLS
240   WRITE (30,490)
      READ (35,820) AWORD
      SPCNTL(3,JCX)=AWORD
      IF (AWORD.NE.STAP) GO TO 250
      WRITE (30,500)
      READ (35,510) SPCNTL(4,JCX),SPCNTL(5,JCX)
      GO TO 270
250   IF (AWORD.NE.DOUT) GO TO 260
      WRITE (30,520)
      READ (35,510) SPCNTL(4,JCX),SPCNTL(5,JCX)
```

```
      GO TO 270
260   WRITE (30,530)
      READ (35,510) SPCNTL(4,JCX)
270   WRITE (30,540)
      READ (35,440) SPCNTL(6,JCX),SPCNTL(7,JCX)
      WRITE (30,550)
      READ (35,510) SPCNTL(1,JCX),SPCNTL(2,JCX)
      WRITE (30,560)
      READ (35,440) SPCNTL(8,JCX),SPCNTL(9,JCX)
      WRITE (30,570) JCX,JCX,(SPCNTL(K,JCX),K=1,9)
      WRITE (6,570) JCX,JCX,(SPCNTL(K,JCX),K=1,9)
      GO TO 330
C     COME HERE FOR OPTIMIZATION VARIABLE
280   WRITE (30,350)
      READ (35,510) SPEC(4,JCX),XKON
      KONFIG(3,JCX)=XKON
      WRITE (30,360)
      READ (35,370) SPEC(9,JCX),SPEC(2,JCX),SPEC(3,JCX)
      GO TO 60
C     COME HERE FOR LIMIT VARIABLE
290   WRITE (30,380)
      READ (35,820) AWORD
      SPLIMV(4,JCX)=AWORD
      IF (AWORD.NE.STAP) GO TO 300
      WRITE (30,500)
      READ (35,510) SPLIMV(5,JCX),SPLIMV(6,JCX)
      GO TO 320
300   IF (AWORD.NE.DOUT) GO TO 310
      WRITE (30,520)
      READ (35,510) SPLIMV(5,JCX),SPLIMV(6,JCX)
      GO TO 320
310   WRITE (30,530)
      READ (35,510) SPLIMV(5,JCX)
320   WRITE (30,390)
      READ (35,370) SPLIMV(9,JCX),SPLIMV(2,JCX),SPLIMV(3,JCX)
      WRITE (30,400) JCX,(KONFIG(K,JCX),K=1,5),JCX,(SPLIMV(KK,JCX),KK=1,
     19)
      WRITE (6,400) JCX,(KONFIG(K,JCX),K=1,5),JCX,(SPLIMV(KK,JCX),KK=1,9
     1)
      GO TO 330
330   CONTINUE
340   CONTINUE
      STOP
C
C
C
350   FORMAT (' OPTV- ENTER SPEC NO. FREE TO VARY AND COMPONENT NO. OF C
     1OMPONENT HAVING THE INDEPENDENT VARIABLE'//'  -- --')
360   FORMAT (' ENTER 1. TO TURN ON OPTV, 0.=OFF, MIN VALUE AND MAX VALU
     1E ALLOWED'//'  ON MINIMUM MAXIMUM')
370   FORMAT (F3.0,2F8.0)
380   FORMAT (' LIMV- ENTER WHETHER STAP, DOUT, OR PERF'//'  ----')
390   FORMAT (' ENTER 1. TO TURN ON LIMV, 0.=OFF, MIN VALUE AND MAX VALU
     1E ALLOWED'//'  ON MINIMUM MAXIMUM')
400   FORMAT (' KONFIG(1,',I2,')=4H',A4,4(I2,1H,),'SPLIMV(1,',I2,')=',F3
```

```
     1,0,1H,,2(G10.4,1H,),A4,5(F3.0,1H,))
 410  FORMAT (' MUST SET SWITCHES- (SWCH1=0. FOR CONV.,=1. FOR CD NOZZ)'
     1/'(SWCH2=0. FIXED AREA,=1. FLOAT AREA) (SWCH3=1.-SPECIFY EXIT STAT
     2IC P'/'  SWCH1 SWCH2 SWCH3')
 420  FORMAT (' ENTER LOAD HORSEPOWER (NEGATIVE) OR MAP NO.'/'  _______'
     1)
 430  FORMAT (' IF PROPELLOR, ENTER EFFICIENCY AND F/SHP @ SLS'/'  _____
     1__ _______')
 440  FORMAT (2F8.0)
 450  FORMAT (' SHFT- ENTER AS INTEGERS, THE COMPONENT NUMBERS OF THOSE
     1COMPONENTS CONNECTED TO THIS SHAFT'/' FROM FRONT TO REAR OF ENGINE
     2'/'  __ __ __ __')
 460  FORMAT (' ENTER SHAFT RPM AND THE GEAR RATIO FOR EACH COMPONENT'/'
     1  ______ ____ ____ ____ ____')
 470  FORMAT (F7.0,4F5.0)
 480  FORMAT (' ENTER MECH. EFF. FOR EACH COMPONENT (ACTUAL/IDEAL HP)'/'
     1 _____ _____ _____ _____')
 490  FORMAT (' CNTL- ENTER WHETHER 'ERROR' IS STAP, DOUT, OR PERF'/'  _
     1___')
 500  FORMAT (' ENTER NO. OF STATION PROPERTY AND FLOW STATION NUMBER'/'
     1  __ __')
 510  FORMAT (2F3.0)
 520  FORMAT (' ENTER NO. OF DATOUT PROPERTY AND COMPONENT NUMBER FOR WH
     1ICH THIS PROPERTY APPLIES'/'  __ __')
 530  FORMAT (' ENTER NO. OF PERFORMANCE PROPERTY'/'  __')
 540  FORMAT (' ENTER VALUE TO BE ACHIEVED AND TOLERANCE'/'  _______ ___
     1____')
 550  FORMAT (' ENTER SPEC NO. FREE TO VARY AND THE COMPONENT NO. OF COM
     1PONENT BEING VARIED'/'  __ __')
 560  FORMAT (' ENTER (IF DESIRED) NON ZERO MINIMUM AND MAXIMUM VALUES F
     1OR THE FREE VARIABLE JUST ENTERED'/'  MINIMUM MAXIMUM')
 570  FORMAT (' KONFIG(1,',I2,')=4HCNTL,SPCNTL(1,',I2,')=',2(G10.4,1H,),
     1'4H',A4,1H,G10.4,1H,/1X,5(G10.4,1H,))
 580  FORMAT (' ILLEGAL COMPONENT NAME',A6,'RE-DO THIS COMPONENT')
 590  FORMAT (' MIXR- ENTER TOTAL TO STATIC PRESSURE RATIO(>1.)OR MACH N
     1O. (<1.) FOR MAIN FLOW INLET, OR 0.'/'  ______')
 600  FORMAT (' ENTER INLET AREAS OF MAIN AND SECONDARY FLOWS'/'  ______
     1_ _______')
 610  FORMAT (' ENTER VELOCITY COEFFICIENT AND SET VABI=1. IF DESIRED'/'
     1  VCOEFF VABI')
 620  FORMAT (' NOZZ- ENTER FLOW COEFF, VEL COEFF, COMP. NO. OF INLET'/'
     1  FCOEFF VCOEFF INLET#')
 630  FORMAT (' ENTER NOZZ STATIC PRESSURE AT EXIT'/'  STATIC')
 640  FORMAT (' ENTER MAP NOS. IF USING MAPS FOR CF AND CV'/'  CFMP CVMP
     1')
 650  FORMAT (' WINJ- IF YOU WANT WATER ON NOW- ENTER 1 OTHERWISE 0'/'
     1_')
 660  FORMAT (I2)
 670  FORMAT (' ENTER FRACTION OF H2O VAPORIZED, PRESSURE DROP, AND SATU
     1RATION SWITCH (0 OR 1)'/'  _____ _____ _')
 680  FORMAT (2F6.0,F2.0)
 690  FORMAT (' ENTER WATER/AIRFLOW RATIO'/'  ______')
 700  FORMAT (' TURB- ENTER PRATIO,EFF, CORR SPEED, % BLEED IN,% OF BLEE
     1D INTO FRONT'/'  ______ ______ ______ ______ ______')
 710  FORMAT (5F7.0)
```

```
720  FORMAT (' ENTER FACTOR FOR COOLING TYPE, NUMBER OF STAGES, AND HOR
    1SEPOWER SPLIT (USUALLY=1)'/'  ________ ___ ___')
730  FORMAT (F9.0,2F4.0)
740  FORMAT (' IF USING MAPS ENTER NOS. AND 3D ARG VALUE)'/'  WMAP EMAP
    1 3DVALUE')
750  FORMAT (2F5.0,F8.0)
760  FORMAT (' HTEX- ENTER DELP PRIM., DELP SEC., DELTA T GUESS, EFFECT
    1IVENESS'/'  ______ ______ ______ ______')
770  FORMAT (' IF USING MAPS ENTER MAP NOS. FOR DELPP,DELPS,EFF'/'  DEL
    1P DELS EFFC')
780  FORMAT (' ENTER SCALE FACTOR ON EFFECTIVENESS MAP (USUALLY-1)'/'
    1_____')
790  FORMAT (' SPLT-ENTER BYPASS RATIO, DELTA P MAIN, DELTA P SEC.'/'
    1______ ______ ______')
800  FORMAT ('1WHEN ENTERING DATA YOU MUST RIGHT ADJUST OR USE DECIMAL
    1POINTS')
810  FORMAT (' ENTER TYPE FOR COMPONENT',I4,', IF FINISHED ENTER DONE'/
    1'  ____')
820  FORMAT (1X,A4)
830  FORMAT (' ENTER UPSTREAM AND DOWNSTREAM STATION NUMBERS OR ZEROS (
    1AS INTEGERS)'/'  __ __ __ __')
840  FORMAT (4I3)
850  FORMAT (' INLET-ENTER INLET WT FLOW,MACH NO., ALT., RECOV, AND DEL
    1TA T'/'  _______ _____ ______ ______ ______')
860  FORMAT (F8.0,F6.0,3F7.0)
870  FORMAT (' IF USING MAPS FOR INLET- ENTER MAP NOS. OR ZEROS'/'  DRA
    1G ETAR')
880  FORMAT (' KONFIG(1,'I2,')=4H',A4,1H,4(I2,1H,),'SPEC(1,',I2,')=',5(
    1G10.4,1H,)/1X,10(G10.4,1H,))
890  FORMAT (' DUCT- ENTER DELP, MACH, CET, ETA,& HVFUEL'/'  _____ ____
    1_ _____ _____ ______')
900  FORMAT (4F6.0,F7.0)
910  FORMAT (' IS THERE BLEED FLOW IN OR OUT OR AIR NOT HEATED?- ENTER
    1 AS FRACTIONS'/'  ______ ______ ______')
920  FORMAT (' IF MAPS FOR BURNER EFF. OR FUEL HV- ENTER NOS.'/'  EMAP
    1HMAP')
930  FORMAT (' COMP-ENTER R VALUE, BLEED FRACTION, EFF, PRATIO, CORR.SP
    1EED'/'  _____ _____ _____ ______ _______')
940  FORMAT (3F6.0,F7.0,F8.0)
950  FORMAT (' IF USING MAPS ENTER NOS. AND 3D ARG VALUE'/'  WMAP EMAP
    1PMAP 3DVALUE')
960  FORMAT (3F5.0,F8.0)
     END
EOF
```

APPENDIX C

SAMPLE CASE TERMINAL LISTING FOR KONFIG

```
WHEN ENTERING DATA YOU MUST RIGHT ADJUST OR USE DECIMAL POINTS
ENTER TYPE FOR COMPONENT   1, IF FINISHED ENTER DONE
 ----

 inlt
ENTER UPSTREAM AND DOWNSTREAM STATION NUMBERS OR ZEROS (AS INTEGERS)
 -- -- -- --

 01 00 02 00
INLET-ENTER INLET WT FLOW,MACH NO., ALT., RECOV, AND DELTA T
 ------- ----- ------ ------ ------

  100.     .8  35000.  .98    14.
IF USING MAPS FOR INLET- ENTER MAP NOS. OR ZEROS
 DRAG ETAR

 0.    0.
KONFIG(1, 1)=4HINLT, 1, 0, 2, 0,SPEC(1, 1)= 100.0    ,0.0000    ,0.0000    ,0.0000    ,0.8000    ,
0.9800    ,0.0000    ,0.0000    ,0.3500E 05,0.0000    ,0.0000    , 14.00    ,
ENTER TYPE FOR COMPONENT   2, IF FINISHED ENTER DONE
 ----

 comp
ENTER UPSTREAM AND DOWNSTREAM STATION NUMBERS OR ZEROS (AS INTEGERS)
 -- -- -- --

 02 00 03 05
COMP-ENTER R VALUE, BLEED FRACTION, EFF, PRATIO, CORR.SPEED
 ----- ----- ----- ------ -------

  1.6   .05   .88    10.    100.
IF USING MAPS ENTER NOS. AND 3D ARG VALUE
 WMAP EMAP PMAP 3DVALUE

 1001 1002 1003   0.
KONFIG(1, 2)=4HCOMP, 2, 0, 3, 5,SPEC(1, 2)= 1.600    ,0.5000E-01, 1.000    , 1001.    , 1.000    ,
 1002.    , 1.000    , 1003.    , 1.000    ,0.0000    ,0.0000    ,0.8800    , 10.00    , 100.0    ,
ENTER TYPE FOR COMPONENT   3, IF FINISHED ENTER DONE
 ----

 duct
ENTER UPSTREAM AND DOWNSTREAM STATION NUMBERS OR ZEROS (AS INTEGERS)
 -- -- -- --

 03 00 04 00
DUCT- ENTER DELP, MACH, CET, ETA,& HVFUEL
 ----- ----- ----- ----- ------

  .05    .3  2560.   .99  18500
IS THERE BLEED FLOW IN OR OUT OR AIR NOT HEATED?- ENTER  AS FRACTIONS
 ------ ------ ------

   0.     0.     0.
IF MAPS FOR BURNER EFF. OR FUEL HV- ENTER NOS.
 EMAP HMAP
```

```
 0.    0.
KONFIG(1, 3)=4HDUCT, 3, 0, 4, 0,SPEC(1, 3)=0.5000E-01,0.3000    ,0.0000    , 2560.    ,0.9900    ,
0.1850E 05,
ENTER TYPE FOR COMPONENT   4, IF FINISHED ENTER DONE
 ----

 turb
ENTER UPSTREAM AND DOWNSTREAM STATION NUMBERS OR ZEROS (AS INTEGERS)
 -- -- -- --

 04 05 06 00
TURB- ENTER PRATIO,EFF, CORR SPEED, % BLEED IN,% OF BLEED INTO FRONT
 ------ ------ ------ ------ ------

  2.6    .90    1.0    1.     .5
ENTER FACTOR FOR COOLING TYPE, NUMBER OF STAGES, AND HORSEPOWER SPLIT (USUALLY=1)
 -------- --- ---

  0.       1. 1.
IF USING MAPS ENTER NOS. AND 3D ARG VALUE)
 WMAP EMAP 3DVALUE

 1007 1008   1.
KONFIG(1, 4)=4HTURB, 4, 5, 6, 0,SPEC(1, 4)= 2.600    , 1.000    , 1.000    , 1007.    , 1.000    ,
 1008.    , 1.000    , 1.000    ,0.5000    , 1.000    ,0.9000    , 1.000    , 1.000    ,0.0000    , 1.000    ,
ENTER TYPE FOR COMPONENT   5, IF FINISHED ENTER DONE
 ----

 nozz
ENTER UPSTREAM AND DOWNSTREAM STATION NUMBERS OR ZEROS (AS INTEGERS)
 -- -- -- --

 06 00 07 00
NOZZ- ENTER FLOW COEFF, VEL COEFF, COMP. NO. OF INLET
 FCOEFF VCOEFF INLET#

   .98   .98    1.
MUST SET SWITCHES- (SWCH1=0. FOR CONV.,=1. FOR CD NOZZ)
SWCH2=0. FIXED AREA,=1. FLOAT AREA) (SWCH3=1.-SPECIFY EXIT STATIC P
 SWCH1 SWCH2 SWCH3

  1.    0.    0.
ENTER MAP NOS. IF USING MAPS FOR CF AND CV
 CFMP CVMP

  0.   0.
KONFIG(1, 5)=4HNOZZ, 6, 0, 7, 0,SPEC(1, 5)=0.0000    ,0.9800    ,0.0000    ,0.0000    ,0.9800    ,
 1.000    ,0.0000    ,0.0000    , 1.000    ,
ENTER TYPE FOR COMPONENT   6, IF FINISHED ENTER DONE
 ----
```

```
shft
SHFT- ENTER AS INTEGERS, THE COMPONENT NUMBERS OF THOSE COMPONENTS CONNECTED TO THIS SHAFT
FROM FRONT TO REAR OF ENGINE
 -- -- -- --

02 04 07 00
ENTER SHAFT RPM AND THE GEAR RATIO FOR EACH COMPONENT
 ------ ---- ---- ---- ----

 8000.  1.  1.  1.  0.
ENTER MECH. EFF. FOR EACH COMPONENT (ACTUAL/IDEAL HP)
 ----- ----- ----- -----

  1.   1.   1.   1.
KONFIG(1, 6)=4HSHFT, 2, 4, 7, 0,SPEC(1, 6)= 8000.    , 1.000    , 1.000    , 1.000    ,0.0000    ,
 1.000    , 1.000    , 1.000    , 1.000    ,
ENTER TYPE FOR COMPONENT   7, IF FINISHED ENTER DONE
 ----

 load
ENTER LOAD HORSEPOWER (NEGATIVE) OR MAP NO.
 -------

  -100.
IF PROPELLOR, ENTER EFFICIENCY AND F/SHP @ SLS
 ------- -------

    0.     0.
KONFIG(1, 7)=4HLOAD, 0, 0, 0, 0,SPEC(1, 7)=-100.0    ,
ENTER TYPE FOR COMPONENT   8, IF FINISHED ENTER DONE
 ----

 cntl
CNTL- ENTER WHETHER "ERROR" IS STAP, DOUT, OR PERF
 ----

 stap
ENTER NO. OF STATION PROPERTY AND FLOW STATION NUMBER
 -- --

 08 06
ENTER VALUE TO BE ACHIEVED AND TOLERANCE
 ------- -------

   0.     .001
ENTER SPEC NO. FREE TO VARY AND THE COMPONENT NO. OF COMPONENT BEING VARIED
 -- --

 01 04
ENTER (IF DESIRED) NON ZERO MINIMUM AND MAXIMUM VALUES FOR THE FREE VARIABLE JUST ENTERED
 MINIMUM MAXIMUM

   0.     0.
```

```
KONFIG(1, 8)=4HCNTL,SPCNTL(1, 8)= 1.000     , 4.000     ,4HSTAP, 8.000     ,
 6.000     ,0.0000     ,0.1000E-02,0.0000     ,0.0000     ,
ENTER TYPE FOR COMPONENT   9, IF FINISHED ENTER DONE
 ----

 cntl
CNTL- ENTER WHETHER 'ERROR' IS STAP, DOUT, OR PERF
 ----

 stap
ENTER NO. OF STATION PROPERTY AND FLOW STATION NUMBER
 -- --

 08 04
ENTER VALUE TO BE ACHIEVED AND TOLERANCE
 ------- -------

  0.       .001
ENTER SPEC NO. FREE TO VARY AND THE COMPONENT NO. OF COMPONENT BEING VARIED
 -- --

 01 02
ENTER (IF DESIRED) NON ZERO MINIMUM AND MAXIMUM VALUES FOR THE FREE VARIABLE JUST ENTERED
 MINIMUM MAXIMUM

   1.2    2.6
KONFIG(1, 9)=4HCNTL,SPCNTL(1, 9)= 1.000     , 2.000     ,4HSTAP, 8.000     ,
 4.000     ,0.0000     ,0.1000E-02, 1.200     , 2.600     ,
ENTER TYPE FOR COMPONENT  10, IF FINISHED ENTER DONE
 ----

 cntl
CNTL- ENTER WHETHER 'ERROR' IS STAP, DOUT, OR PERF
 ----

 stap
ENTER NO. OF STATION PROPERTY AND FLOW STATION NUMBER
 -- --

 08 02
ENTER VALUE TO BE ACHIEVED AND TOLERANCE
 ------- -------

   0.      .001
ENTER SPEC NO. FREE TO VARY AND THE COMPONENT NO. OF COMPONENT BEING VARIED
 -- --

 01 01
ENTER (IF DESIRED) NON ZERO MINIMUM AND MAXIMUM VALUES FOR THE FREE VARIABLE JUST ENTERED
 MINIMUM MAXIMUM

     0.     0.
KONFIG(1,10)=4HCNTL,SPCNTL(1,10)= 1.000     , 1.000     ,4HSTAP, 8.000     ,
 2.000     ,0.0000     ,0.1000E-02,0.0000     ,0.0000     ,
ENTER TYPE FOR COMPONENT  11, IF FINISHED ENTER DONE
 ----
```

```
 cntl
CNTL- ENTER WHETHER 'ERROR' IS STAP, DOUT, OR PERF
 ----

 dout
ENTER NO. OF DATOUT PROPERTY AND COMPONENT NUMBER FOR WHICH THIS PROPERTY APPLIES
 -- --

 08 06
ENTER VALUE TO BE ACHIEVED AND TOLERANCE
 ------- -------

   0.     .001
ENTER SPEC NO. FREE TO VARY AND THE COMPONENT NO. OF COMPONENT BEING VARIED
 -- --

 01 06
ENTER (IF DESIRED) NON ZERO MINIMUM AND MAXIMUM VALUES FOR THE FREE VARIABLE JUST ENTERED
 MINIMUM MAXIMUM

   0.     10000.
KONFIG(1,11)=4HCNTL,SPCNTL(1,11)= 1.000    , 6.000    ,4HDOUT, 8.000    ,
 6.000    ,0.0000    ,0.1000E-02,0.0000    ,0.1000E 05,
ENTER TYPE FOR COMPONENT  12, IF FINISHED ENTER DONE
 ----

 optv
OPTV- ENTER SPEC NO. FREE TO VARY AND COMPONENT NO. OF COMPONENT HAVING THE INDEPENDENT VARIABLE
 -- --

 04 03
ENTER 1. TO TURN ON OPTV, 0.=OFF, MIN VALUE AND MAX VALUE ALLOWED
 ON MINIMUM MAXIMUM

 0.. 2160.   2760.
KONFIG(1,12)=4HOPTV, 0, 3, 0, 0,SPEC(1,12)=0.0000    , 2160.    , 2760.    , 4.000    ,
ENTER TYPE FOR COMPONENT  13, IF FINISHED ENTER DONE
 ----

 done
```

```
KONFIG(1,1)=4HINLT,1,0,2,0,SPEC(1,1)=100.0,0.,0.,0.,0.8000,
0.9800,0.,0.,0.3500E05,0.,0.,14.00,
KONFIG(1,2)=4HCOMP,2,0,3,5,SPEC(1,2)=1.600,0.5000E-01,1.0,1001.,1.0,
1002.,1.0,1003.,1.0,0.,0.,0.8800,10.00,100.0,
KONFIG(1,3)=4HDUCT,3,0,4,0,SPEC(1,3)=0.5000E-01,0.3000,0.,2560.,0.9900,
0.1850E05,
KONFIG(1,4)=4HTURB,4,5,6,0,SPEC(1,4)=2.600,1.0,1.0,1007.,1.0,
1008.,1.0,1.0,0.5000,1.0,0.9000,1.0,1.0,0.,1.0,
KONFIG(1,5)=4HNOZZ,6,0,7,0,SPEC(1,5)=0.,0.9800,0.,0.,0.9800,
1.0,0.,0.,1.0,
KONFIG(1,6)=4HSHFT,2,4,7,0,SPEC(1,6)=8000.,1.0,1.0,1.0,0.,
1.0,1.0,1.0,1.0,
KONFIG(1,7)=4HLOAD,0,0,0,0,SPEC(1,7)=-100.0,
KONFIG(1,8)=4HCNTL,SPCNTL(1,8)=1.0,4.0,4HSTAP,8.0,
6.0,0.,0.1000E-02,0.,0.,
KONFIG(1,9)=4HCNTL,SPCNTL(1,9)=1.0,2.0,4HSTAP,8.0,
4.0,0.,0.1000E-02,1.200,2.600,
KONFIG(1,10)=4HCNTL,SPCNTL(1,10)=1.0,1.0,4HSTAP,8.0,
2.0,0.,0.1000E-02,0.,0.,
KONFIG(1,11)=4HCNTL,SPCNTL(1,11)=1.0,6.0,4HDOUT,8.0,
6.0,0.,0.1000E-02,0.,0.1000E05,
KONFIG(1,12)=4HOPTV,0,3,0,0,SPEC(1,12)=0.,2160.,2760.,4.0,
```

KONFIG-COMPONENT INPUT CARDS IMAGES

APPENDIX D

PROGRAM LISTING FOR REKONFIG

```
      IMPLICIT REAL*8 (A-H,O-Z)
      REAL *8MACH,II,JJ,KK,LL,MM,NN
      COMMON /DBL/ DATINP(15,60),DATOUT(9,60),WTF(40),TOPRES(40),TOTEMP(
     140),FAR(40),CORFLO(40),VMACH(40),STATP(40),ERROR(40),TOL,TOLT,TOLT
     2T,DEPV(20),DTOL(20),PERPF(20),C2HRAT,STCRAT,TFUEL
      COMMON /SNGL/ JM1,JM2,JP1,JP2,JCX,LOCTBL(9,60),JCOMP(70),IWAY,NIT,
     1ITAB(70),JCONF(60,4),JTYPE(60),JFLOW(70),IDEDAP(15),KKINDS(14,25),
     2NCOMP,NOSTAT,NITER,NFINIS,NPASS,JCC,NTBL,NCTS,JCIND(20),JCDEP(20),
     3JCVIND(20),JCVDEP(20),KDTYP(20),IDONE(60)
      DIMENSION WIPOUT(40), SPCNTL(11,60), SPECSV(9), SPLIMV(15,60)
      DIMENSION ICAMP(10)
      LOGICAL DOALL,DOTHIS
      DIMENSION IWORD(14), SPECS(15,60), KONFIG(5,60), SPEC(15,60)
      LOGICAL TABLES,LONG,PUNT,AMAC,LABEL,PINPUT,SPILL,BOAT,INLTDS,DRAW
      EQUIVALENCE (WIPOUT,WTF), (SPEC,SPECS,DATINP,SPLIMV)
      NAMELIST / D/NCODE,NCOMP,NOSTAT,IWAY,ITPRT,KONFIG,SPECS,NMODES,MOD
     1E,ENDIT,IDONE,MODESN,SPEC,TABLES,LONG,PUNT,AMAC,LABEL,SPCNTL,PINPU
     2T,AMINDS,BLMAX,SIZINL,SPLDES,SPILL,BOAT,INLTDS,NVOPT,NJOPT,TOLOPT,
     3DRAW,NCASE,MACH,ALTP,ETAR,CALBLD,ELIFE,SPLIMV,SEPDAT,DEBUG,C2HRAT,
     4TFUEL,NEWEFF,YEARV,YEARB
      DATA ENDIT,MODESV/0.D0,0/,TABLES/.TRUE./,SPCNTL/660*0.D0/
      DATA LABEL/.FALSE./,ITPRT/0/,NMODES/1/,MODESN/1/,PINPUT/.TRUE./
      DATA IWORD/4HINLT,4HDUCT,4HWINJ,4HCOMP,4HTURB,4HHTEX,4HSPLT,4HMIXR
     1,4HNOZZ,4HLOAD,4HSHFT,4HCNTL,4HOPTV,4HLIMV/,STAP,DOUT,PERF/4HSTAP,
     24HDOUT,4HPERF/,DRAW/.FALSE./
      DATA AA,BB,CC,DD,EE,FF,GG,HH,II,JJ,KK,LL,MM,NN,PP,QQ,RR,TT/1HA,1HB
     1,1HC,1HD,1HE,1HF,1HG,1HH,1HI,1HJ,1HK,1HL,1HM,1HN,1HP,1HQ,1HR,1HT/
      READ (9,280) IDEDAP
      WRITE (10,280) IDEDAP
      PINPUT=.TRUE.
      CALL NAMEPR (9,10,8,PINPUT)
      DO 10 J=1,10
10    ICAMP(J)=0
      READ (8,D)
      DO 20 J=1,1760
20    DATINP(J,1)=0.D0
      NMADES=NMODES
      DO 230 K=1,NMADES
      AWORD=0
      DO 30 I=1,300
30    KONFIG(I,1)=0
      PINPUT=.FALSE.
      CALL NAMEPR (9,10,8,PINPUT)
      READ (8,D)
      DOALL=.FALSE.
      WRITE (30,240)
      READ (35,250) ICAMP
      IF (ICAMP(1).EQ.0) DOALL=.TRUE.
      WRITE (10,290) MODE
      DO 220 JCX=1,60
      IF (KONFIG(1,JCX).EQ.0) GO TO 220
      ITT=15
      DO 40 J=1,14
      IF (KONFIG(1,JCX).EQ.IWORD(J).OR.KONFIG(1,JCX).EQ.J) ITT=J
40    CONTINUE
```

```
      DOTHIS=DOALL
      IF (DOALL) GO TO 60
      DO 50 ICT=1,10
      IF (JCX.EQ.ICAMP(ICT)) DOTHIS=.TRUE.
50    CONTINUE
60    CONTINUE
      IF (.NOT.DOTHIS) GO TO 190
      IF (ITT.EQ.15) STOP 001
      IF (AWORD.EQ.QQ) GO TO 190
      WRITE (30,260) JCX,IWORD(ITT)
      GO TO (70,80,90,100,110,120,130,140,150,160,170,190,190,190),ITT
70    WRITE (30,350) (SPEC(I,JCX),I=1,12)
      WRITE (30,340)
      GO TO 180
80    WRITE (30,360) SPEC(1,JCX),SPEC(2,JCX),(SPEC(I,JCX),I=4,10)
      WRITE (30,340)
      GO TO 180
90    WRITE (30,370) (SPEC(I,JCX),I=1,4)
      WRITE (30,340)
      GO TO 180
100   WRITE (30,380) (SPEC(I,JCX),I=1,14)
      WRITE (30,340)
      GO TO 180
110   WRITE (30,390) (SPEC(I,JCX),I=1,15)
      WRITE (30,340)
      GO TO 180
120   WRITE (30,400) (SPEC(I,JCX),I=1,5)
      WRITE (30,340)
      GO TO 180
130   WRITE (30,410) (SPEC(I,JCX),I=1,3)
      WRITE (30,340)
      GO TO 180
140   WRITE (30,420) (SPEC(I,JCX),I=1,5)
      WRITE (30,340)
      GO TO 180
150   WRITE (30,430) SPEC(1,JCX),SPEC(2,JCX),(SPEC(I,JCX),I=4,7),SPEC(9,
     1JCX)
      WRITE (30,340)
      GO TO 180
160   WRITE (30,440) (SPEC(I,JCX),I=1,3)
      WRITE (30,340)
      GO TO 180
170   WRITE (30,450) (SPEC(I,JCX),I=1,9)
      WRITE (30,340)
180   READ (35,270) AWORD,VALUE
      IF (AWORD.EQ.AA) SPEC(1,JCX)=VALUE
      IF (AWORD.EQ.BB) SPEC(2,JCX)=VALUE
      IF (AWORD.EQ.CC) SPEC(3,JCX)=VALUE
      IF (AWORD.EQ.DD) SPEC(4,JCX)=VALUE
      IF (AWORD.EQ.EE) SPEC(5,JCX)=VALUE
      IF (AWORD.EQ.FF) SPEC(6,JCX)=VALUE
      IF (AWORD.EQ.GG) SPEC(7,JCX)=VALUE
      IF (AWORD.EQ.HH) SPEC(8,JCX)=VALUE
      IF (AWORD.EQ.II) SPEC(9,JCX)=VALUE
      IF (AWORD.EQ.JJ) SPEC(10,JCX)=VALUE
```

```
      IF (AWORD.EQ.KK) SPEC(11,JCX)=VALUE
      IF (AWORD.EQ.LL) SPEC(12,JCX)=VALUE
      IF (AWORD.EQ.MM) SPEC(13,JCX)=VALUE
      IF (AWORD.EQ.NN) SPEC(14,JCX)=VALUE
      IF (AWORD.EQ.PP) SPEC(15,JCX)=VALUE
      IF (AWORD.EQ.RR) GO TO (70,80,90,100,110,120,130,140,150,160,170,1
     190,190,190),ITT
      IF (AWORD.EQ.TT) GO TO 190
      IF (AWORD.EQ.QQ) GO TO 190
      GO TO 180
190   DO 200 IJK=1,15
      KJI=16-IJK
      IF (SPEC(KJI,JCX).NE.0.) GO TO 210
200   CONTINUE
210   IF (ITT.LE.11) WRITE (10,330) JCX,(KONFIG(I,JCX),I=1,5),JCX,(SPEC(
     1KL,JCX),KL=1,KJI)
      IF (ITT.EQ.12) WRITE (10,320) JCX,JCX,(SPCNTL(I,JCX),I=1,9)
      IF (ITT.EQ.13) WRITE (10,330) JCX,(KONFIG(I,JCX),I=1,5),JCX,(SPEC(
     1KL,JCX),KL=1,9)
      IF (ITT.EQ.14) WRITE (10,310) JCX,(KONFIG(I,JCX),I=1,5),JCX,(SPLIM
     1V(KL,JCX),KL=1,9)
220   CONTINUE
      IF (AWORD.EQ.QQ) WRITE (10,300)
230   CONTINUE
      PINPUT=.TRUE.
      DO 235 LAST=1,100
235   CALL NAMEPR (9,10,8,PINPUT)
      STOP 002
C
C
C
240   FORMAT (' ENTER AS INTEGERS, THE COMPONENTS YOU WISH TO CHANGE SPE
     1CS FOR'/' IF YOU WISH TO STEP THROUGH THE ENTIRE ENGINE- JUST HIT
     2RETURN'/'  -- -- -- -- -- -- -- -- -- --')
250   FORMAT (10I3)
260   FORMAT ('0COMPONENT NO.',I3,' IS A ',A4/'0TO CHANGE A VALUE, ENTER
     1 IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT
     2 NEED DECIMAL POINT)'/'0INDEX    VALUE     DEFINITION')
270   FORMAT (A1,G40.0)
280   FORMAT (15A4)
290   FORMAT (' &D MODE=',I2)
300   FORMAT (' &END')
310   FORMAT (' KONFIG(1,',I2,')=4H',A4,4(I2,1H,),'SPLIMV(1,',I2,')=',F3
     1.0,1H,,2(G10.4,1H,),A4,5(F3.0,1H,))
320   FORMAT (' KONFIG(1,',I2,')=4HCNTL,SPCNTL(1,',I2,')=',2(G10.4,1H,),
     1'4H',A4,1H,G10.4,1H,/1X,5(G10.4,1H,))
330   FORMAT (' KONFIG(1,',I2,')=4H',A4,1H,4(I2,1H,),'SPEC(1,',I2,')=',5(
     1G10.4,1H,)/1X,10(G10.4,1H,))
340   FORMAT (4H  R ,14X,'  REVIEW ALL VALUES'/4H  T ,14X,'  TERMINATE-G
     1O ON TO NEXT COMPONENT'/4H  Q ,14X,'  QUIT-END OF PROCESSING FOR E
     2NTIRE ENGINE')
350   FORMAT (4H  A ,G14.5,'  INLET WEIGHT FLOW'/4H  B ,G14.5,'  FREE ST
     1REAM TEMP.'/4H  C ,G14.5,'  FREE STREAM PRESS.'/4H  D ,G14.5,'  IN
     2LET DRAG TABLE NO.'/4H  E ,G14.5,'  MACH NUMBER'/4H  F ,G14.5,'  I
     3NLET RECOV. OR TABLE NO.'/4H  G ,G14.5,'  MAX FLOW ON RECOV TABLE'
```

```
     4/4H  H ,G14.5,'  SCALE F ON FLOW IN TABLE'/4H  I ,G14.5,'  ALTITUD
     5E'/4H  J ,G14.5,'  F/A AT INLET'/4H  K ,G14.5,'  IF NON ZERO,I=GEO
     6POTENTIAL ALT.'/4H  L ,G14.5,'  DEL T-NON STD. DAY')
 360  FORMAT (4H  A ,G14.5,'  DEL P/P OR TABLE NO.'/4H  B ,G14.5,'  DESI
     1GN DUCT MACH #'/4H  D ,G14.5,'  BURNER OUTLET TEMP.'/4H  E ,G14.5,
     2'  EFF. OR TABLE NO.'/4H  F ,G14.5,'  FUEL HV'/4H  G ,G14.5,'  CRO
     3SS SECT. AREA'/4H  H ,G14.5,'  INLET BLEED FLOW/TOT. BLEED FLOW'/4
     4H  I ,G14.5,'  EXIT BLEED FLOW/TOT. BLEED FLOW'/4H  J ,G14.5,'  FR
     5ACT. OF AIR NOT HEATED')
 370  FORMAT (4H  A ,G14.5,'  WATER/AIR FLOW RATIO'/4H  B ,G14.5,'  FRAC
     1TION VAPORIZED'/4H  C ,G14.5,'  PRESSURE DROP'/4H  D ,G14.5,'  SAT
     2URATION SWITCH (=1)')
 380  FORMAT (4H  A ,G14.5,'  R VALUE'/4H  B ,G14.5,'  BLEED FLOW FRACTI
     1ON'/4H  C ,G14.5,'  SCALE F ON CORR.SPEED'/4H  D ,G14.5,'  CORR AI
     2RFLOW OR TABLE NO.'/4H  E ,G14.5,'  SCALE F ON CORR AIRFLOW'/4H  F
     3 ,G14.5,'  EFF. OR TABLE NO.'/4H  G ,G14.5,'  SCALE F ON EFF.'/4H
     4 H ,G14.5,'  PRATIO OR MAP NO.'/4H  I ,G14.5,'  SCALE F ON PRATIO'
     5/4H  J ,G14.5,'  3D MAP Z VALUE'/4H  K ,G14.5,'  FRACT. BLEED HP L
     6OSS'/4H  L ,G14.5,'  EFFICIENCY'/4H  M ,G14.5,'  PRATIO'/4H  N ,G1
     74.5,'  CORRECTED SPEED')
 390  FORMAT (4H  A ,G14.5,'  PRESSURE RATIO'/4H  B ,G14.5,'  TOT BLEED
     1IN/TOT BLEED AVAILABLE'/4H  C ,G14.5,'  SCALE F ON CORR. SPEED'/4H
     2  D ,G14.5,'  CORR. FLOW TABLE NO.'/4H  E ,G14.5,'  SCALE F ON COR
     3R. FLOW'/4H  F ,G14.5,'  EFFICIENCY TABLE NO.'/4H  G ,G14.5,'  SCA
     4LE F ON EFFICIENCY'/4H  H ,G14.5,'  SCALE F ON PRESSURE RATIO
     5'/4H  I ,G14.5,'  BLEED AT ENTRANCE/TOT BLEED IN'/4H  J ,G14.5,'
     63D ARG ON MAP'/4H  K ,G14.5,'  EFFICIENCY'/4H  L ,G14.5,'  CORRECT
     7ED SPEED'/4H  M ,G14.5,'  HORSEPOWER SPLIT'/4H  N ,G14.5,'  FACTOR
     8 FOR COOLING TYPE'/4H  P ,G14.5,'  NUMBER OF STAGES')
 400  FORMAT (4H  A ,G14.5,'  DEL P/P OR TAB. REF NO. OF MAIN (HEATED) F
     1LOW'/4H  B ,G14.5,'  DEL P/P OR TAB. REF NO. OF SEC. (COOLED) FLOW
     2'/4H  C ,G14.5,'  DELTA T (GUESSED VALUE)'/4H  D ,G14.5,'  EFFECTI
     3VENESS OR TAB. REF. NO.'/4H  E ,G14.5,'  SCALE F ON EFFECTIVENESS'
     4)
 410  FORMAT (4H  A ,G14.5,'  BYPASS RATIO (BYPASS/MAIN)'/4H  B ,G14.5,'
     1  DEL P/P MAIN STREAM'/4H  C ,G14.5,'  DEL P/P SECD. STREAM')
 420  FORMAT (4H  A ,G14.5,'  INLET AREA MAIN FLOW (NO ITEM C)'/4H  B ,G
     114.5,'  INLET AREA SECD FLOW (NO ITEM C)'/4H  C ,G14.5,'  TOT. TO
     2STATIC PRATIO OR MACH NO.'/4H  D ,G14.5,'  VEL. COEFF. ON MIXED FL
     3OW VELOCITY'/4H  E ,G14.5,'  VABI SWITCH-IF=1 TOT AREA FIXED ALWAY
     4S')
 430  FORMAT (4H  A ,G14.5,'  AREA-EXIT CONV.,THROAT CD'/4H  B ,G14.5,'
     1 FLOW COEFF OR TAB REF NO.'/4H  D ,G14.5,'  NOZZLE EXIT STATIC P'/
     24H  E ,G14.5,'  VELOCITY COEFF. OR TAB. REF. NO.'/4H  F ,G14.5,'
     3SWITCH-(0=CONV OR 1=C-D) NOZZLE'/4H  G ,G14.5,'  AREA SWITCH-(0=FI
     4X AREA OR 1=FLOAT AREA)'/4H  I ,G14.5,'  IF ITEM D=0. SET = INLET
     5COMPONENT NO.')
 440  FORMAT (4H  A ,G14.5,'  LOAD HP (NEG.) OR TAB. REF. NO.'/4H  B ,G1
     14.5,'  PROPELLER EFFICIENCY'/4H  C ,G14.5,'  THRUST/SHP AT SLS')
 450  FORMAT (4H  A ,G14.5,'  SHAFT RPM'/4H  B ,G14.5,'  GEAR RATIO JM1'
     1/4H  C ,G14.5,'  GEAR RATIO JM2'/4H  D ,G14.5,'  GEAR RATIO JP1'/4
     2H  E ,G14.5,'  GEAR RATIO JP2'/4H  F ,G14.5,'  MECH. EFF. JM1'/4H
     3 G ,G14.5,'  MECH. EFF. JM2'/4H  H ,G14.5,'  MECH. EFF. JP1'/4H  I
     4 ,G14.5,'  MECH. EFF. JP2')
      END
```

```
      SUBROUTINE NAMEPR (IN,NOUT,NREAD,PINPUT)
      INTEGER*2 A(120),AMP/1H&/,E/1HE/,D/1HD/
      LOGICAL PINPUT
C      THIS ROUTINE WRITES NAMELIST CARD IMAGES ON 'NOUT' FROM UNIT 'IN'
C
      REWIND NREAD
10    READ (IN,50,END=40) A
      IF (PINPUT) WRITE (NOUT,50) A
      WRITE (NREAD,50) A
      DO 20 I=1,120
      IF (A(I).EQ.AMP.AND.A(I+1).EQ.E.AND.A(I+3).EQ.D) GO TO 30
20    CONTINUE
      GO TO 10
30    REWIND NREAD
      RETURN
40    STOP 00003
C
C
50    FORMAT (120A1)
      END
EOF
```

APPENDIX E

SAMPLE CASE TERMINAL LISTING FOR REKONFIG

```
REKONFIG SAMPLE.SEPFLOTF,SOME.COMPONTS
ENTER AS INTEGERS, THE COMPONENTS YOU WISH TO CHANGE SPECS FOR
IF YOU WISH TO STEP THROUGH THE ENTIRE ENGINE- JUST HIT RETURN
 -- -- -- -- -- -- -- -- -- --

 01 05

COMPONENT NO.  1 IS A INLT

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT  NEED DECIMAL POINT)

INDEX    VALUE      DEFINITION
 A      100.00      INLET WEIGHT FLOW
 B     0.00000      FREE STREAM TEMP.
 C     0.00000      FREE STREAM PRESS.
 D     0.00000      INLET DRAG TABLE NO.
 E     0.00000      MACH NUMBER
 F     0.00000      INLET RECOV. OR TABLE NO.
 G     0.00000      MAX FLOW ON RECOV TABLE
 H     0.00000      SCALE F ON FLOW IN TABLE
 I     0.00000      ALTITUDE
 J     0.00000      F/A AT INLET
 K     0.00000      IF NON ZERO,I=GEOPOTENTIAL ALT.
 L      18.000      DEL T-NON STD. DAY
 R                  REVIEW ALL VALUES
 T                  TERMINATE-GO ON TO NEXT COMPONENT
 Q                  QUIT-END OF PROCESSING FOR ENTIRE ENGINE

A 80.

T

COMPONENT NO.  5 IS A DUCT

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT  NEED DECIMAL POINT)

INDEX    VALUE      DEFINITION
 A     0.50000D-01  DEL P/P OR TABLE NO.
 B     0.30000      DESIGN DUCT MACH #
 D      3000.0      BURNER OUTLET TEMP.
 E     0.99000      EFF. OR TABLE NO.
 F      18300.      FUEL HV
 G     0.00000      CROSS SECT. AREA
 H     0.00000      INLET BLEED FLOW/TOT. BLEED FLOW
 I     0.00000      EXIT BLEED FLOW/TOT. BLEED FLOW
 J     0.50000D-01  FRACT. OF AIR NOT HEATED
 R                  REVIEW ALL VALUES
 T                  TERMINATE-GO ON TO NEXT COMPONENT
 Q                  QUIT-END OF PROCESSING FOR ENTIRE ENGINE

D 2800.

Q
 TERMINATED: STOP 00003
 SAMPLE.SEPFLOTF HAS BEEN USED TO CREATE SOME.COMPONTS
GO:
```

```
    SAMPLE SEPARATE FLOW TURBOFAN
&D DRAW=T,TABLES=T,PINPUT=T &END
&D MODE=1
KONFIG(1,1)=4HINLT,1,0,2,0,SPEC(1,1)=80.00,0.,0.,0.,0.,
0.,0.,0.,0.,0.,0.,18.00,
KONFIG(1,2)=4HCOMP,2,0,3,0,SPEC(1,2)=1.500,0.,1.0,1001.,1.0,
1002.,1.0,1003.,1.0,0.,0.,0.8500,3.0,1.0,
KONFIG(1,3)=4HSPLT,3,0,4,10,SPEC(1,3)=1.0,0.2000D-01,0.2000D-01,
KONFIG(1,4)=4HCOMP,4,0,5,13,SPEC(1,4)=1.300,0.5000D-01,1.0,1004.,1.0,
1005.,1.0,1006.,1.0,0.,0.,0.8600,6.0,1.0,
KONFIG(1,5)=4HDUCT,5,0,6,0,SPEC(1,5)=0.5000D-01,0.3000,0.,2800.,0.9900,
0.1830D05,0.,0.,0.,0.5000D-01,
KONFIG(1,6)=4HTURB,6,13,7,0,SPEC(1,6)=3.500,0.7500,1.0,1007.,1.0,
1008.,1.0,1.0,0.8000,1.0,0.9000,5000.,1.0,
KONFIG(1,7)=4HTURB,7,13,8,0,SPEC(1,7)=2.500,0.2500,1.0,1009.,1.0,
1010.,1.0,1.0,1.0,1.0,0.9000,5000.,1.0,
KONFIG(1,8)=4HNOZZ,8,0,9,0,SPEC(1,8)=0.,0.9800,0.,0.,0.9750,
1.0,0.,0.,1.0,
KONFIG(1,9)=4HDUCT,10,0,11,0,SPEC(1,9)=0.3000D-01,
KONFIG(1,10)=4HNOZZ,11,0,12,0,SPEC(1,10)=0.,0.9800,0.,0.,0.9800,
1.0,0.,0.,1.0,
KONFIG(1,11)=4HLOAD,0,0,0,0,SPEC(1,11)=-200.0,
KONFIG(1,12)=4HSHFT,4,6,11,0,SPEC(1,12)=8000.,1.0,1.0,1.0,0.,
1.0,1.0,1.0,
KONFIG(1,13)=4HSHFT,2,7,0,0,SPEC(1,13)=6000.,1.0,1.0,0.,0.,
1.0,1.0,
KONFIG(1,14)=4HCNTL,SPCNTL(1,14)=1.0,7.0,4HSTAP,8.0,
8.0,0.,0.1000D-02,0.,0.,
KONFIG(1,15)=4HCNTL,SPCNTL(1,15)=1.0,6.0,4HSTAP,8.0,
7.0,0.,0.1000D-02,0.,0.,
KONFIG(1,16)=4HCNTL,SPCNTL(1,16)=1.0,4.0,4HSTAP,8.0,
6.0,0.,0.1000D-02,1.100,1.750,
KONFIG(1,17)=4HCNTL,SPCNTL(1,17)=1.0,3.0,4HSTAP,8.0,
11.00,0.,0.1000D-02,0.,0.,
KONFIG(1,18)=4HCNTL,SPCNTL(1,18)=1.0,2.0,4HSTAP,8.0,
4.0,0.,0.1000D-02,1.100,2.100,
KONFIG(1,19)=4HCNTL,SPCNTL(1,19)=1.0,1.0,4HSTAP,8.0,
2.0,0.,0.1000D-02,0.,0.,
KONFIG(1,20)=4HCNTL,SPCNTL(1,20)=1.0,12.00,4HDOUT,8.0,
12.00,0.,0.1000D-02,0.,0.,
KONFIG(1,21)=4HCNTL,SPCNTL(1,21)=1.0,13.00,4HDOUT,8.0,
13.00,0.,0.1000D-02,0.,0.,
 &END
&D ALTP=5000,MACH=.3 &END
```

REKONFIG-CHANGE TWO COMPONENTS

```
  REKONFIG SAMPLE.SEPFLOTF,ALL.COMPONTS
ENTER AS INTEGERS, THE COMPONENTS YOU WISH TO CHANGE SPECS FOR
IF YOU WISH TO STEP THROUGH THE ENTIRE ENGINE- JUST HIT RETURN

 -- -- -- -- -- -- -- -- -- --


COMPONENT NO.  1 IS A INLT

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT  NEED DECIMAL POINT)

INDEX   VALUE      DEFINITION
 A     100.00      INLET WEIGHT FLOW
 B    0.00000      FREE STREAM TEMP.
 C    0.00000      FREE STREAM PRESS.
 D    0.00000      INLET DRAG TABLE NO.
 E    0.00000      MACH NUMBER
 F    0.00000      INLET RECOV. OR TABLE NO.
 G    0.00000      MAX FLOW ON RECOV TABLE
 H    0.00000      SCALE F ON FLOW IN TABLE
 I    0.00000      ALTITUDE
 J    0.00000      F/A AT INLET
 K    0.00000      IF NON ZERO,I=GEOPOTENTIAL ALT.
 L     18.000      DEL T-NON STD. DAY
 R                 REVIEW ALL VALUES
 T                 TERMINATE-GO ON TO NEXT COMPONENT
 Q                 QUIT-END OF PROCESSING FOR ENTIRE ENGINE

A 80.

F .97

R
 A     80.000      INLET WEIGHT FLOW
 B    0.00000      FREE STREAM TEMP.
 C    0.00000      FREE STREAM PRESS.
 D    0.00000      INLET DRAG TABLE NO.
 E    0.00000      MACH NUMBER
 F    0.97000      INLET RECOV. OR TABLE NO.
 G    0.00000      MAX FLOW ON RECOV TABLE
 H    0.00000      SCALE F ON FLOW IN TABLE
 I    0.00000      ALTITUDE
 J    0.00000      F/A AT INLET
 K    0.00000      IF NON ZERO,I=GEOPOTENTIAL ALT.
 L     18.000      DEL T-NON STD. DAY
 R                 REVIEW ALL VALUES
 T                 TERMINATE-GO ON TO NEXT COMPONENT
 Q                 QUIT-END OF PROCESSING FOR ENTIRE ENGINE

T
```

COMPONENT NO. 2 IS A COMP

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT NEED DECIMAL POINT)

INDEX	VALUE	DEFINITION
A	1.5000	R VALUE
B	0.00000	BLEED FLOW FRACTION
C	1.0000	SCALE F ON CORR.SPEED
D	1001.0	CORR AIRFLOW OR TABLE NO.
E	1.0000	SCALE F ON CORR AIRFLOW
F	1002.0	EFF. OR TABLE NO.
G	1.0000	SCALE F ON EFF.
H	1003.0	PRATIO OR MAP NO.
I	1.0000	SCALE F ON PRATIO
J	0.00000	3D MAP Z VALUE
K	0.00000	FRACT. BLEED HP LOSS
L	0.85000	EFFICIENCY
M	3.0000	PRATIO
N	1.0000	CORRECTED SPEED
R		REVIEW ALL VALUES
T		TERMINATE-GO ON TO NEXT COMPONENT
Q		QUIT-END OF PROCESSING FOR ENTIRE ENGINE

L .88

M 2.95

T

COMPONENT NO. 3 IS A SPLT

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT NEED DECIMAL POINT)

INDEX	VALUE	DEFINITION
A	1.0000	BYPASS RATIO (BYPASS/MAIN)
B	0.20000D-01	DEL P/P MAIN STREAM
C	0.20000D-01	DEL P/P SECD. STREAM
R		REVIEW ALL VALUES
T		TERMINATE-GO ON TO NEXT COMPONENT
Q		QUIT-END OF PROCESSING FOR ENTIRE ENGINE

T

COMPONENT NO. 4 IS A COMP

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT NEED DECIMAL POINT)

INDEX	VALUE	DEFINITION
A	1.3000	R VALUE
B	0.50000D-01	BLEED FLOW FRACTION
C	1.0000	SCALE F ON CORR.SPEED
D	1004.0	CORR AIRFLOW OR TABLE NO.
E	1.0000	SCALE F ON CORR AIRFLOW
F	1005.0	EFF. OR TABLE NO.
G	1.0000	SCALE F ON EFF.
H	1006.0	PRATIO OR MAP NO.
I	1.0000	SCALE F ON PRATIO
J	0.00000	3D MAP Z VALUE
K	0.00000	FRACT. BLEED HP LOSS
L	0.85000	EFFICIENCY
M	6.0000	PRATIO
N	1.0000	CORRECTED SPEED
R		REVIEW ALL VALUES
T		TERMINATE-GO ON TO NEXT COMPONENT
Q		QUIT-END OF PROCESSING FOR ENTIRE ENGINE

L .87

M 6.2

N .985

T

COMPONENT NO. 5 IS A DUCT

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT NEED DECIMAL POINT)

INDEX	VALUE	DEFINITION
A	0.50000D-01	DEL P/P OR TABLE NO.
B	0.30000	DESIGN DUCT MACH #
D	3000.0	BURNER OUTLET TEMP.
E	0.99000	EFF. OR TABLE NO.
F	18300.	FUEL HV
G	0.00000	CROSS SECT. AREA
H	0.00000	INLET BLEED FLOW/TOT. BLEED FLOW
I	0.00000	EXIT BLEED FLOW/TOT. BLEED FLOW
J	0.50000D-01	FRACT. OF AIR NOT HEATED
R		REVIEW ALL VALUES
T		TERMINATE-GO ON TO NEXT COMPONENT
Q		QUIT-END OF PROCESSING FOR ENTIRE ENGINE

D 2800.

T

COMPONENT NO. 6 IS A TURB

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT NEED DECIMAL POINT)

INDEX	VALUE	DEFINITION
A	3.5000	PRESSURE RATIO
B	0.75000	TOT BLEED IN/TOT BLEED AVAILABLE
C	1.0000	SCALE F ON CORR. SPEED
D	1007.0	CORR. FLOW TABLE NO.
E	1.0000	SCALE F ON CORR. FLOW
F	1008.0	EFFICIENCY TABLE NO.
G	1.0000	SCALE F ON EFFICIENCY
H	1.0000	SCALE F ON PRESSURE RATIO
I	0.80000	BLEED AT ENTRANCE/TOT BLEED IN
J	1.0000	3D ARG ON MAP
K	0.90000	EFFICIENCY
L	5000.0	CORRECTED SPEED
M	1.0000	HORSEPOWER SPLIT
N	0.00000	FACTOR FOR COOLING TYPE
P	0.00000	NUMBER OF STAGES
R		REVIEW ALL VALUES
T		TERMINATE-GO ON TO NEXT COMPONENT
Q		QUIT-END OF PROCESSING FOR ENTIRE ENGINE

T

COMPONENT NO. 7 IS A TURB

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT NEED DECIMAL POINT)

INDEX	VALUE	DEFINITION
A	2.5000	PRESSURE RATIO
B	0.25000	TOT BLEED IN/TOT BLEED AVAILABLE
C	1.0000	SCALE F ON CORR. SPEED
D	1009.0	CORR. FLOW TABLE NO.
E	1.0000	SCALE F ON CORR. FLOW
F	1010.0	EFFICIENCY TABLE NO.
G	1.0000	SCALE F ON EFFICIENCY
H	1.0000	SCALE F ON PRESSURE RATIO
I	1.0000	BLEED AT ENTRANCE/TOT BLEED IN
J	1.0000	3D ARG ON MAP
K	0.90000	EFFICIENCY
L	5000.0	CORRECTED SPEED
M	1.0000	HORSEPOWER SPLIT
N	0.00000	FACTOR FOR COOLING TYPE
P	0.00000	NUMBER OF STAGES
R		REVIEW ALL VALUES
T		TERMINATE-GO ON TO NEXT COMPONENT
Q		QUIT-END OF PROCESSING FOR ENTIRE ENGINE

K .91

L 5200.

R

A	2.5000	PRESSURE RATIO
B	0.25000	TOT BLEED IN/TOT BLEED AVAILABLE
C	1.0000	SCALE F ON CORR. SPEED
D	1009.0	CORR. FLOW TABLE NO.
E	1.0000	SCALE F ON CORR. FLOW
F	1010.0	EFFICIENCY TABLE NO.
G	1.0000	SCALE F ON EFFICIENCY
H	1.0000	SCALE F ON PRESSURE RATIO
I	1.0000	BLEED AT ENTRANCE/TOT BLEED IN
J	1.0000	3D ARG ON MAP
K	0.91000	EFFICIENCY
L	5200.0	CORRECTED SPEED
M	1.0000	HORSEPOWER SPLIT
N	0.00000	FACTOR FOR COOLING TYPE
P	0.00000	NUMBER OF STAGES
R		REVIEW ALL VALUES
T		TERMINATE-GO ON TO NEXT COMPONENT
Q		QUIT-END OFP ROCESSING FOR ENTIRE ENGINE

T

COMPONENT NO. 8 IS A NOZZ

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT NEED DECIMAL POINT)

INDEX	VALUE	DEFINITION
A	0.00000	AREA-EXIT CONV.,THROAT CD
B	0.98000	FLOW COEFF OR TAB REF NO.
D	0.00000	NOZZLE EXIT STATIC P
E	0.97500	VELOCITY COEFF. OR TAB. REF. NO.
F	1.0000	SWITCH-(0=CONV OR 1=C-D) NOZZLE
G	0.00000	AREA SWITCH-(0=FIX AREA OR 1=FLOAT AREA)
I	1.0000	IF ITEM D=0. SET = INLET COMPONENT NO.
R		REVIEW ALL VALUES
T		TERMINATE-GO ON TO NEXT COMPONENT
Q		QUIT-END OF PROCESSING FOR ENTIRE ENGINE

F 0.

T

```
COMPONENT NO.  9 IS A DUCT

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT  NEED DECIMAL POINT)

INDEX    VALUE        DEFINITION
 A     0.30000D-01   DEL P/P OR TABLE NO.
 B     0.00000       DESIGN DUCT MACH #
 D     0.00000       BURNER OUTLET TEMP.
 E     0.00000       EFF. OR TABLE NO.
 F     0.00000       FUEL HV
 G     0.00000       CROSS SECT. AREA
 H     0.00000       INLET BLEED FLOW/TOT. BLEED FLOW
 I     0.00000       EXIT BLEED FLOW/TOT. BLEED FLOW
 J     0.00000       FRACT. OF AIR NOT HEATED
 R                   REVIEW ALL VALUES
 T                   TERMINATE-GO ON TO NEXT COMPONENT
 Q                   QUIT-END OF PROCESSING FOR ENTIRE ENGINE

T

COMPONENT NO. 10 IS A NOZZ

TO CHANGE A VALUE, ENTER IN COLUMN 1 THE INDEX LETTER FOLLOWED BY NEW VALUE (ANYWHERE BUT  NEED DECIMAL POINT)

INDEX    VALUE        DEFINITION
 A     0.00000       AREA-EXIT CONV.,THROAT CD
 B     0.98000       FLOW COEFF OR TAB REF NO.
 D     0.00000       NOZZLE EXIT STATIC P
 E     0.98000       VELOCITY COEFF. OR TAB. REF. NO.
 F      1.0000       SWITCH-(0=CONV OR 1=C-D) NOZZLE
 G     0.00000       AREA SWITCH-(0=FIX AREA OR 1=FLOAT AREA)
 I      1.0000       IF ITEM D=0. SET = INLET COMPONENT NO.
 R                   REVIEW ALL VALUES
 T                   TERMINATE-GO ON TO NEXT COMPONENT
 Q                   QUIT-END OF PROCESSING FOR ENTIRE ENGINE

E 1.

Q
 TERMINATED: STOP 00003
 SAMPLE.SEPFLOTF HAS BEEN USED TO CREATE ALL.COMPONTS
GO:
```

SAMPLE SEPARATE FLOW TURBOFAN

```
&D DRAW=T,TABLES=T,PINPUT=T &END
&D MODE=1
 KONFIG(1,1)=4HINLT,1,0,2,0,SPEC(1,1)=80.00,0.,0.,0.,0.,
 0.9700,0.,0.,0.,0.,0.,18.00,
KONFIG(1,2)=4HCOMP,2,0,3,0,SPEC(1,2)=1.500,0.,1.0,1001.,1.0,
1002.,1.0,1003.,1.0,0.,0.,0.8800,2.950,1.0,
KONFIG(1,3)=4HSPLT,3,0,4,10,SPEC(1,3)=1.0,0.2000D-01,0.2000D-01,
KONFIG(1,4)=4HCOMP,4,0,5,13,SPEC(1,4)=1.300,0.5000D-01,1.0,1004.,1.0,
1005.,1.0,1006.,1.0,0.,0.,0.8700,6.200,0.9850,
KONFIG(1,5)=4HDUCT,5,0,6,0,SPEC(1,5)=0.5000D-01,0.3000,0.,2800.,0.9900,
0.1830D05,0.,0.,0.,0.5000D-01,
KONFIG(1,6)=4HTURB,6,13,7,0,SPEC(1,6)=3.500,0.7500,1.0,1007.,1.0,
1008.,1.0,1.0,0.8000,1.0,0.9000,5000.,1.0,
KONFIG(1,7)=4HTURB,7,13,8,0,SPEC(1,7)=2.500,0.2500,1.0,1009.,1.0,
1010.,1.0,1.0,1.0,1.0,0.9100,5200.,1.0,
KONFIG(1,8)=4HNOZZ,8,0,9,0,SPEC(1,8)=0.,0.9800,0.,0.,0.9750,
0.,0.,0.,1.0,
KONFIG(1,9)=4HDUCT,10,0,11,0,SPEC(1,9)=0.3000D-01,
KONFIG(1,10)=4HNOZZ,11,0,12,0,SPEC(1,10)=0.,0.9800,0.,0.,1.0,
1.0,0.,0.,1.0,
KONFIG(1,11)=4HLOAD,0,0,0,0,SPEC(1,11)=-200.0,
KONFIG(1,12)=4HSHFT,4,6,11,0,SPEC(1,12)=8000.,1.0,1.0,1.0,0.,
1.0,1.0,1.0,
KONFIG(1,13)=4HSHFT,2,7,0,0,SPEC(1,13)=6000.,1.0,1.0,0.,0.,
1.0,1.0,
KONFIG(1,14)=4HCNTL,SPCNTL(1,14)=1.0,7.0,4HSTAP,8.0,
8.0,0.,0.1000D-02,0.,0.,
KONFIG(1,15)=4HCNTL,SPCNTL(1,15)=1.0,6.0,4HSTAP,8.0,
7.0,0.,0.1000D-02,0.,0.,
KONFIG(1,16)=4HCNTL,SPCNTL(1,16)=1.0,4.0,4HSTAP,8.0,
6.0,0.,0.1000D-02,1.100,1.750,
KONFIG(1,17)=4HCNTL,SPCNTL(1,17)=1.0,3.0,4HSTAP,8.0,
11.00,0.,0.1000D-02,0.,0.,
KONFIG(1,18)=4HCNTL,SPCNTL(1,18)=1.0,2.0,4HSTAP,8.0,
4.0,0.,0.1000D-02,1.100,2.100,
KONFIG(1,19)=4HCNTL,SPCNTL(1,19)=1.0,1.0,4HSTAP,8.0,
2.0,0.,0.1000D-02,0.,0.,
KONFIG(1,20)=4HCNTL,SPCNTL(1,20)=1.0,12.00,4HDOUT,8.0,
12.00,0.,0.1000D-02,0.,0.,
KONFIG(1,21)=4HCNTL,SPCNTL(1,21)=1.0,13.00,4HDOUT,8.0,
13.00,0.,0.1000D-02,0.,0.,
 &END
&D ALTP=5000,MACH=.3 &END
```

REKONFIG-CHANGE ALL COMPONENTS

DEFINITION OF INPUT AND OUTPUT UNITS

```
REKONFIG0000000 PROCDEF REKONFIG
REKONFIG0000100 PARAM $OLD,$NEW
REKONFIG0000200 RELEASE FT;RELEASE XXYYZZ
REKONFIG0000300 DDEF XXYYZZ,VP,LIB.DUMBNNEP,OPTION=JOBLIB
REKONFIG0000400 DDEF FT10F001,VS,$NEW
REKONFIG0000500 DDEF FT09F001,VS,$OLD
REKONFIG0000600 DDEF FT08F001,VS,SKRATCH,RET=T
REKONFIG0000700 FINPUT
REKONFIG0000800 DEFAULT SYSINX=E
REKONFIG0000900 REDIT $NEW,MPIC
REKONFIG0001000 N2;C/ //1000,ALL
REKONFIG0001040 T;C/0.0000/0./1000,ALL
REKONFIG0001080 T;C/.000/.0/1000,ALL
REKONFIG0001100 T;C/%END/ %END/1000
REKONFIG0001150 T;C/%D/%D /1000
REKONFIG0001200 T;C// /1000
REKONFIG0001300 VS $NEW;Q
REKONFIG0001400 DEFAULT SYSINX=G
REKONFIG0001500 D ' $OLD HAS BEEN USED TO CREATE $NEW'
```

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA TM-82636		
4. Title and Subtitle KONFIG AND REKONFIG - TWO INTERACTIVE PREPROCESSING PROGRAMS TO THE NAVY/NASA ENGINE PROGRAM (NNEP)		5. Report Date May 1981 6. Performing Organization Code 505-05-92
7. Author(s) Laurence H. Fishbach		8. Performing Organization Report No. E-889 10. Work Unit No.
9. Performing Organization Name and Address National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio 44135		11. Contract or Grant No. 13. Type of Report and Period Covered Technical Memorandum
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20546		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

The NAVY/NASA Engine Program (NNEP) is a computer program than is currently being used to simulate the thermodynamic cycle performance of almost all types of turbine engines by many government, industry, and university personnel. NNEP uses arrays of input data to set up the engine simulation and component matching method as well as to describe the characteristics of the components. This report describes a preprocessing program (KONFIG) in which the user at a terminal on a time shared computer can interactively prepare the arrays of data required. It is intended to make it easier for the occasional or new user to operate NNEP. This report also describes REKONFIG, another preprocessing program, in which the user can modify the component specifications of a previously configured NNEP dataset. It is intended to aid in preparing data for parametric studies and/or studies of similar engines such as mixed flow turbofans, turboshafts, etc.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Computer simulation Turbine engines Simulation	Unclassified - unlimited STAR Category 61

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified		

* For sale by the National Technical Information Service, Springfield, Virginia 22161

National Aeronautics and
Space Administration

Washington, D.C.
20546

Official Business
Penalty for Private Use, $300

SPECIAL FOURTH CLASS MAIL
BOOK

Postage and Fees Paid
National Aeronautics and
Space Administration
NASA-451

U.S.MAIL

NASA

POSTMASTER: If Undeliverable (Section 158 Postal Manual) Do Not Return